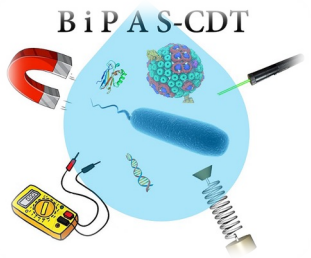
DEVELOPING MULTISCALE MODELS TO STUDY MOLECULAR TRANSPORT INTO TISSUES



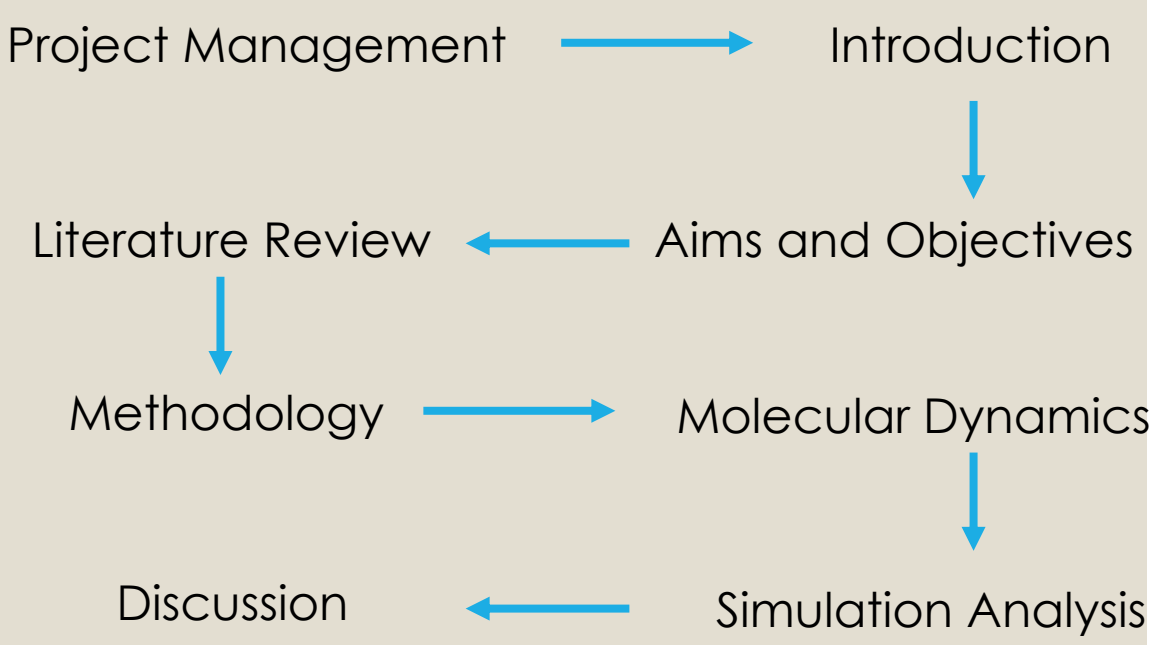
Melissa Jade Mitchell

Project Outline

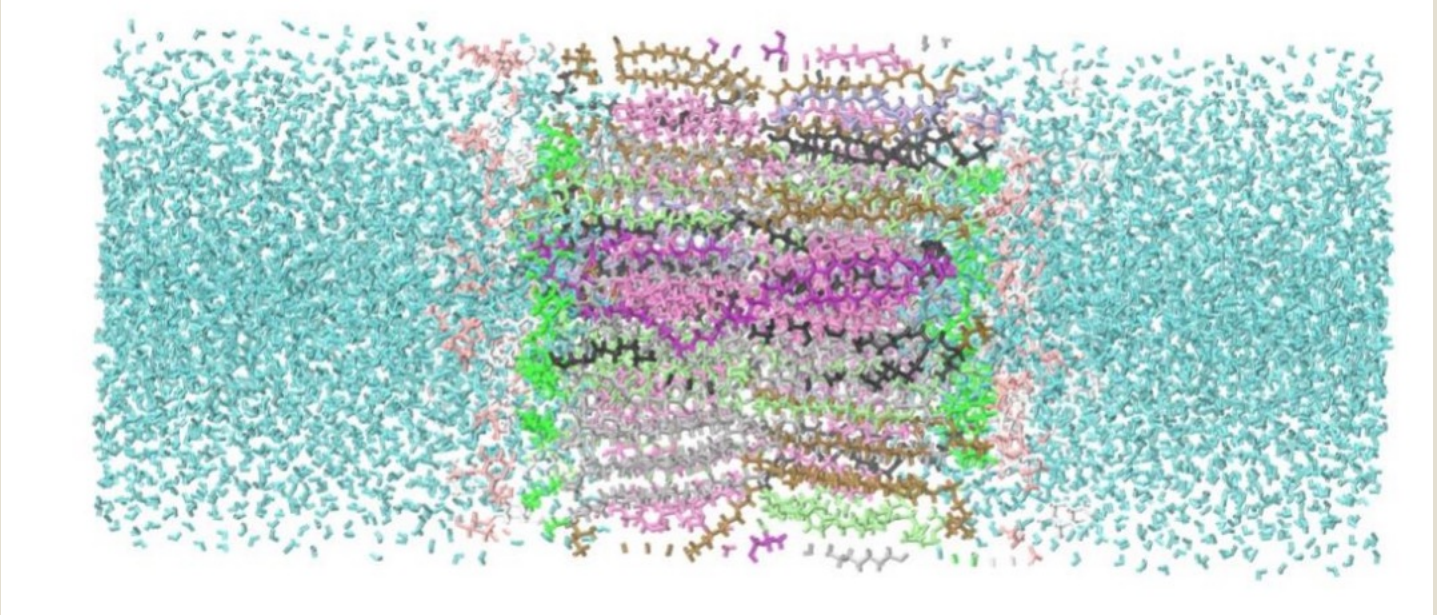
Investigate how drug molecules affects its ability to transport across the model gut lipid membrane

I'm looking at how drugs interact with different lipid compositions in the membrane.

