Lumera Corporation

MOLECULAR PLASMONICS

MICRO NANO BREAKTHROUGH CONFERENCE

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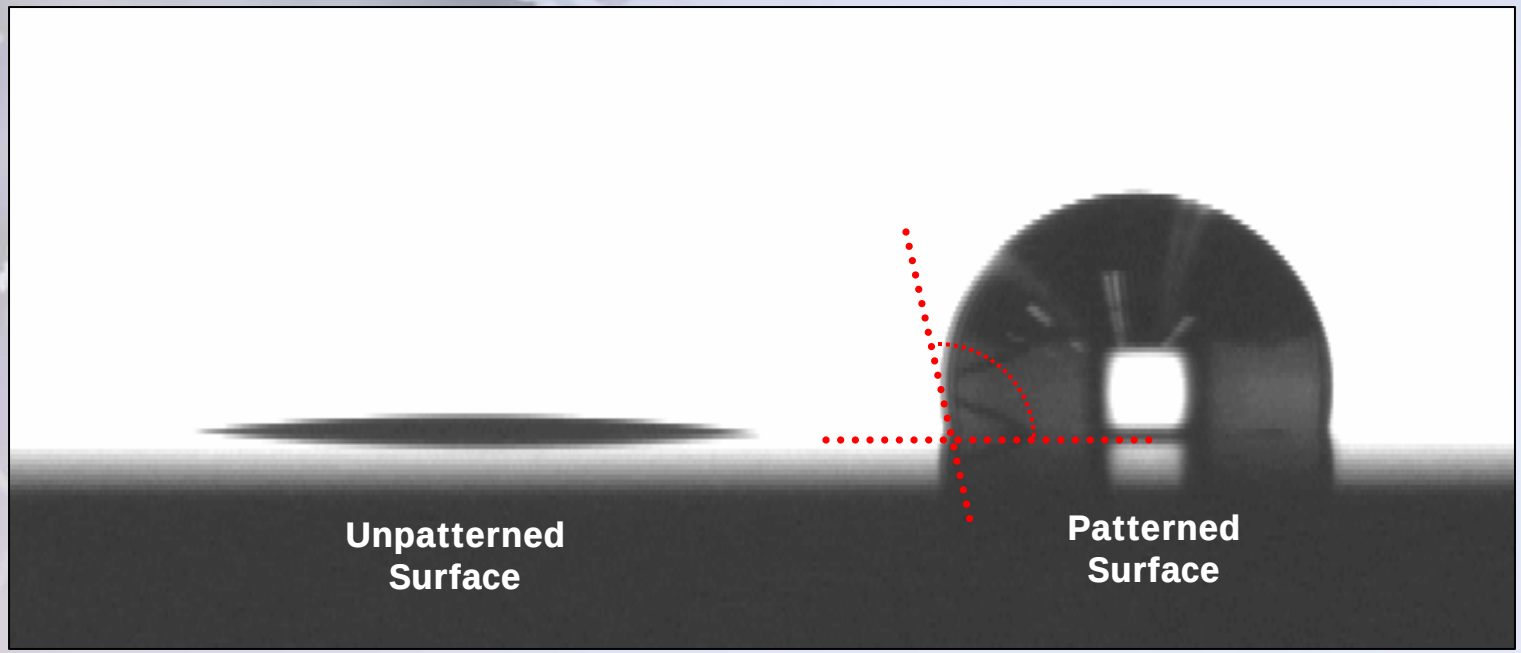
HOW DO YOU CREATE A BIOLOGIC MICRO REACTOR ARRAY AND PLASMONICS ANALYSIS PLATFORM?

- BUILD AN ARRAY OF SURFACE TENSION MICRO REACTORS ON A CHIP SURFACE
- UTILIZE A NOVEL PROTEIN BINDING SURFACE CHEMISTRY THAT ALLOWS PROTEIN TRANSLATION AND CAPTURE WITHIN THE MICRO REACTORS
- DEVELOP A MINATURE SURFACE PLASMON RESONANCE (SPR) READER WHICH CAN DETECT AND MEASURE BIOLOGIC EVENTS IN REAL TIME IN THE MICRO REACTORS

How Do you Build a Biologic Micro Reactor Array



- Contact Angle = 110°
- Sample is isolated in the well
- more analyte per unit area

