

Simple toxin identification using a chemical 'tongue'

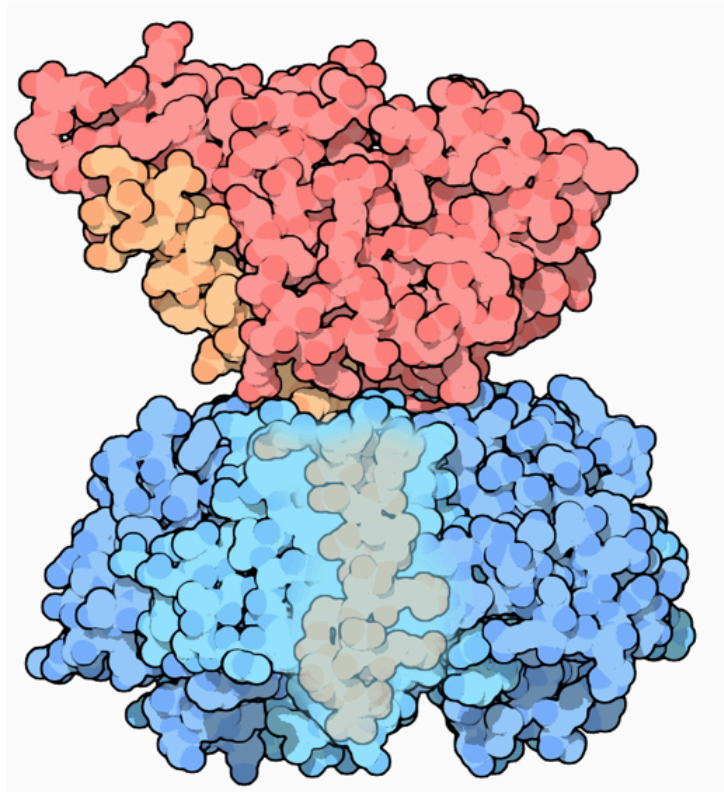
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Cholera toxin and Ricin

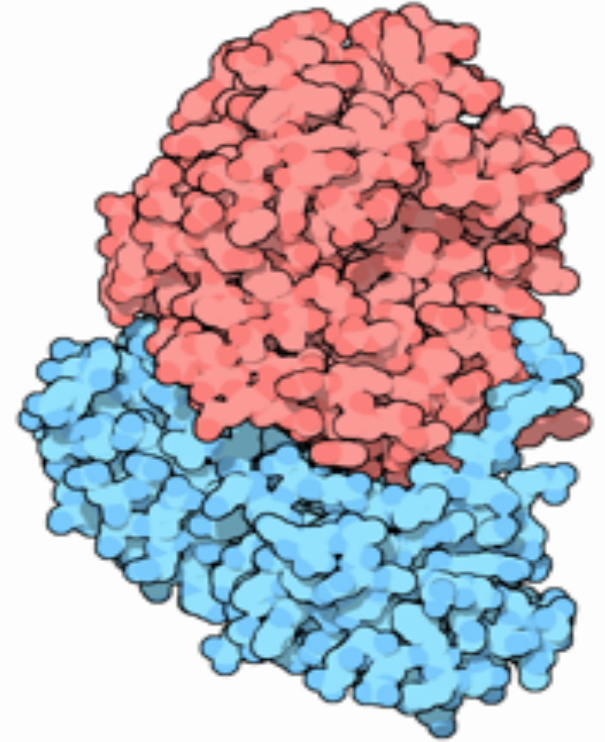


Enzymatic domain

Carbohydrate binding domain

3-5 million cases a year

100-120,000 deaths



A dose the same size as a couple of grains of table salt can kill an adult

Cholera infection and ricin poisoning

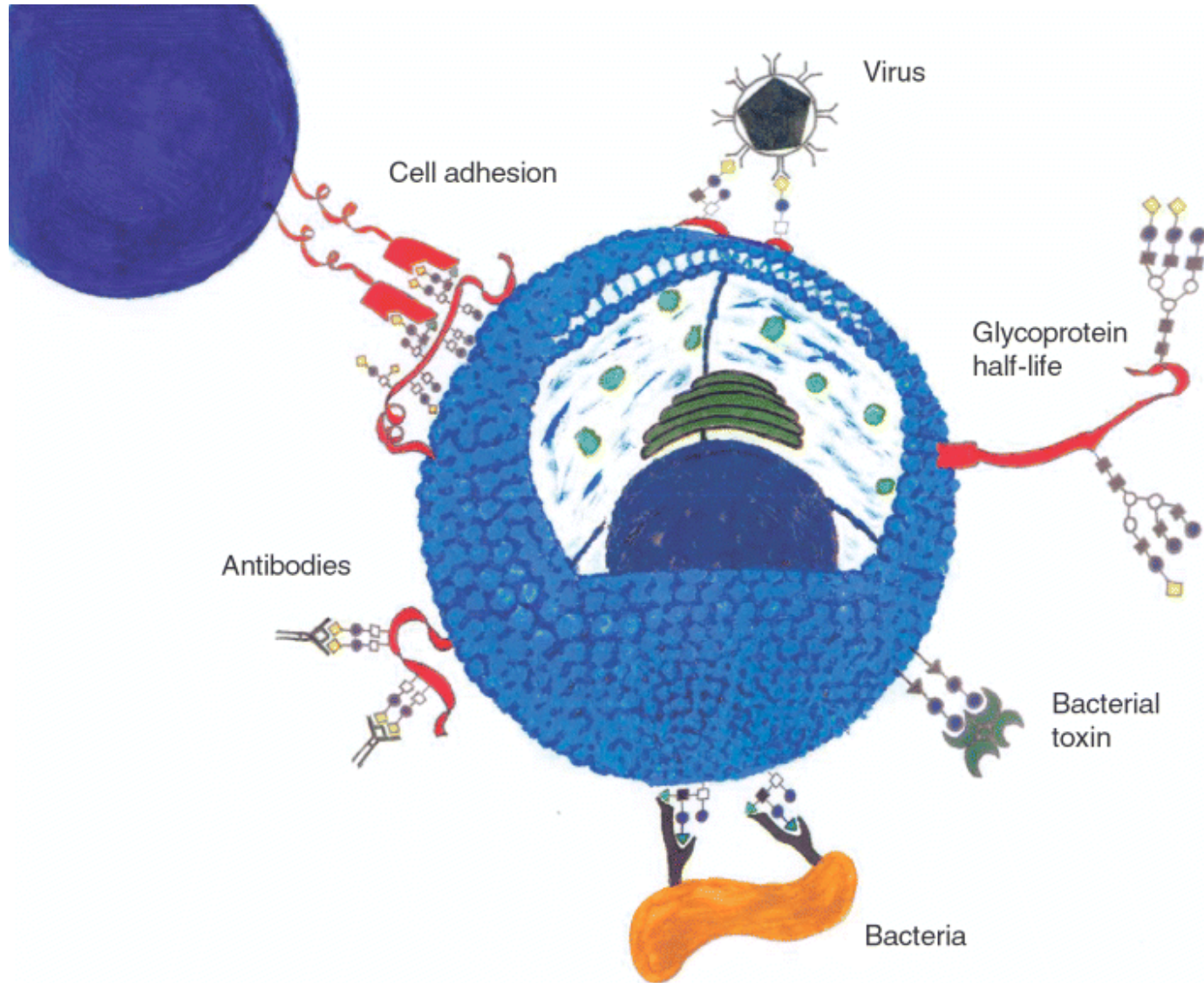
Severe cholera infection

- **Vomiting**
- **Diarrhea**
- **Severe dehydration**
- **Drop in blood pressure**
- **Clinical shock**
- Stomach cramps
- **Death**

