

Glycolipids applications, hydrophobic balance rules them all.

Germán Günther S.

Laboratorio de Cinética y Fotoquímica

Departamento de Química Orgánica y Físico Química

Facultad de Ciencias Químicas y Farmacéuticas.

Universidad de Chile



Glycolipids applications, hydrophobic balance rules them all.

Susana Sánchez D.

Departamento de Polímeros
Facultad de Cs. Químicas.
Universidad de Concepción

Catalina Sandoval A.

Depto. de Qca. Org. y Fco. Qca.
Facultad de Cs. Qcas. y Farm.
Universidad de Chile

Glycolipids:

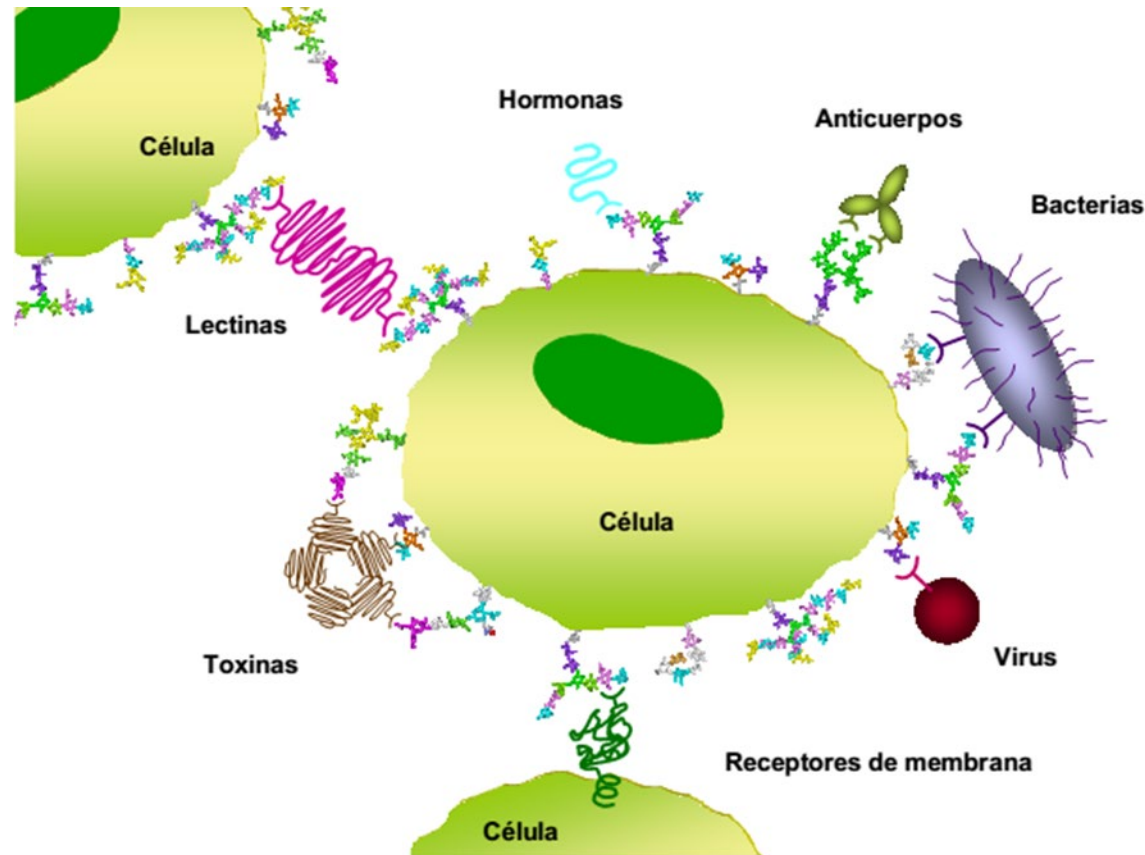
Biomolecules lipid chain (lipophilic) plus a monosaccharide/oligosaccharide (hydrophilic)

The most common contain:

galactose, mannose, fucose, glucose, glucosamine, galactosamine, or sialic acid as sugar

Glycolipids:

Involved in cell-cell interactions (signaling, recognition and adhesion) are modulated by sugar molecules located on the surface of cell as glycoconjugates.



Families of Compounds Studied

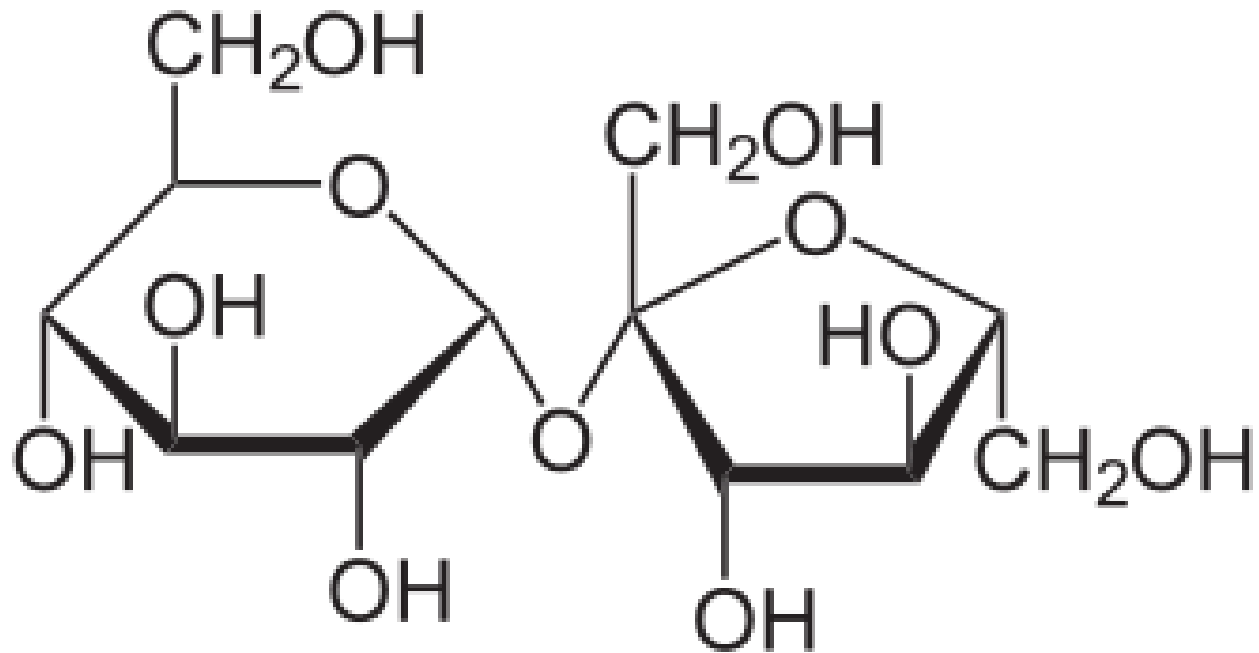
1 Sucrose Esters (Monoacyl)

2 Lactose Derivatives

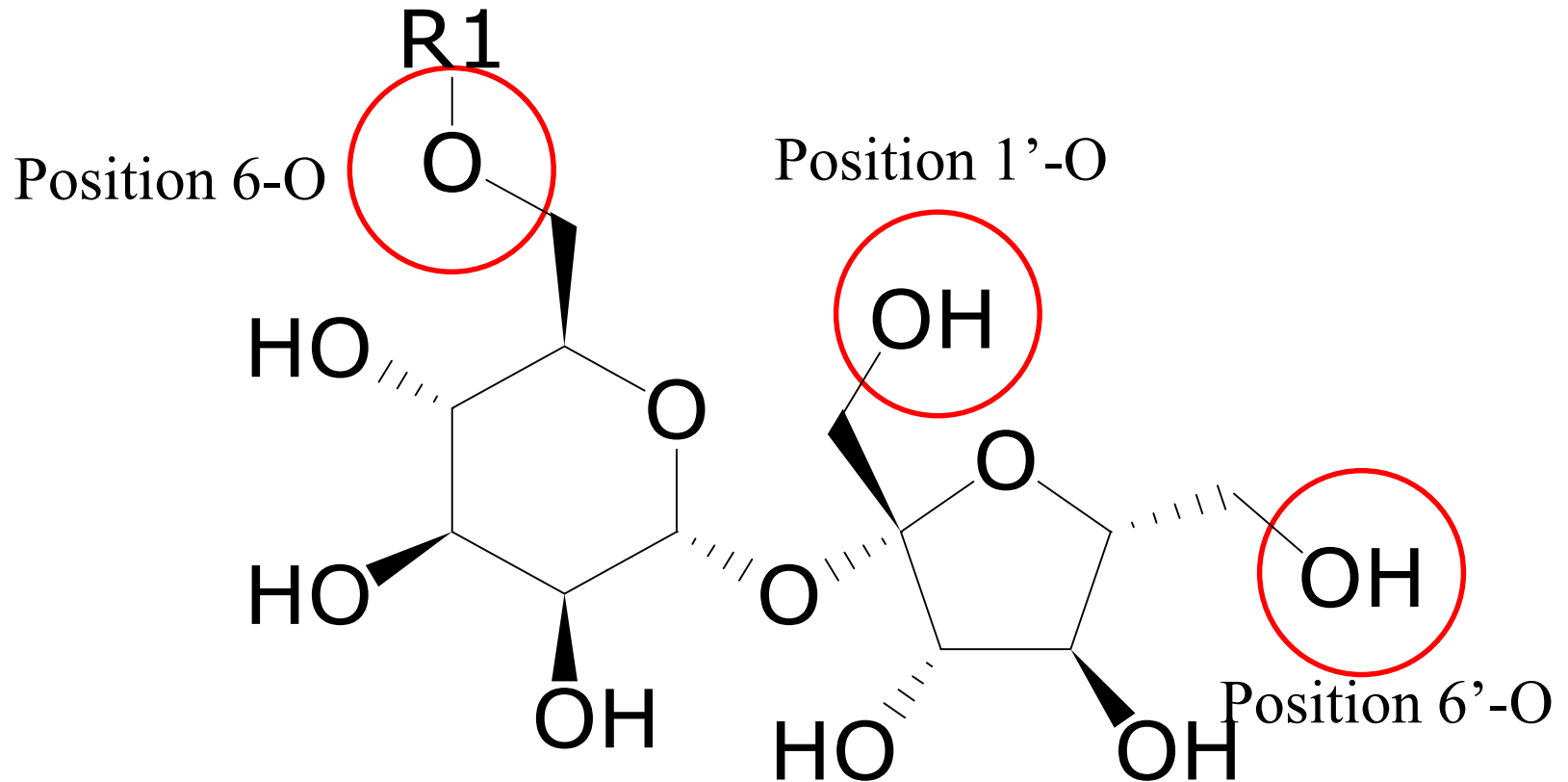
3 Mannose Derivatives

galactose, mannose, fucose, glucose, glucosamine, galactosamine, or sialic acid as sugar