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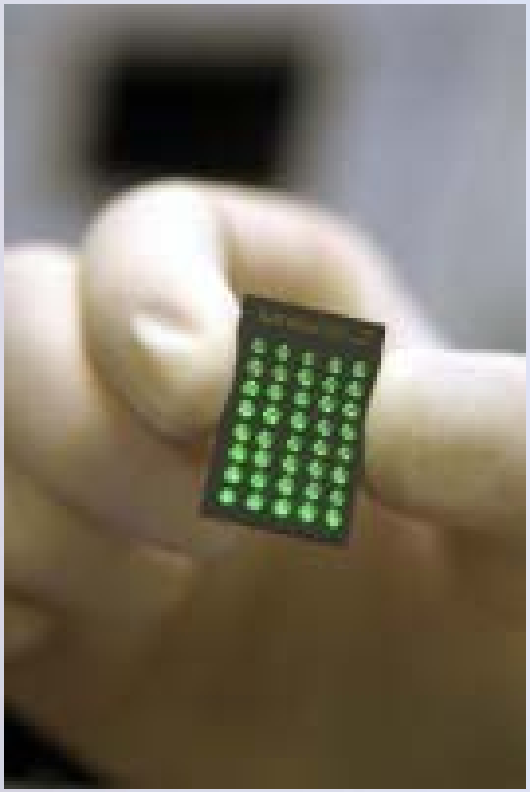
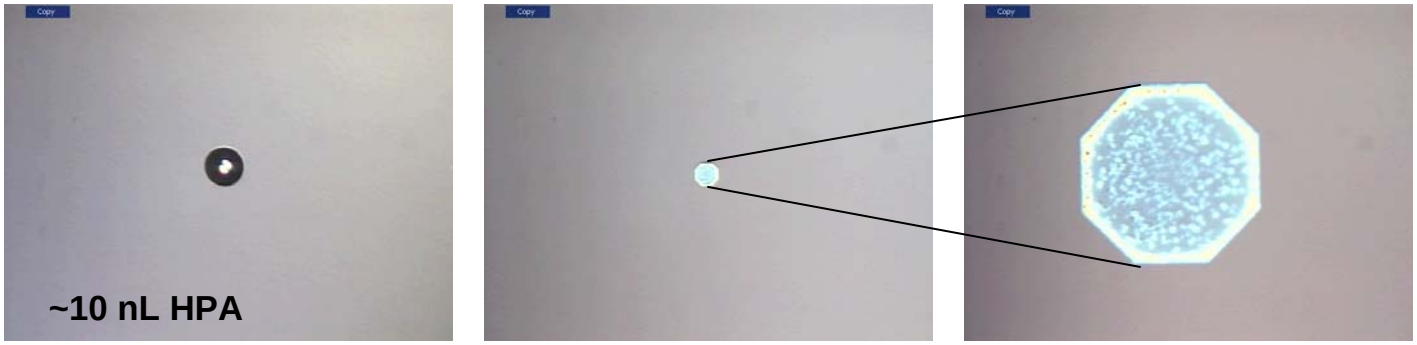
What is NanoCapture™ ?

- Surface Tension based wells



MALDI Ready Array



- Surface tension based wells via patterned self assembled monolayers (SAMs)
  - **Hydrophobic** coating surrounds the **Hydrophilic** SiOx
    - Control of crystal morphology – critical for MALDI
    - No cross contamination
    - Enhanced resolution – spot morphology

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What is Molecular Plasmonics?

- The interaction of light with nanostructured materials in which the electrons are disturbed by impinging light and various physical changes can be observed (such as reflectivity) at the nanostructure molecule interface.

Why Surface Plasmon Resonance

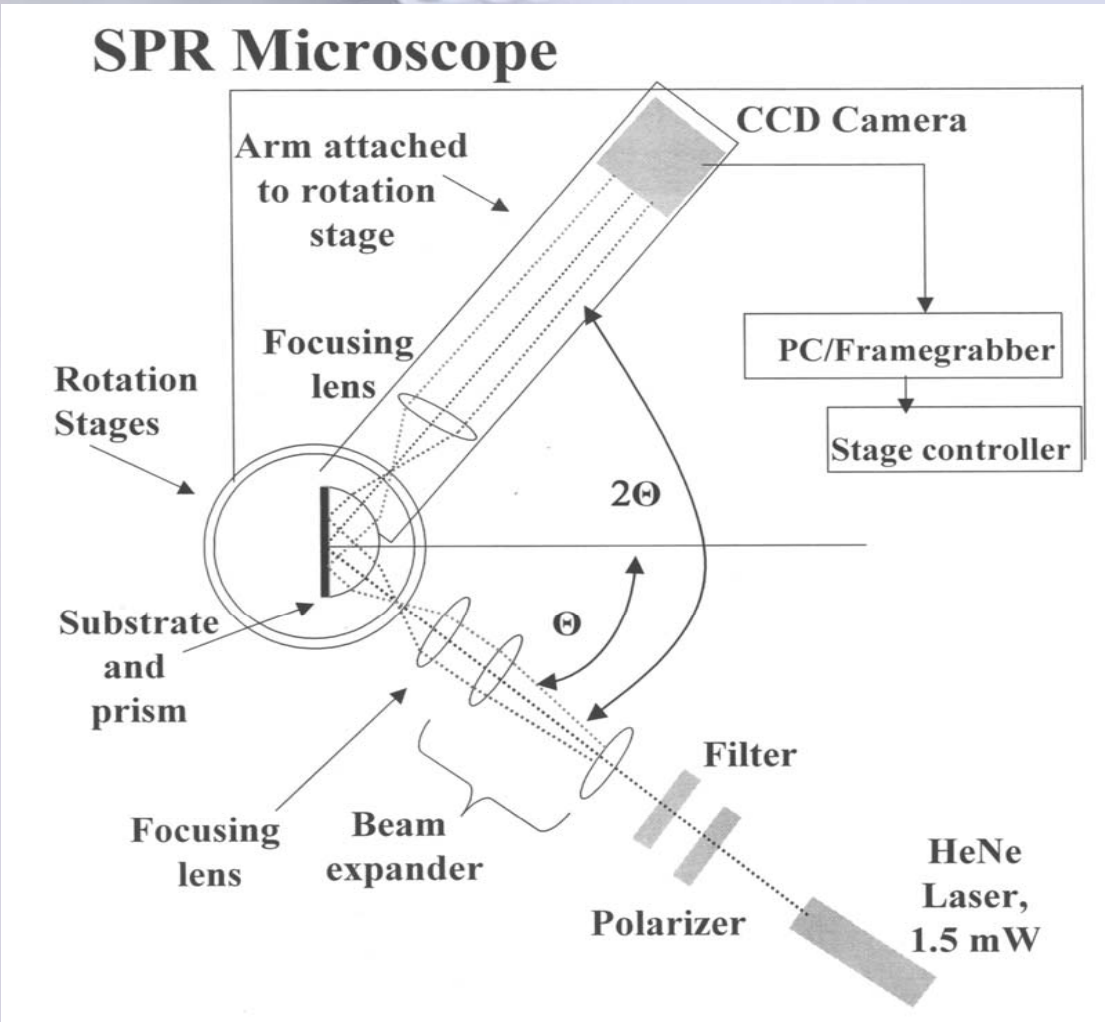
- Only technique at the present time that allows label free detection of protein analyte interactions