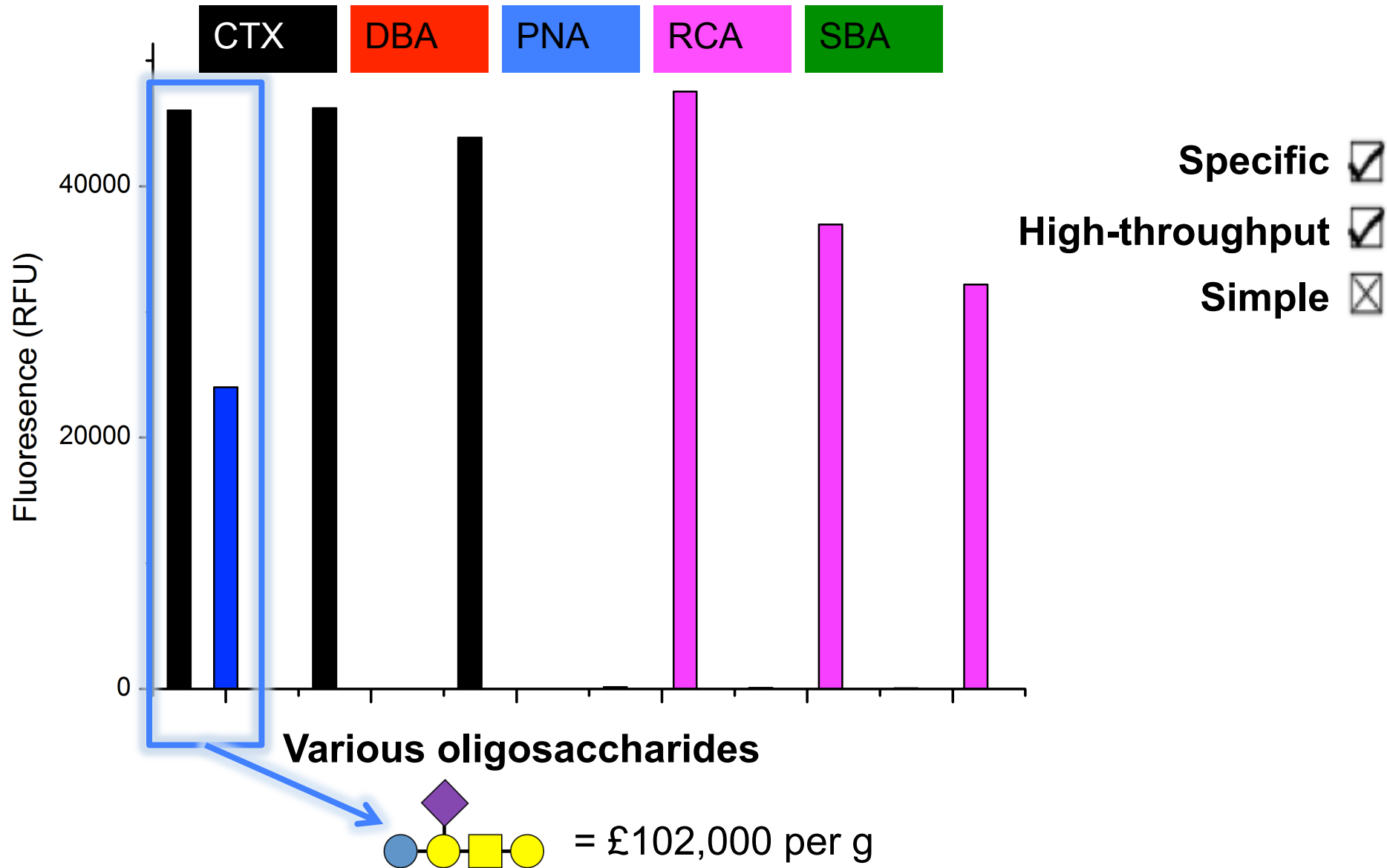
Ricin poisoning through ingestion

- **Vomiting**
- **Diarrhea**
- **Severe dehydration**
- **Drop in blood pressure**
- **Clinical shock**
- Seizures
- Hematuria
- Multiple organ failure
- **Death**

