Using CarboGrove to guide experimental design and data interpretation

GLIC Seminar Series: Glycan Arrays

3/06/23

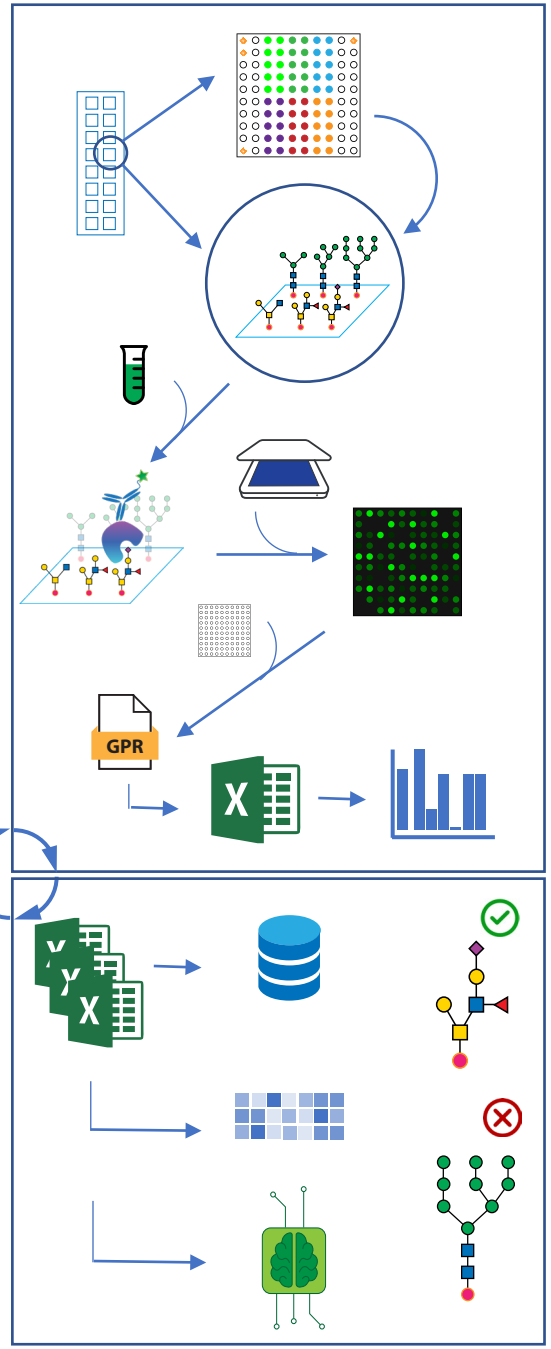
Zachary Klamer

Big Picture

Demo Application

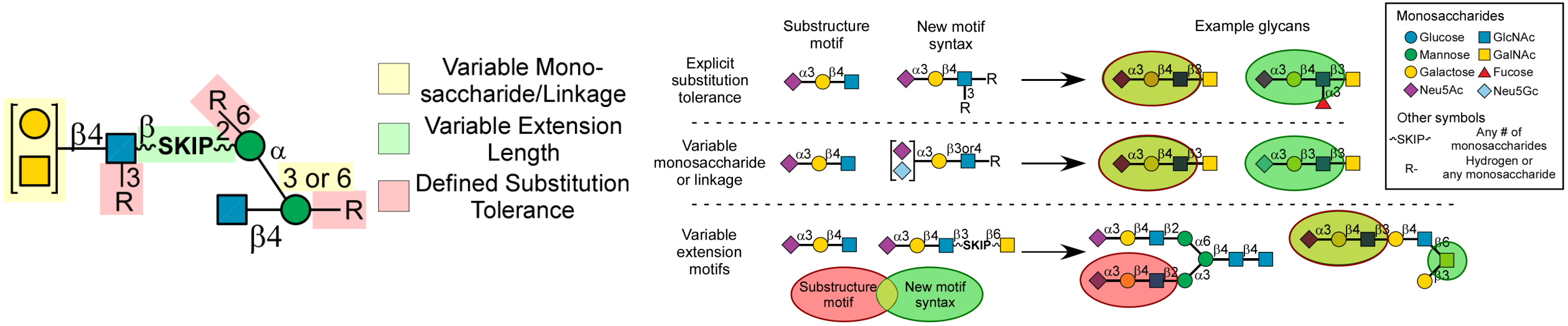
Our work has touched on nearly every aspect of glycan arrays

