Smart microarray platforms for understanding biochemical interactions

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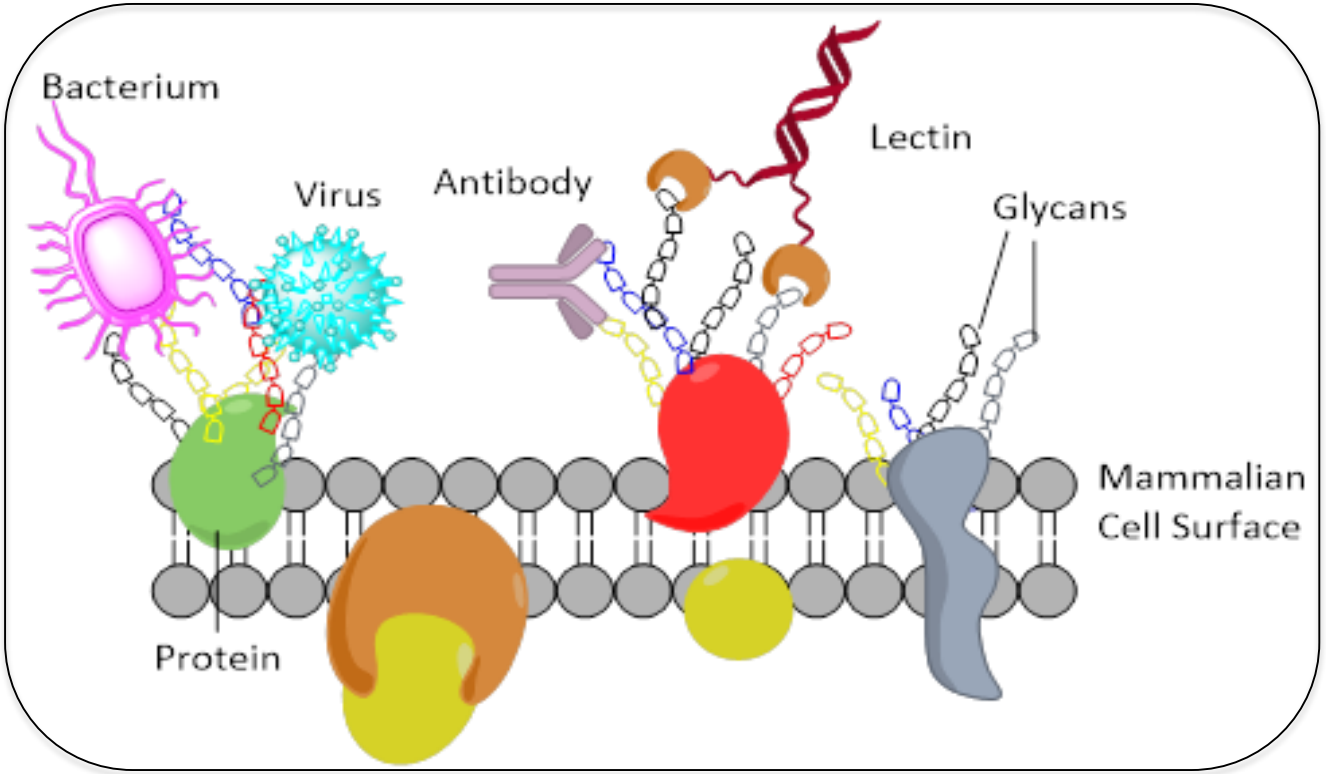
Protein-carbohydrate interactions

Cell signalling

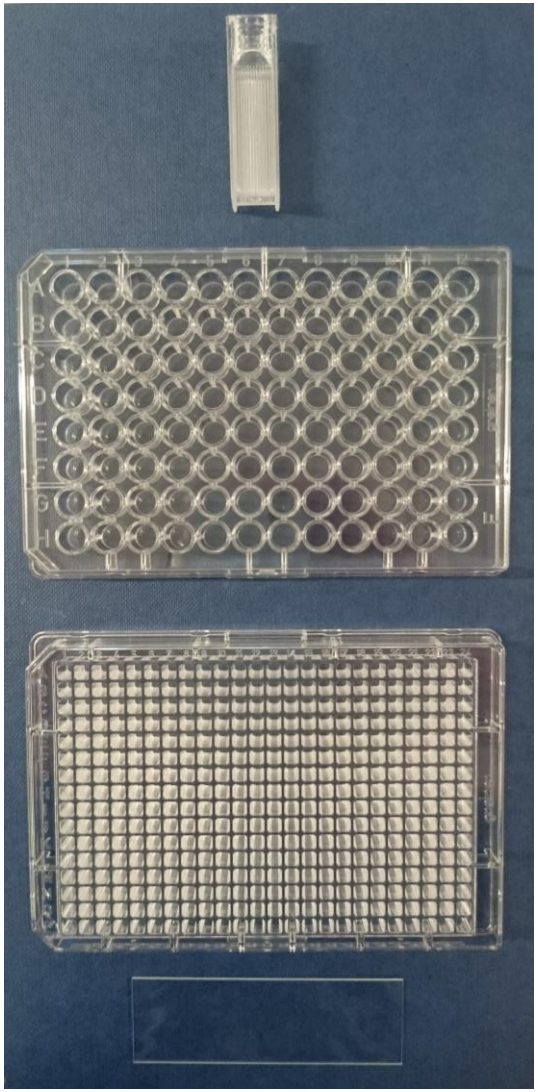
Fertilisation

Inflammation



Cellular adhesion of: Viruses, Bacteria,Toxins

Increasing information density



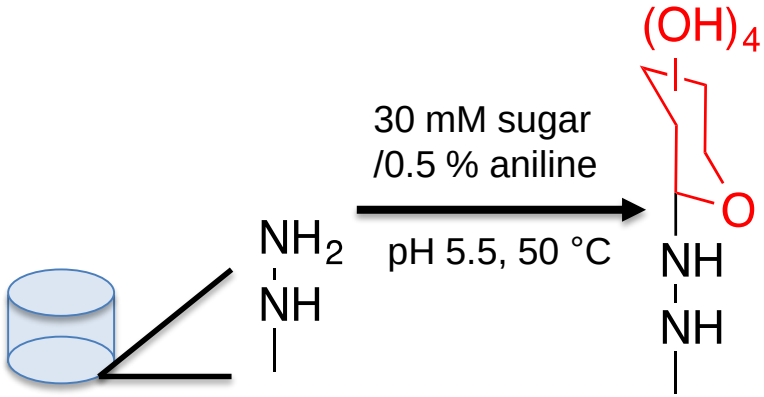
1

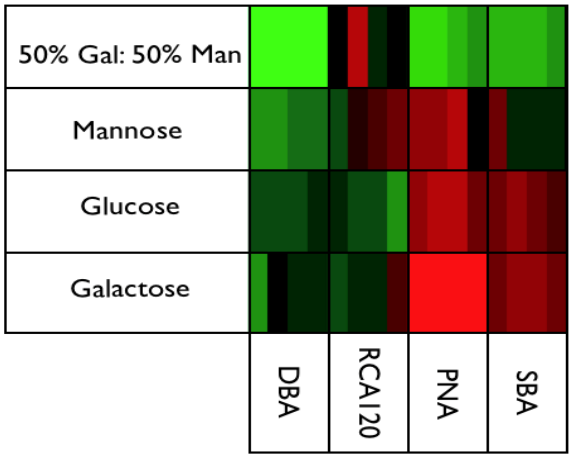
96

384

1000

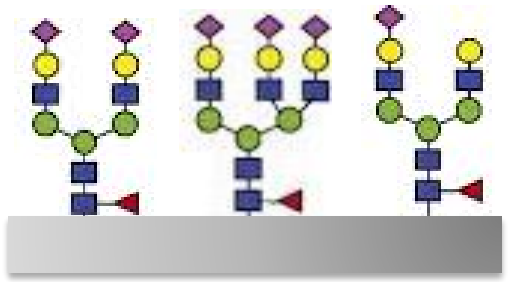
Importance of high density for lectin/ bacteria discrimination



