Surface Plasmon Resonance

Presented by: Md. Hedayetul Islam Chy.

ID: 17702013
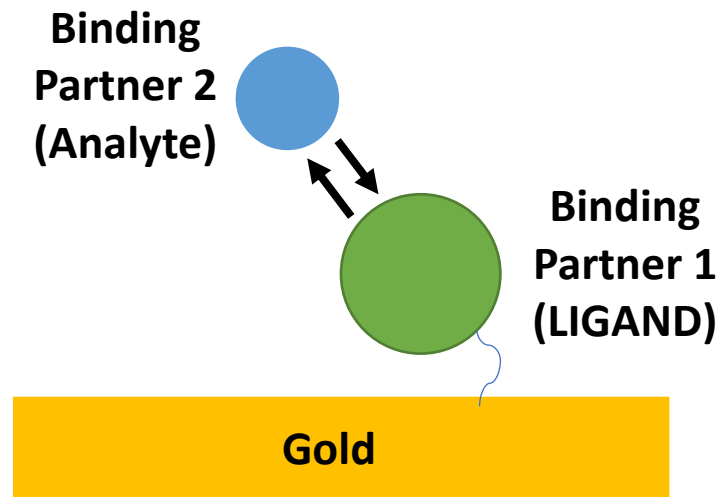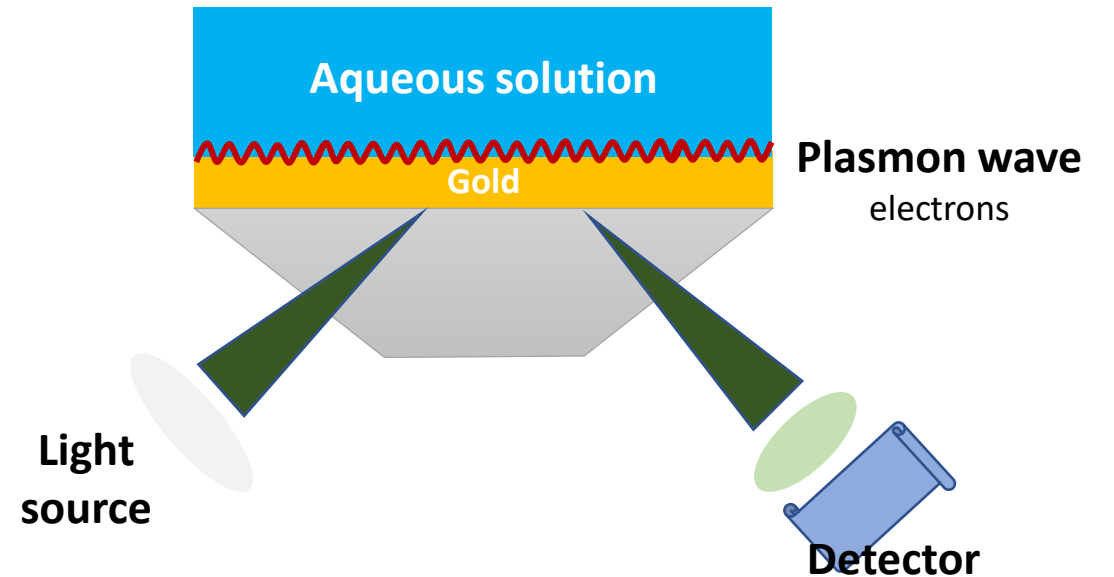
Session: 2020-21

Outline

- Introduction
- Interactions at the surface
- Aspects of interaction
- Optical detection system
  - Change in buffer layer shift dip
  - Binding event
  - Unbinding event
- Response unit
- SPR sensor configuration
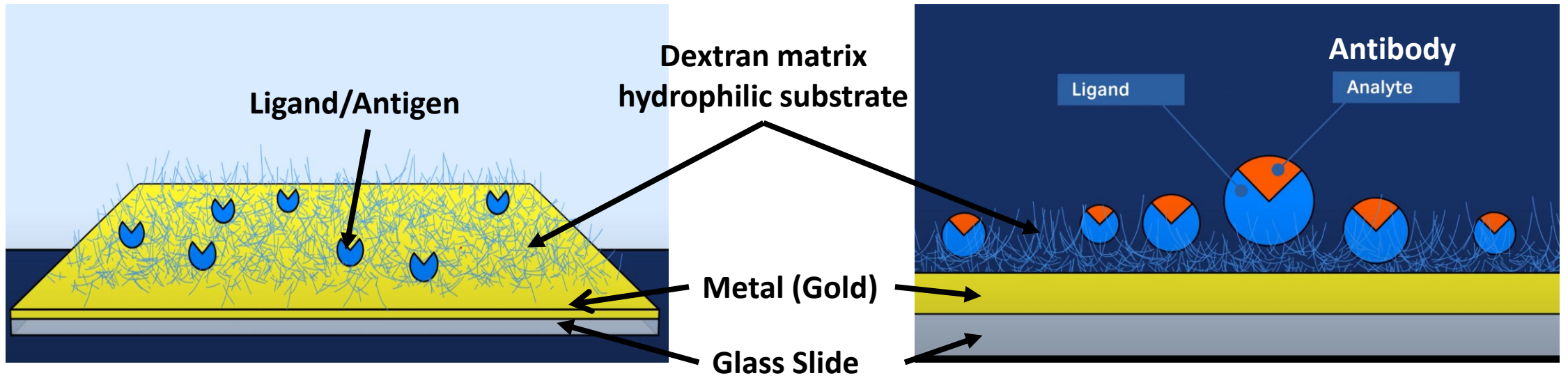- Application
- Limitation