- Provides kinetic data (binding constants) that helps;

  understand drug efficacy

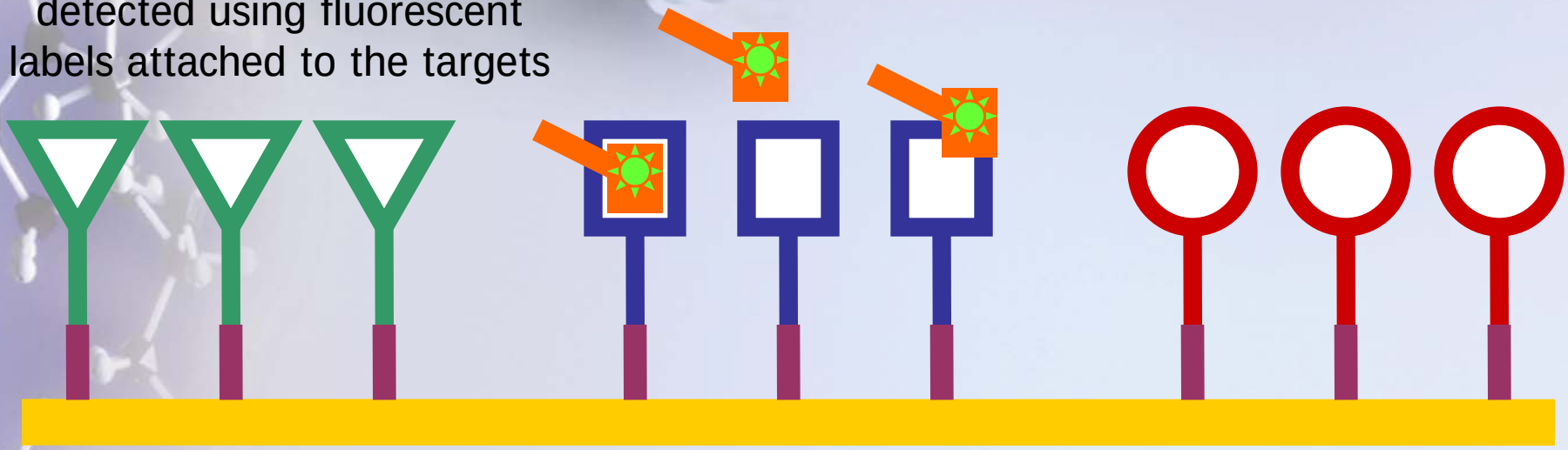
  reactions observed in real time

How Does SPR Work?



