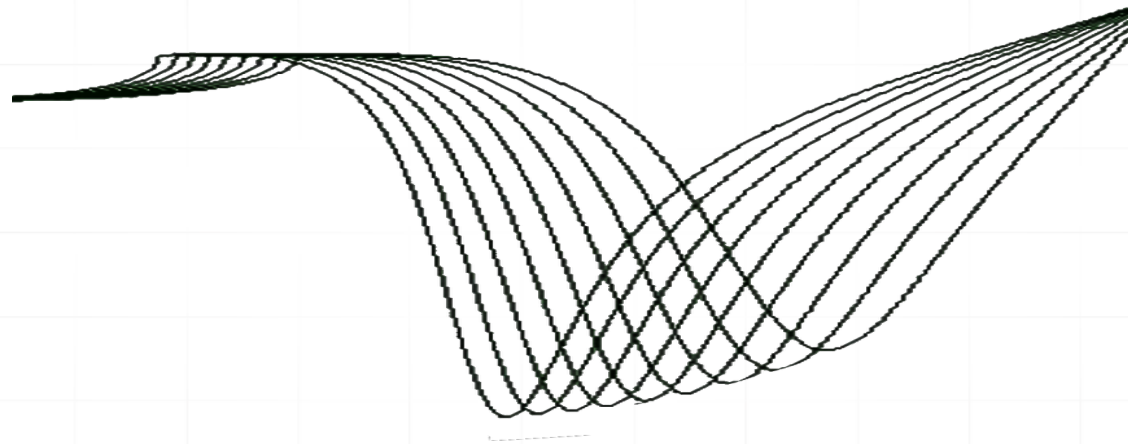


Application of dynamic surface-sensing technologies for measurement, process development and control of SiO_2 Sol-Gel surface coatings



Dr Walis Jones



HR EXCELLENCE IN RESEARCH



Wrocław University
of Science and Technology

Overview:

I Personal background

II Surface Plasmon Resonance [SPR]

III Application of SPR to Silica Coatings

I / Brief Career Summary:

A journey from Biology to Physics.....

GlaxoSmithKline [GSK] Drug Discovery

Mechanism behind biomolecular interactions

Biacore

Surface Plasmon Resonance [SPR]

Sensorgram measurements of kinetics & affinity

Farfield Group

Dual Polarisation Interferometry [DPI]

Biophysical screening & conformational change

BioNavis

Multi-Parametric SPR [MP-SPR]

Application of SPR in biomaterials analysis

BioPharm Enterprises

Orthogonal biophysical measurements

Novel approaches for smart screening

Structure-Conformation Activity Relationships [SCAR]

I / Pan-European Collaborations:

Jian Lu

The University of Manchester

> Biological Interfaces > Biophysical characterisation > Neutron Reflectance

Tapani Viitala

Helsinki University

> Bio-pharmaceutical applications > Cell-based biosensor studies > QCM

Alekzander Sikorski

University of Wroclaw

> Membrane-associated proteins

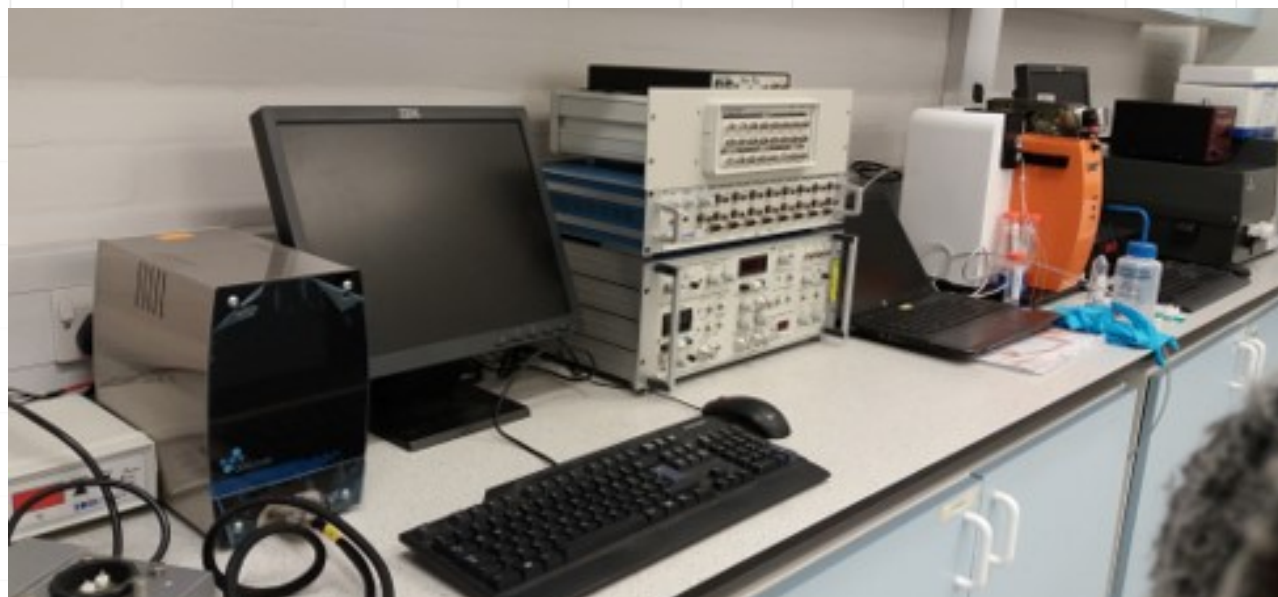
Justyna Krzak

Wroclaw University of Science and Technology

> Interfaces [Bio and Industrial] > Novel surface properties through chemical modification

> HyStor > SiO₂ Sol-Gel Coatings

I / Biophysical Measurement Suite - The University of Manchester:



Biacore X

SPR Navi 200L

AnaLight 4D

KSV QCM-Z500

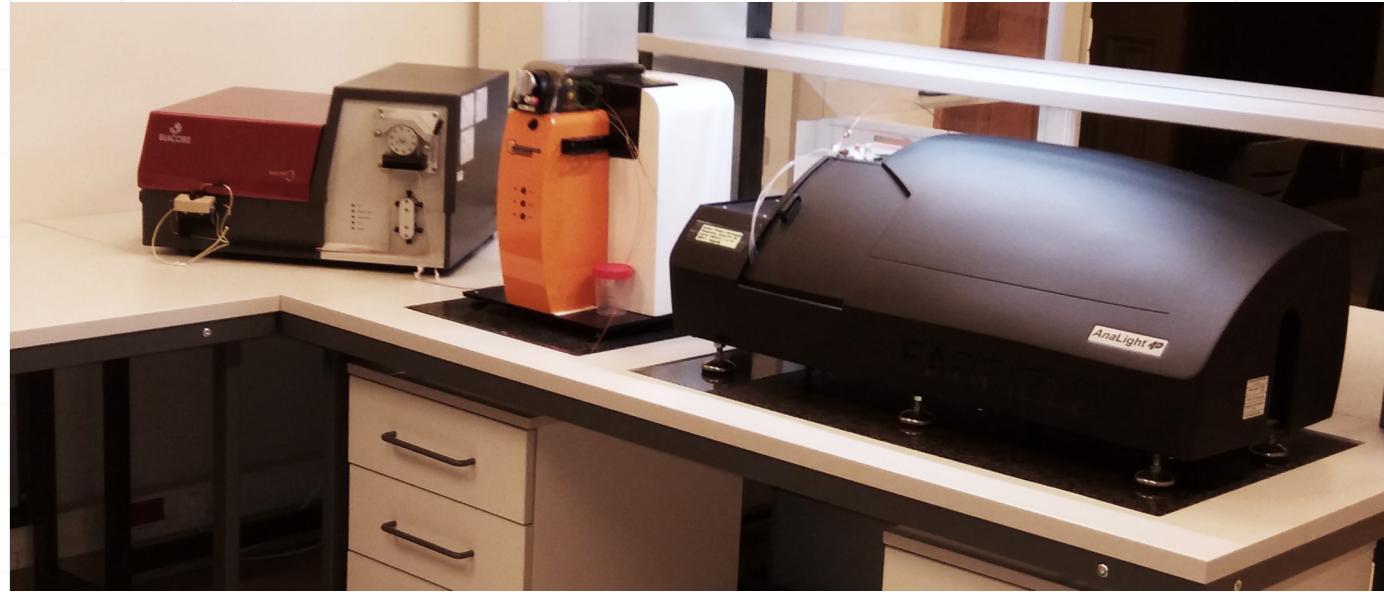
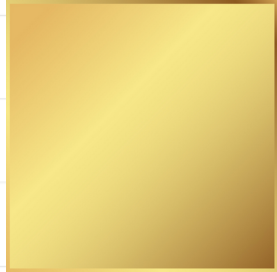
Surface Plasmon Resonance [SPR]