Introduction

Surface

Binding Partner 2 (Analyte)

Binding Partner 1 (LIGAND)

Gold

Interactors are monitored at a surface

Plasmon Resonance

Aqueous solution

Plasmon wave
electrons

Gold

Light source

Detector

Light energy converted to plasmons

Interactions at the surface

Why need SPR?

- Optical biosensing technology

- Able to know details about **biomolecular binding interactions** not only the **qualitative** manner but also the **quantitively** data

- **Spectroscopic** technique (absorption and emission of light)

- **Label free** technology
  - Detection technology uses optics based **biosensors**.
  - Convert biological binding response in signals.
  - Without using a fluorescent or any other detection. Label

- Real-time, **non-invasive** nature
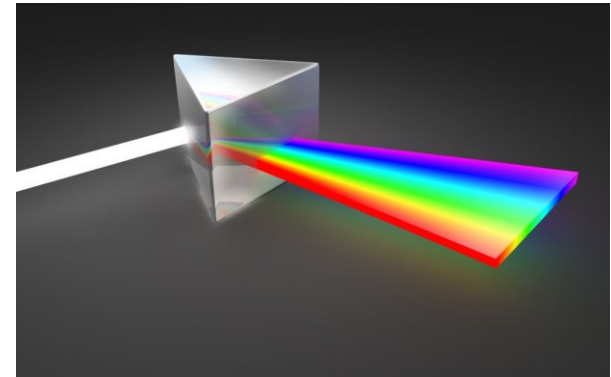
Materials

- Metal = (Gold, Silver)
- Aqueous solution = (Deionized water)
- Total internal reflection
- Refractive index
- P-polarized light

Positive permittivity → Bad conductance
Negative permittivity → Good Conductance

Aspects of interaction

Affinity
How strong is the interaction?

Binding kinetics
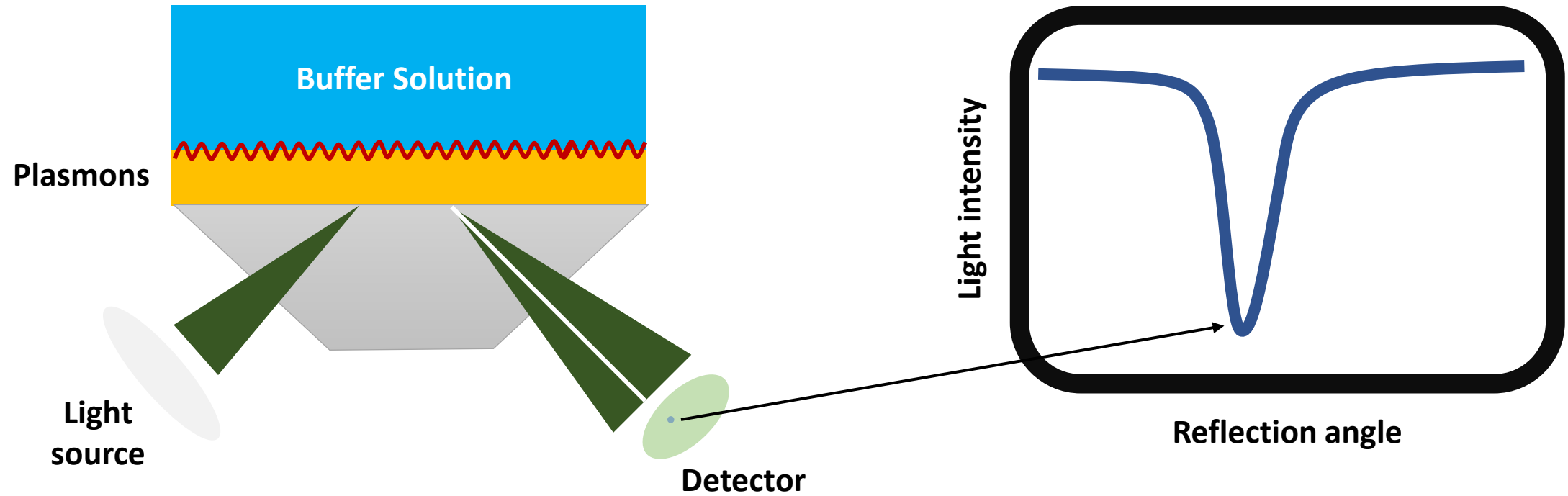How fast or slow does the complex form and decay?

