

UCSD NANOENGINEERING/CHEMICAL ENGINEERING  
*Distinguished Seminar*Wednesday, February 5, 2020  
Seminar Presentation: 11:00am – 12:00pm  
**SME room 248***“Microneedle patch technology for long-acting contraception  
and dermal interstitial fluid diagnostics”***Mark R. Prausnitz Ph.D.***Regents' Professor and J. Erskine Love, Jr. Chair  
of Chemical & Biomolecular Engineering  
Georgia Institute of Technology***Abstract:** Microneedle patches enable minimally invasive access to the body interior.

This access can be used to administer drug formulations that would otherwise require injection, and can be used to create pathways for flow of interstitial fluid from the skin. Two applications of microneedle patch technology will be discussed.

Our first project is motivated by the need for many women to have improved access to contraception. To address this need, we designed a microneedle patch with rapidly separable biodegradable polylactic acid and poly(lactico-glycolic acid) needles, and studied its application for the continuous release of levonorgestrel, a contraceptive hormone. Bubble structures between each microneedle and the patch backing allow the microneedles to efficiently penetrate into skin under compression, and to snap off under shear within five seconds after patch administration. In rats, the microneedle patch was well tolerated, leaving little visible evidence of use, and maintained plasma concentrations of the hormone above the human therapeutic level for one month.

Our second project is motivated by an interest in sampling tissue interstitial fluid (ISF) as a novel source of biomarkers. However, ISF has received limited attention due largely to lack of simple collection methods. To address this need, we developed a method to sample ISF from human skin in a relatively simple manner with minimally invasive microneedles, that was well tolerated by study participants. We sampled ISF from human participants and identified valuable and sometimes unique biomarkers in ISF when compared to companion plasma samples based on mass spectrometry analysis. Because ISF does not clot, these biomarkers could be continuously monitored in ISF like current continuous glucose monitors, but without an indwelling subcutaneous sensor.

**Educational development and training:** This seminar will provide training on microdevice design, fabrication and use; skin barrier properties; global health; contraceptive technology; and novel diagnostics. Two case studies will be presented to show the process of medical device development, starting with idea and invention through device development and culminating in human and animal studies.

**Biosketch:** Mark Prausnitz is Regents' Professor and J. Erskine Love, Jr. Chair of Chemical & Biomolecular Engineering at the Georgia Institute of Technology. He earned a BS degree from Stanford University and PhD degree from MIT, both in chemical engineering. Dr. Prausnitz and colleagues carry out research on biophysical methods of drug delivery using microneedles, lasers, ionic liquids and other microdevices for transdermal, ocular and intracellular delivery of drugs and vaccines. Dr. Prausnitz teaches an introductory course on engineering calculations, as well as two advanced courses on pharmaceuticals. He has published almost 280 journal articles and has co-founded five start-up companies including Micron Biomedical and Clearside Biomedical.