Multi-Parametric SPR [MP-SPR]

Dual Polarisation Interferometry [DPI]

Quartz Crystal Microbalance with Dissipation [QCM-I]

I / Biophysical Measurement Suite - WUST:



Biacore J

SPR Navi 200L

AnaLight 4D

KSV QCM-Z500

Surface Plasmon Resonance [SPR]

Multi-Parametric SPR [MP-SPR]

Dual Polarisation Interferometry [DPI]

Quartz Crystal Microbalance with Dissipation [QCM-I]

II / Surface Plasmon Resonance: SPR



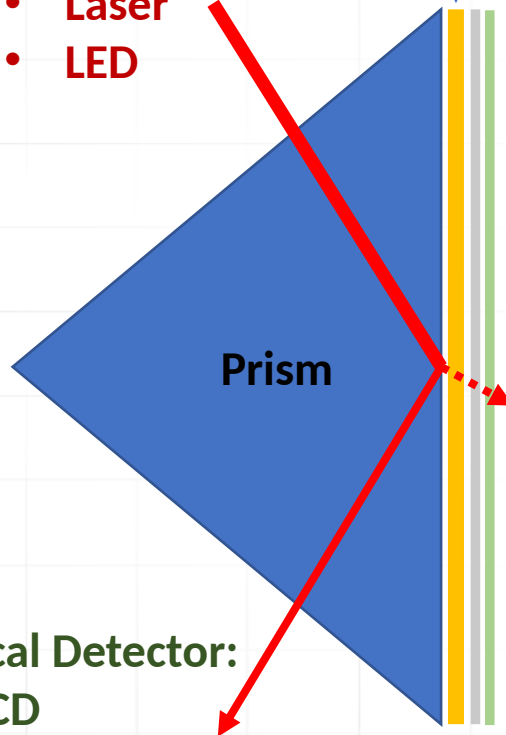
Total Internal Reflection

https://en.wikipedia.org/wiki/Total_internal_reflection

Whole Device
= Transducer

Optical Detector:
• CCD

Light Source:
• White Light
• Laser
• LED



Metallic Plasmonic layer:

- Gold
- Silver
- Aluminium
- Copper
- Titanium
- Steel
- etc.....



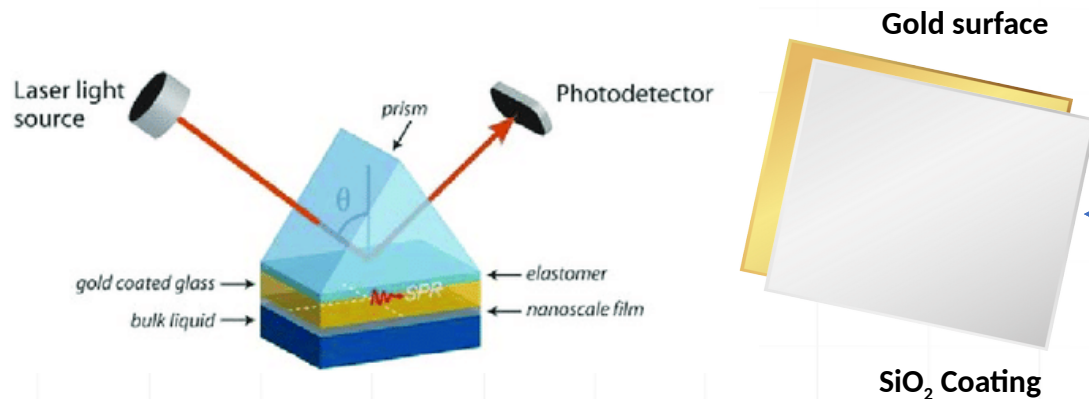
<https://www.cytivalifesciences.com/en/us/shop/protein-analysis/spr-label-free-analysis/spr-consumables/sensor-chips/sensor-chip-cm5-p-05858>