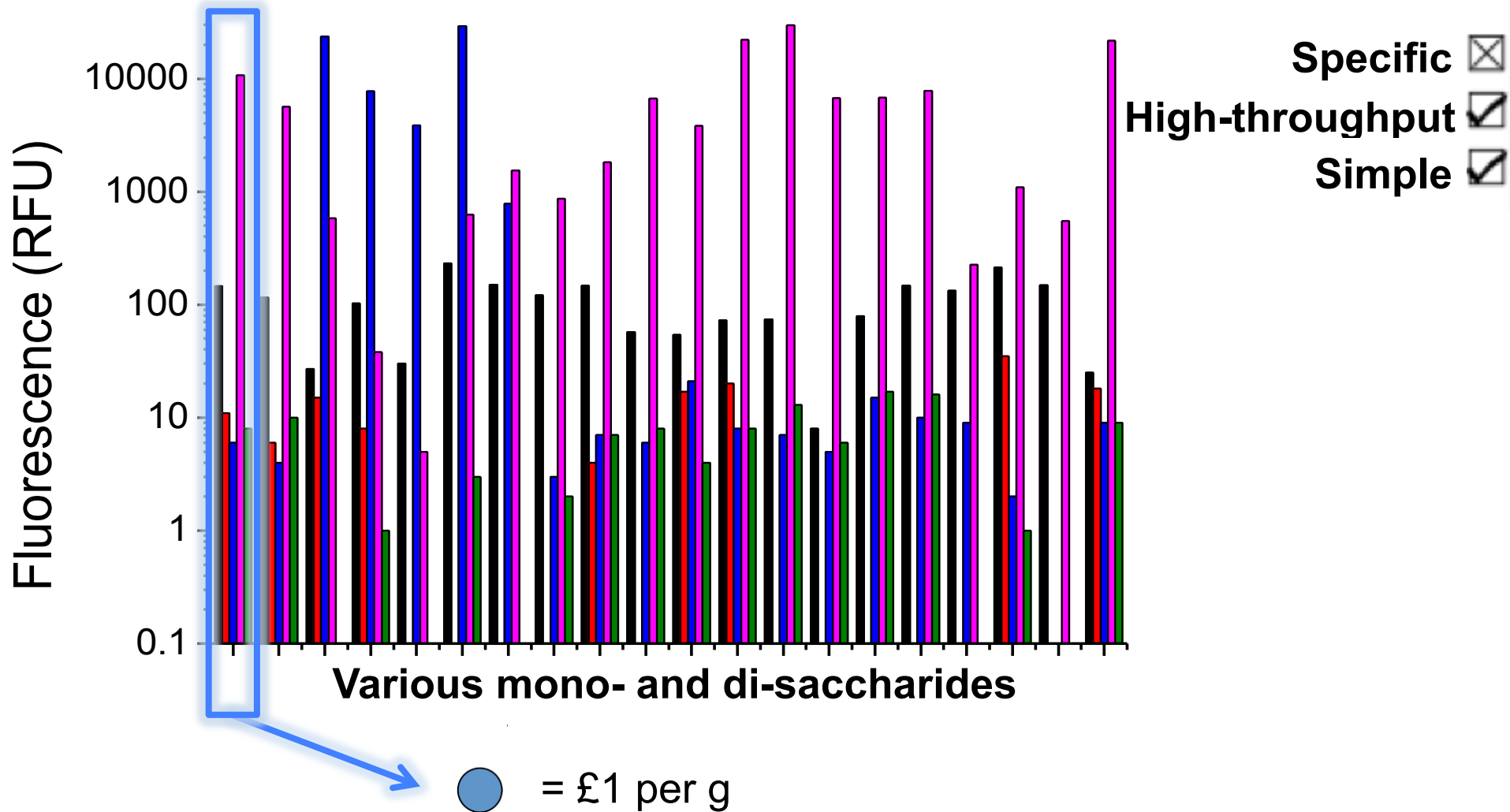
Protein Carbohydrate interactions



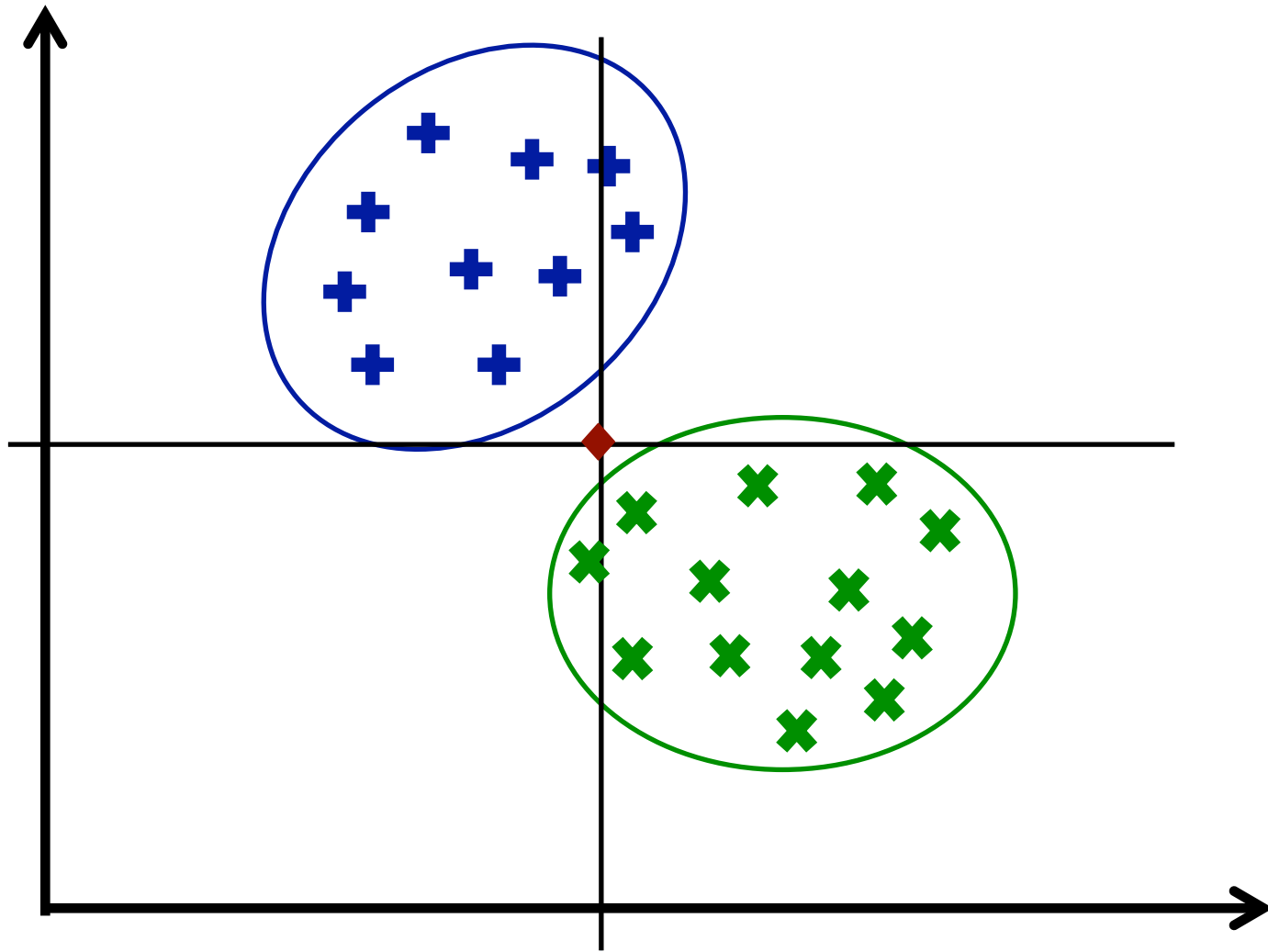
Carbohydrate microarray: oligosaccharides



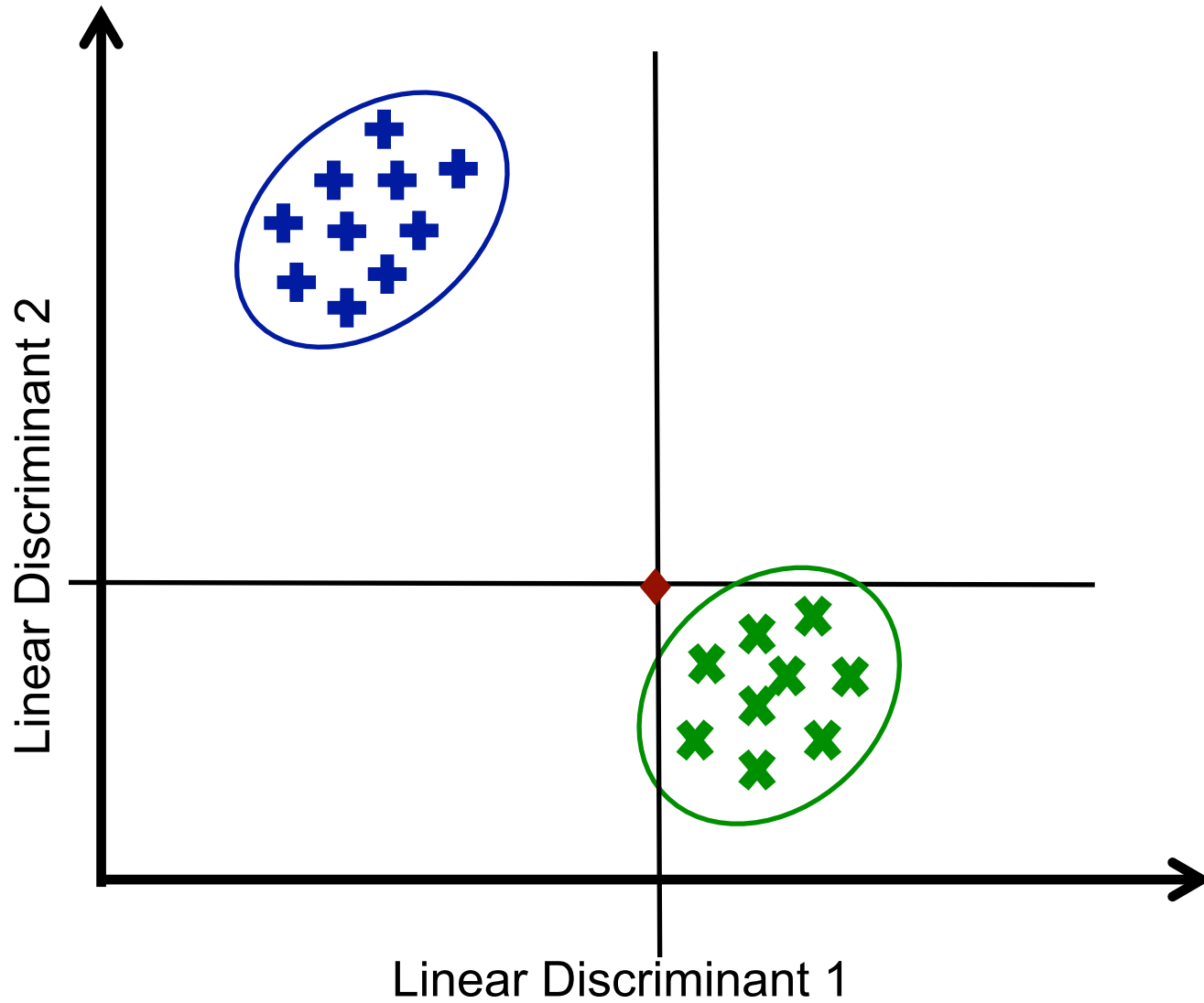
Carbohydrate microarray: mono-/di-saccharides



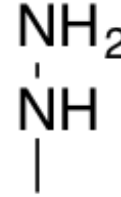
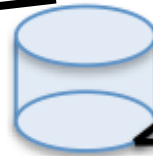
Linear Discriminant Analysis