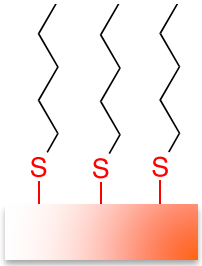


Otten, L.C., Gibson, M.I. RSC Advances, **2015**, 5, 53911 - 53914

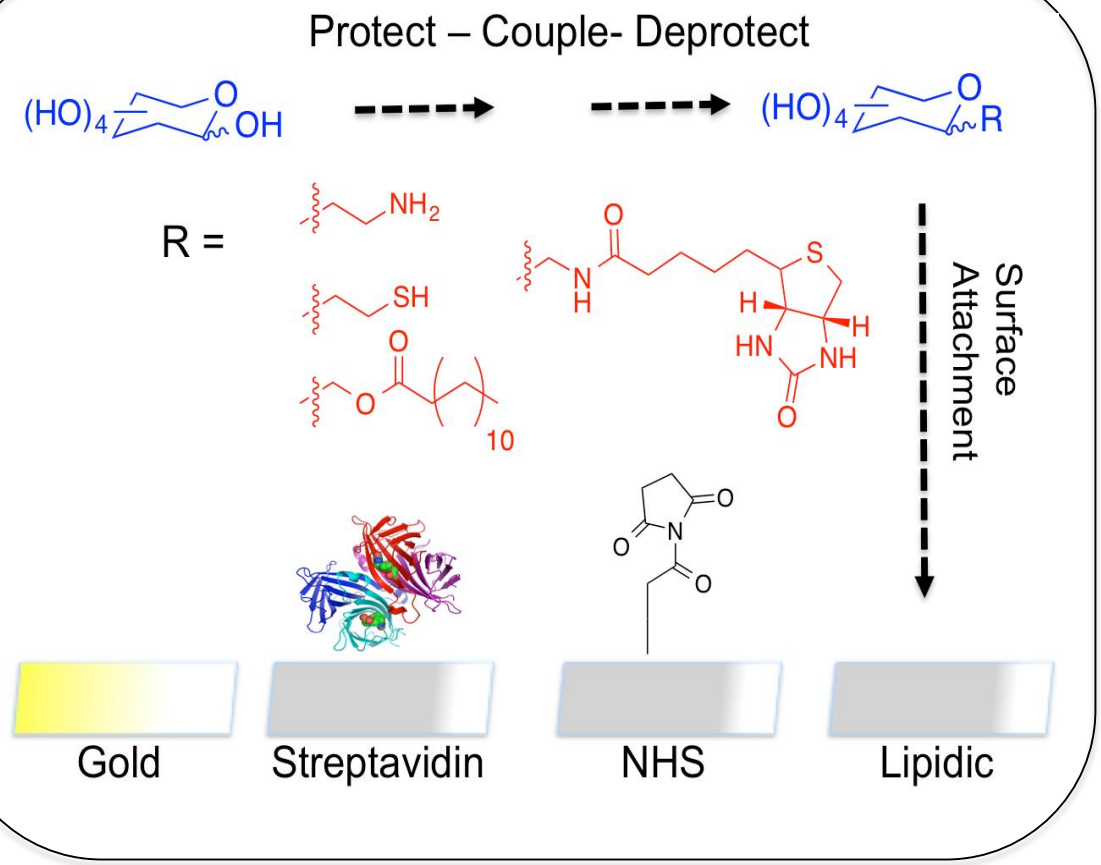
Carbohydrate microarrays



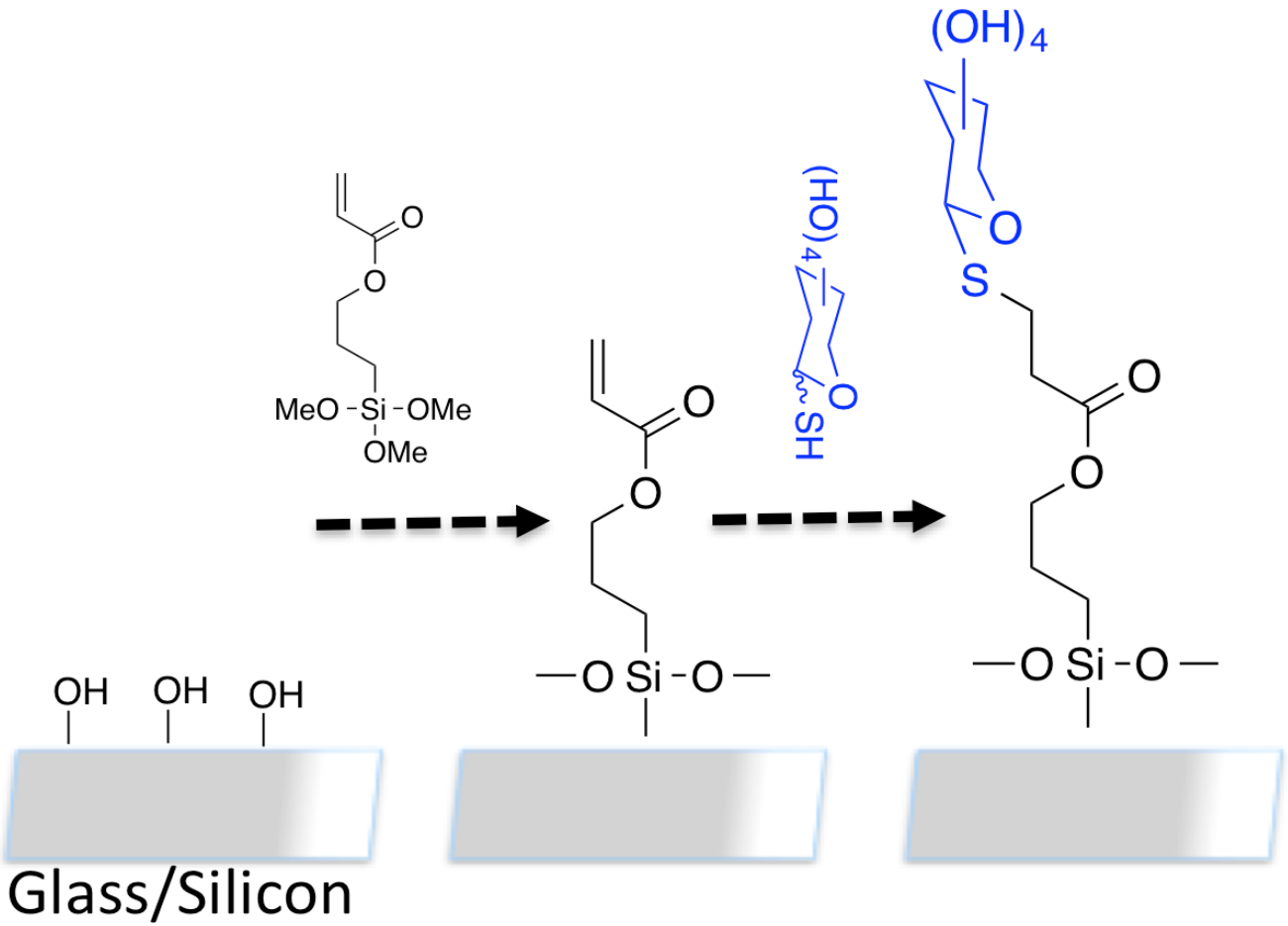
Thiol-Gold



- Easy
- Orthogonal
- Versatile



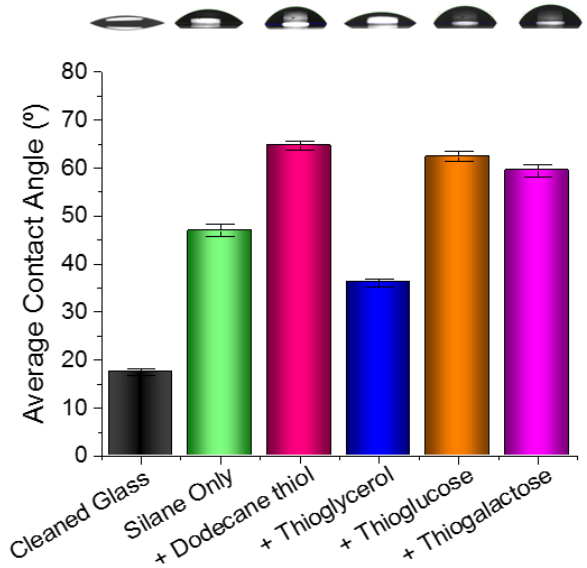
Easy thiol-ene "click" fabrication of carbohydrate arrays onto glass or silicon surfaces