Conventional Biological Microarray Screening

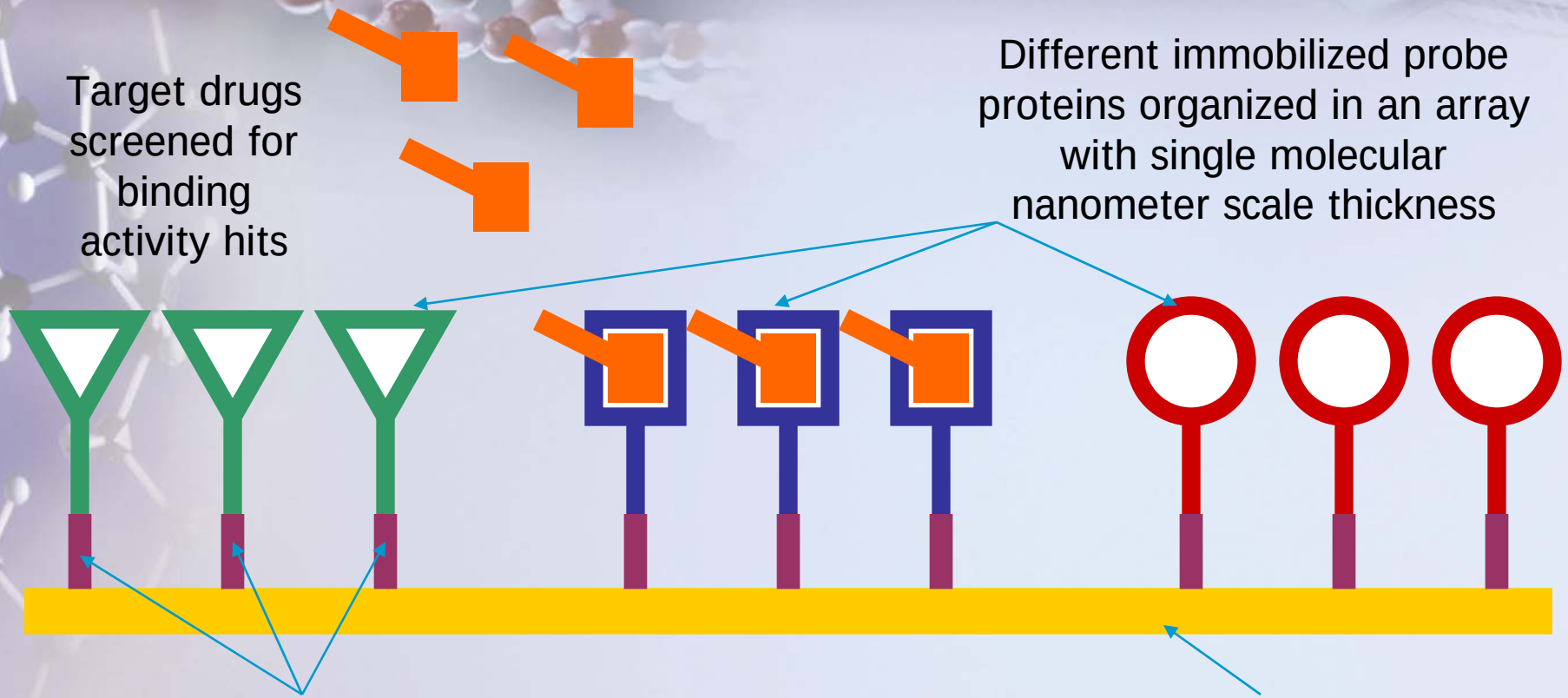
Hits are commonly optically detected using fluorescent labels attached to the targets



Fluorescent labels....

- affect the activity of the target such that binding may be inhibited whereas the opposite result would be observed if un-labeled
- are observed after the binding event such that events cannot be monitored in real time
- are not completely developed in the burgeoning field of proteomics