Linear Discriminant Analysis

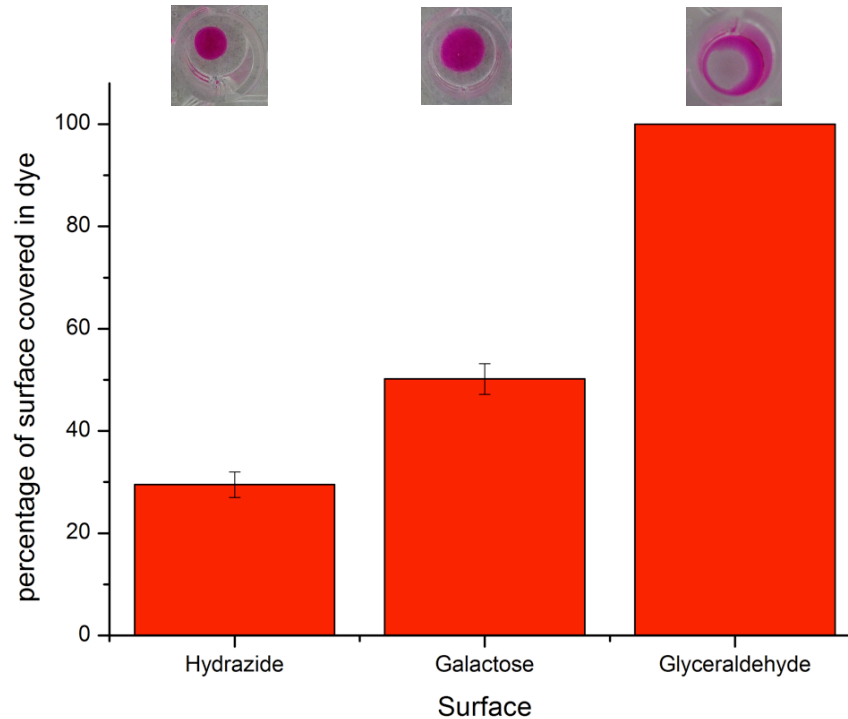
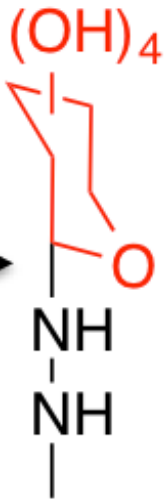


Carbohydrate surfaces

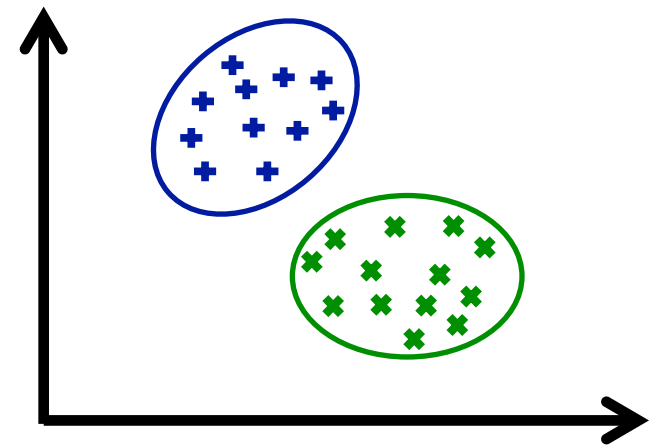
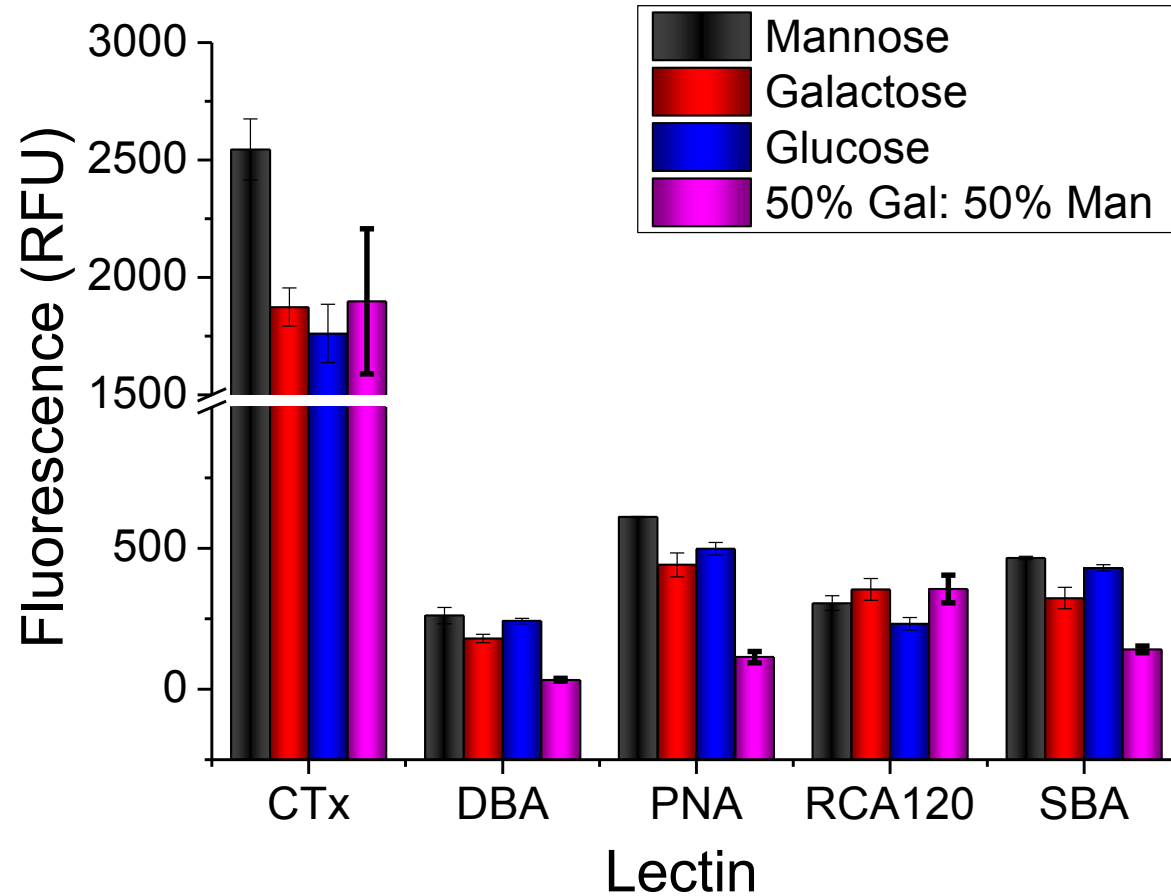


30 mM sugar
/0.5 % aniline

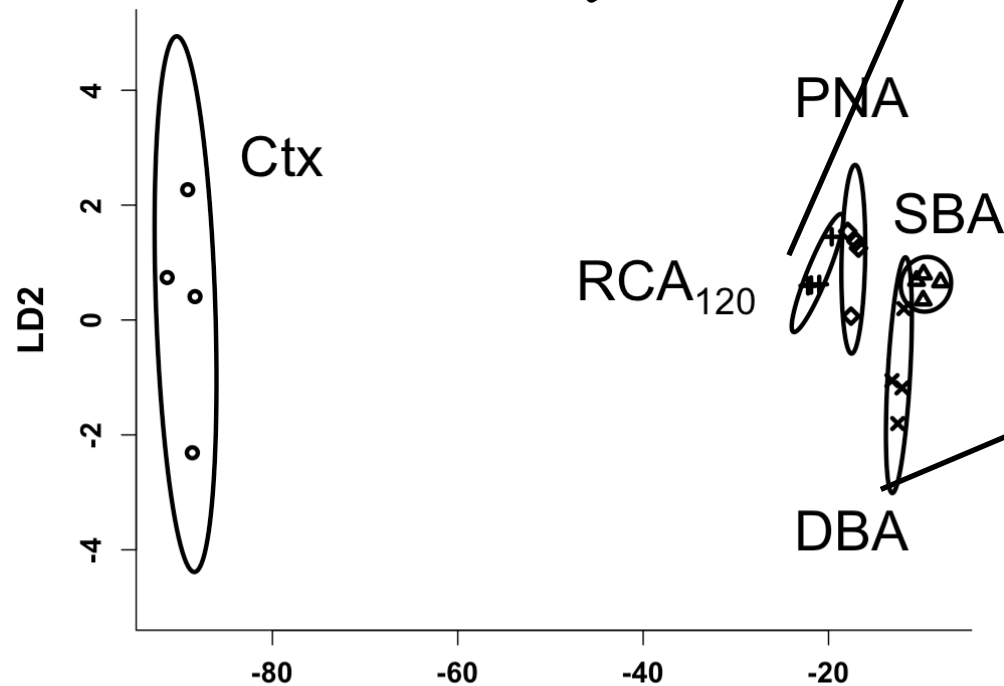
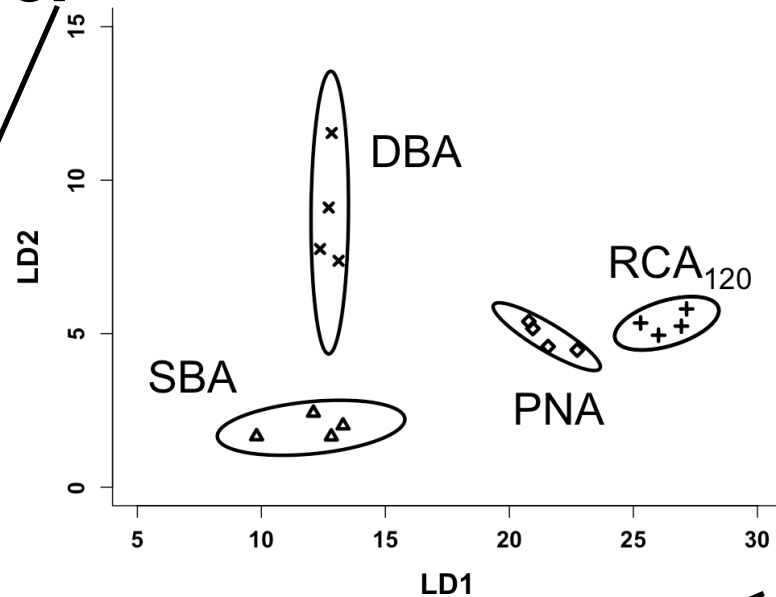
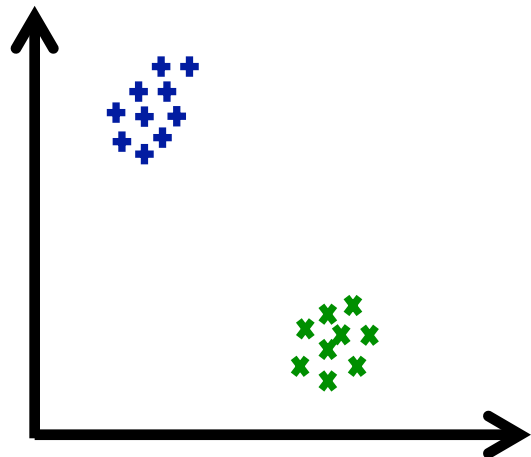
pH 5.5, 50 °C