Biggs, C.I.; Edmondson, S.; Gibson, M.I.; *Biomaterials Science,* **2014**, 3, 175–181

Surface analysis

A



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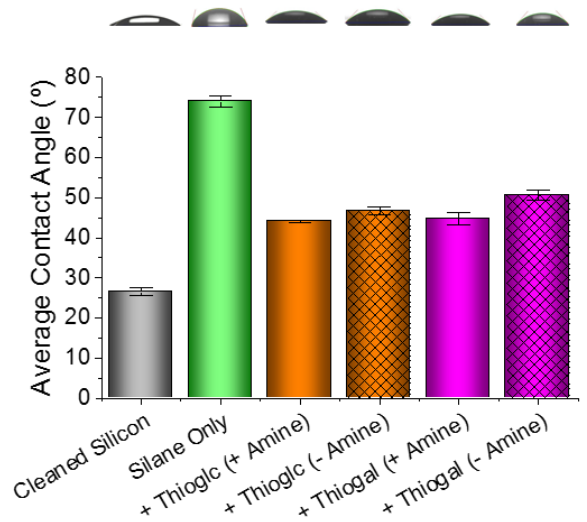

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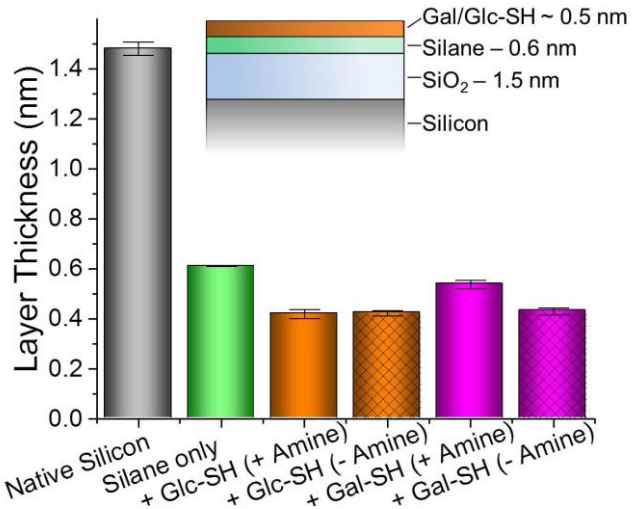
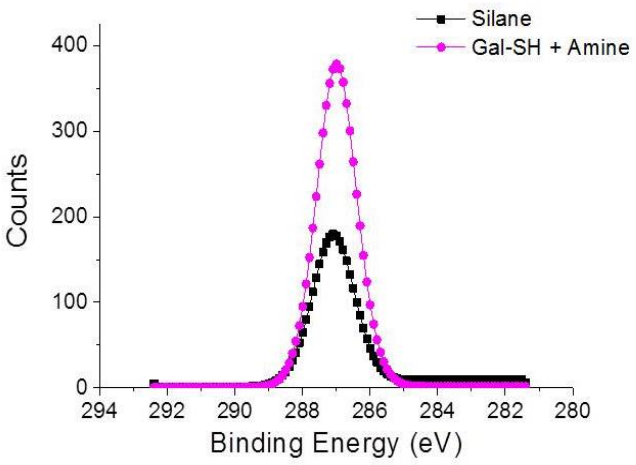
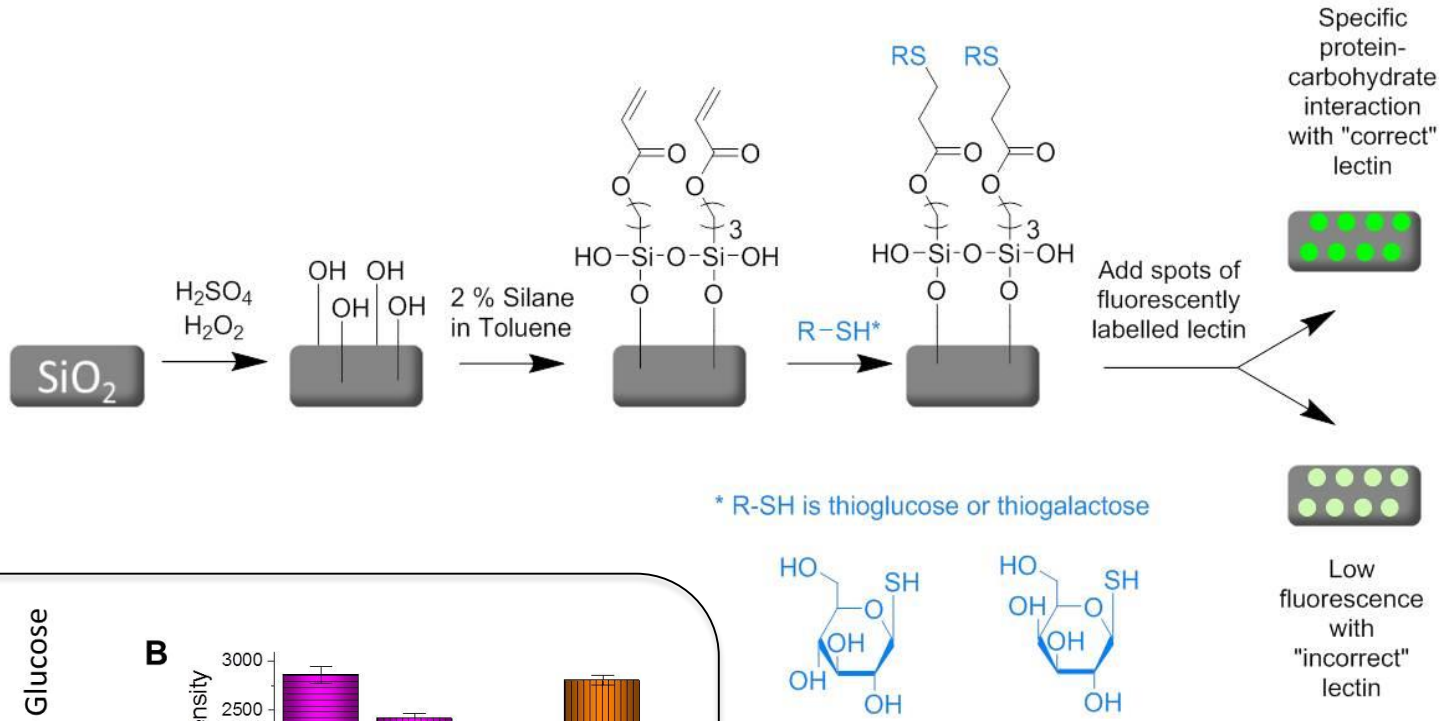


