

## Modulation of the Foreign Body Reaction for Implants in the Subcutaneous Space: Microdialysis Probes as Localized Drug Delivery/Sampling Devices

Xiaodun Mou, Ph.D.,<sup>1,5</sup> Michelle R. Lennartz, Ph.D.,<sup>2</sup> Daniel J. Loegering, Ph.D.,<sup>3</sup>  
and Julie A. Stenken, Ph.D.<sup>4</sup>

### Abstract

Modulation of the foreign body reaction is considered to be an important step toward creation of implanted sensors with reliable long-term performance. In this work, microdialysis probes were implanted into the subcutaneous space of Sprague-Dawley rats. The probe performance was evaluated by comparing collected endogenous glucose concentrations with internal standard calibration (2-deoxyglucose, antipyrine, and vitamin B<sub>12</sub>). Probes were tested until failure, which for this work was defined as loss of fluid flow. In order to determine the effect of fibrous capsule formation on probe function, monocyte chemoattractant protein-1/CC chemokine ligand 2 (MCP-1/CCL2) was delivered locally via the probe to increase capsule thickness and dexamethasone 21-phosphate was delivered to reduce capsule thickness. Probes delivering MCP-1 had a capsule that was twice the thickness (500–600  $\mu\text{m}$ ) of control probes (200–225  $\mu\text{m}$ ) and typically failed 2 days earlier than control probes. Probes delivering dexamethasone 21-phosphate had more fragile capsules and the probes typically failed 2 days later than controls. Unexpectedly, extraction efficiency and collected glucose concentrations exhibited minor differences between groups. This is an interesting result in that the foreign body capsule formation was related to the duration of probe function but did not consistently relate to probe calibration.

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**Author Affiliations:** <sup>1</sup>Department of Chemistry and Chemical Biology, Rensselaer Polytechnic Institute, Troy, New York; <sup>2</sup>Center for Cell Biology and Cancer Research, Albany Medical College, Albany, New York; <sup>3</sup>Center for Cardiovascular Sciences, Albany Medical College, Albany, New York; <sup>4</sup>Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, Arkansas; and <sup>5</sup>currently with Pfizer, Pearl River, New York

**Abbreviations:** (2-DG) 2-deoxyglucose, (ANOVA) analysis of variance, (BSA) bovine serum albumin, (dex) dexamethasone, (dex-phos) dexamethasone 21-phosphate, (EE) extraction efficiency, (ESI) electron spray ionization, (HPLC) high-performance liquid chromatography, (IC-PAD) ion-exchange chromatography with pulsed amperometric detection, (MCP-1/CCL2) monocyte chemoattractant protein-1/CC chemokine ligand 2, (MWCO) molecular weight cutoff, (MS) mass spectroscopy, (PBS) phosphate-buffered saline, (PES) polyethersulfone, (UV) ultraviolet, (VB<sub>12</sub>) vitamin B<sub>12</sub>

**Keywords:** calibration, dexamethasone 21-phosphate, foreign body reaction, glucose, in vivo microdialysis sampling, MCP-1/CCL2

**Corresponding Author:** Julie A. Stenken, Ph.D., Department of Chemistry and Biochemistry, University of Arkansas, 119 Chemistry Building, Fayetteville, AR, 72701; email address [jstenken@uark.edu](mailto:jstenken@uark.edu)