- Worked closely with array developers in designing new arrays (ZBiotech)
- Developed software for the quantification and summarization of array images (SignalFinder Microarray)
- Developed software for interactive and automated analysis of glycan array data (MotifFinder)
- Compiled the analysis of over a thousand datasets into a database of specificities (CarboGrove)



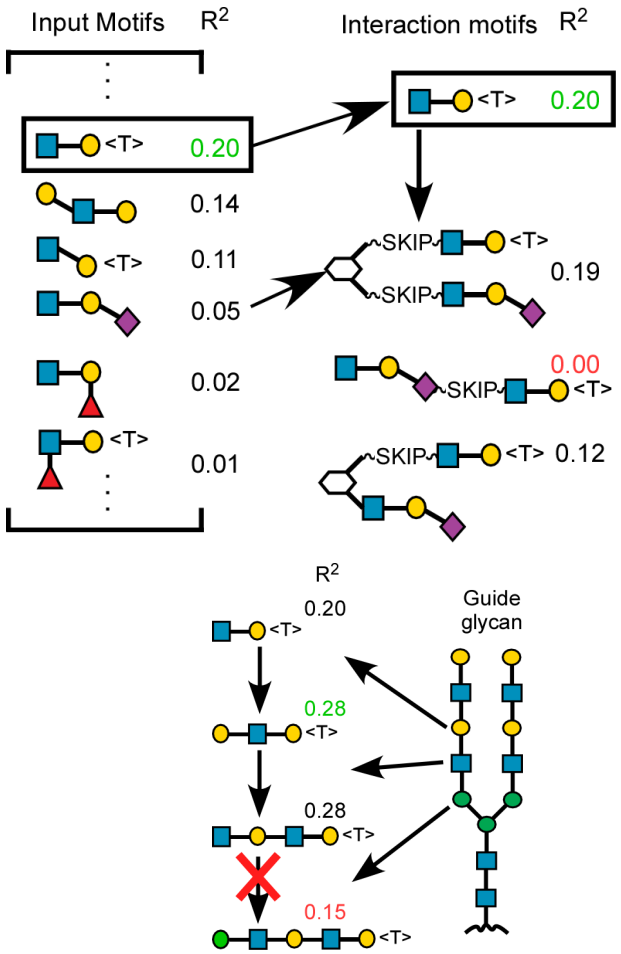
What is a motif?

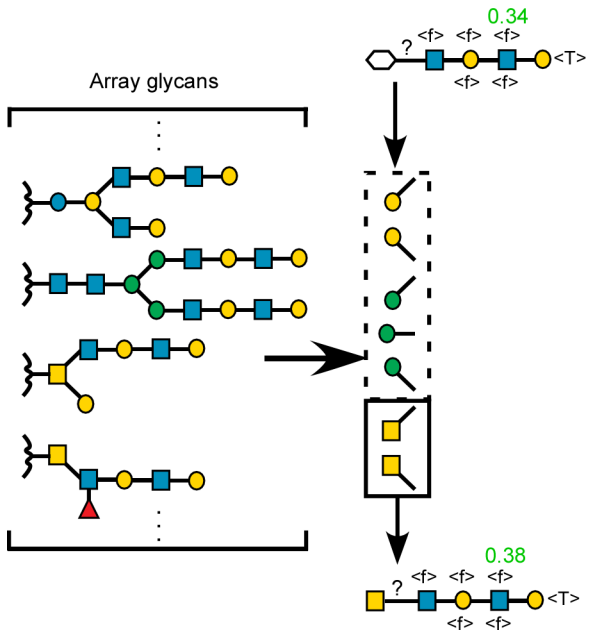
- A motif is a pattern – commonly a substructure but can be more