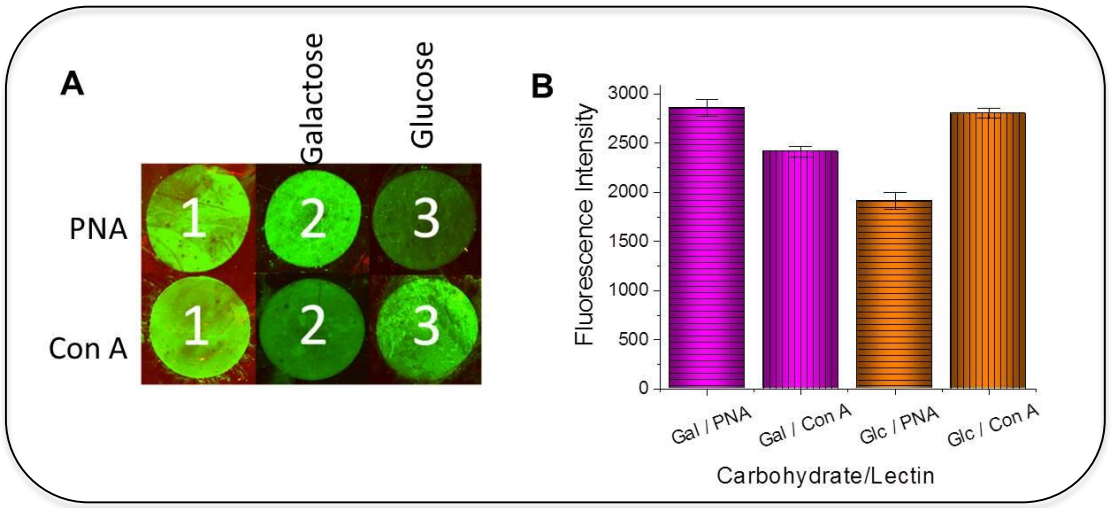
D



Biggs, C.I.; Edmondson, S.; Gibson, M. I.; *Biomaterials Science,* **2014**, 3, 175–181

Compatibility with current microarray technology





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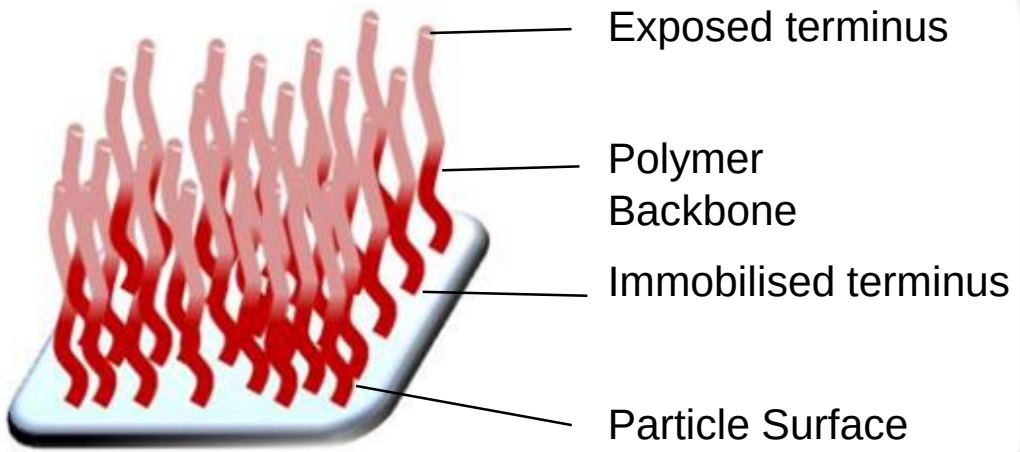
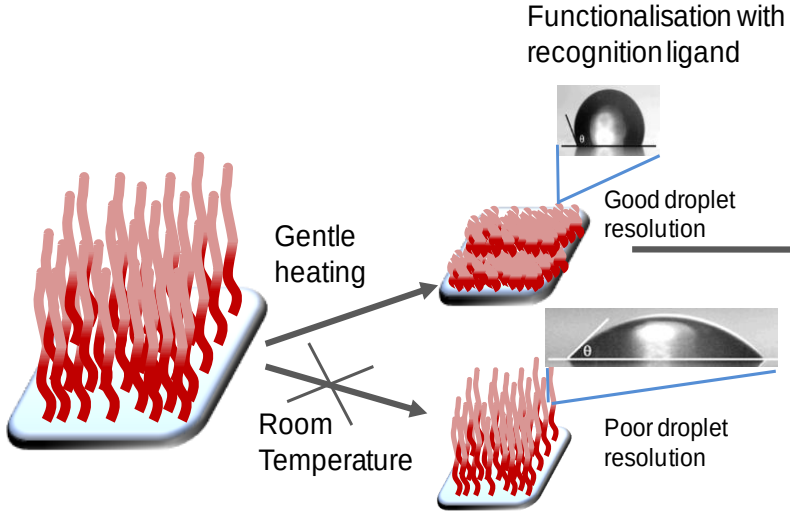
Using polymer tethers