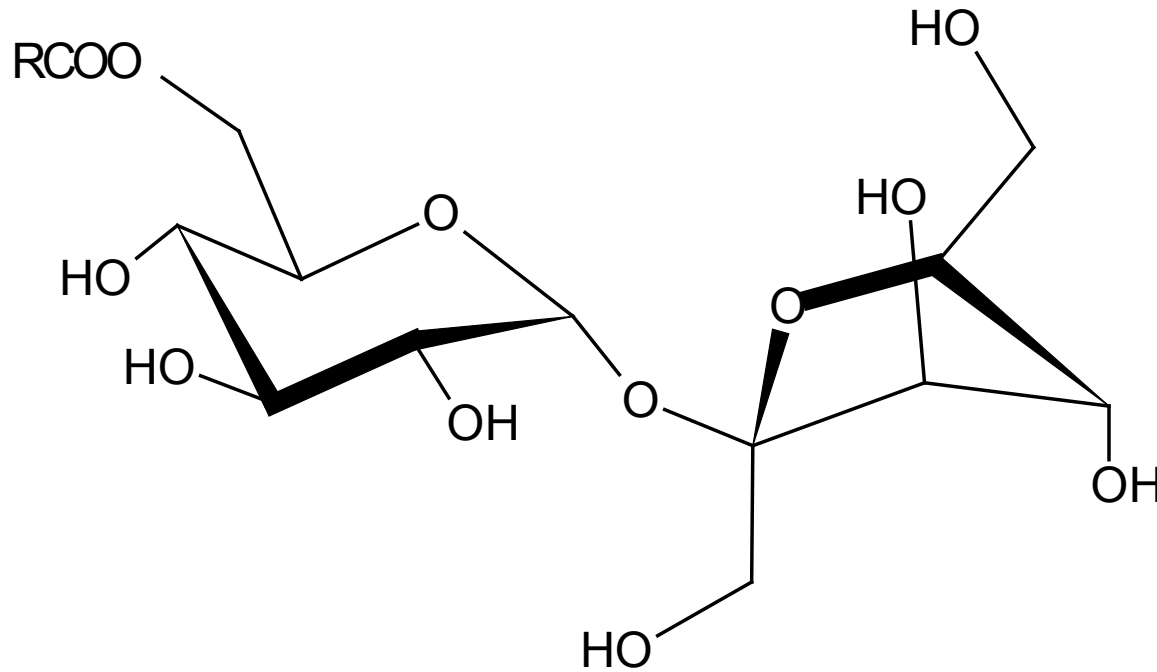
1. Sucrose



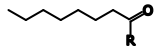
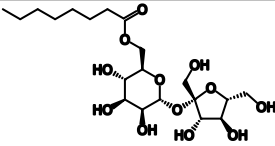
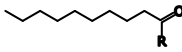
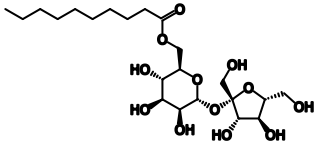
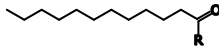
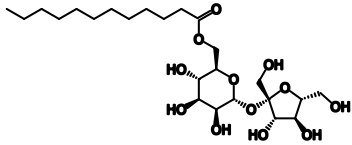
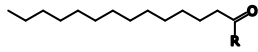
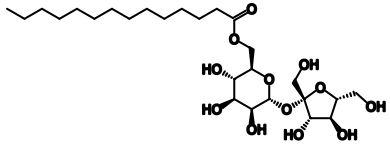
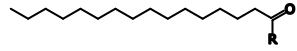
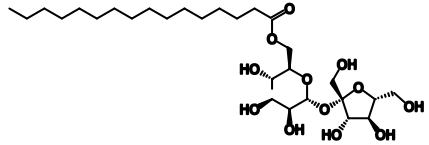
Sucrose esterification



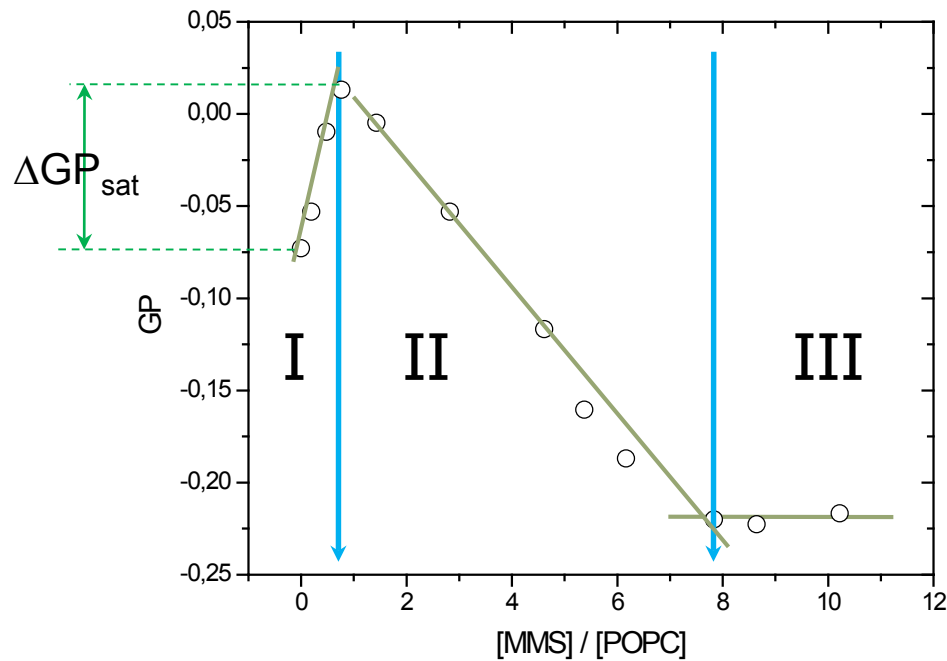
General structure of 6-O sucrose esters



Sucrose derivatives

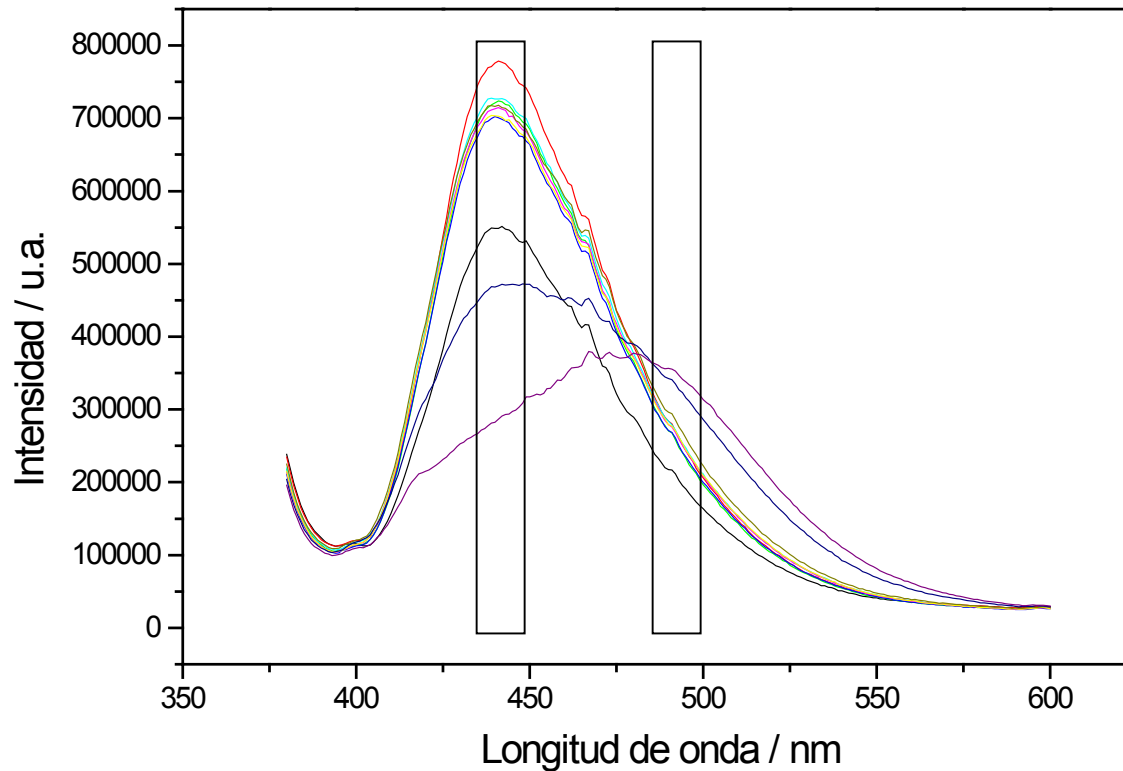
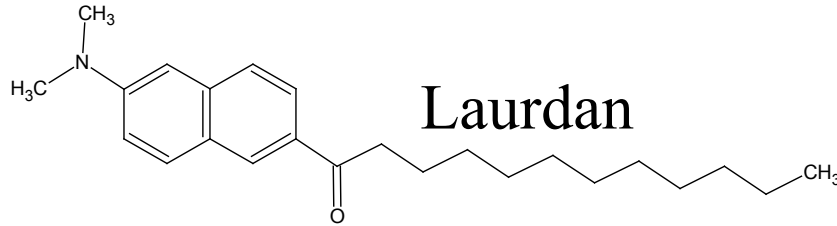
Substituent	name	Molecule
	MOS	
	MDS	
	MLS	
	MMS	
	MPS	

1.1 Three Stage Model of Solubilization



- I Saturation
- II Solubilization
- III Mixed Micelles

Laurdan GP on Cuvette

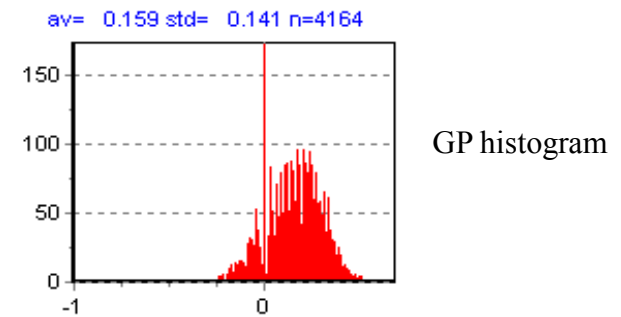
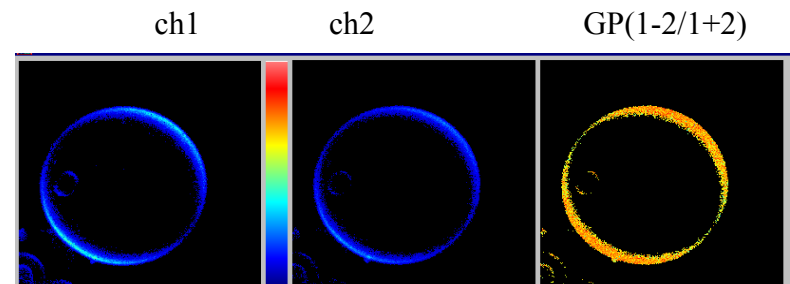
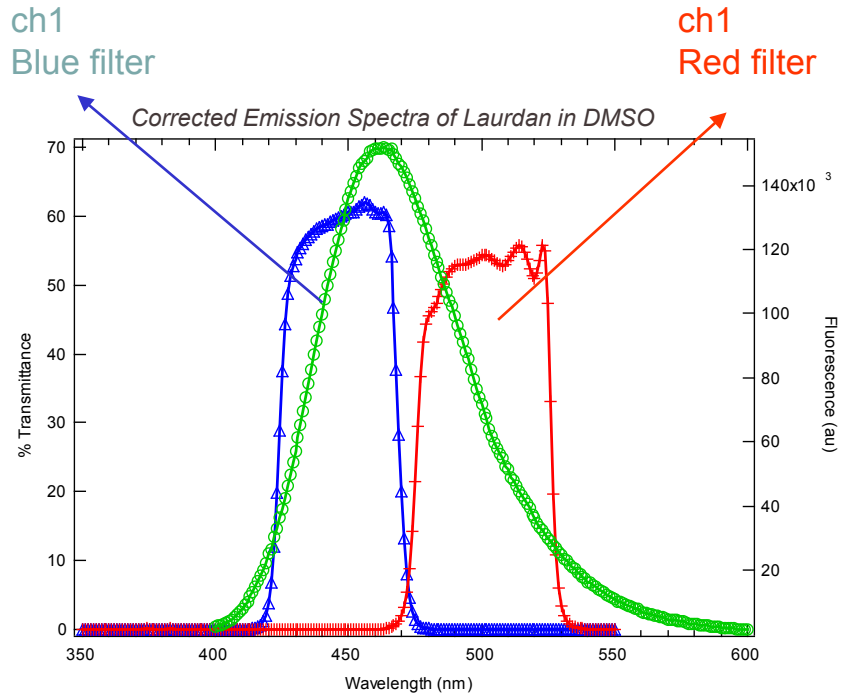


$$GP = \frac{I_{\text{blue}} - I_{\text{red}}}{I_{\text{blue}} + I_{\text{red}}}$$