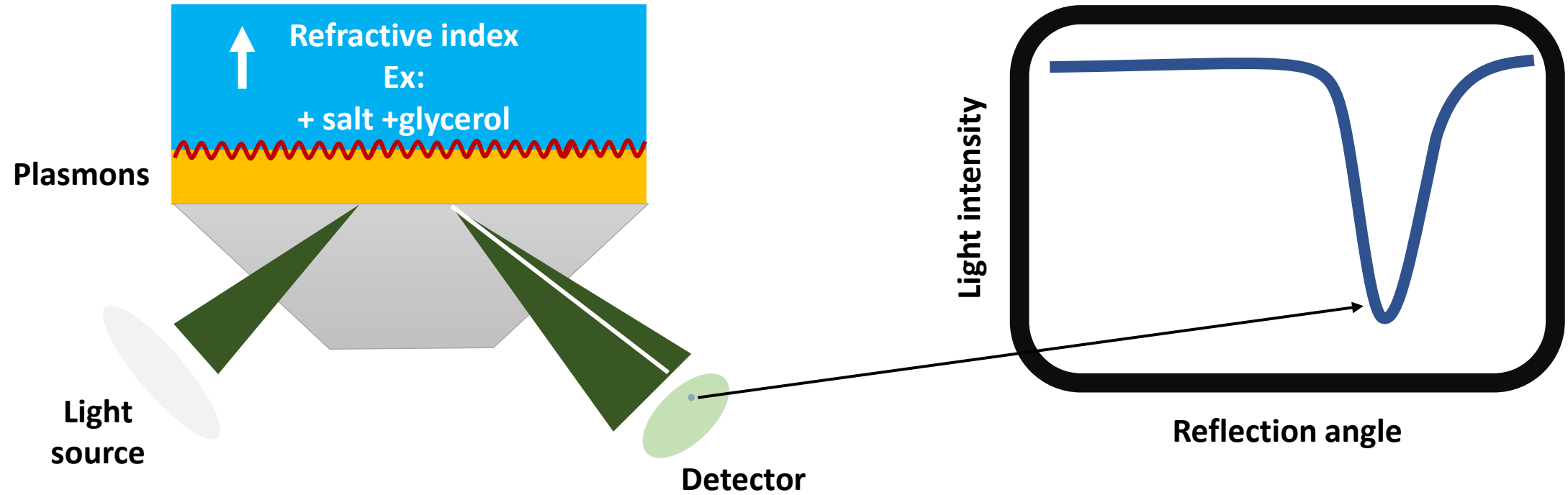**Concentration**
How much of a given molecule is active?