Above Critical Temperature

- Hydrophobic surface
- Small defined spots
- High resolution



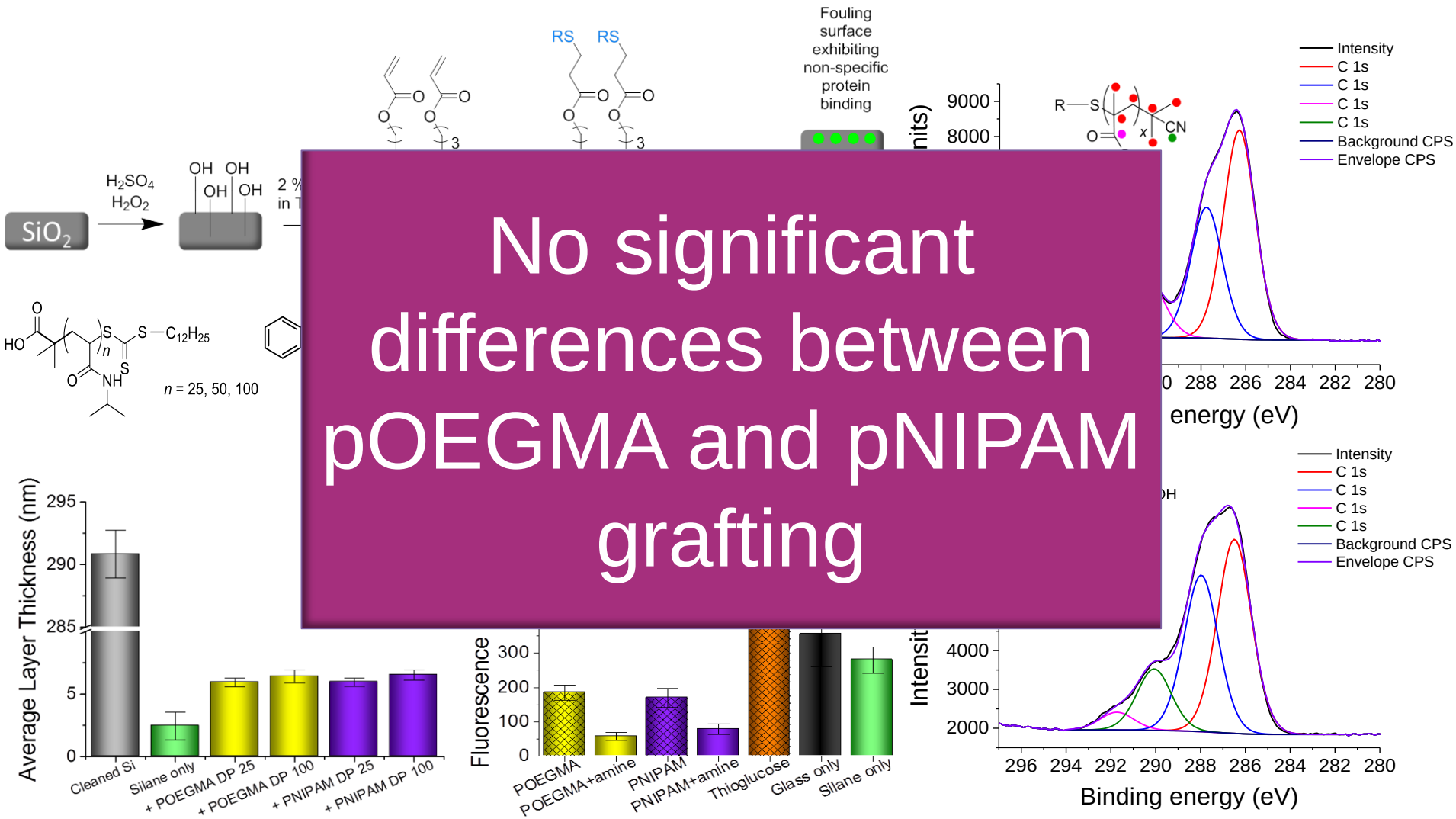
- *Aid protein-carbohydrate interactions*
- *Reduce non-specific interactions*
- *Potential thermoresponsive behaviour*

Below Critical Temperature

- Hydrophilic surface
- Non-fouling
- Reduce false-positives

Biggs, C.I.; Walker, M.; Gibson, M.I.; *Biomacromolecules,* **2016**, DOI: 10.1021/acs.biomac.6b00662

Which polymers to use?

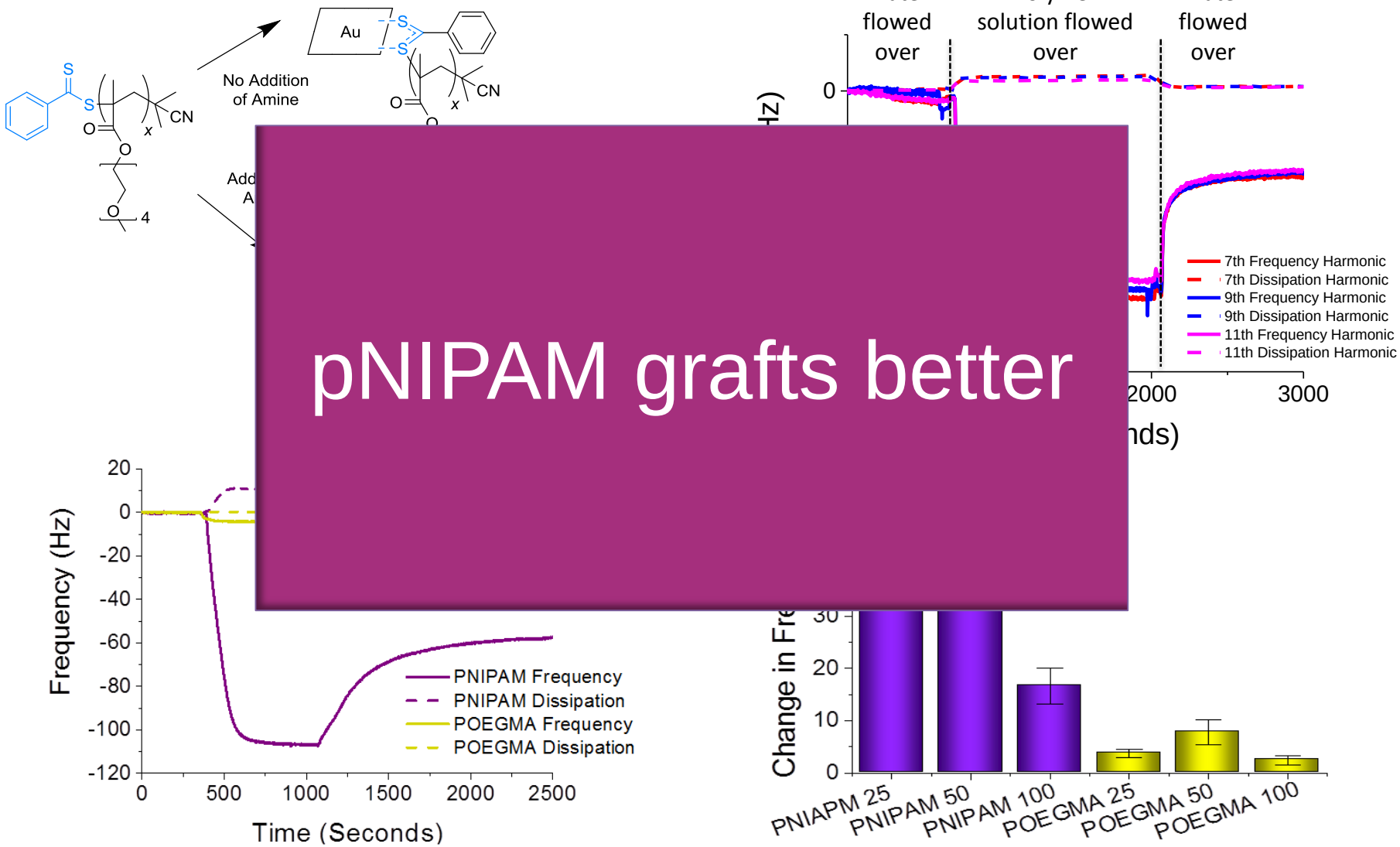


No significant differences between pOEGMA and pNIPAM grafting

With fluorescent-labelled Con A

Biggs, C.I.; Walker, M.; Gibson, M.I.; *Biomacromolecules,* **2016**, DOI: 10.1021/acs.biomac.6b00662