$$I_{\text{blue}} = 440\text{nm}$$

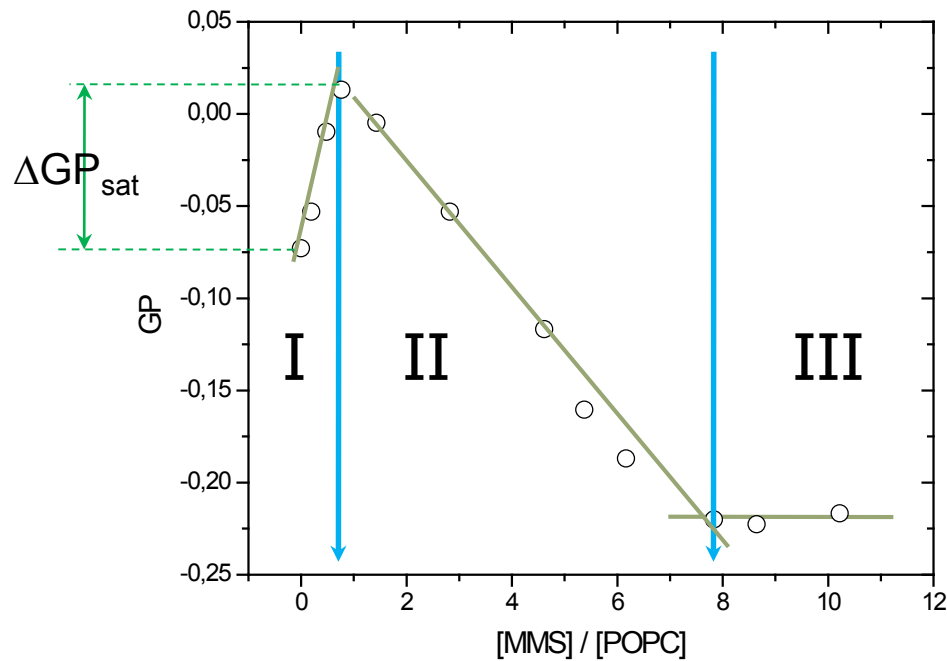
$$I_{\text{red}} = 490\text{nm}$$

GP on the two-channel microscope



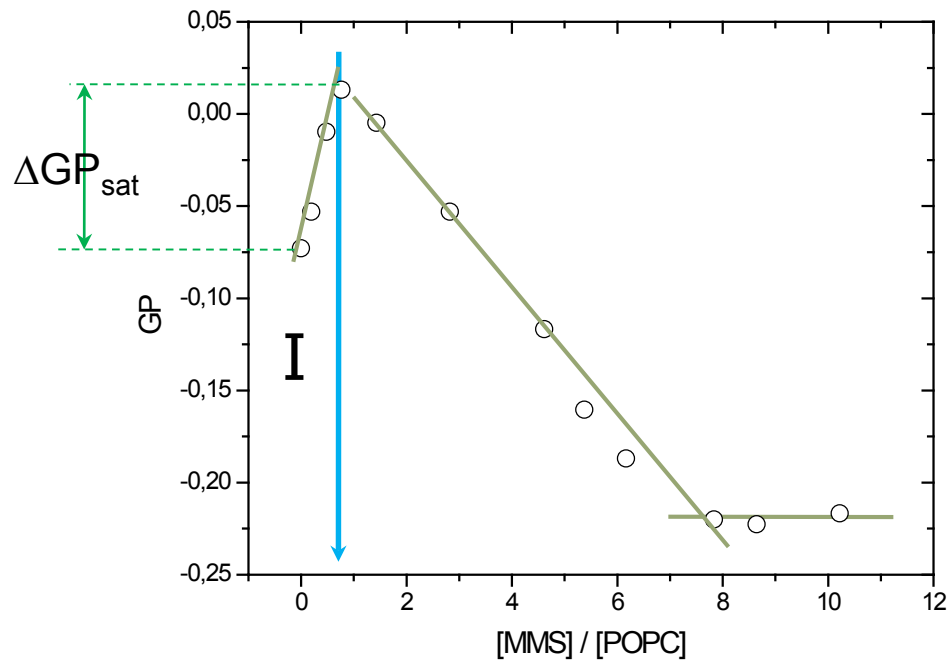
Measurement of Laurdan GP in the GUVs using Sim-FCS program

1.1 Three Stage Model of Solubilization

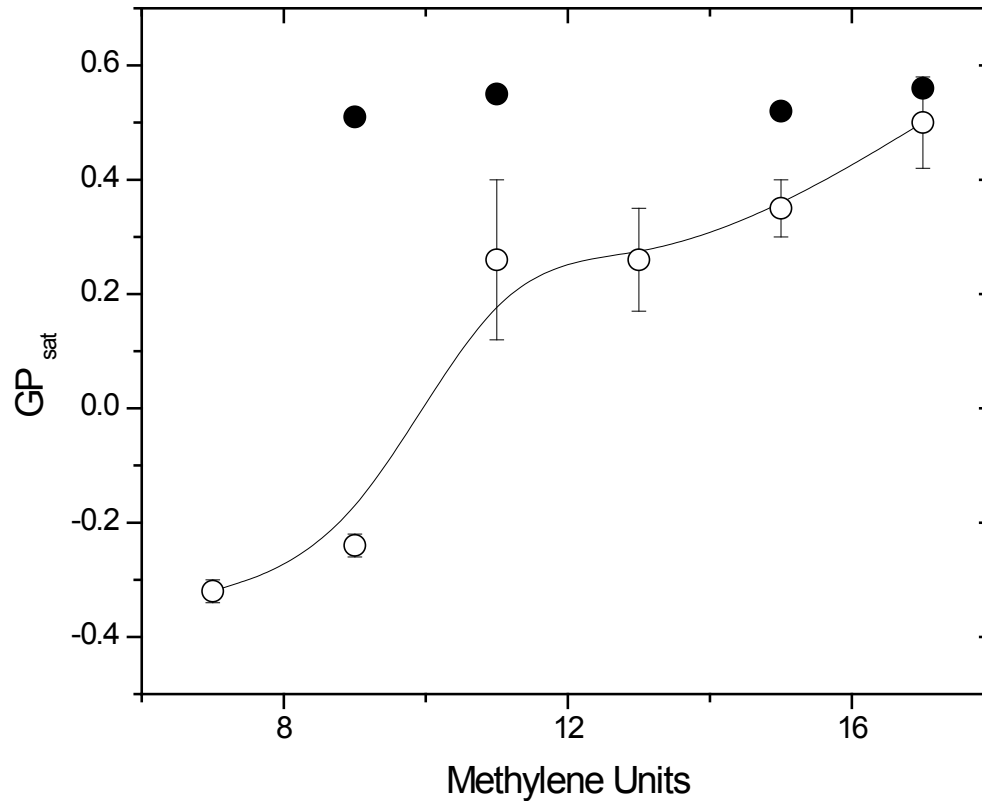


- I Saturation
- II Solubilization
- III Mixed Micelles

1.1 Three Stage Model of Solubilization



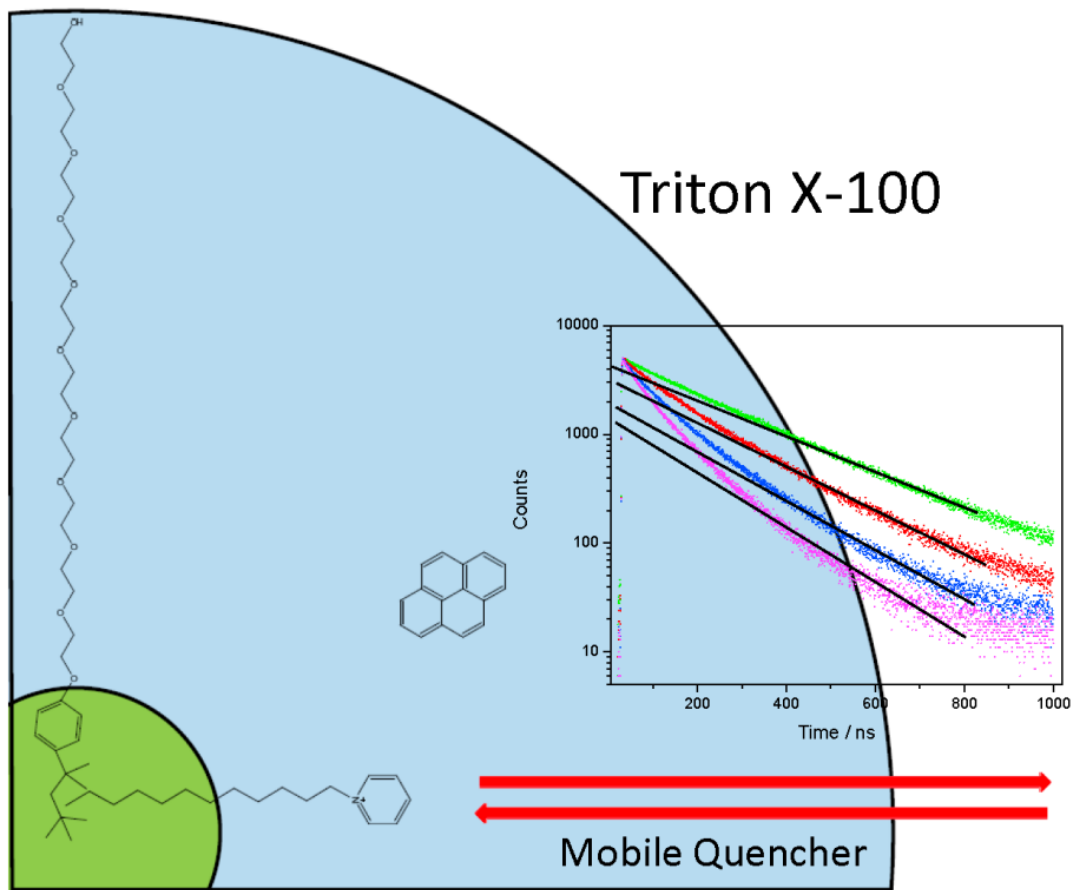
Effect of methylene units on GP_{sat}



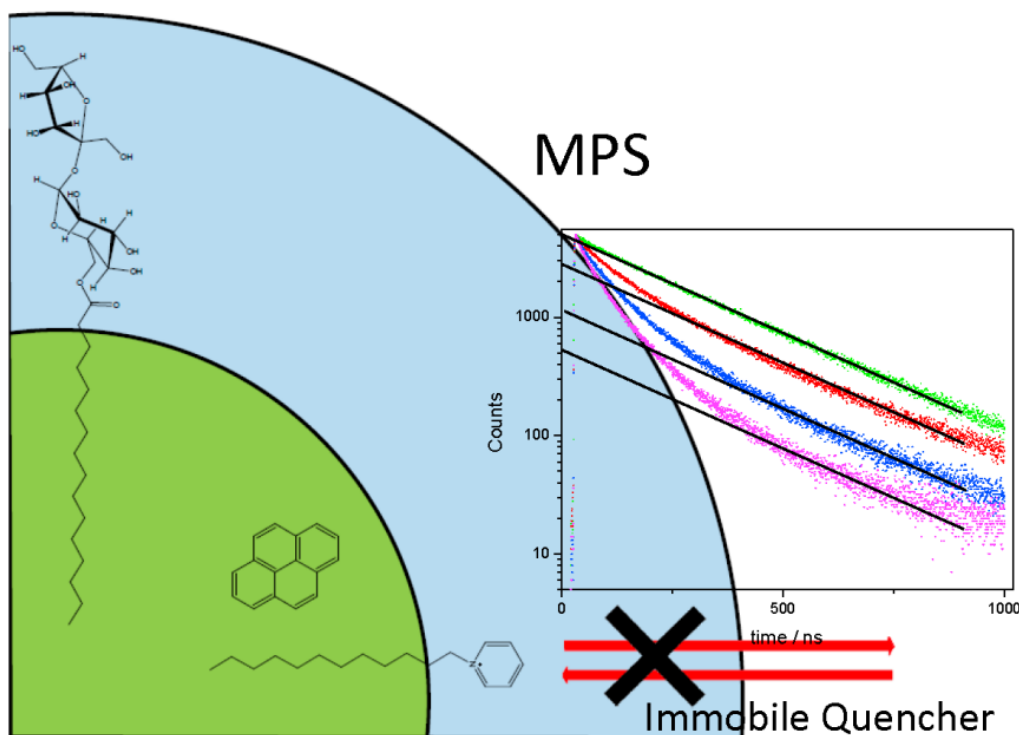
GP_{sat} for DODAC SUV's (\circ) and DPPC vesicles (\bullet) with the series of sucrose esters at 25°C