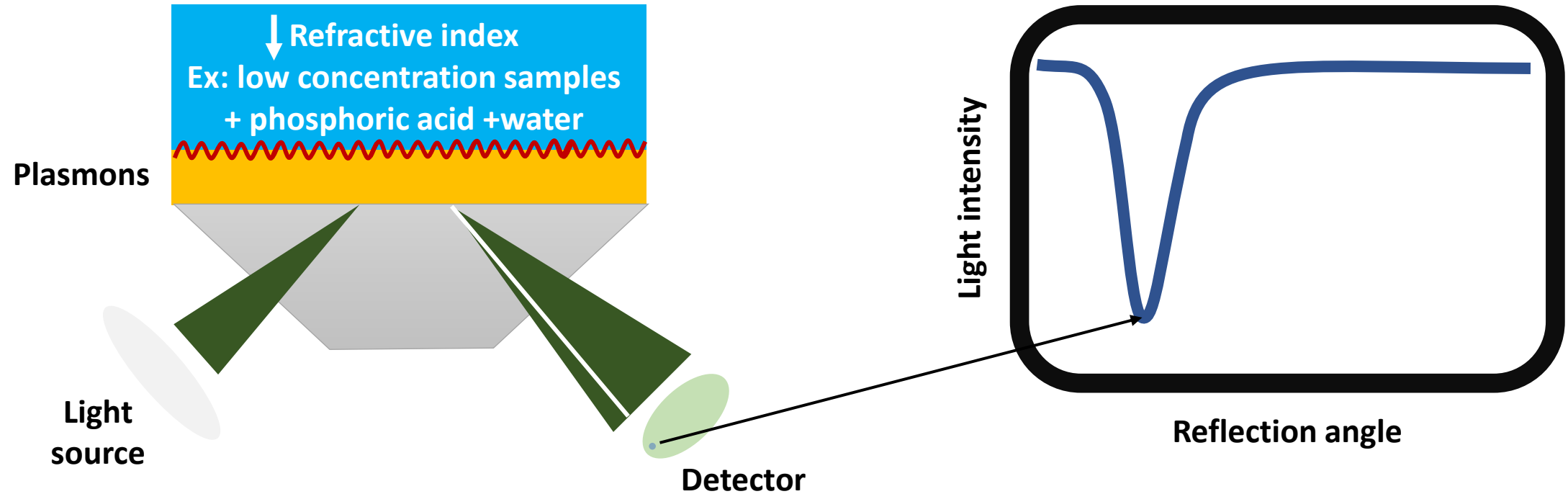
Specificity
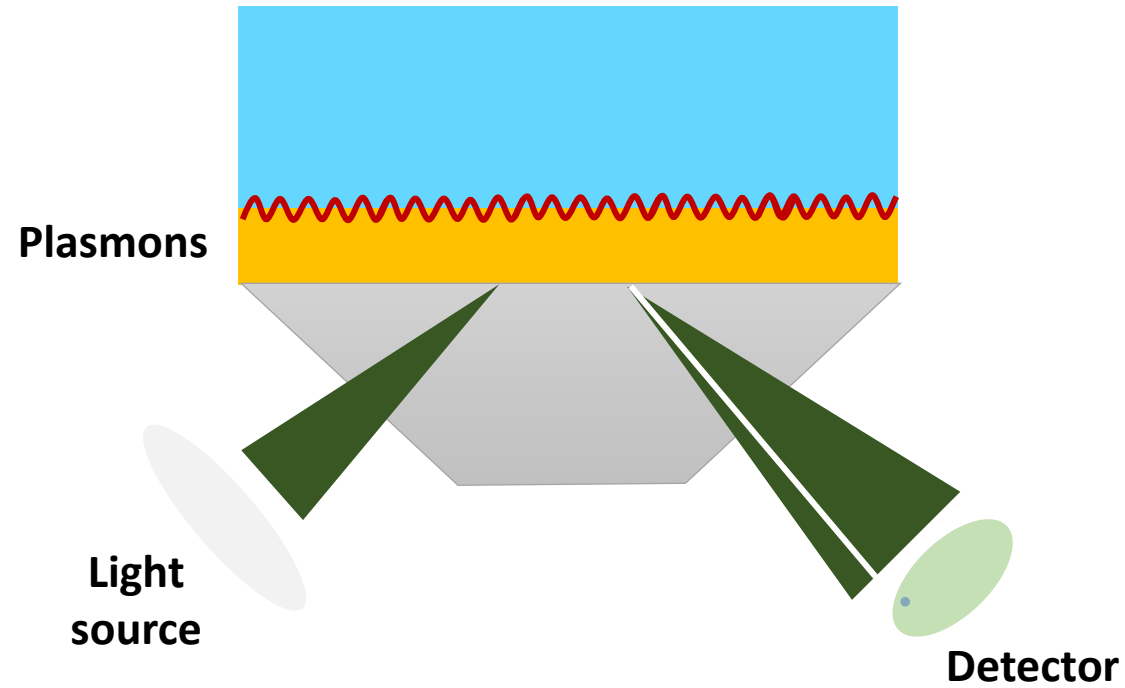How specific is the interaction?