pOEGMA vs pNIPAM by QCM-D



pNIPAM grafts better

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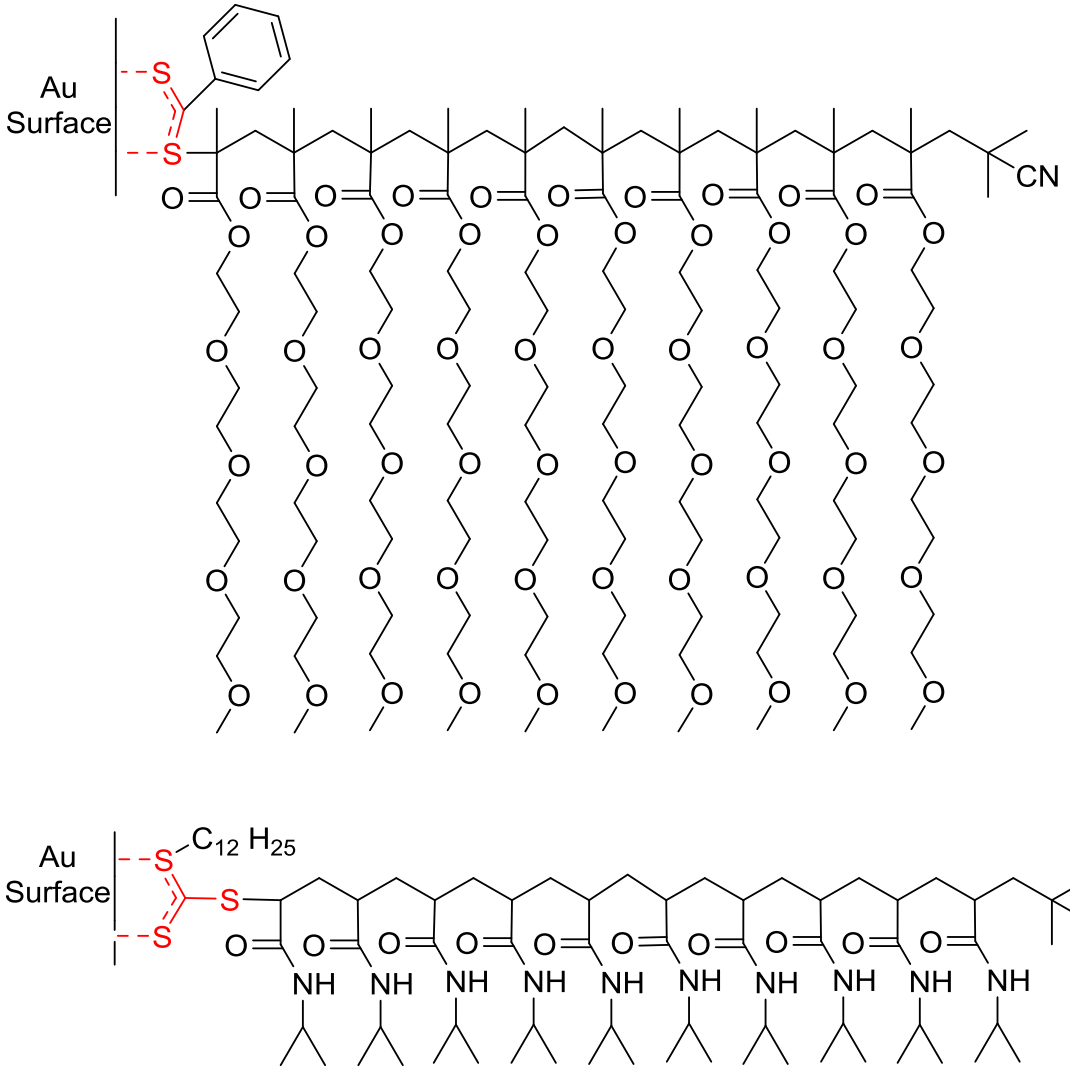
pNIPAM grafts better than pOEGMA



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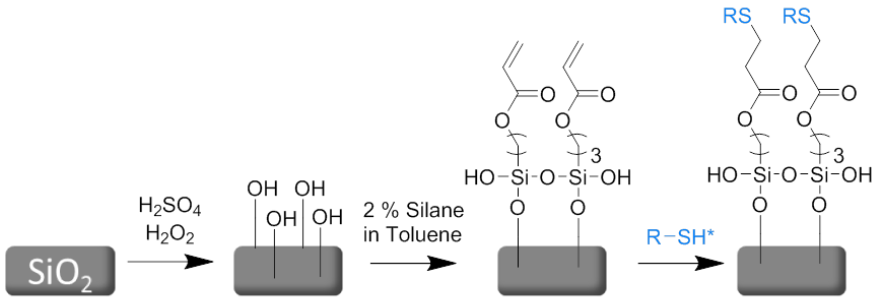
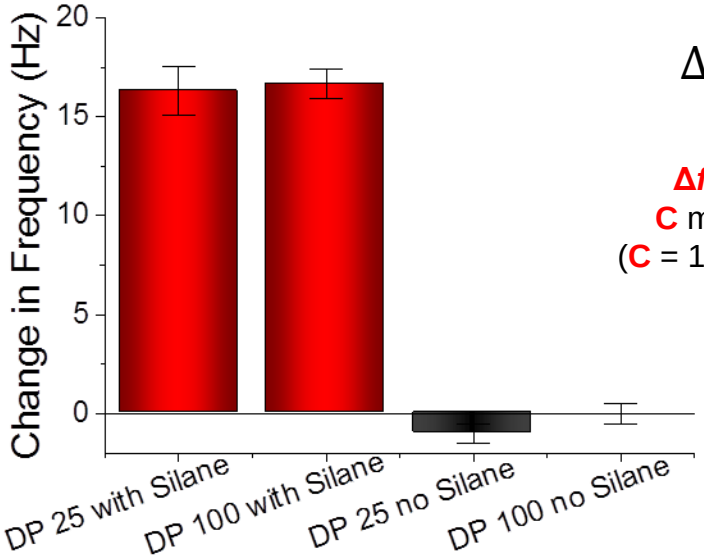
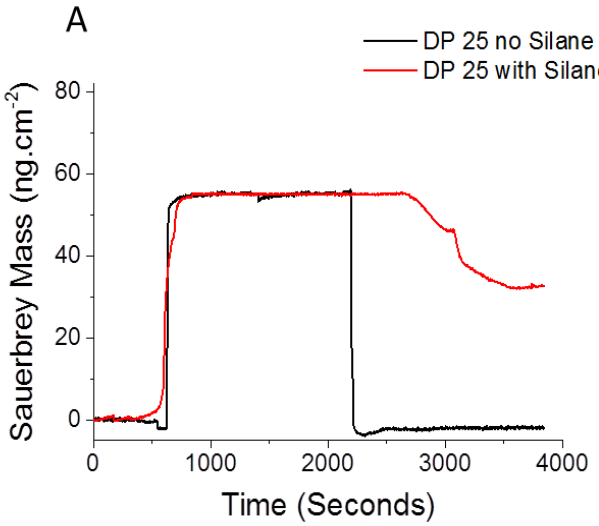
pNIPAM onto SiO_2 by QCM-D

