Microchemical or microfluidic systems have potential for a wide range of applications. This presentation will cover three examples: Electroreduction of CO\textsubscript{2}, protein/pharmaceutical crystallization, and antibiotic susceptibility testing.

Multiple strategies, such as switching to renewable energy sources and improving energy efficiency for buildings and transportation, will need to be pursued to curb the increase of the atmospheric CO\textsubscript{2} levels which has been associated with the undesirable effects of climate change. In this seminar I will highlight our recent efforts in the conversion of CO\textsubscript{2} into value-added chemicals such as CO, ethylene and ethanol, as an additional approach to reduce CO\textsubscript{2} emissions. This presentation will cover our latest catalysts (metal nanoparticles, organometallic compounds, metal-free systems), electrodes, and operating conditions (different electrolyte compositions), for example for the conversion of CO\textsubscript{2} to CO, which can be used for synthetic fuel production via the Fischer-Tropsch process.

The second part will focus on microfluidic platforms for crystallization, for screening and analysis of (membrane) protein crystals and of solid forms of pharmaceuticals. These array chips drastically reduce the amount of material needed thus many more conditions can be screened and by allowing for on-chip characterization they eliminate manual handling of fragile crystals. We have successfully identified crystallization conditions of novel proteins, followed by successful on-chip X-ray structure determination. Similar chips can be used for solid form screening (salts, polymorphs, …) of candidate drugs and subsequent on-chip analysis of the solid forms with Raman or X-ray.

The third section will focus on microfluidic chips for antibiotic susceptibility testing of polymicrobial cultures. Conventional methods to determine the appropriate antibiotic and associated minimum inhibitory concentration often require more than a day, delaying the start of appropriate treatment. The microfluidic approach presented here enables determining MICs within 4 hours, and can be used to study the interplay between different bacteria.

Tuesday, April 26, 2016
Lecture at 4:00 PM
Room 1610 Engineering Hall
Refreshments will be served at 3:45 PM