1.2 Sucrose ester Micelles

1.2 Effect on the Palisade of Direct Mixed Micelles



1.2 Effect on the Palisade of Direct Mixed Micelles

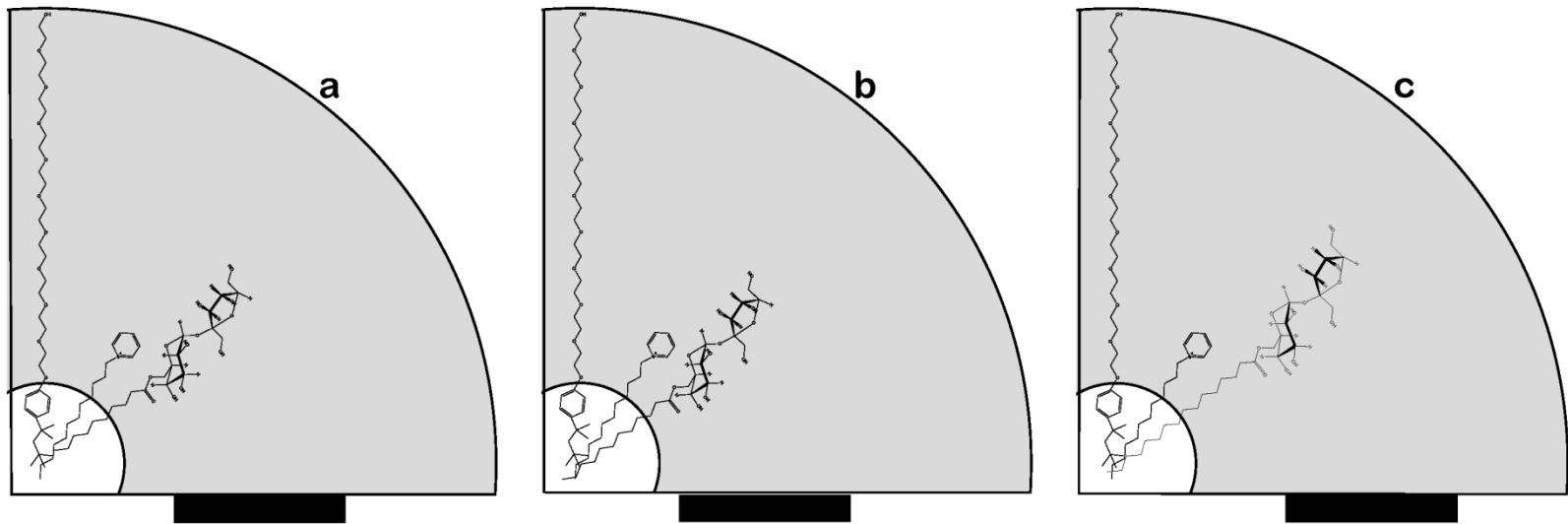


Direct Mixed Micelles

Sucrose esters	$\chi_{\text{Triton X-100}}$	k_0 / 10^6seg^{-1}	$k.$ / 10^6seg^{-1}	k_q / 10^6seg^{-1}
	1	4.26	3.32	6.42
MCS	0.8	3.92	9.55	7.59
	0.6	3.97	7.77	2.32
	0.5	3.95	7.43	4.29
	0	3,57	-	1.11
MLS	0.8	4.51	2.60	6.37
	0.6	4.43	2.35	6.34
	0.5	4.45	1.91	6.29
	0	4.09	0.44	7.10
MPS	0.8	4.14	3.94	7.75
	0.6	4.36	7.67	12.8
	0.5	4.22	9.41	15.3
	0	4.05	-	3.71

Effect of sucrose esters in the quenching process of pyrene by dodecylpyridinium chloride (DPC) in pure and mixed Triton X-100 micelles.

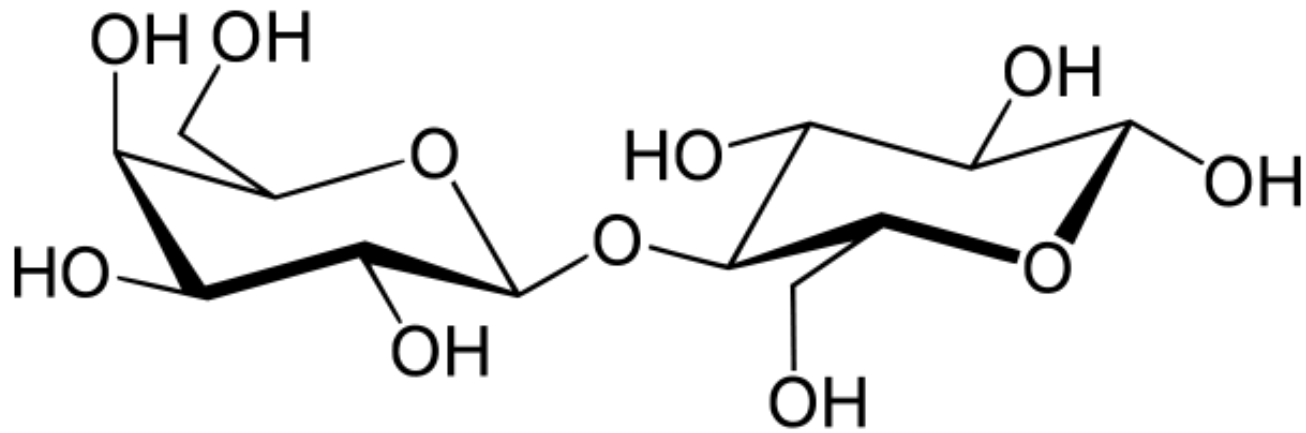
Direct Mixed Micelles



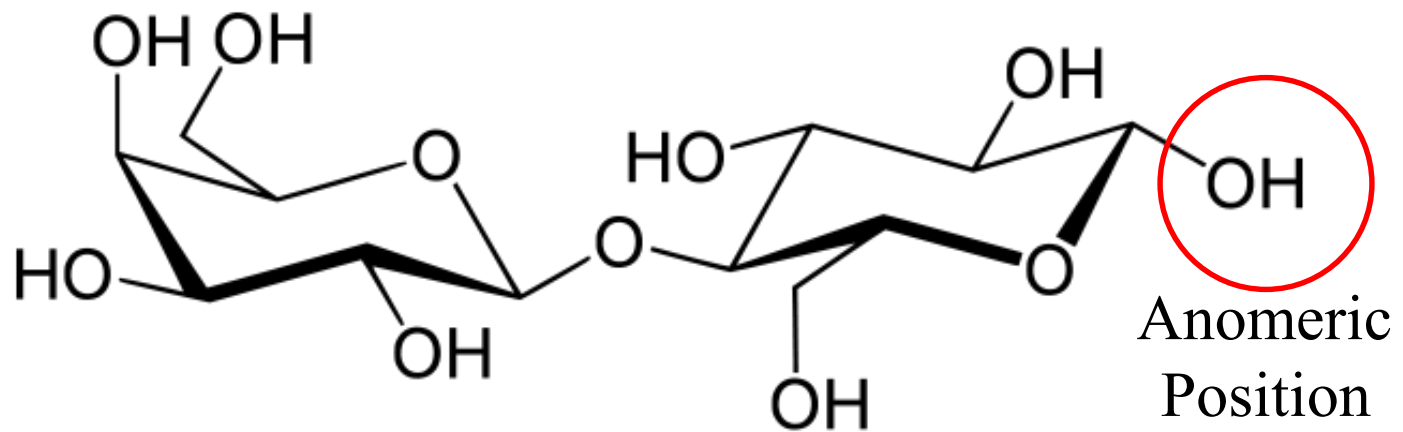
The disturbing effect on the micelle core, consequence of the difference in size of both hydrophobic tails (Triton X-100 and SE), plays an important role, and the blocking effect can be overcome when the hydrophobic tails of SEs are too short or too long compared with Triton alkyl chain.

2 Lactose Derivatives

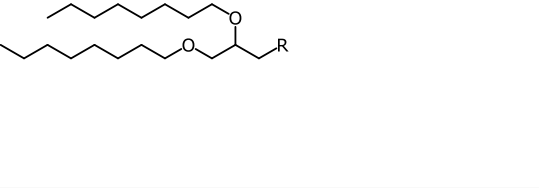
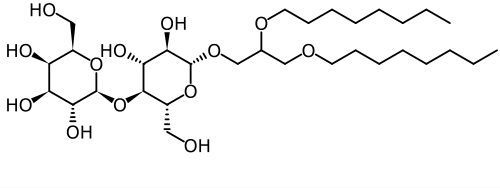
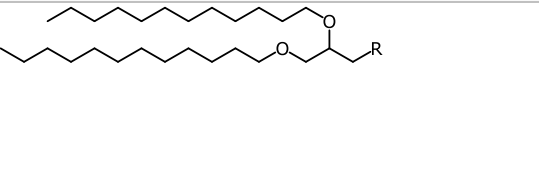
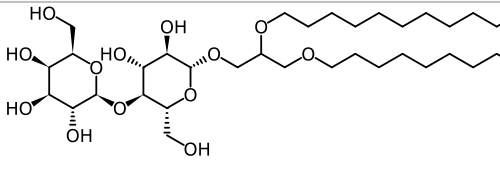
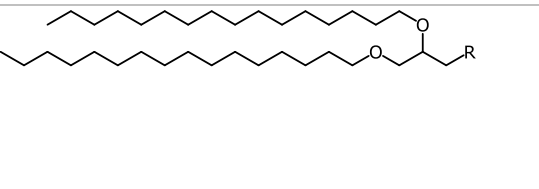
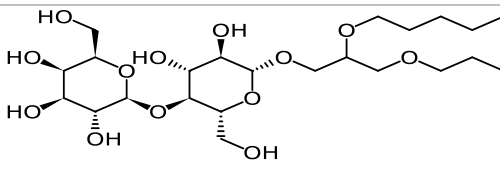
Lactose