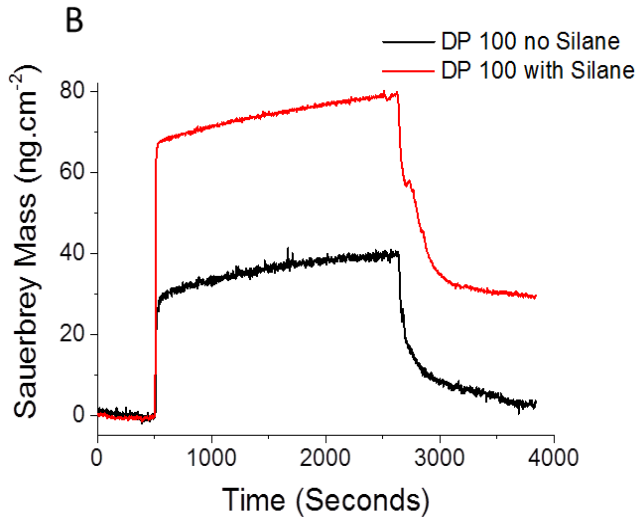




$$\Delta m = \frac{-\,C\,\Delta f_n}{n}$$

Δf_n change in frequency
C mass sensitivity constant
(**C** = 17.7 ng.cm^{-2}.Hz^{-1} at 5 MHz)
n overtone number





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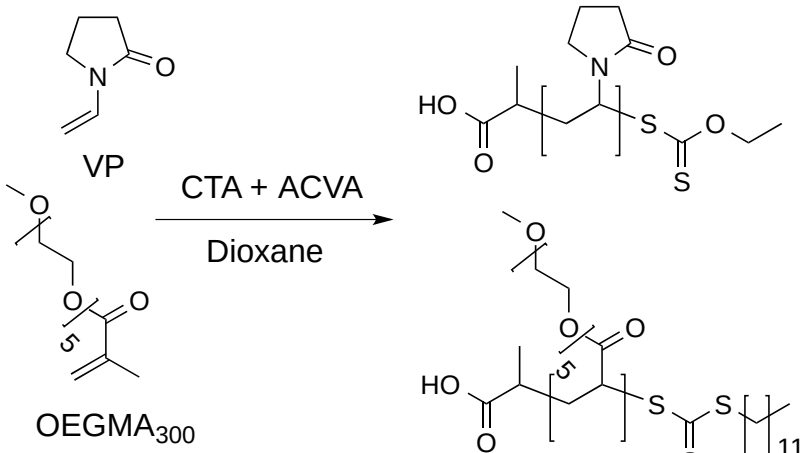
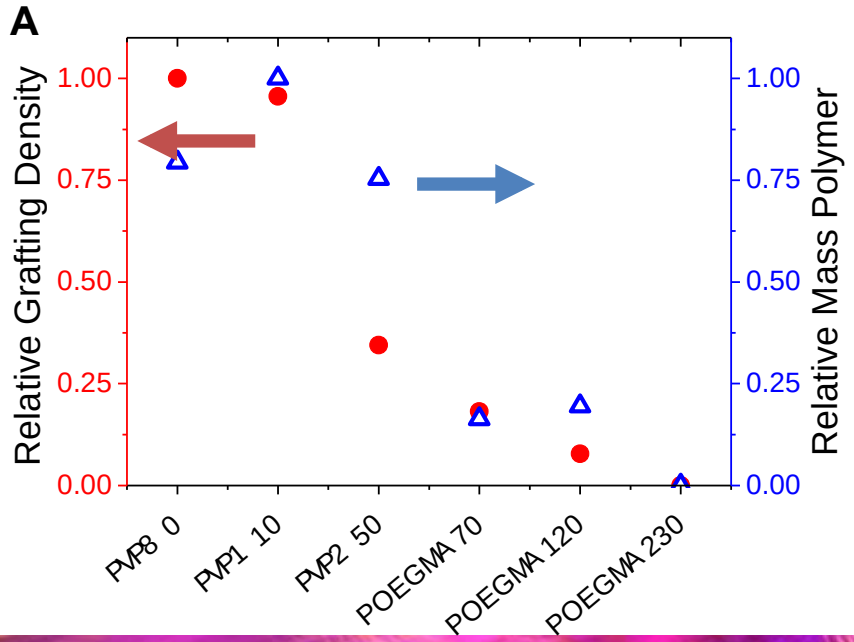
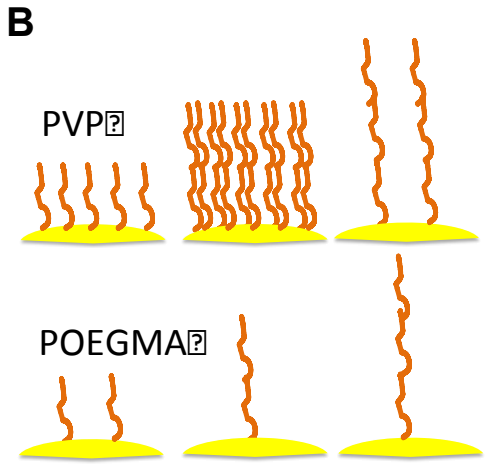
Polymer-gold grafting with AuNPs

Poly(vinylpyrolidone) verses
Poly(oligoethyleneglycol methacrylates)

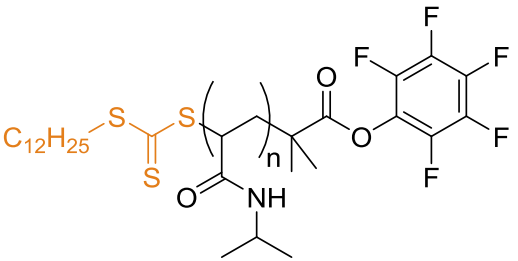


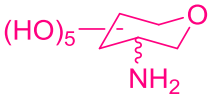




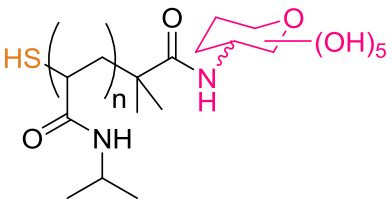
Biggs, C.I.; Gibson, M.I.; *In preparation*