Optical Detection System

Buffer Solution

Plasmons

Light source

Detector

Light intensity

Reflection angle

Change in Buffer Layer shift Dip

Refractive index
Ex:
+ salt +glycerol

Plasmons

Light source

Detector

Light intensity

Reflection angle

Change in Buffer Layer shift Dip

↓ **Refractive index**
Ex: low concentration samples + phosphoric acid +water

Plasmons

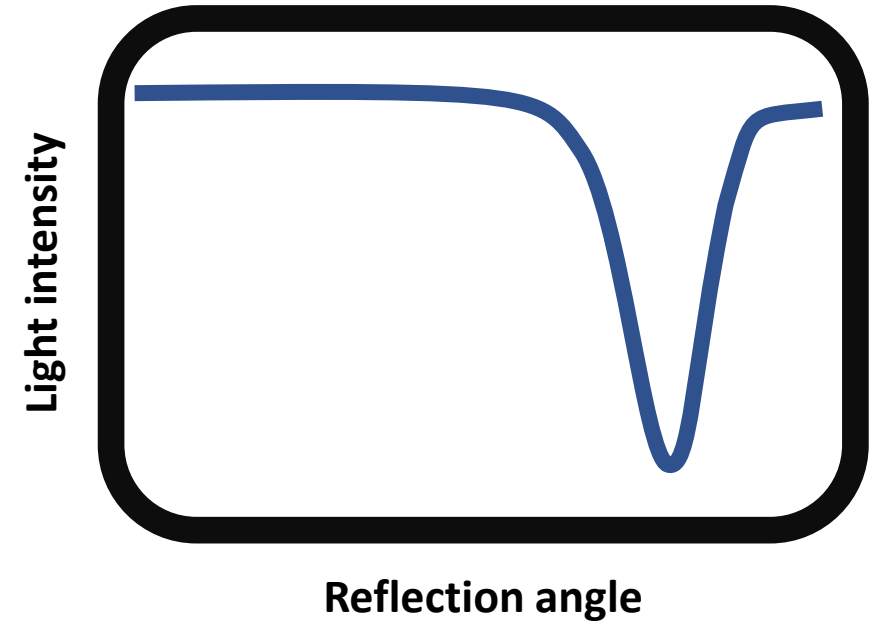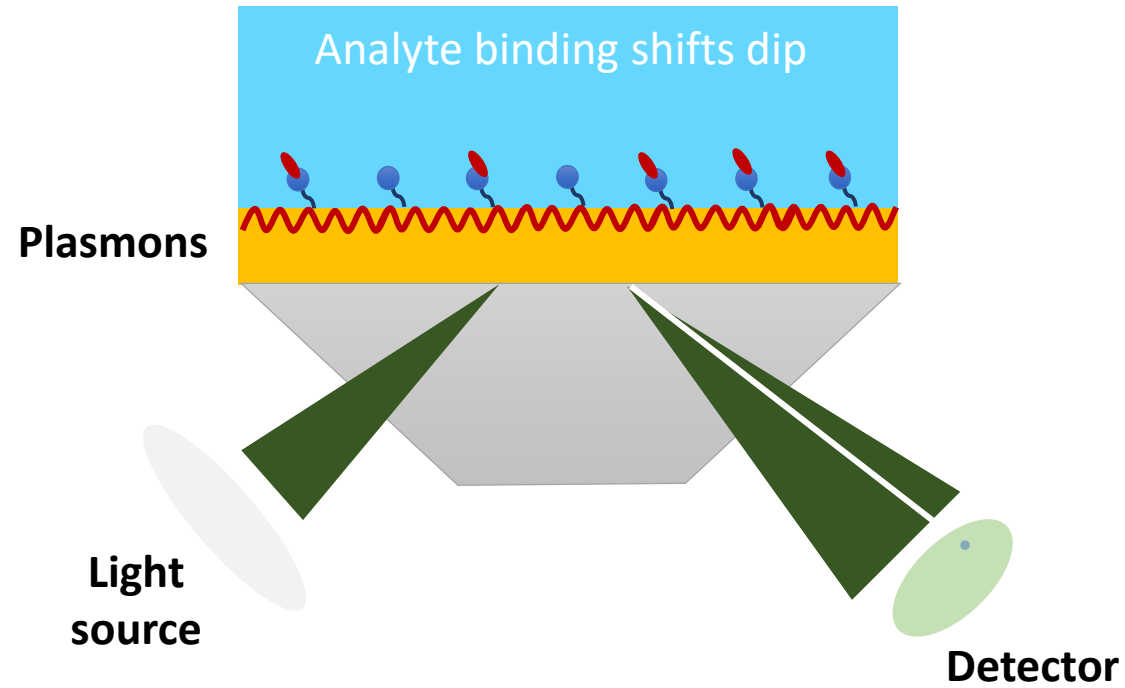**Light source**