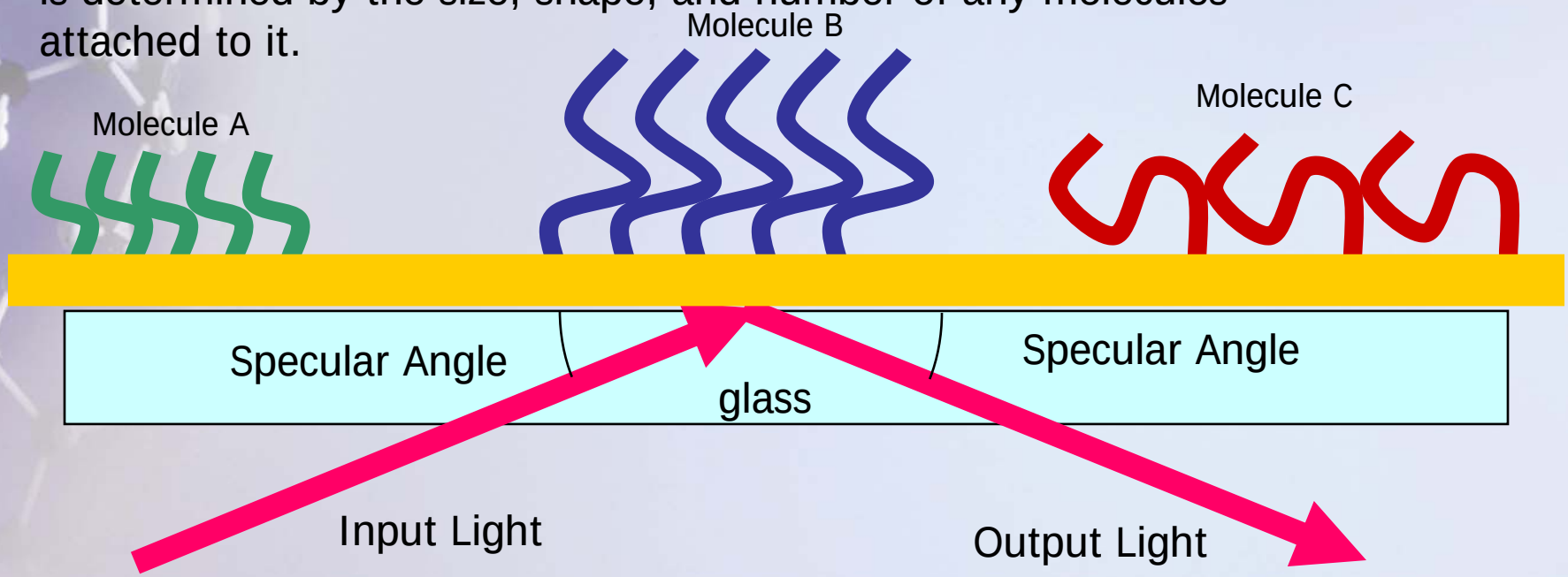
Biological Microarray Screening



Biological Macromolecule Microarray Screening

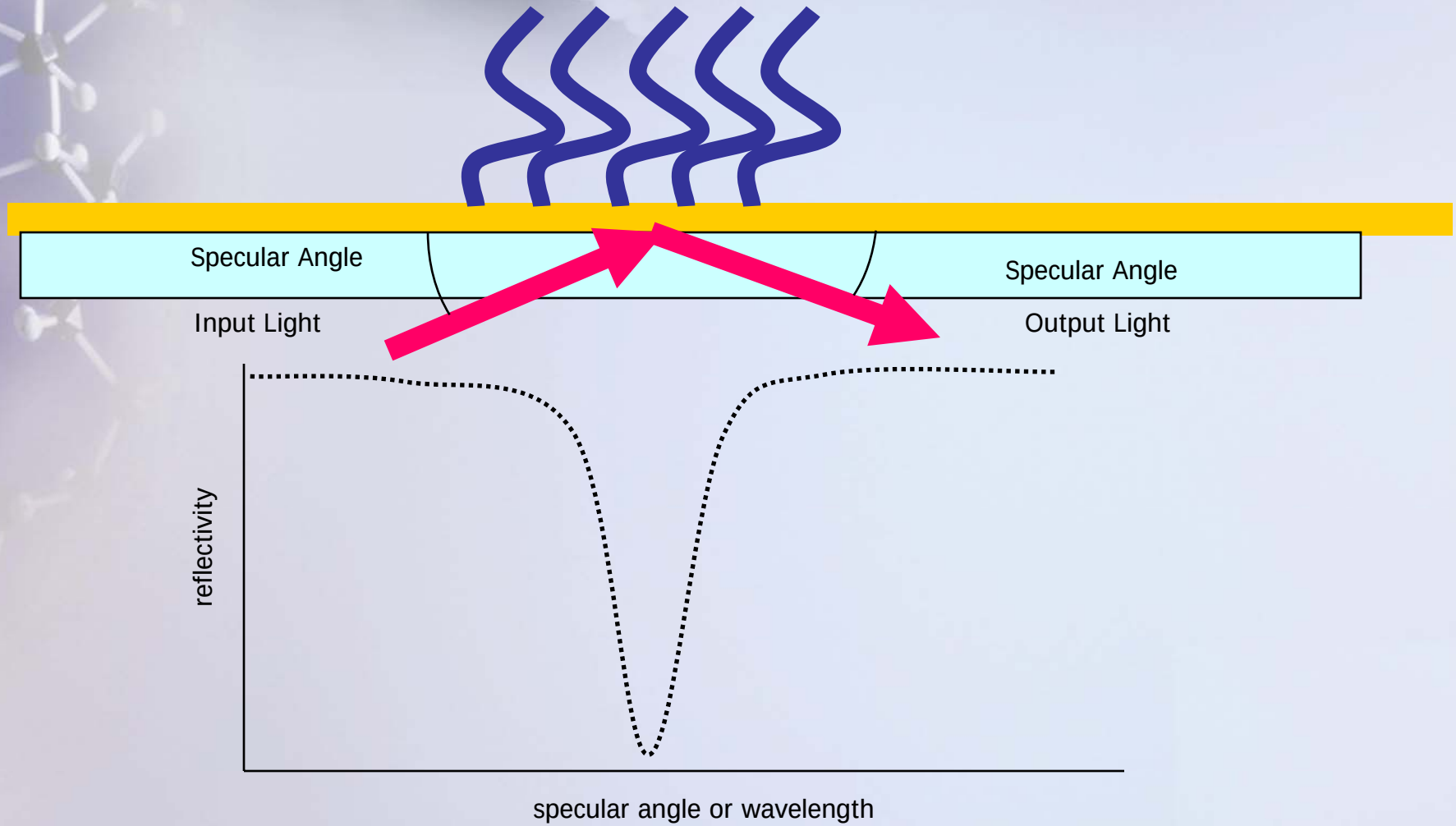
Another method is available for molecular detection at the nano-sale:
Surface Plasmon Resonance

Net Effect: The optical reflectivity of a nanometer scale metal thin film is determined by the size, shape, and number of any molecules attached to it.