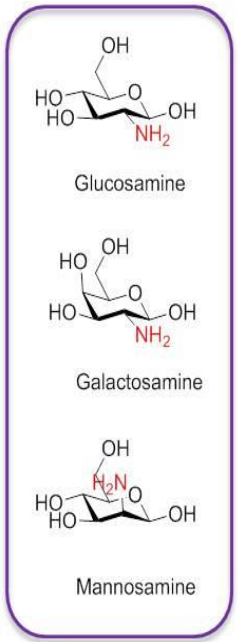
Glycosylated pNIPAMs

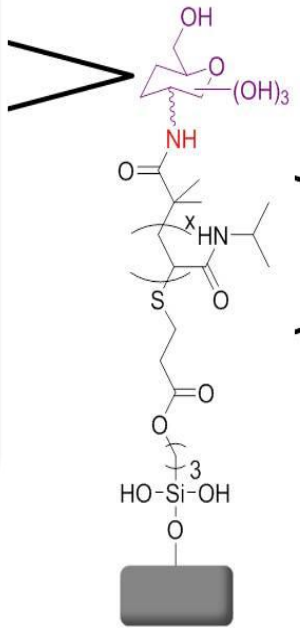


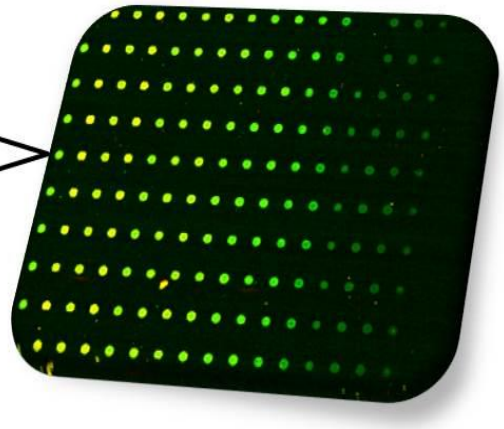


DMF, TEA
50 °C, 16 h

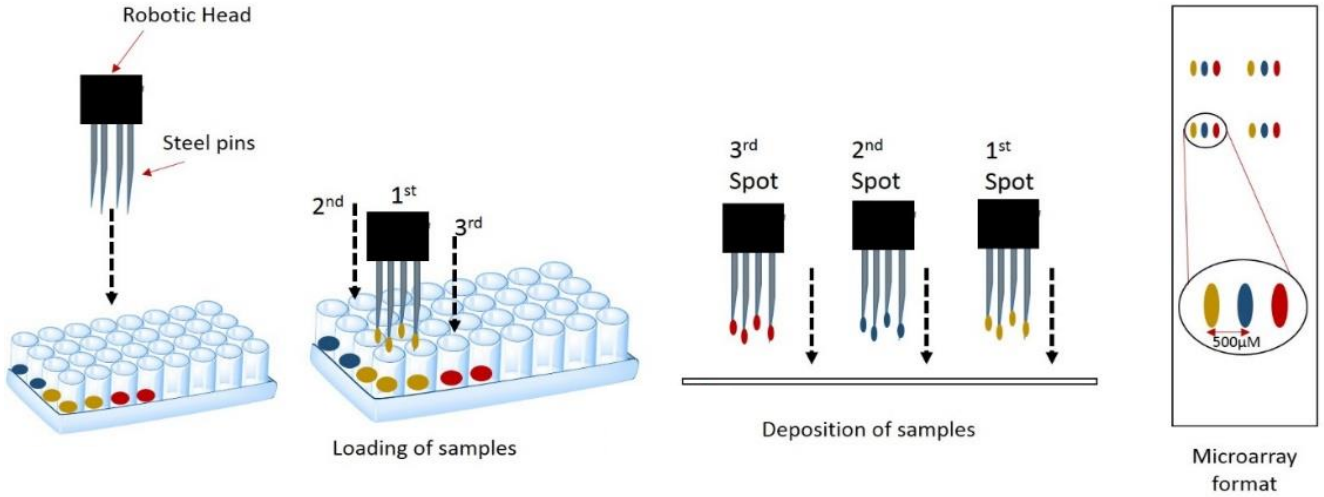


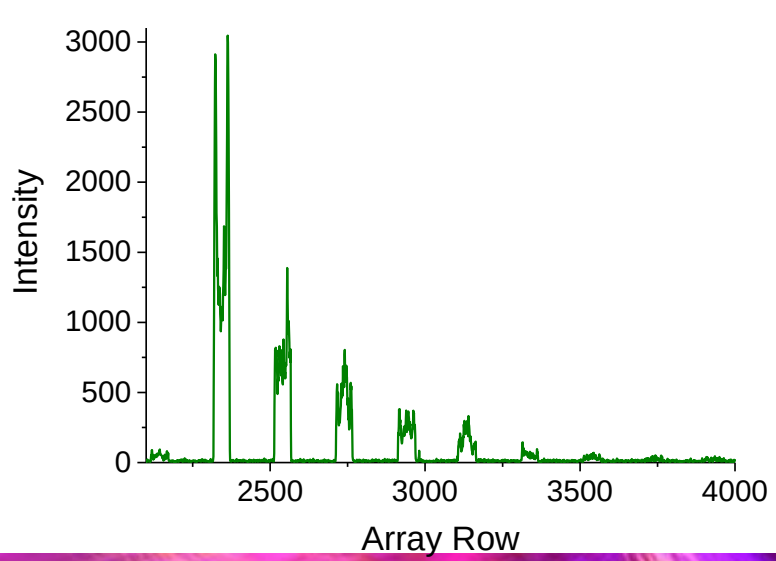


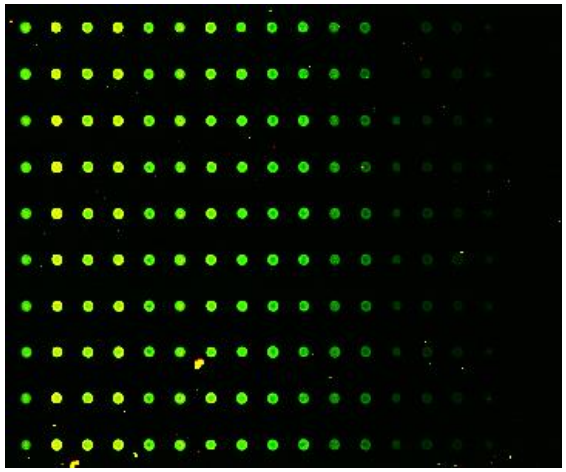




Direct microcontact printing







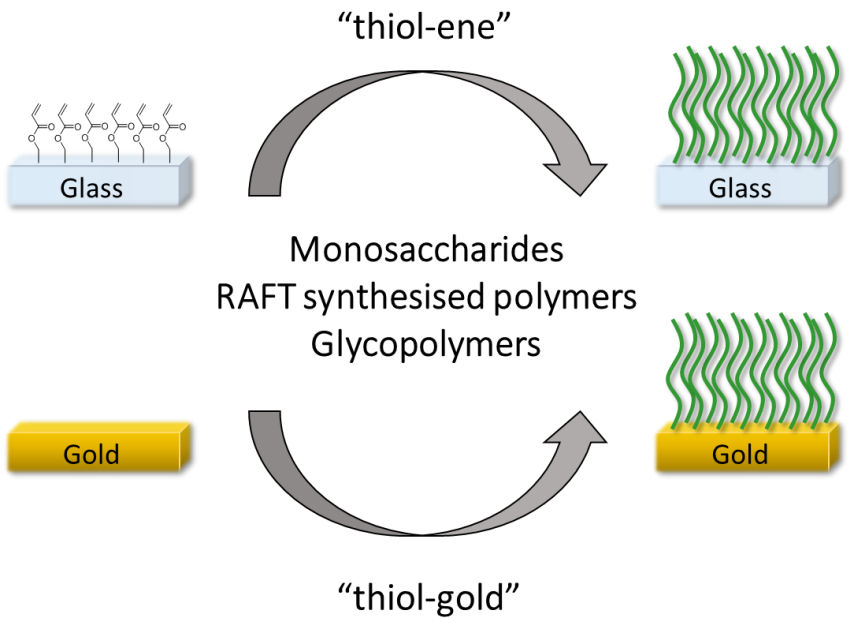
Summary

Silane coating of glass/silicon as an orthogonal linker

Thiol-ene addition
(monosaccharides, RAFT synthesised polymers, post-polymerisation functionalised glycopolymers)

Advantages of pNIPAM vs pOEGMA coatings

High-throughput array printing to probe protein-carbohydrate interactions



Acknowledgements

Gibson Group, **2016**

Post-docs
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- *Chris Packer*
- *Shin Yiing Lim*

Undergrad Students
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- *Josh Parkin*

PhD Students
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- *Joseph Healey*
- *Chris Stubbs*
- *Ben Graham*
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