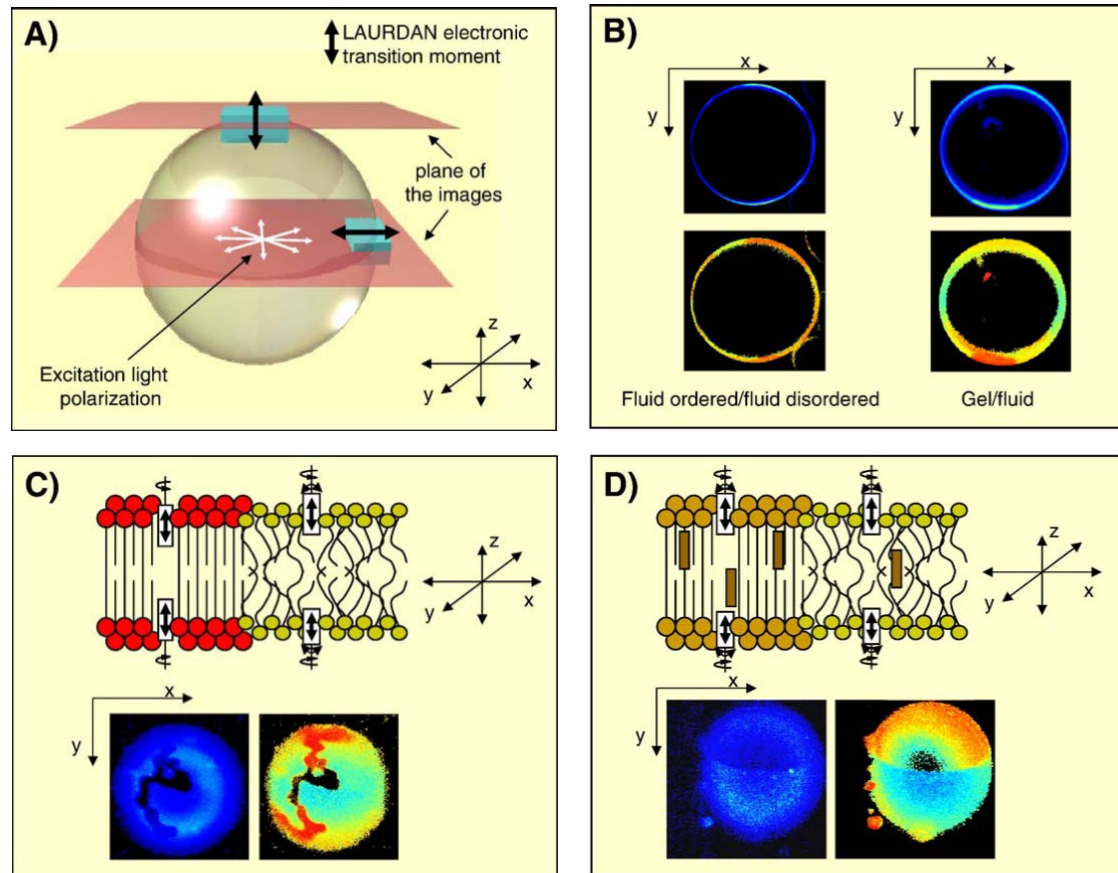
Lactose Reaction



Lactose Derivatives

	DOL	
	DLL	
	DPL	

Photoselection effect in Laurdan emission in GUVs

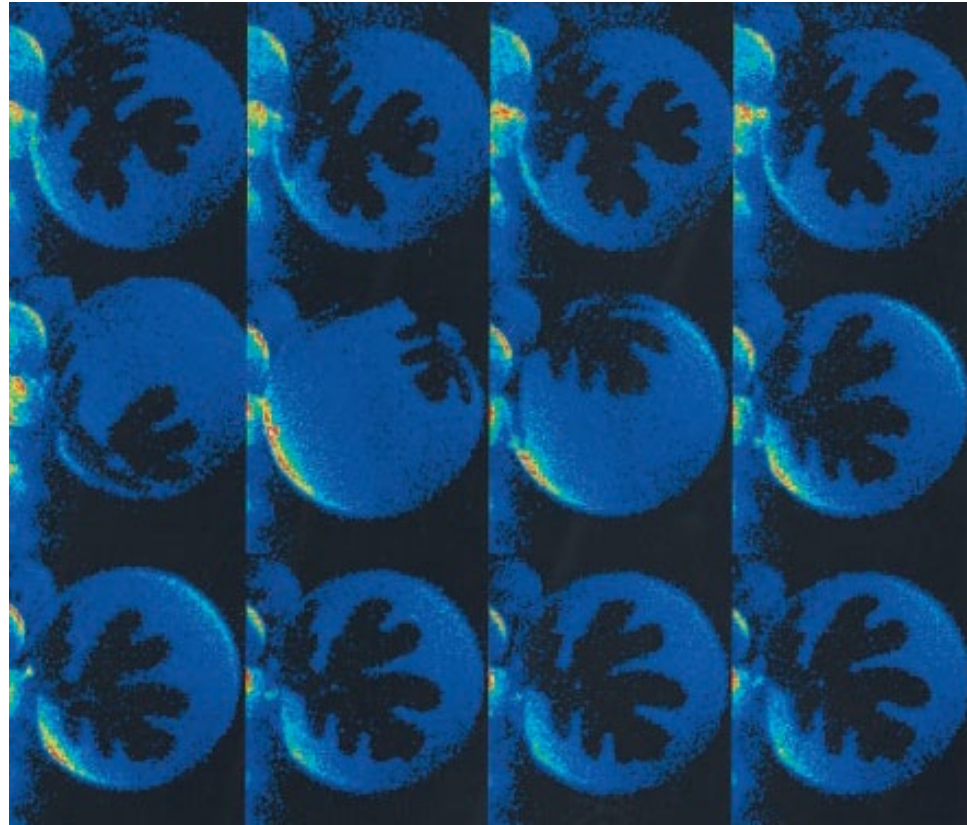


From: Bagatolli, L. A. (2006). "To see or not to see: Lateral organization of biological membranes and fluorescence microscopy." *Biochimica Et Biophysica Acta-Biomembranes* **1758**(10): 1541-1556.

Hydrophobic mismatch in the lipid matrix

Hydrophobic mismatch heads

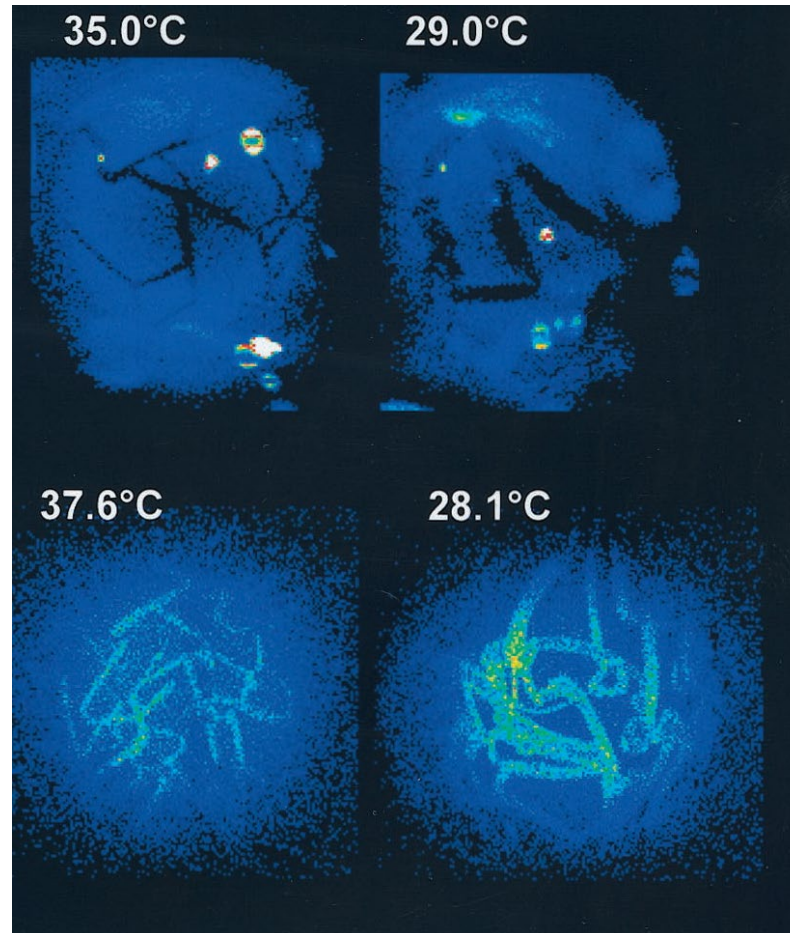
DPPC:DPPE 3:7



L. A. Bagatolli and E. Gratton, *Biophysical Journal* 78: 290 (2000)

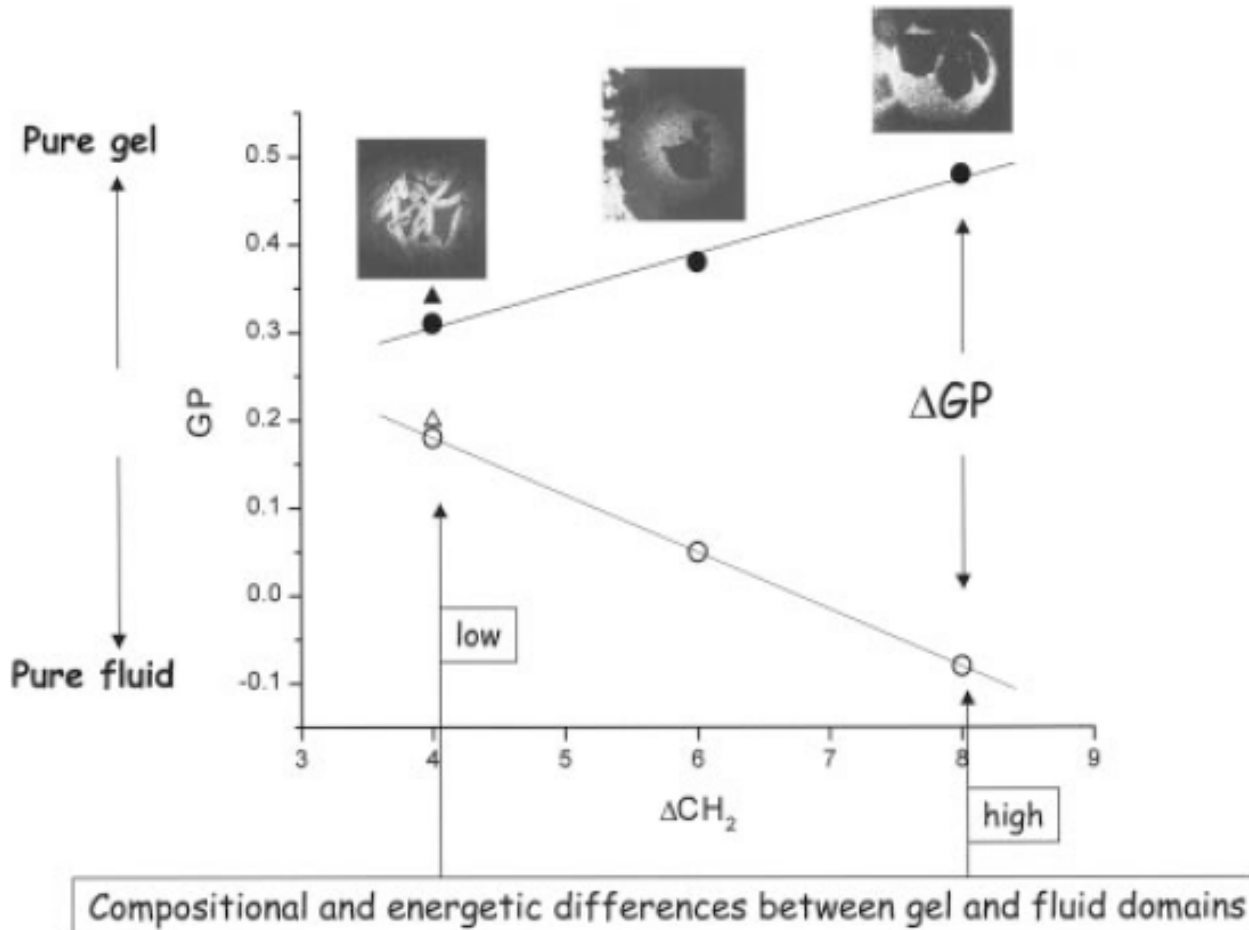
Hydrophobic mismatch tails

DLPC:DPLC 1:1



L. A. Bagatolli and E. Gratton, *Biophysical Journal* 78: 290 (2000)

Hydrophobic mismatch



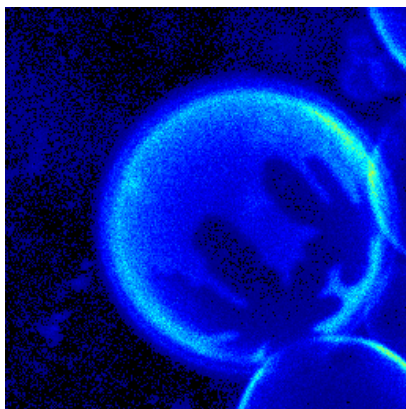
L. A. Bagatolli and E. Gratton, Biophysical Journal 78: 290 (2000)

GUVs

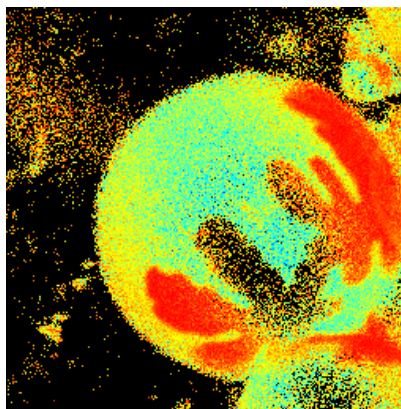
30°C

POPC:DPL (36% POPC) GUVs

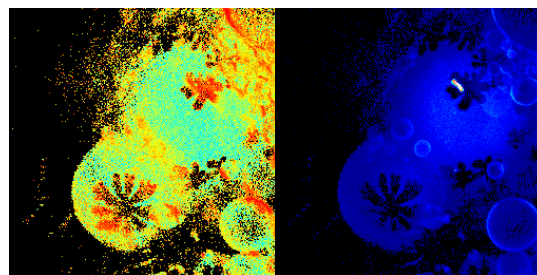
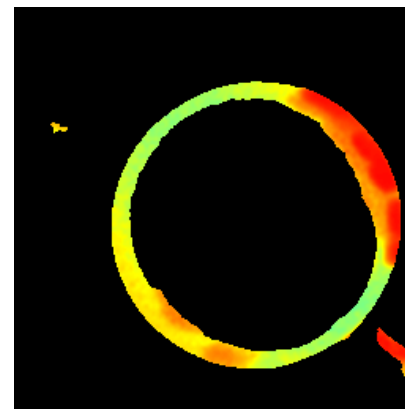
top
Intensity