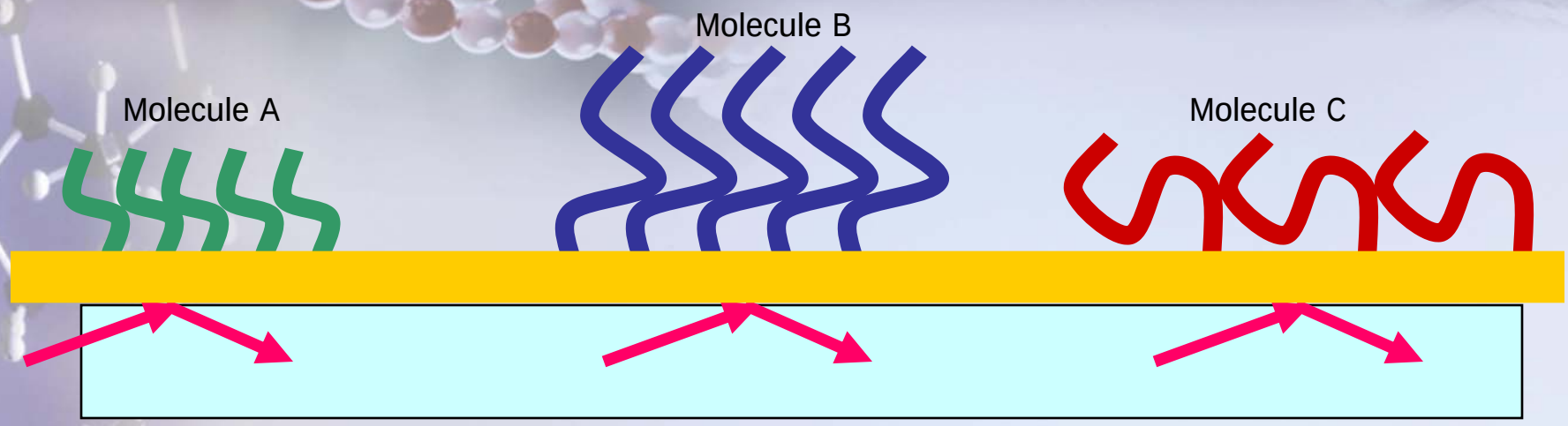


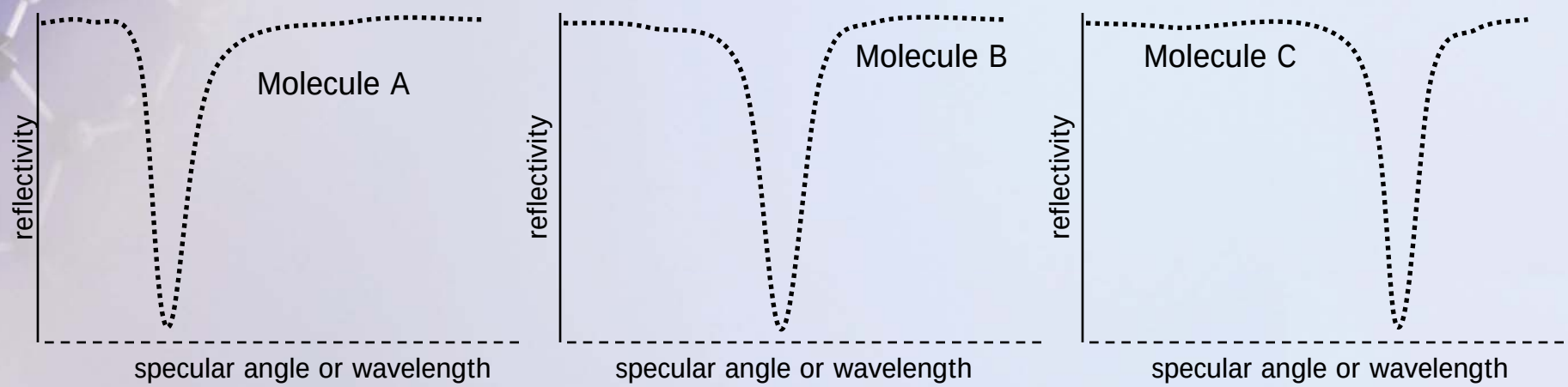
Reflectivity = Output Light Intensity ÷ Input Light Intensity

Surface Plasmon Resonance: At some particular specular angle or wavelength, most of the input light energy will be converted to a plasmon (a charge density wave in the metal)