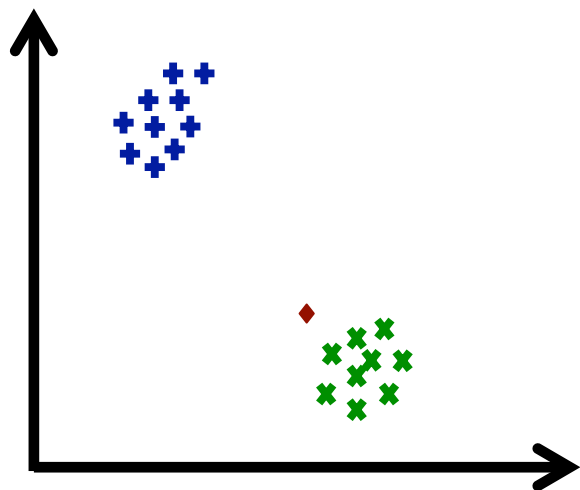
Carbohydrate binding



LDA model

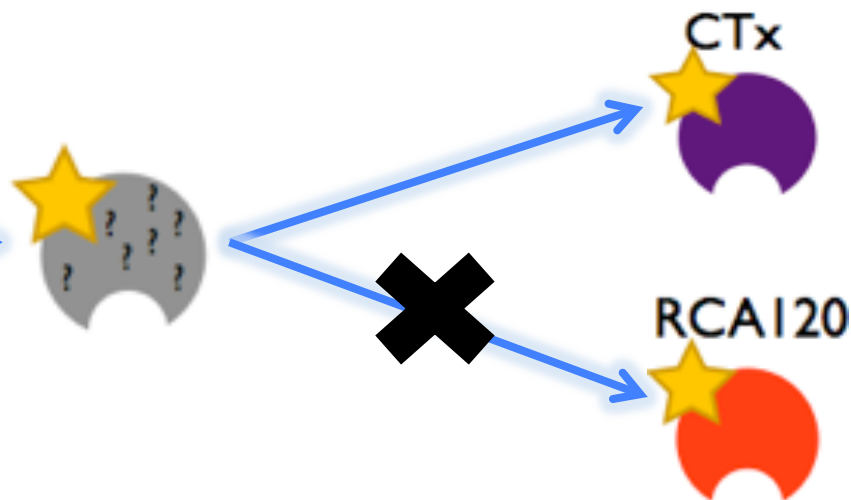
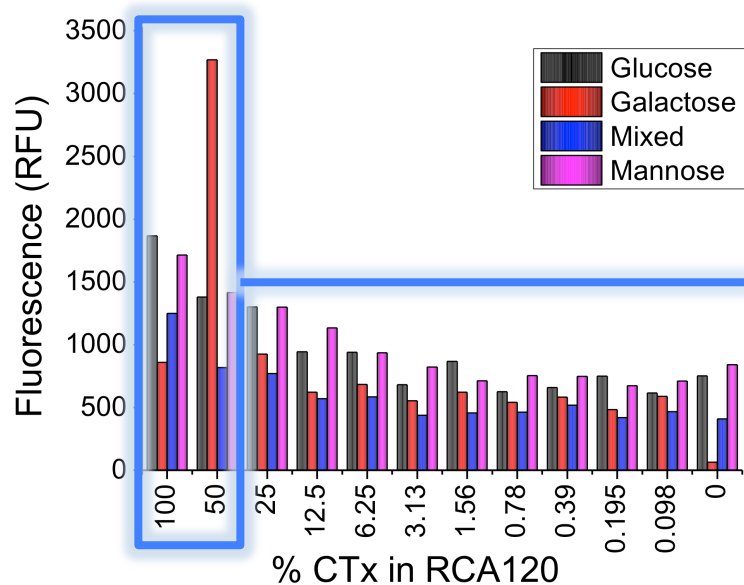


Sample classification

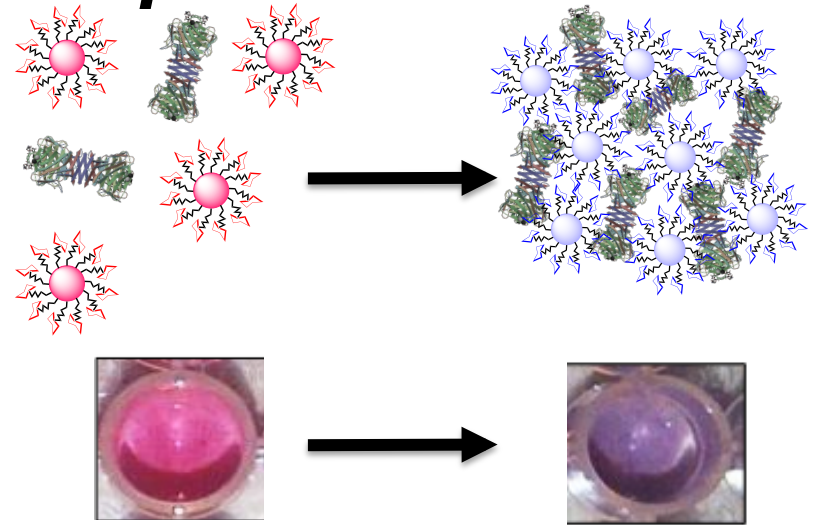
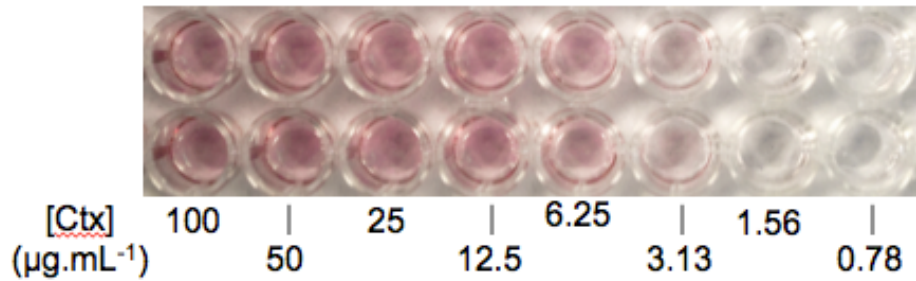


Sample	Predicted	Actual
U1	RCA120	RCA120
U2	PNA	PNA
U3	SBA	SBA
U4	DBA	DBA
U5	CTx	CTx