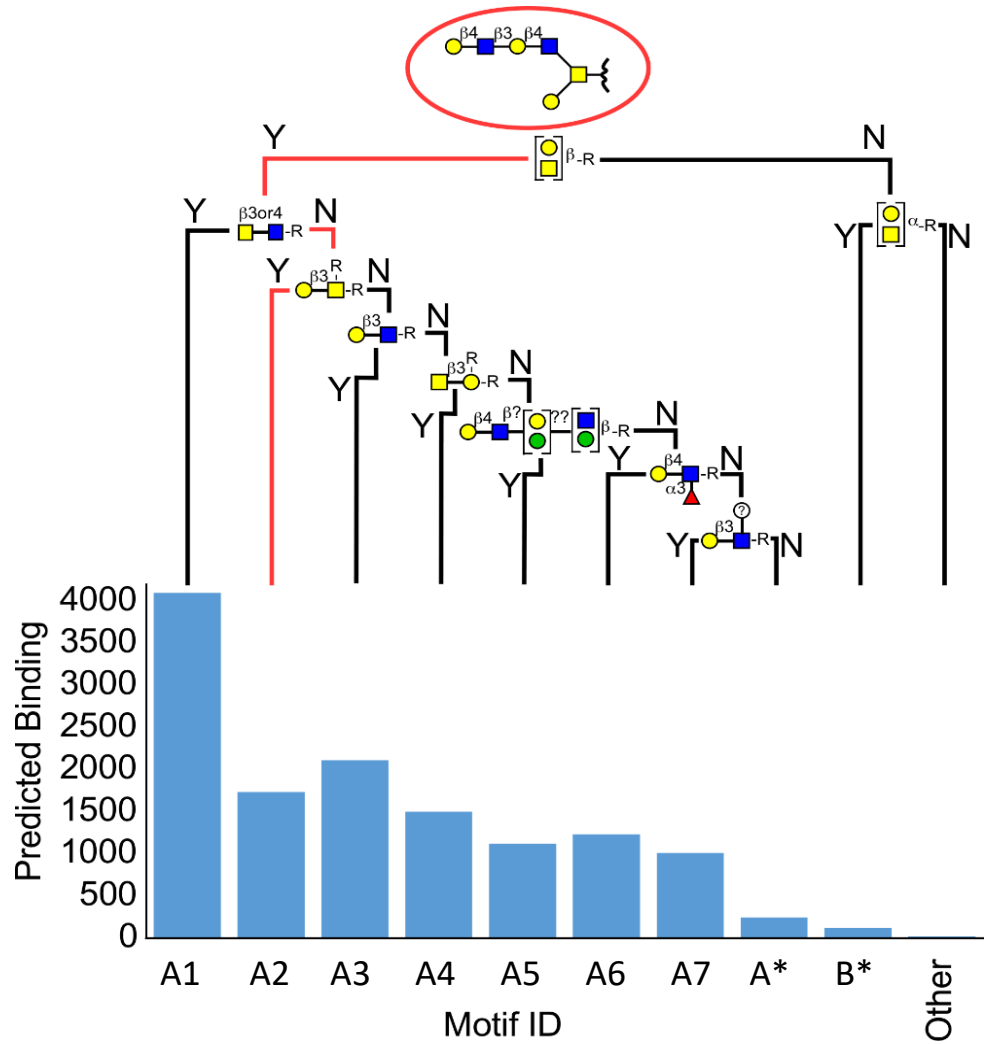


Klamer, Z. *et al*. Mining High-Complexity Motifs in Glycans: A New Language To Uncover the Fine Specificities of Lectins and Glycosidases. *Anal Chem* **89**, 12342–12350 (2017).
Klamer, Z. & Haab, B. Automated Identification of Lectin Fine Specificities from Glycan-Array Data. in vol. 1346 67–82 (American Chemical Society, 2020).