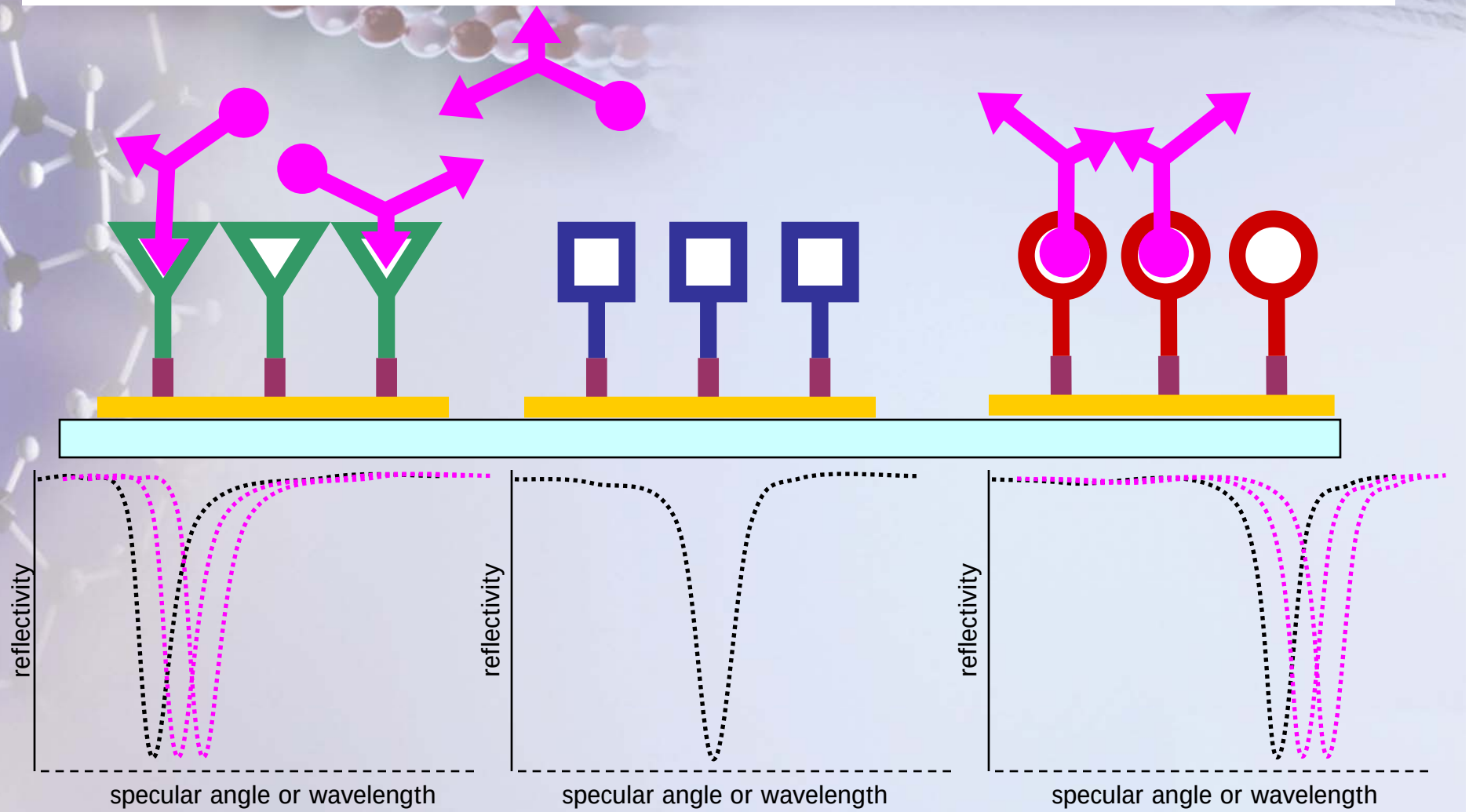


The reflectivity minimum is a function of the specific molecule





By monitoring the SPR curves over time, binding events can be tracked



SPR Protein Immunoassay

EXPERIMENT #1

after anti-BSA IgG binding

EXPERIMENT #2

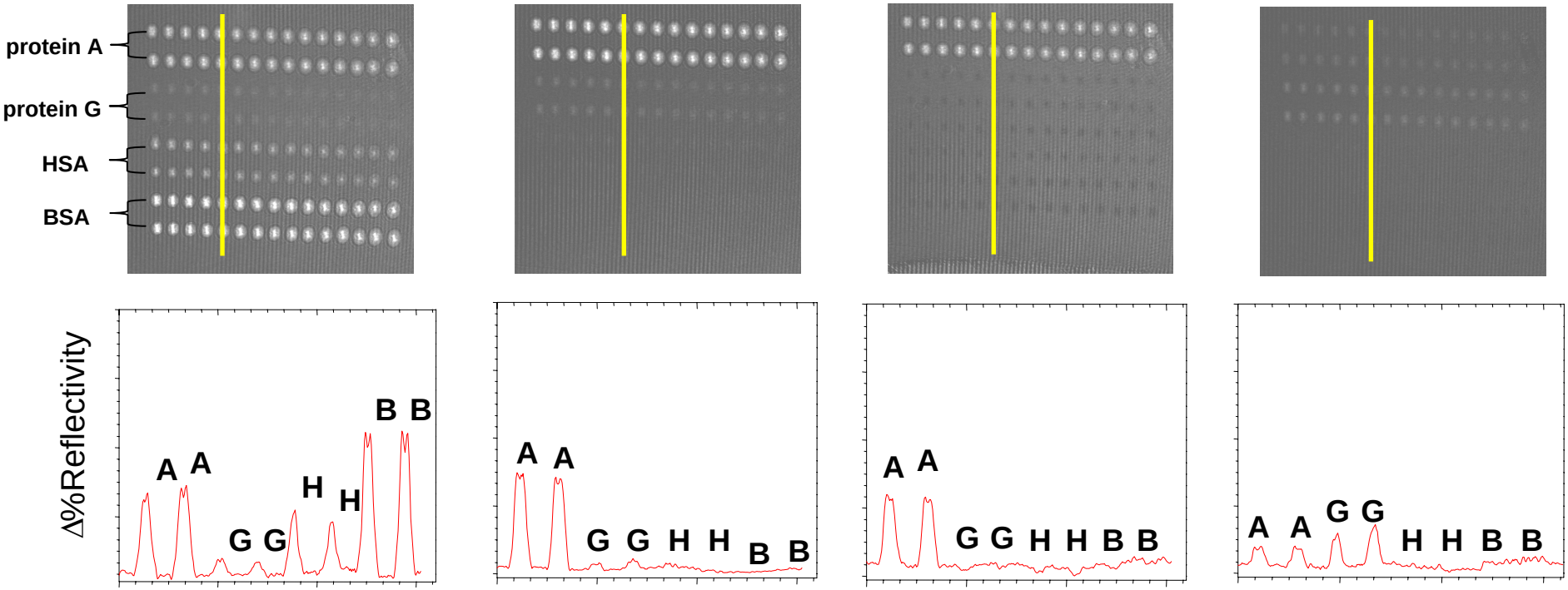
after human IgG binding

EXPERIMENT #3

after cat IgG binding

EXPERIMENT #4

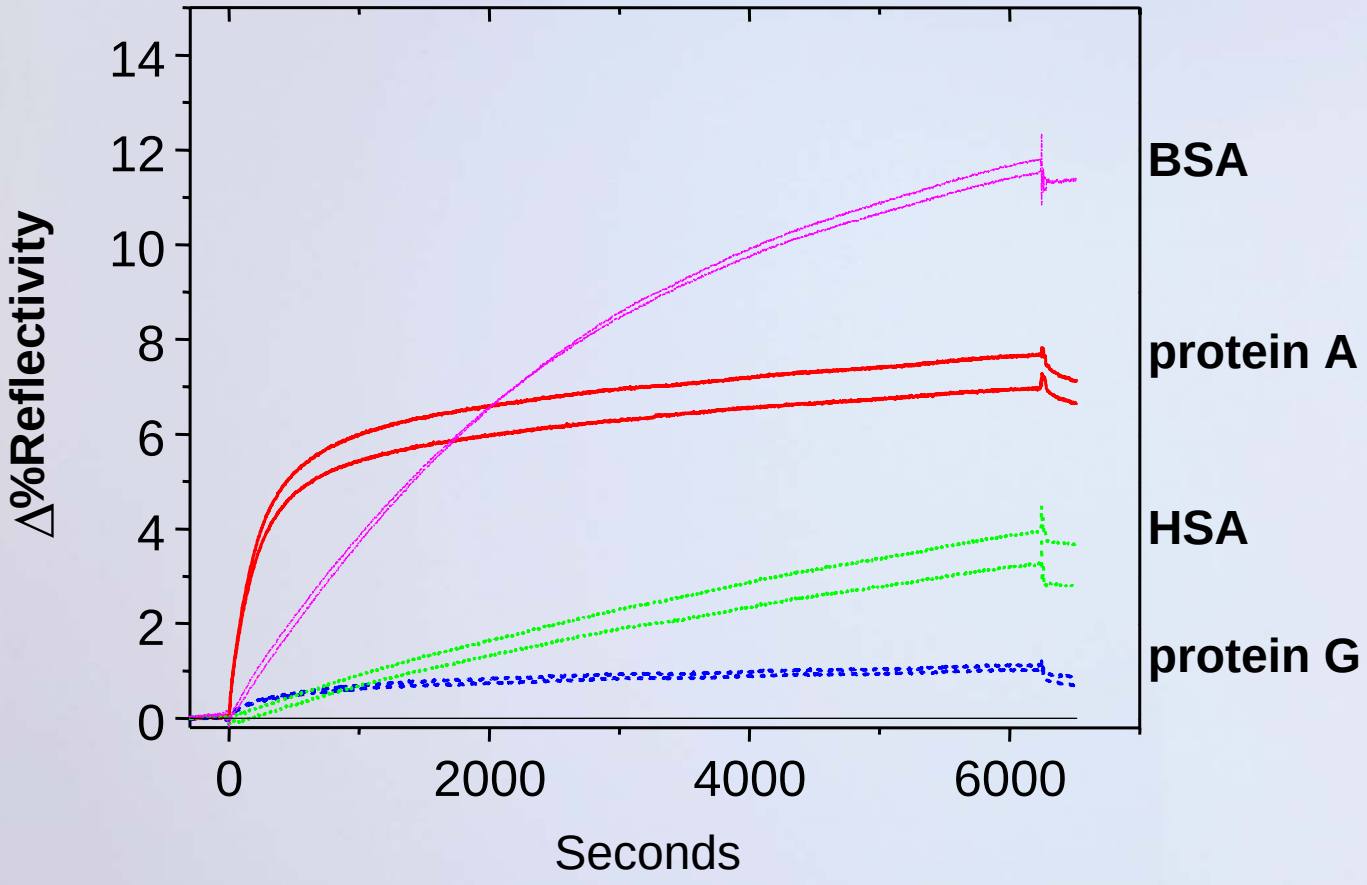
after sheep IgG binding



IgG binding Kinetics

Binding of anti-BSA IgG

(Experiment #1)



Conclusions

- Self assembled monolayers can be used to create micro biologic reaction sites on a chip.
- Proteins can be expressed and captured on a chip surface for subsequent analysis.
- SPR can be used for label free detection and kinetic analysis of biologic events on a 2 D surface.
- SPR can be miniaturized and scaled to read up to 100,000 spots on a single chip.

Lumera Team

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