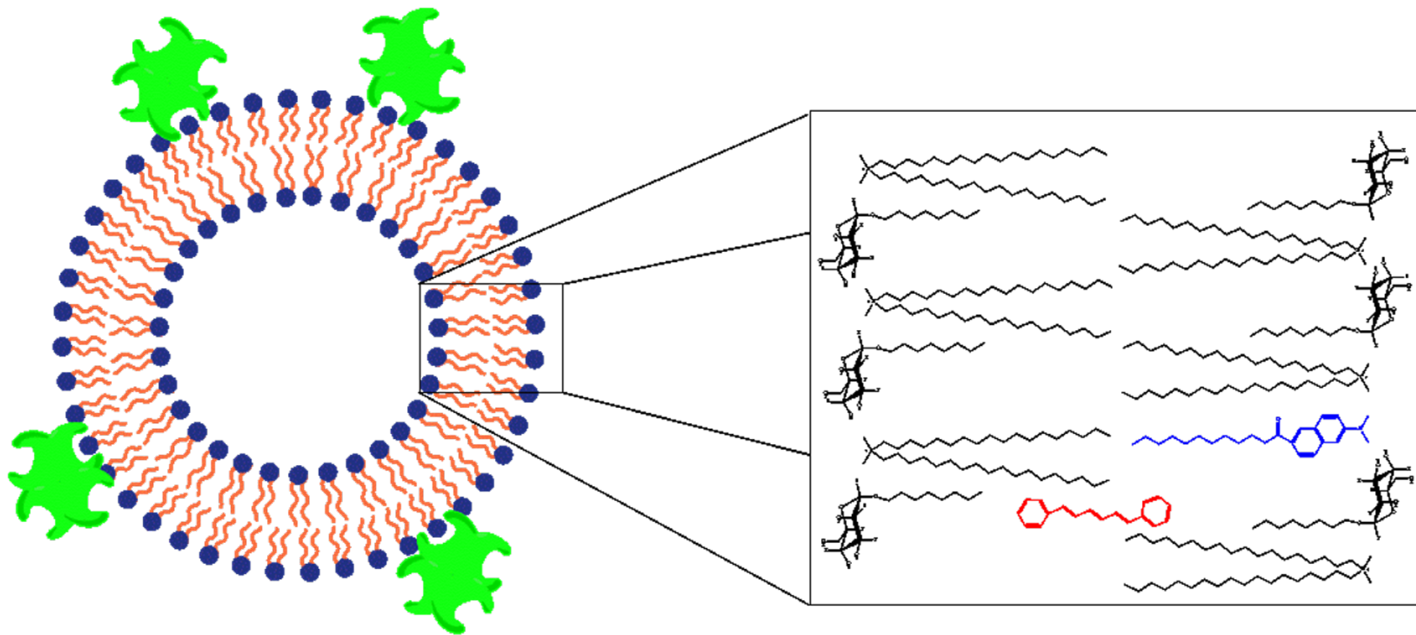
top
GP Image



center
GP Image

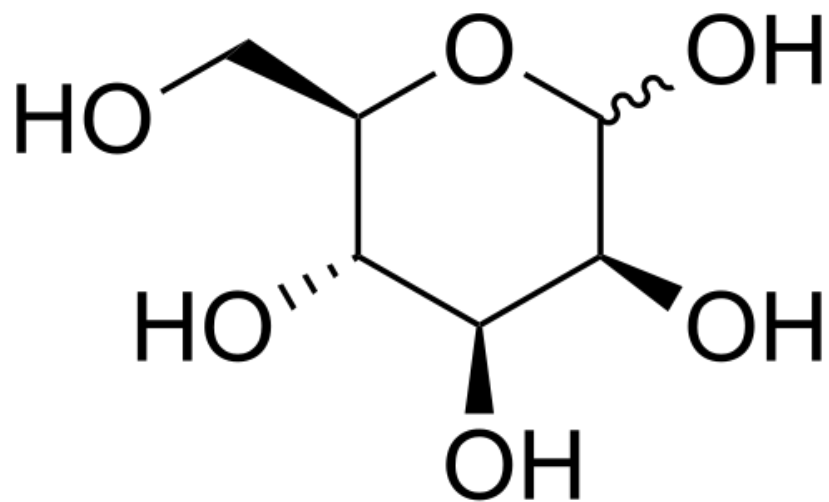


3 Mannose Derivatives

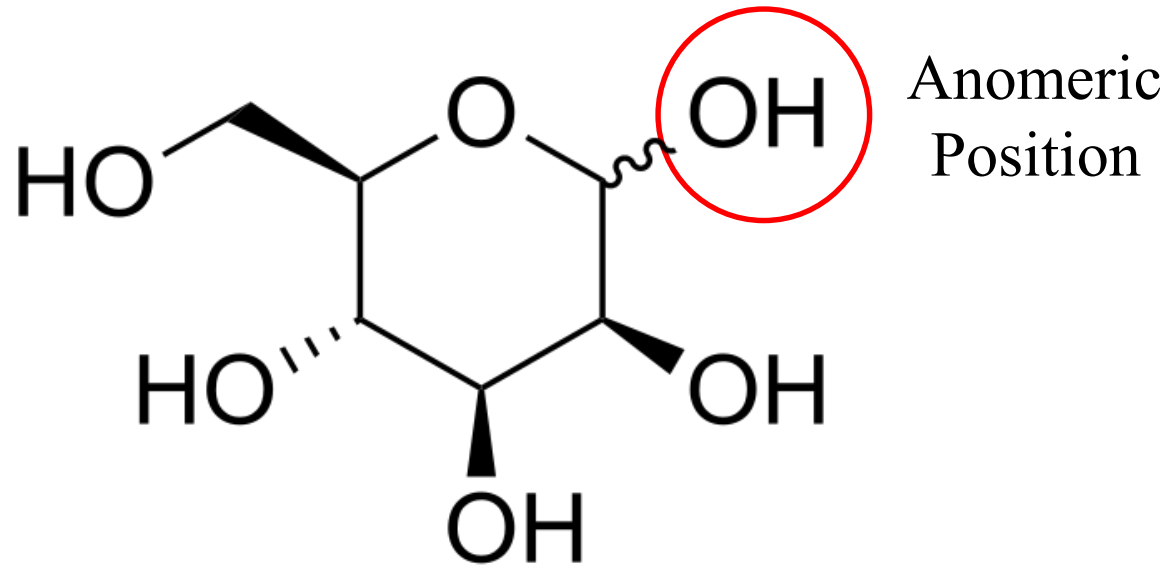


Concanavalin A

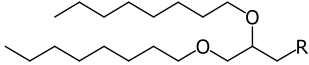
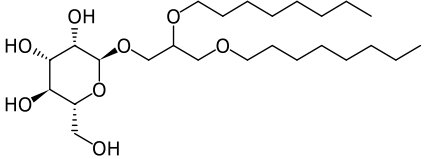
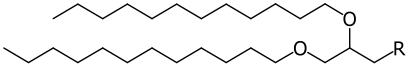
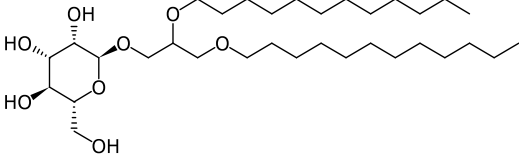
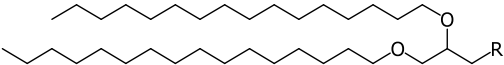
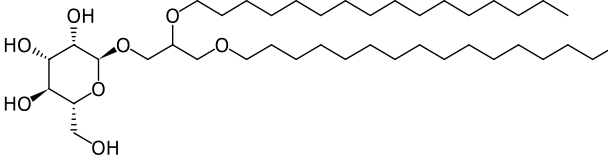
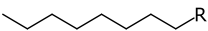
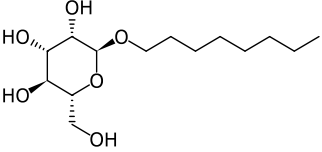
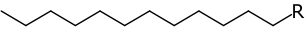
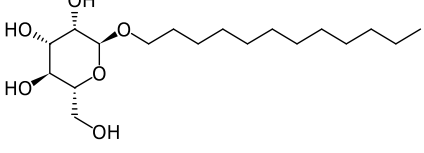
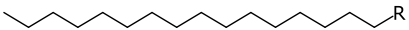
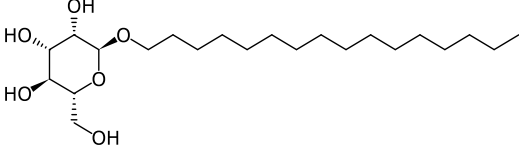
Mannose



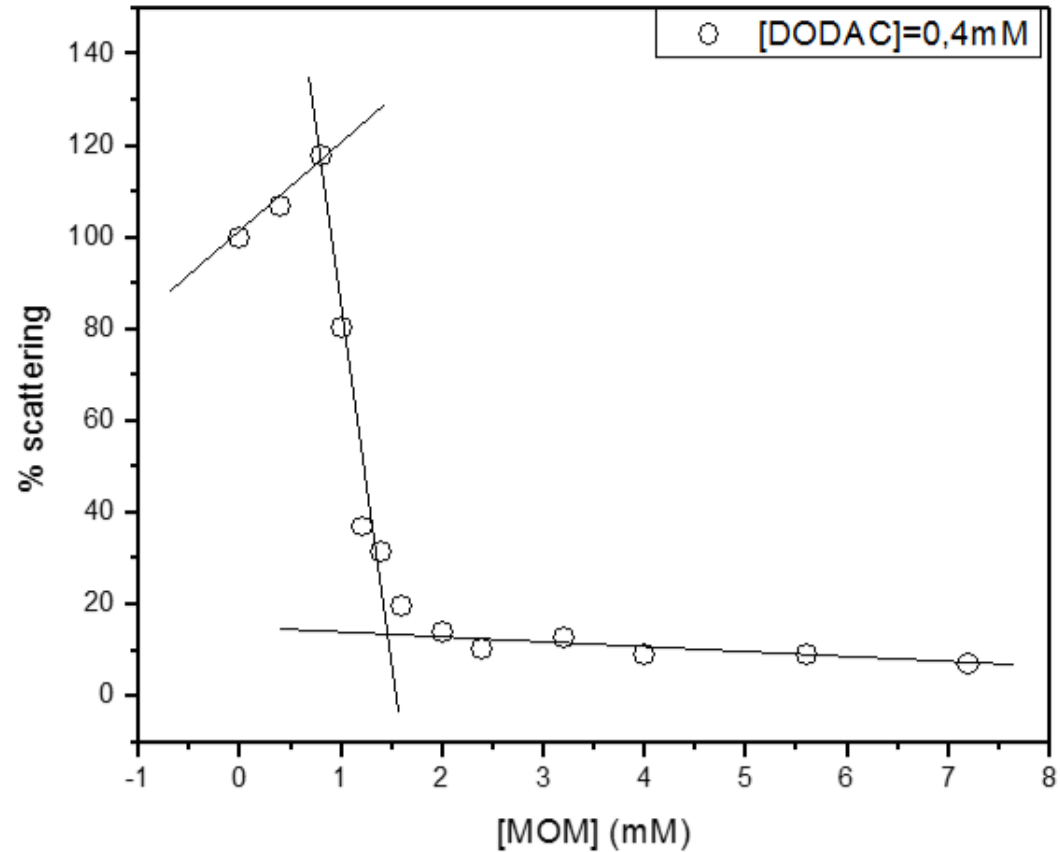
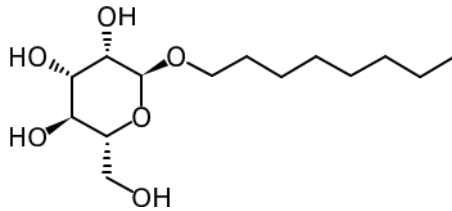
Mannose Reaction