Beyond simply “finding” motifs

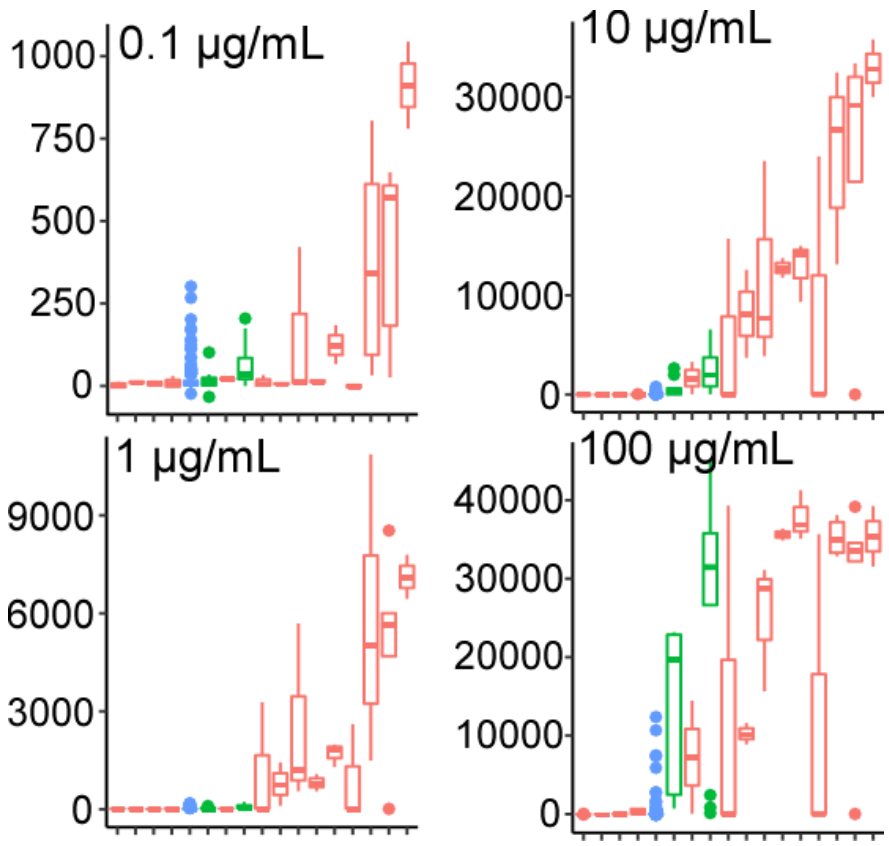


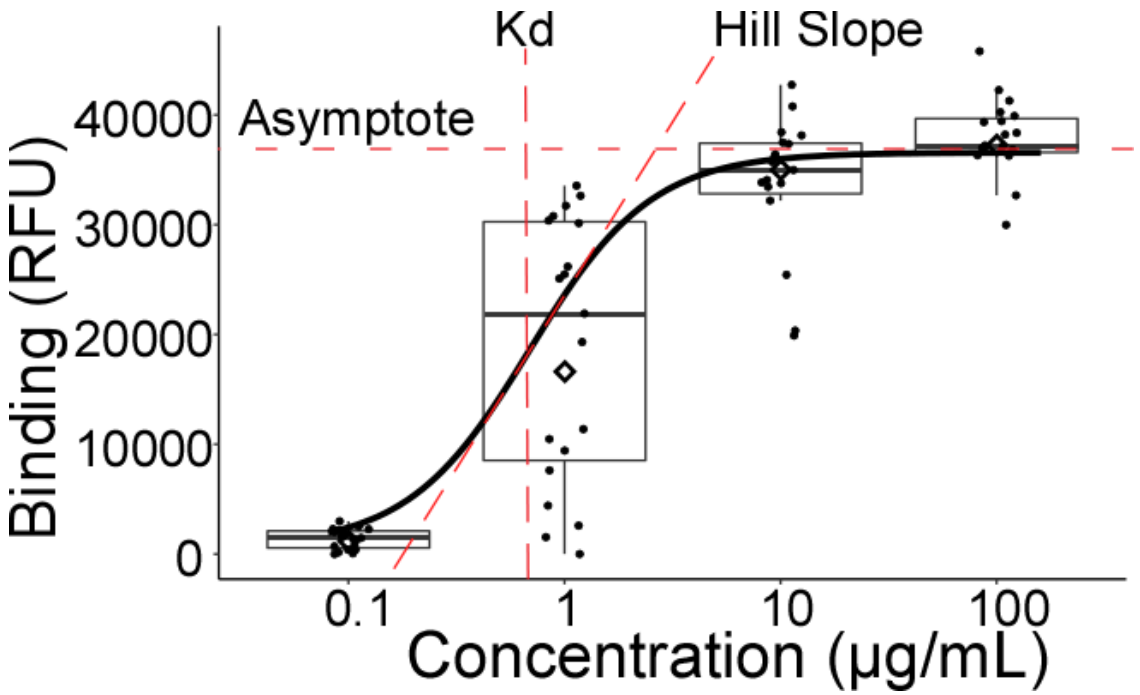




Klamer, Z. & Haab, B. Automated Identification of Lectin Fine Specificities from Glycan-Array Data. in vol. 1346 67–82 (American Chemical Society, 2020).

