

Syllabus – 2019 – CHM 414 / CHM 1102 Biosensor and Chemical Sensor Technology

Mike Thompson, Department of Chemistry and Institute for Biomaterials and Biomedical Engineering, University of Toronto. E-mail: mikethom@chem.utoronto.ca

- **Introduction to biosensor architecture**

Types of sensors; components and design; ideal requirements

- **Probe attachment**

Types of probe – antibodies, nucleic acids, enzymes, receptors; criteria for device surface attachment, introduction to the non-specific adsorption problem

- **Methods for probe attachment to surfaces**

Adsorption; chemisorption v physisorption; polymer trapping; covalent attachment; film deposition techniques; molecular imprinted polymers and biomimicry.

- **Surface characterization**

Probe information required; general characteristics of surface analysis; X-ray photoelectron spectroscopy; secondary ion mass spectrometry; Auger spectroscopy; probe techniques such as atomic force microscopy

- **Electrochemical sensors**

Types of device – potentiometric, amperometric, voltammetric; ion selective electrodes; physics of field effect transistor technology - ISFETS, IMMUNOFETS; history and design of the glucose electrode; nucleic acid –based electrochemical sensing

- **Acoustic wave devices**

The phenomenon of piezoelectricity; operation of devices in air; bulk acoustic wave devices as chemical sensors; the Sauerbrey response equation; propagation of acoustic waves in fluids; other devices – surface acoustic wave, shear horizontal wave, surface transverse wave

- **Optical and electromagnetic radiation based devices**

Sources of radiation for sensors; laser technology; optical components; fiber optic based systems for sensing; intrinsic versus extrinsic sensing mechanisms; evanescent wave technology; the phenomenon of surface plasmon resonance; design of the SPR experiment for bio-sensing; other types such as interferometry

