

#### **423b Electrochemical Impedance Biosensors**

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Electrochemical biosensors are needed for many portable and implantable applications. Electrochemical impedance spectroscopy (EIS) is a promising biosensor method due to its capability for complete frequency characterization of an electrochemical interface. If the measured impedance values are fit to equivalent circuit models of the electrochemical interface, then particular circuit elements and frequencies often show enhanced sensitivity. EIS studies have been performed for two genetically engineered proteins, the glucose/galactose receptor (GGR) and leucine-isovaline-valine (LIV) receptor, from Linda Luck's laboratory at Clarkson University. This involves addition of a cysteine group into otherwise cysteine-free proteins, and the use of Au-thiol self-assembly chemistry to create protein layers directly adsorbed onto Au. The impedance of the GGR/Au interface is reduced by 3-8% upon exposure to glucose, reflecting the reduction in effective surface area during hinge-bending motion of the protein. This hinge-bending motion has been reported to be as large as 20-40 degrees. This is the first report of "reagentless" electrochemical impedance spectroscopy for biosensing of small molecule ligands. However, the use of metal nanoparticle "tags" may be needed in some cases for signal amplification. Results are presented for the model system of fluorescein/anti-fluorescein using 10 nm Au nanoparticle "tags."