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 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 Saucerbrey 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 interferometry