Detector

Light intensity

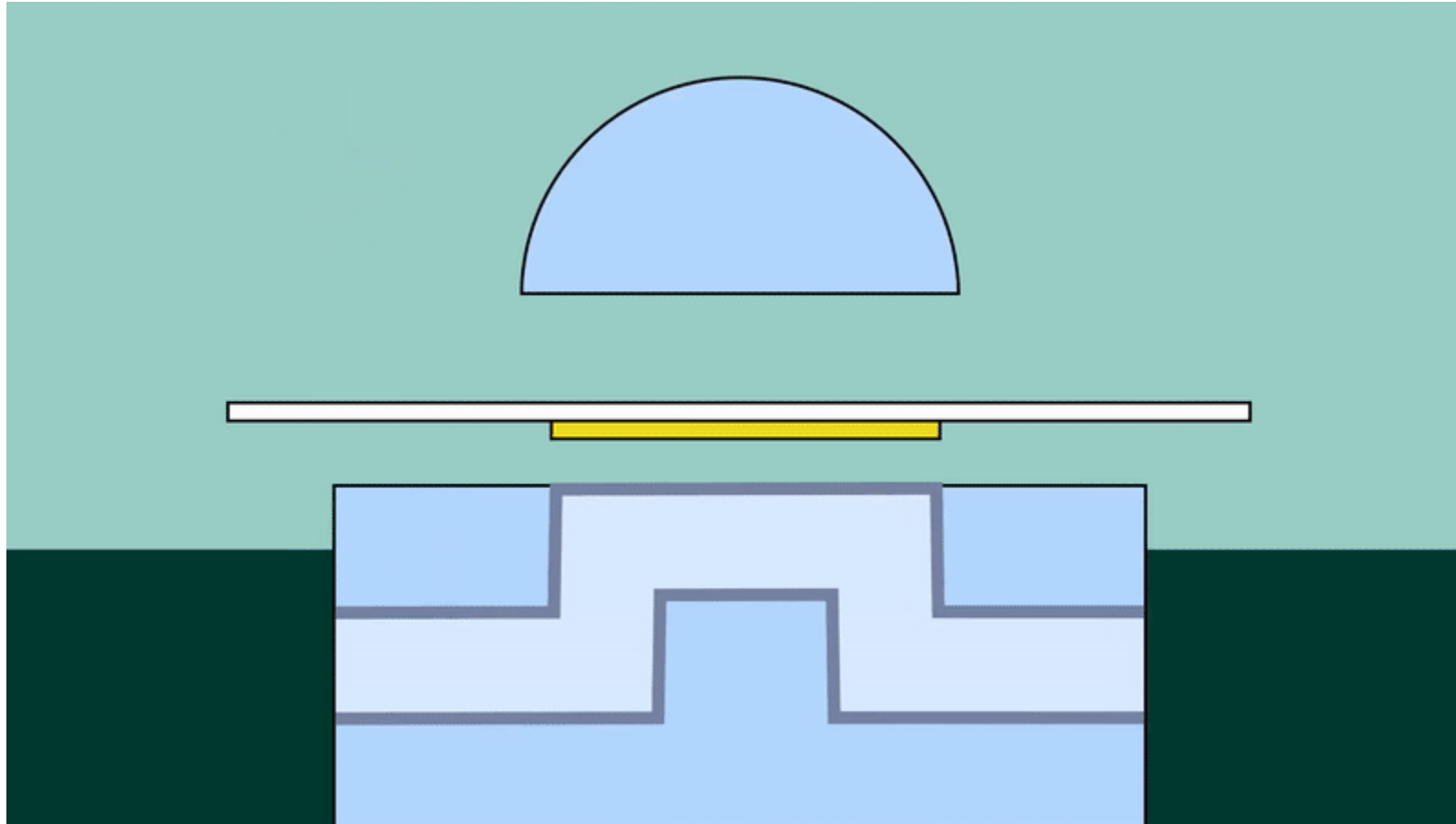**Reflection angle**

Binding Events Shift Dip

Binding Events Shift Dip

Ligands on surface shift dip

Plasmons

Light source

Detector

Light intensity

Reflection angle

Binding Events Shift Dip

Analyte binding shifts dip

Plasmons

Light source

Detector

Light intensity

Reflection angle

Binding Events Shift Dip

Analyte unbinding Shifts dip
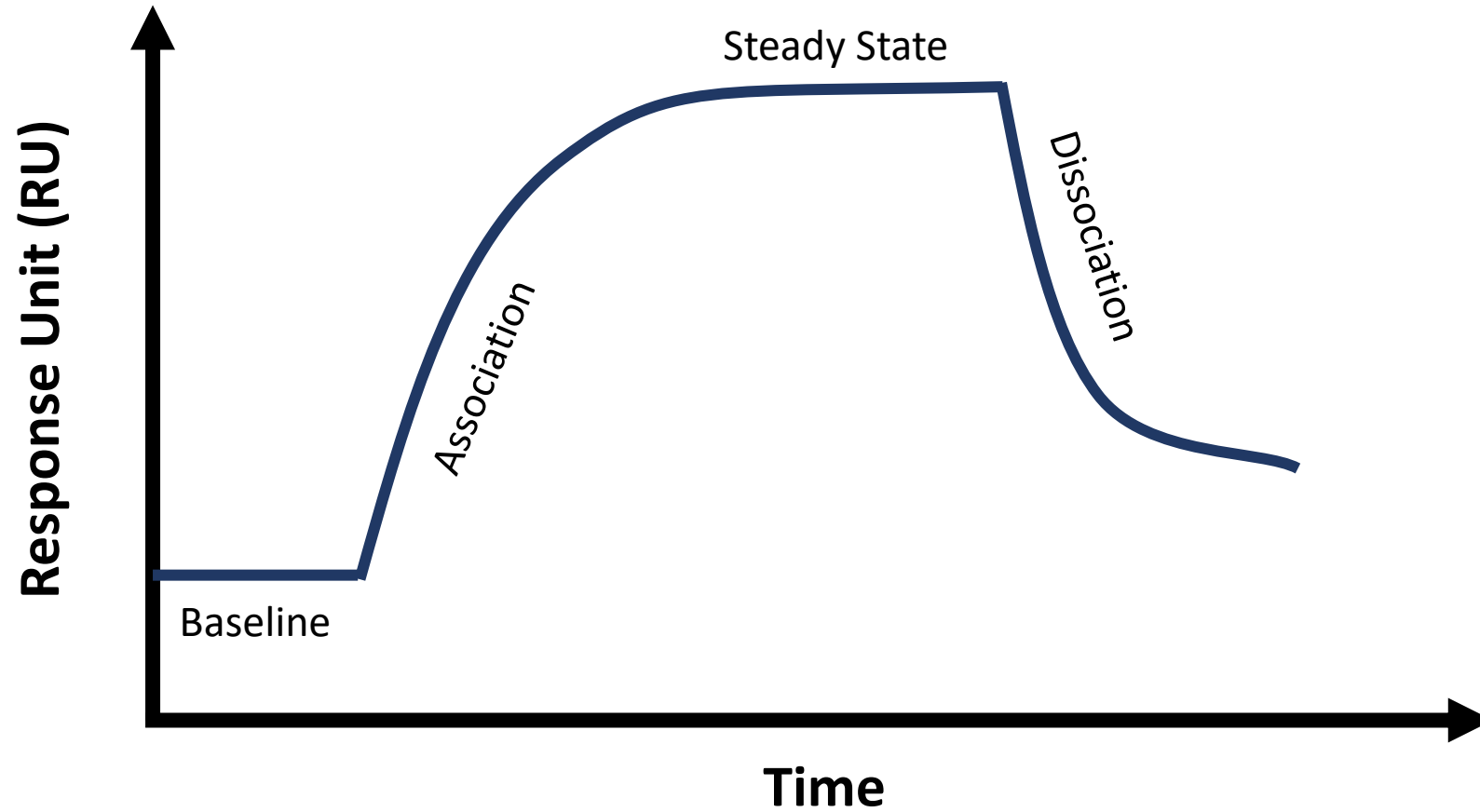
Plasmons