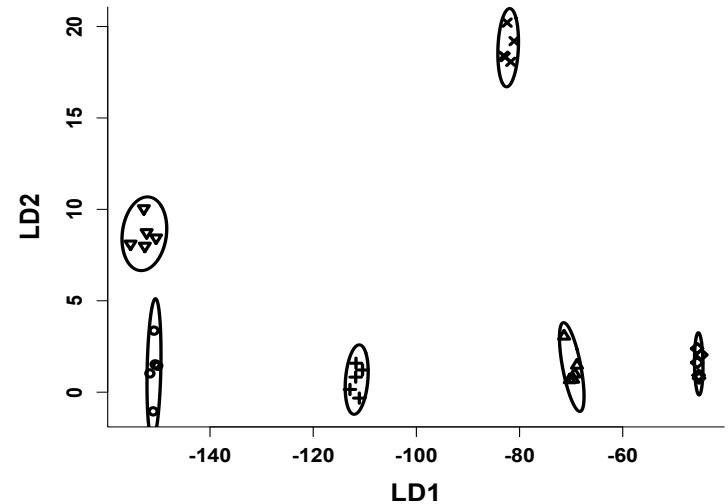
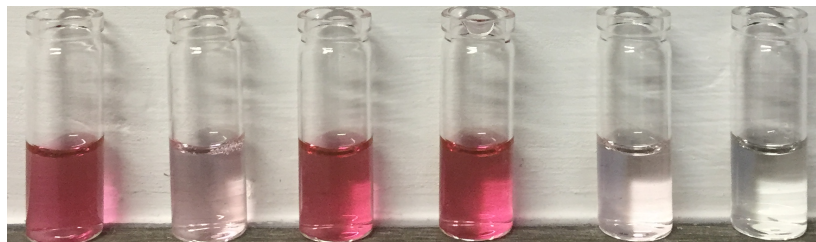
100% correct identification of 'blind' lectin samples



Label free techniques



Otten, L. *et al.* J. Mater. Chem. B (2013)