Layer(s) of Interest:

- Bio-Molecular Interactions
- Surface Coatings
- Polymers
- Layer-by-Layer Deposition
- Surface Chemistry
- Conducting Layers
- Wave-Guides
- Graphene
- Gases

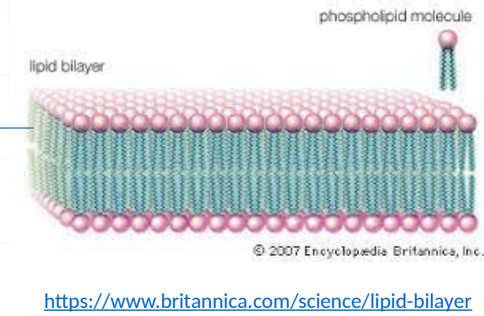
II / Surface Plasmon Resonance: SPR

- The Interface Between Physics and Bio
 - Surface Coatings & Bio-engineering
 - A common interface: metallic layer - SiO_2



SiO_2
Sol-Gel

Lipid
Bilayers



Hydrogen
Gas



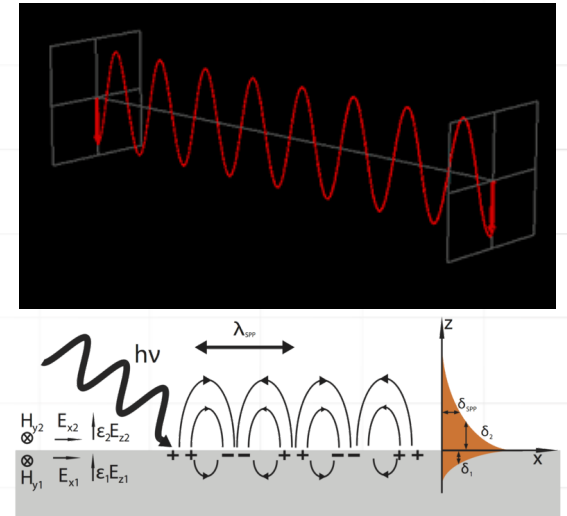
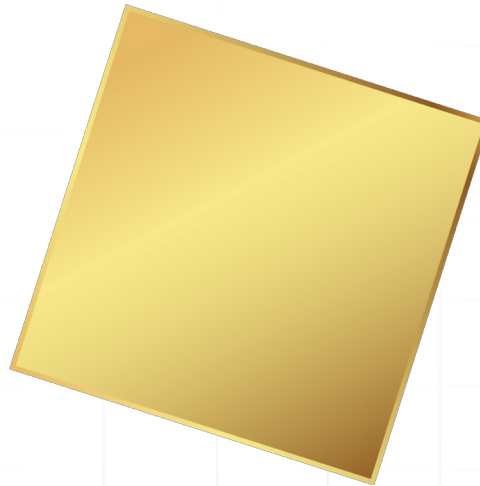
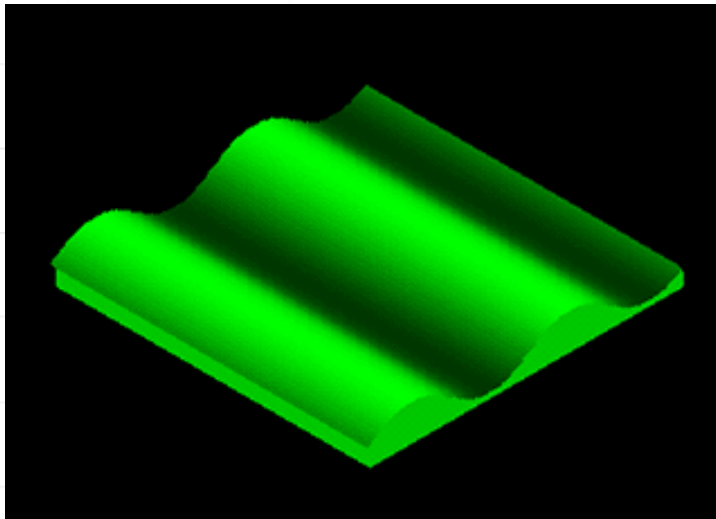
<https://www.vectorstock.com/royalty-free-vector/hydrogen-ic-on-with-arrows-vector-36377324>

II / Surface Plasmon Resonance: SPR

Under certain circumstances.....