From data to insights

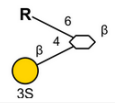
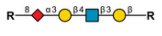
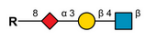
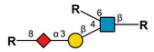


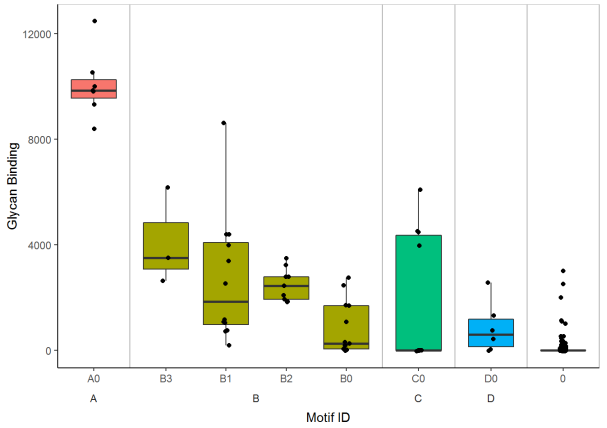


We'll see how this can lead to novel insights in our demo!

Klamer, Z. & Haab, B. Combined Analysis of Multiple Glycan-Array Datasets: New Explorations of Protein–Glycan Interactions. *Anal Chem* (2021).

Improving accessibility of array data

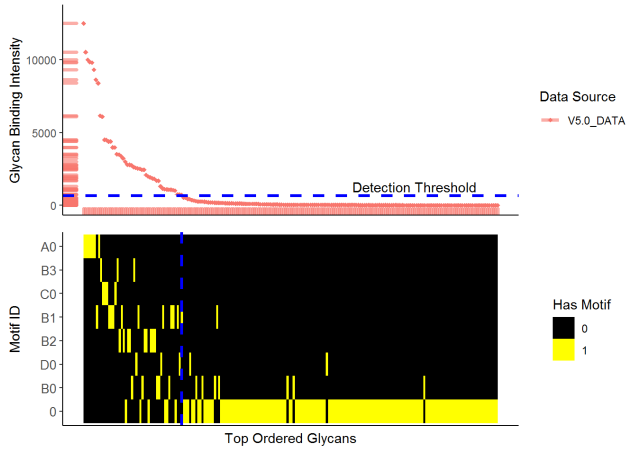
Motif ID	Nearest Common Name (Accuracy%**)	Motif Graphic Structure	Relative Binding	Number of Glycans	P-Value***
A0	Terminal 3' Sulfated Galactose (98%)		1.00	7	<0.001
B3	a3 Sialyl Type 2 LacNAc (95%)		0.40	3	<0.001
B1	a3 Sialyl Type 2 LacNAc (97%)		0.27	12	<0.001
B2	O-GlcNAc Core a3 Sialyl Type 2 LacNAc (99%)		0.24	9	<0.001
B0*	a3 Sialyl Type 2 LacNAc (97%)		0.09	13	<0.001

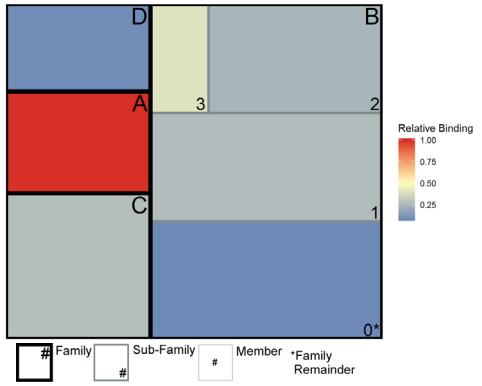


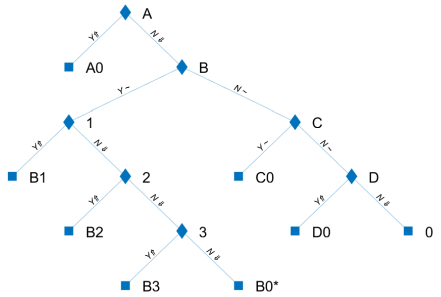
ASNLinked (38)
PolyLacNAc (16)
SialoGlycanNGL (2)
NGGM (12)
Gildersleeve (24)
NGGM-TM (21)
Man6P (1)
Microbial (52)
Gildersleeve (24)
CUPRA (4)
Schistosoma (1)
Asymmetric N-Glycan (38)
OligoMan (31)
LiGA (8)
Reichardt (9)
NCFG (48)
Joshi (5)
Feizi CLL (21)
HMO (13)
Glycan Bead (72)
HeparanSulfate (22)
CEMAOGalNAc (18)
Huflejt (8)
PlantCellWall (4)