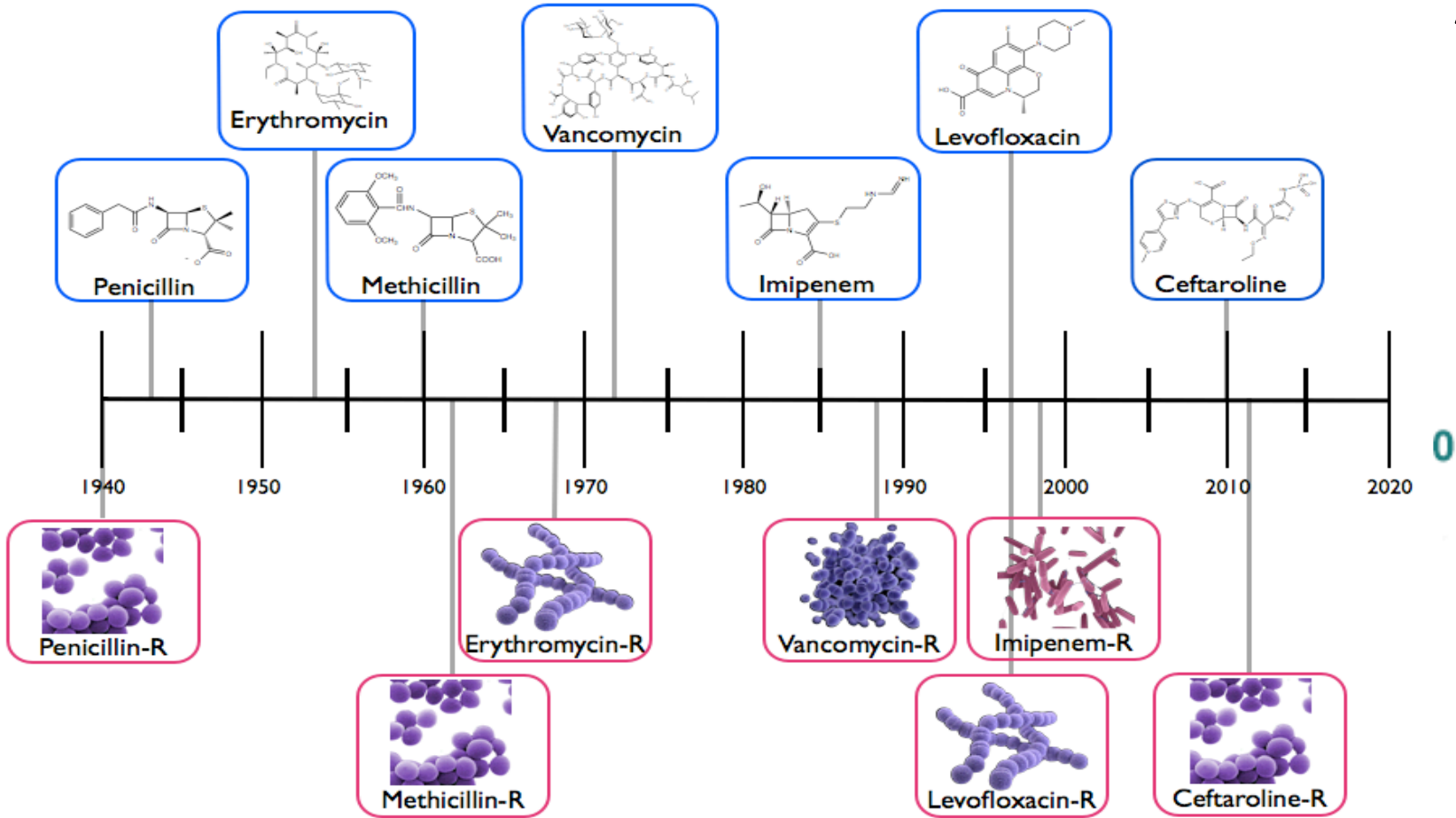


Richards, S-J., Otten, L. and Gibson, M.I., in preparation

Other applications- Bacteria

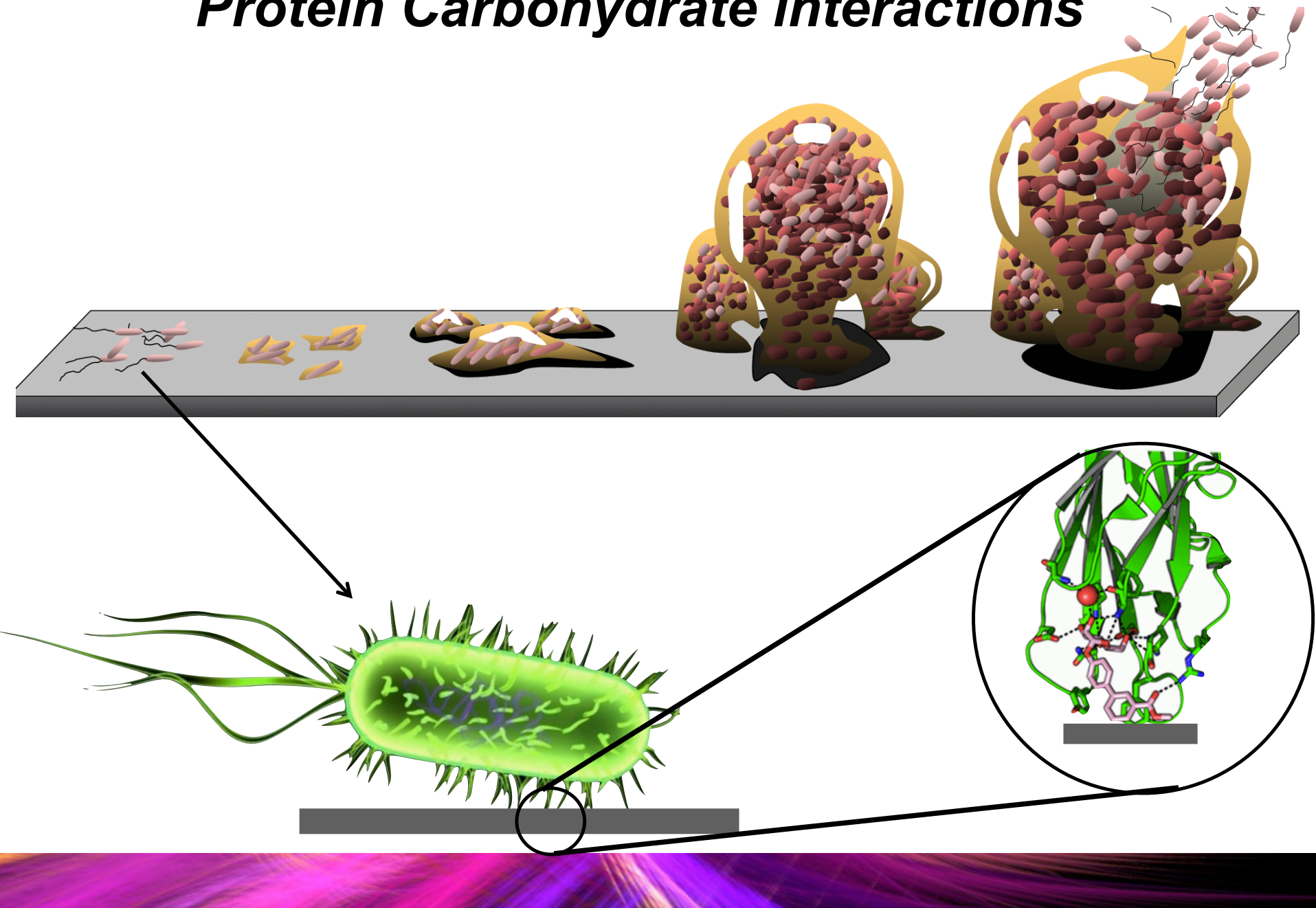
Antibiotic Discovery

Antimicrobial resistance death by

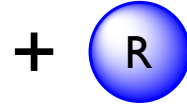
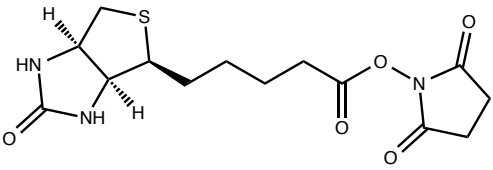


Development of resistance

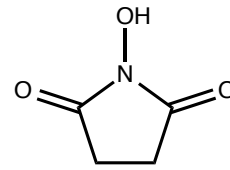
Protein Carbohydrate interactions



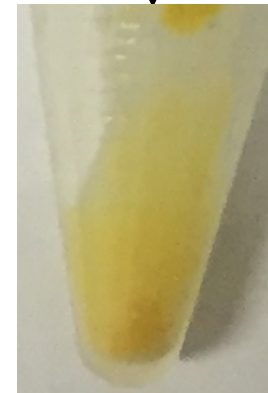
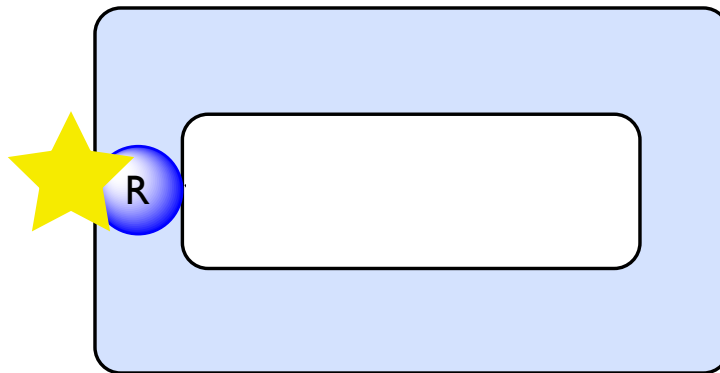
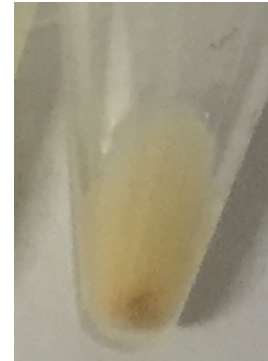
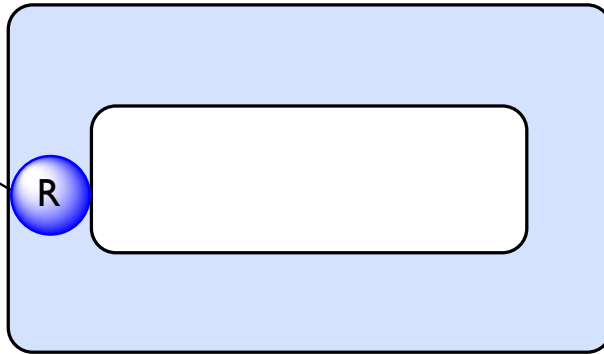
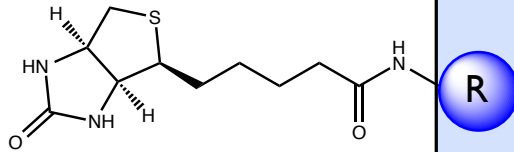
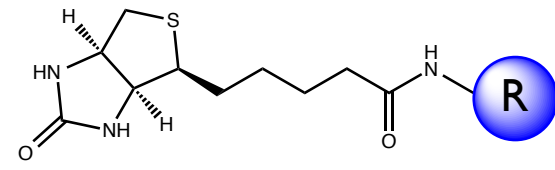
Bacteria Labelling