.....the light striking the gold layer on the surface of the biosensor

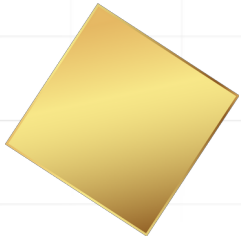
.....is captured as a 'surface plasmon resonance'



.....that establishes an 'evanescent field' monitored by the biosensor

II / Surface Plasmon Resonance: SPR

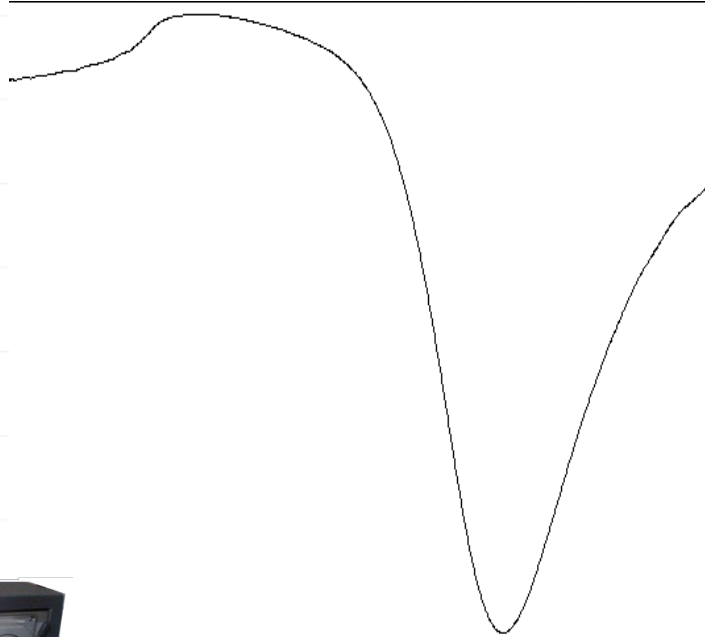
we observe molecular interactions on a gold coated sensor



monitoring these interactions on a biosensor

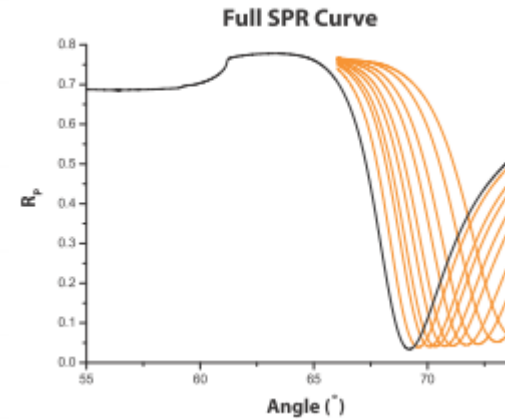


as molecules bind on the surface.....



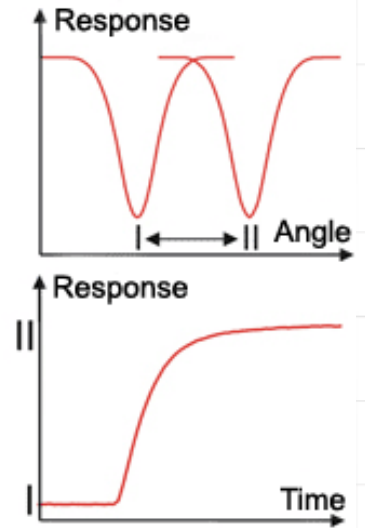
the SPR-Curve changes

this results in an angular change of the reflected light



and we collect a series of SPR-Curves over time

the angular change in the SPR-Curve



can be plotted as a sensorgram