Light source

Detector

Light intensity

Reflection angle
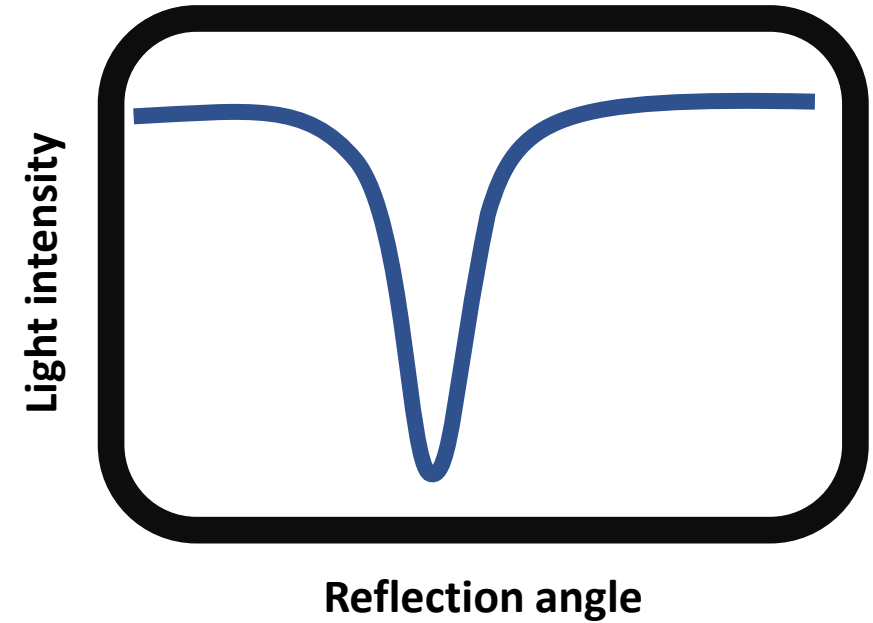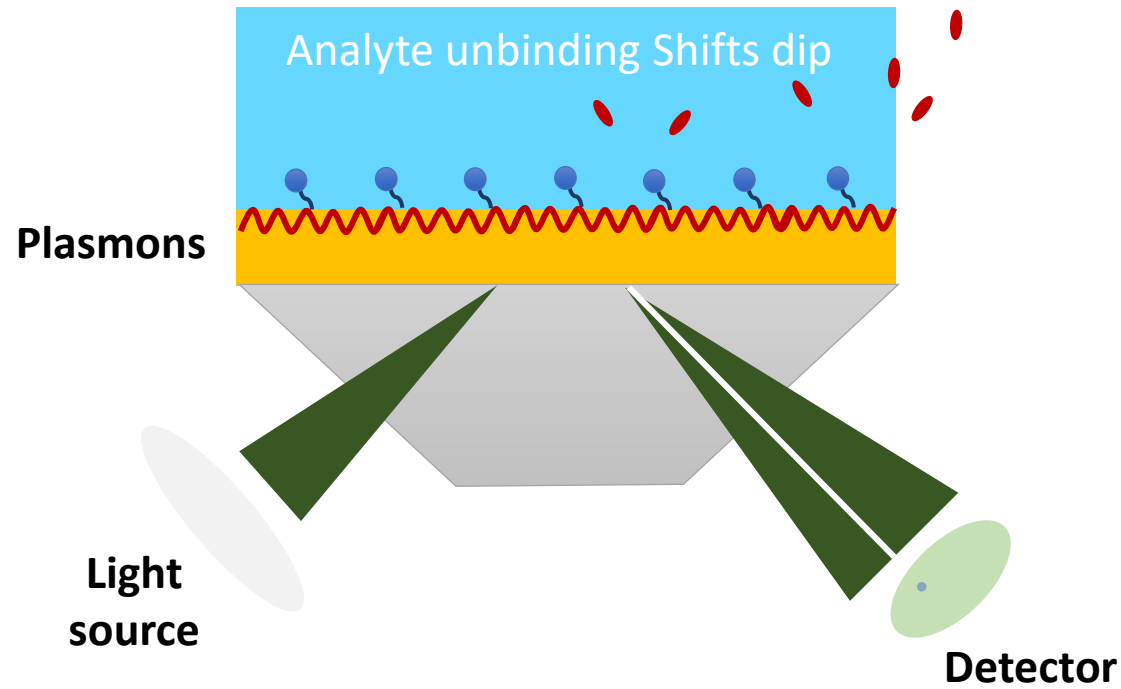
Overall Interaction

Dips to Responses

SPR sensor configuration

Prism coupler based SPR system

Grating coupler based SPR system

Flow channel

Grating

Optical Waveguide based SPR system

grating

light wave

wave guide
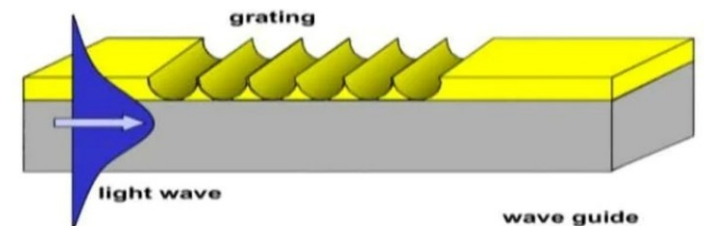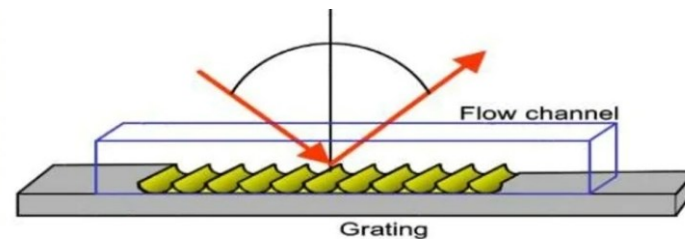
Applications

- Development of biosensors
- Pathogen detection
- Molecular diagnostics
- DNA-RNA interactions
- DNA-Protein interactions
- Protein-Protein interactions

Limitations

- SPR detection relies of mass changes
- SPR detection decreases exponentially with distance from surface
- Estimated detection limit ~ 200nm
- Limited choice of metal (Au, Ag)
- Sample preparation and probe attachment to metal surface can be difficult
- Refractive index is temperature dependent

Thank You!