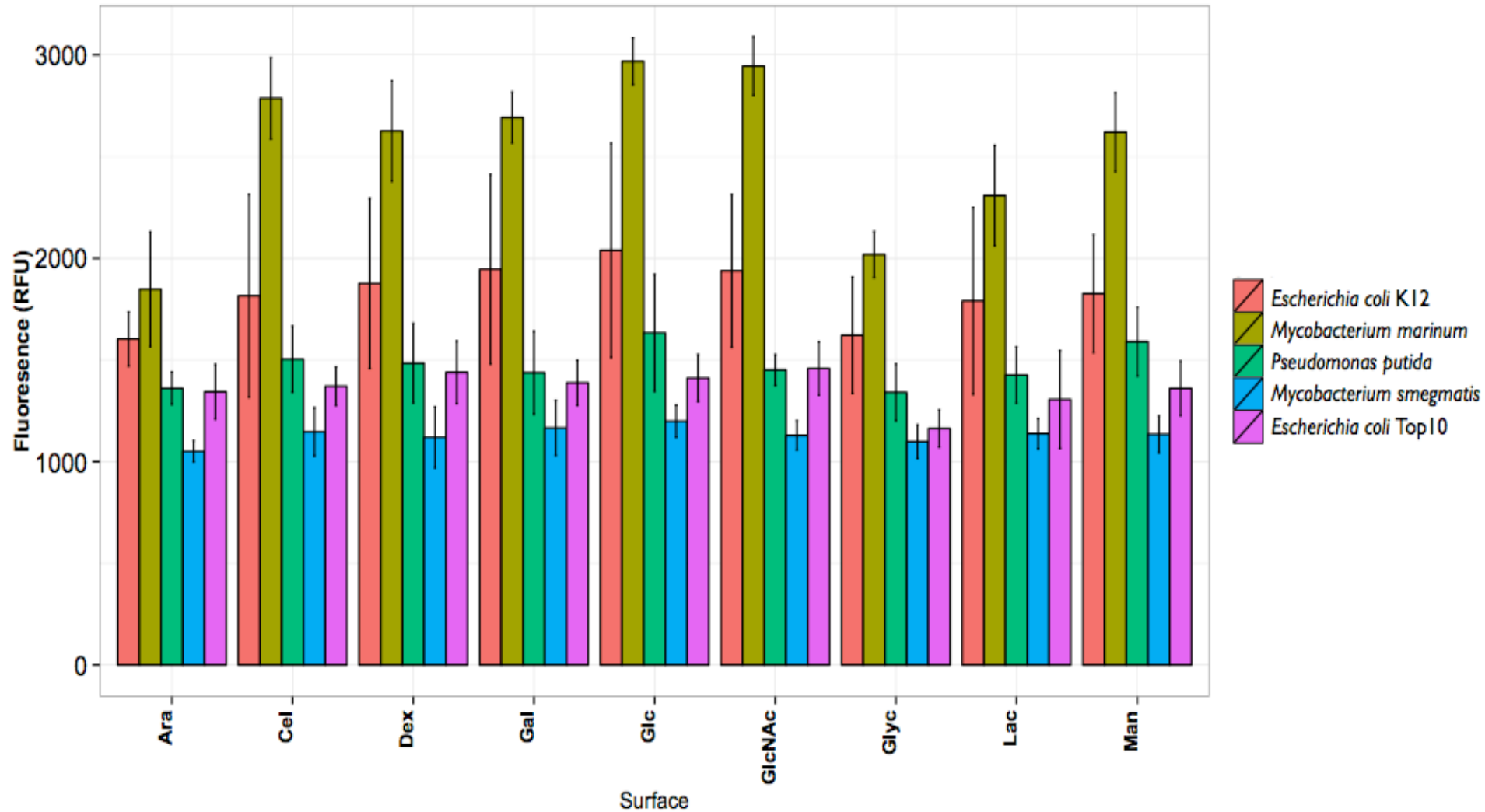
pH 7



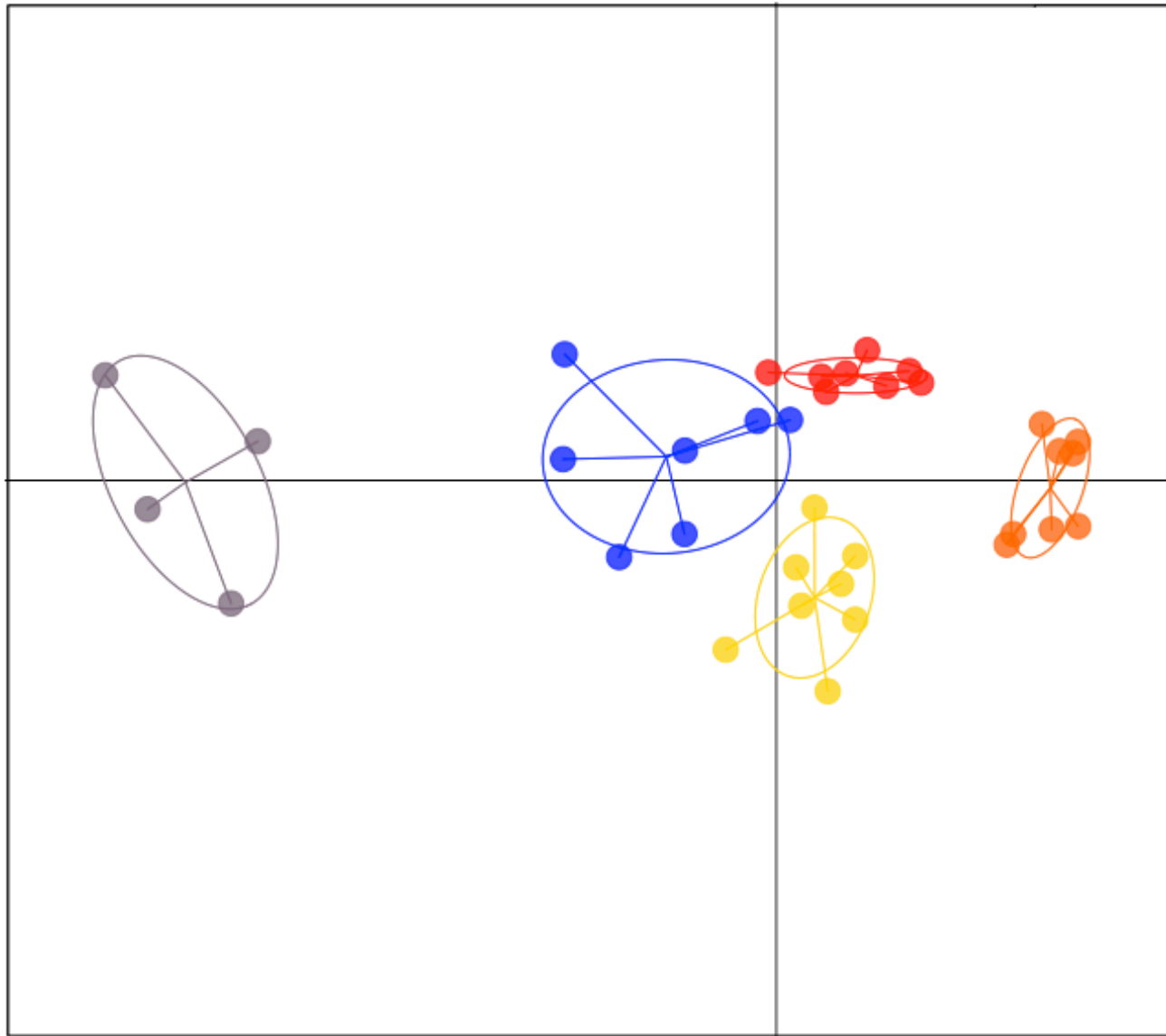
+



Bacterial binding profiles

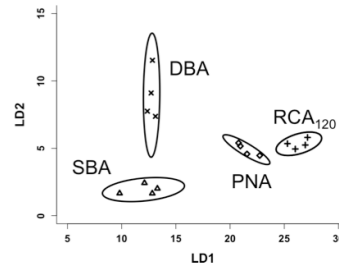
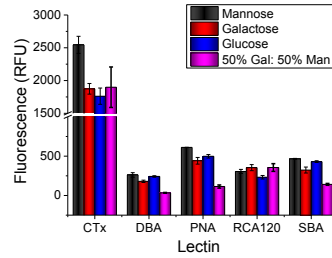


LDA



- *Escherichia coli* K12
- *Mycobacterium marinum*
- *Pseudomonas putida*
- *Mycobacterium smegmatis*
- *Escherichia coli* Top10

Conclusions and further work



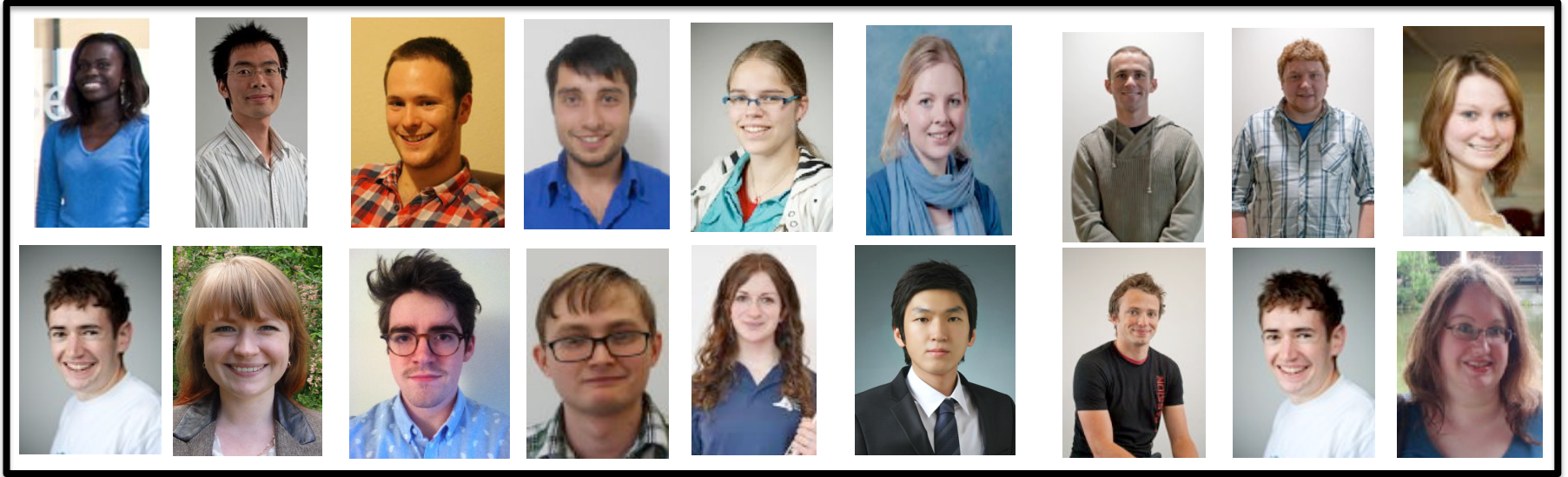
Conclusions:

- Linear discriminant analysis has been shown to aid in the identification of blind lectin samples
- It has also shown to be applicable to identification of bacterial species

Future work:

- Increase the number of bacterial species examined
- Identification of Influenza A strains through differential carbohydrate binding will also be analysed.

Acknowledgements



Matthew Gibson
Elizabeth Fullam
Sarah-Jane Richards



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in **your** future
European Regional Development Fund
European Union



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