Mannose Products

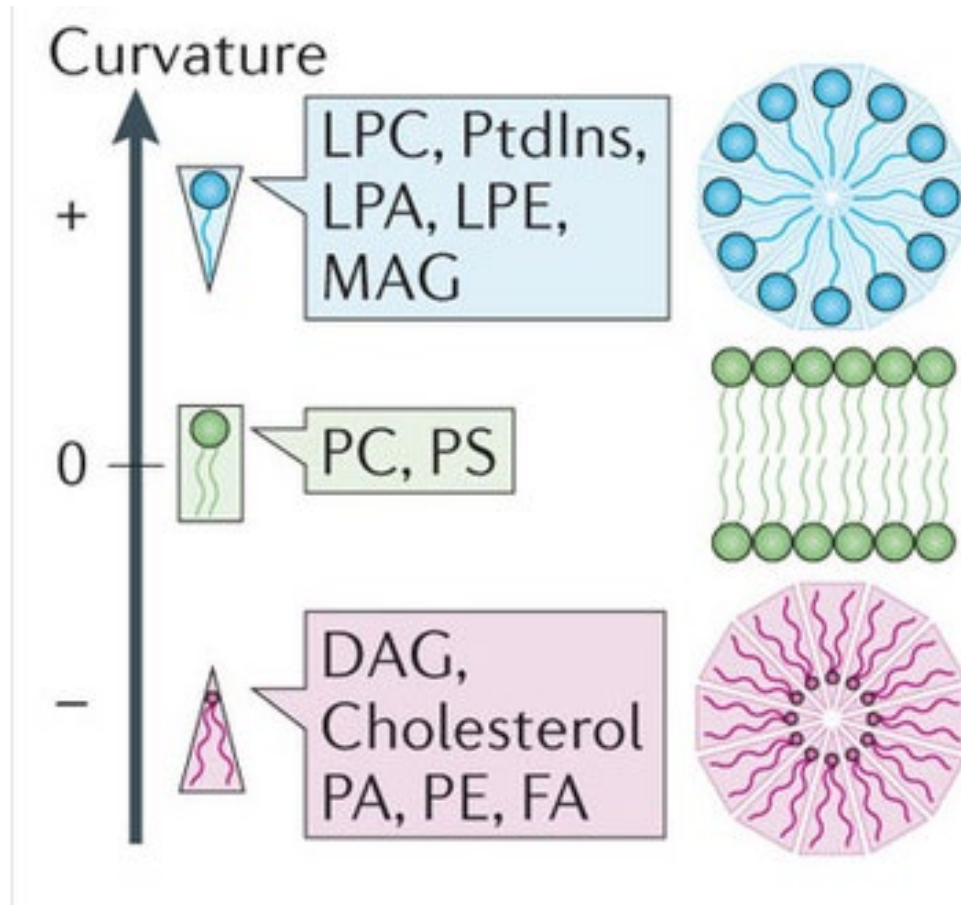
	DOM	
	DLM	
	DPM	
	MOM	
	MLM	
	MPM	

Monoalkyl Mannose



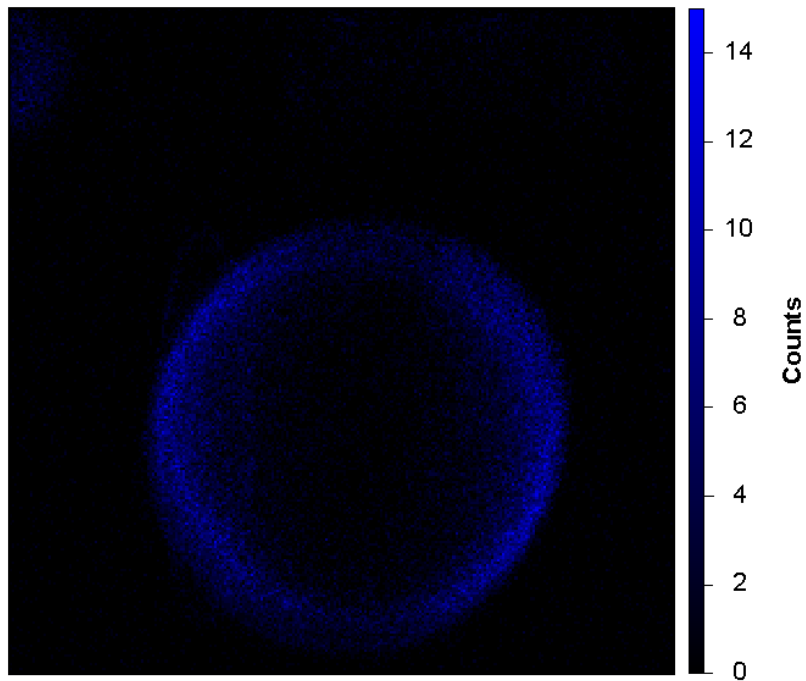
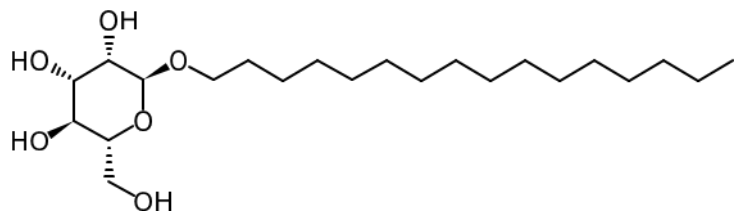
But longer ones iii

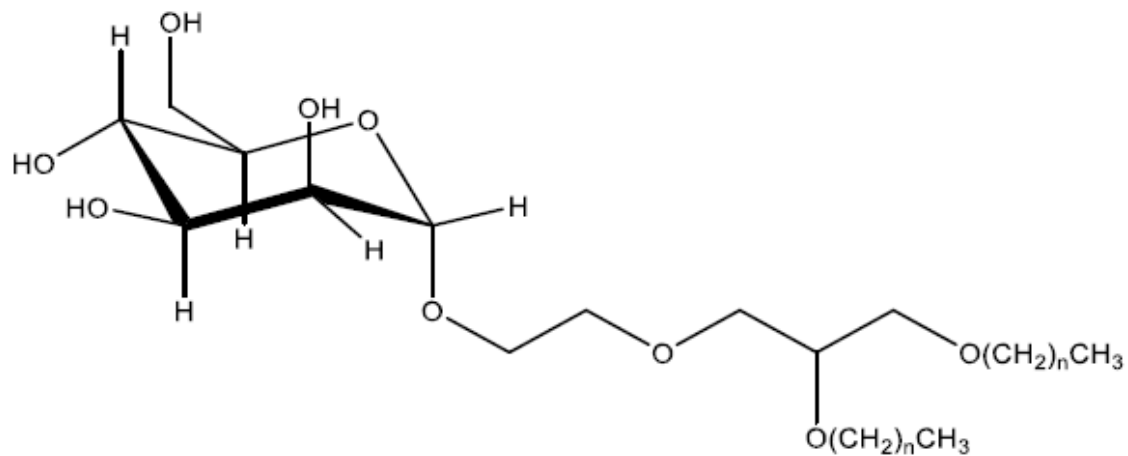
Spontaneous Curvature



Nature Reviews | [Molecular Cell Biology](#)