ZBiotech (116 Total)
- Catch-All (41)
- General100 (28)
- BisectingN (7)
- Heparan Sulfate (7)
- Neu5Ac/Neu5Gc (6)
- N100 (6)
- GSL (5)
- HMO (5)
- Lewis (5)
- OGlycan (4)
- OMannose (2)

CFG (541)







Big Picture

Demo

Application

Carbogrove.org

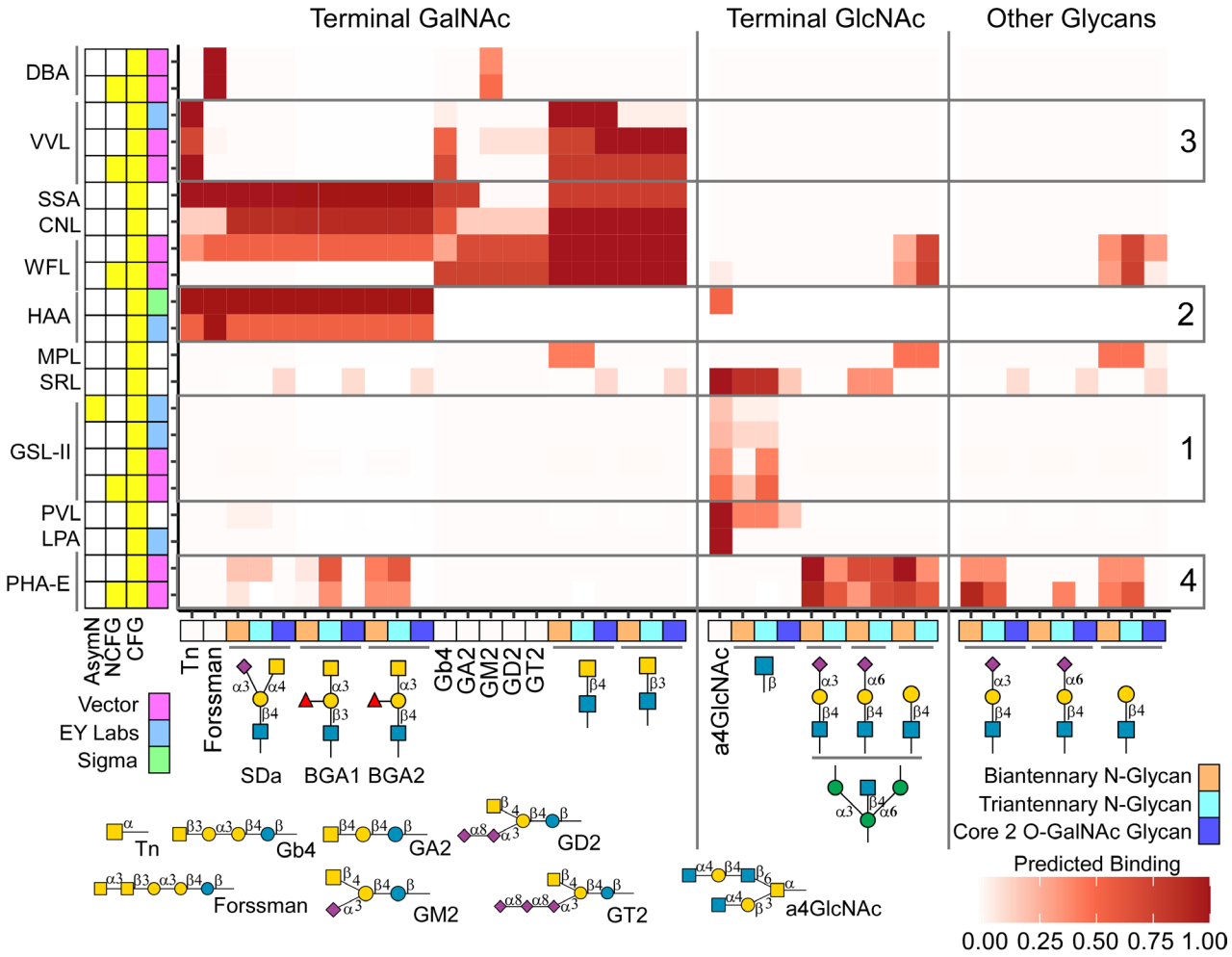
Big Picture

Demo

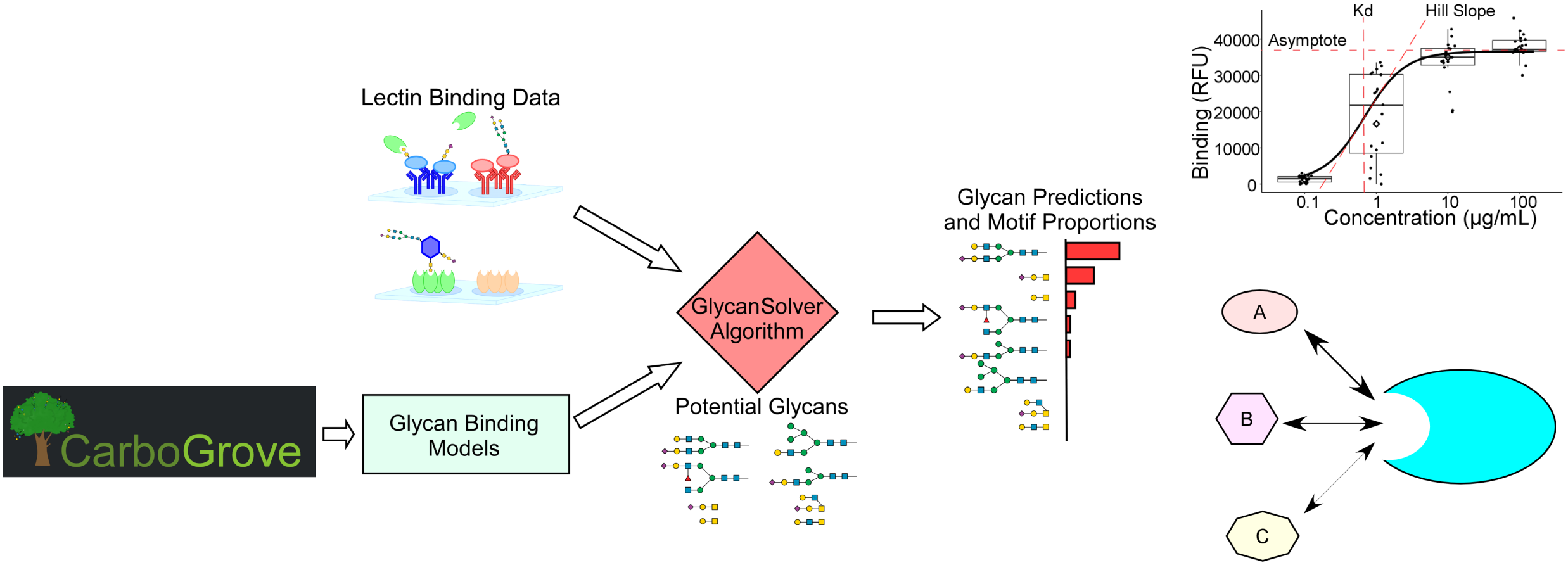
Application

Guiding Experimental Design

- Searching CarboGrove terminal HexNAc glycan binding proteins
- Define examples of different presentations of HexNAc and predict binding
- Select a set of lectins which meet the experimental needs and give as much information as possible



Assisting in result interpretation



Klamer, Z., Hsueh, P., Ayala-Talavera, D. & Haab, B. Deciphering protein glycosylation by computational integration of on-chip profiling, glycan-array data, and mass spectrometry. *Mol Cell Proteomics* **18**, mcp.RA118.000906 (2018).

Questions?

CarboGrove

MotifFinder
SignalFinder Microarray

Brian Haab, Ph.D.
Anna Repesh B.S.
Hoang-Le Tran B.S.

Jian Zhang, Ph.D. Z Biotech

Next Presenter: René Ranzinger

The Glycan Array Data Repository

03/20/2023 10am ET

Event Details