Monoalkyl Mannose



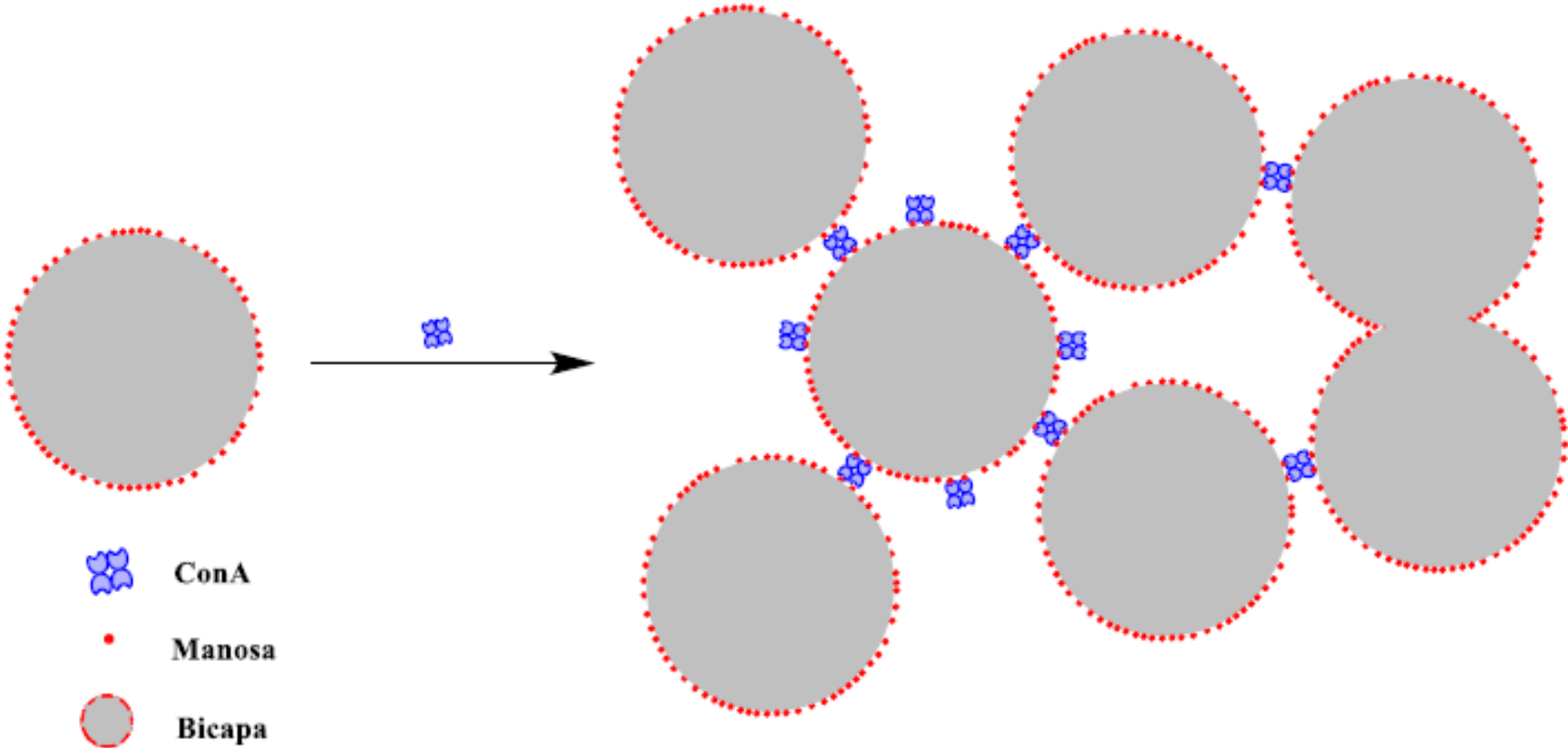


n=7 DOEM

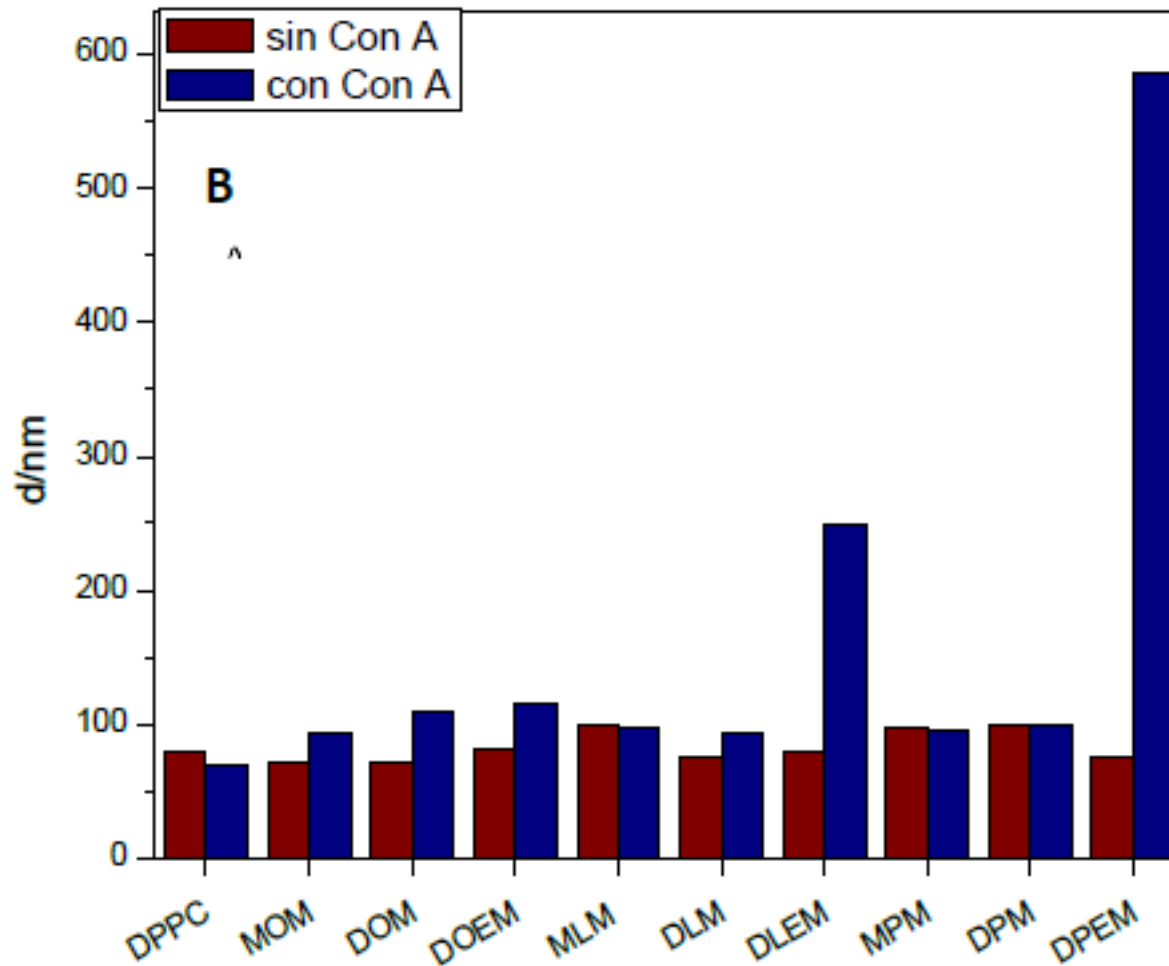
n=11 DLEM

n=15 DPEM

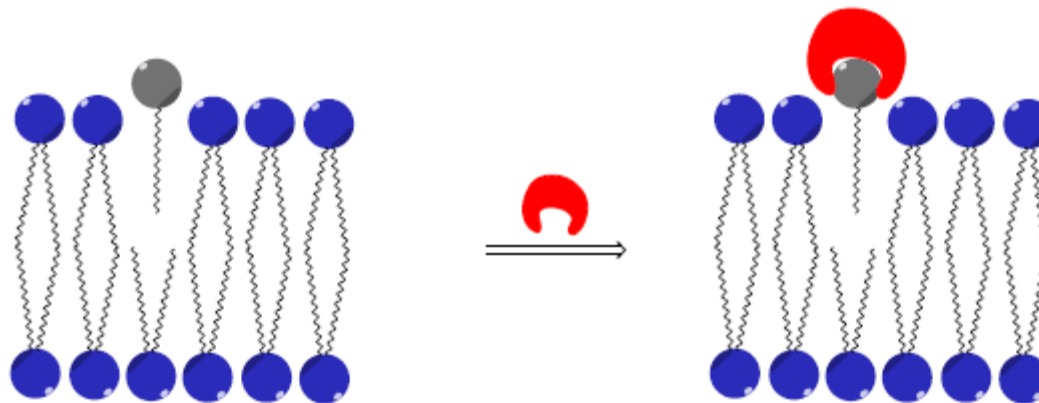
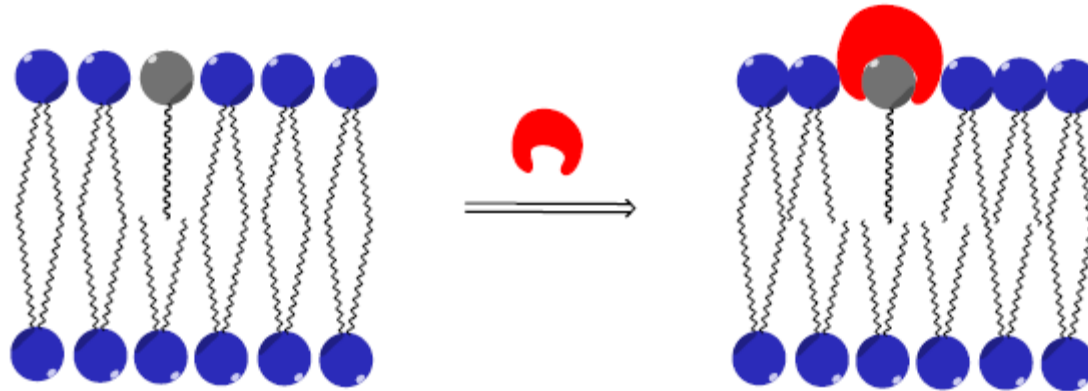
Agglutination



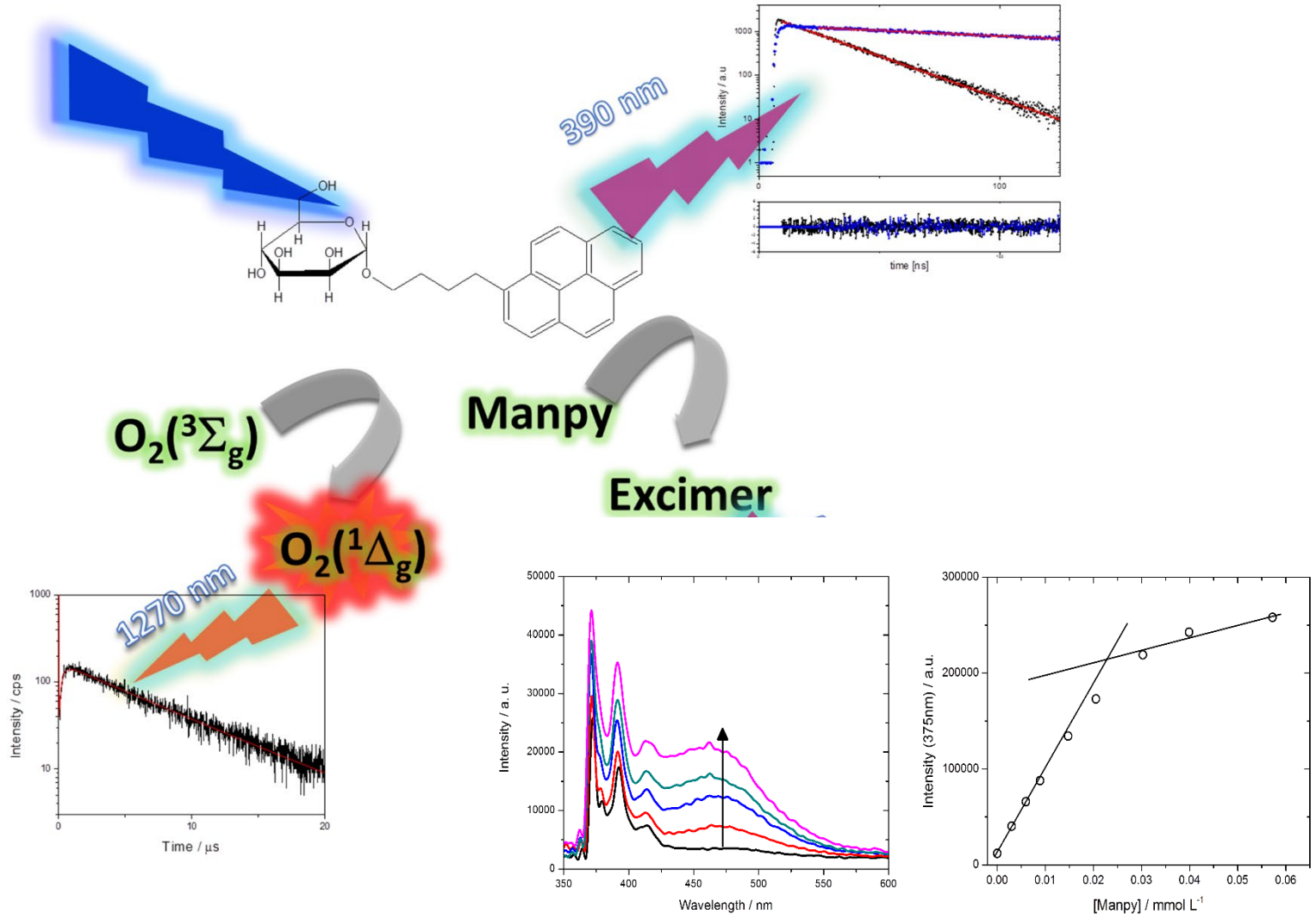
Agglutination



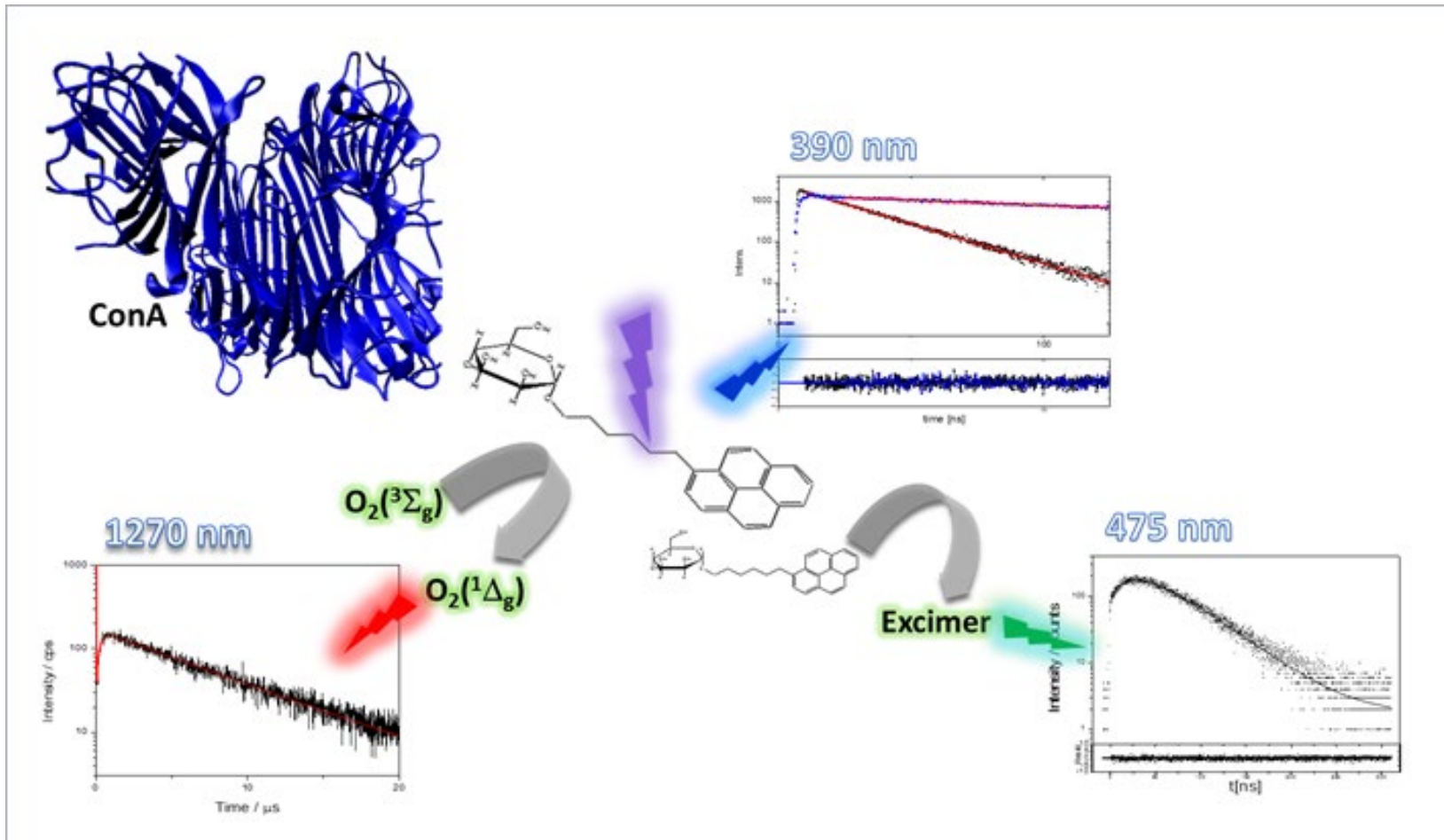
Interaction Affects Membrane



And now, Mannose plus a probe



We hope



Acknowledgments

The authors thank Fondecyt-Chile 1120196 (G.G.) 1140454 (S.S)

C. Sandoval-Altamirano thanks to Conicyt Beca Doctorado Nacional 21120554

And also Thank you