Through the use of simulations and analysis tools, molecular dynamics aids in demonstrating this investigation.

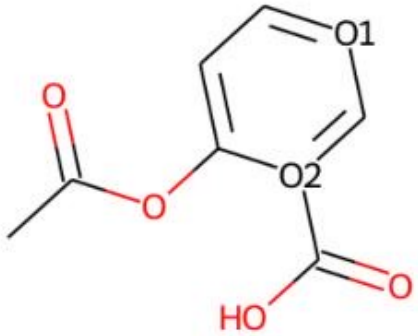


Membrane	Lipid Composition	No. Atoms
Gut Lipid	DOPE	1290
	DPPC	1300
	PEPS	556
	POPE	1250
	SAPI	572
	CER18	3488
	CHL1	2220

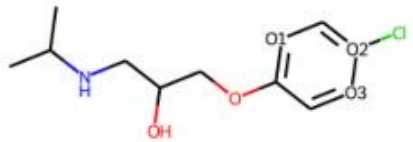


DRUGS

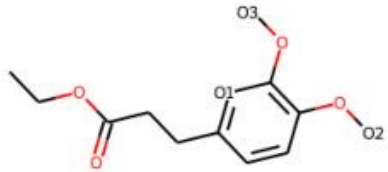
Aspirin



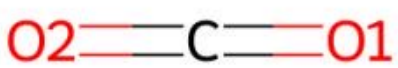
Atenolol



Felodipine



Carbon Dioxide

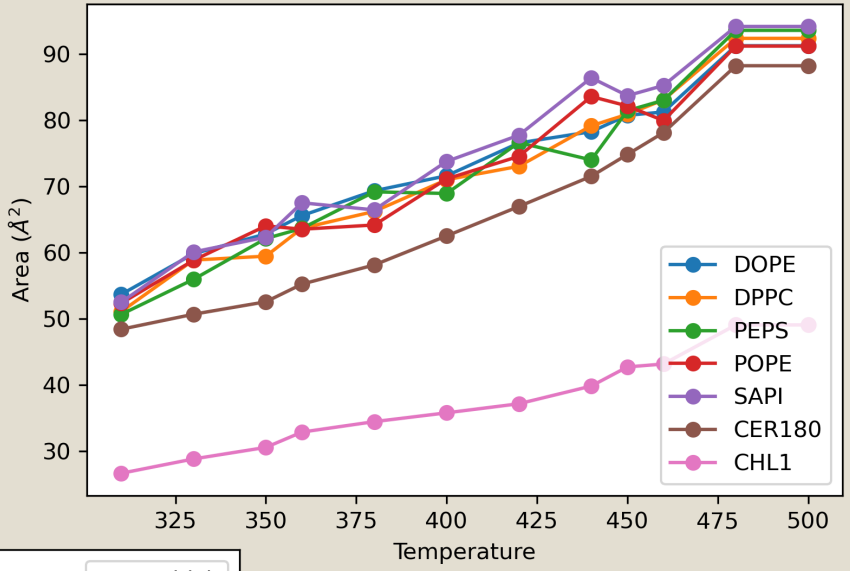


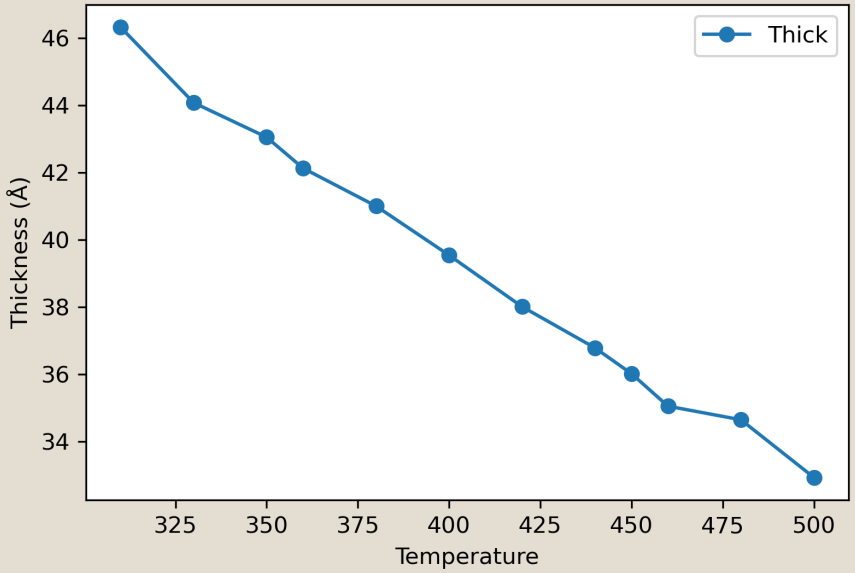
Ethanol

RESULTS

Area Per Lipid & Membrane Thickness

Property		310K	420K
Thickness (Å)		46.3 ± 0.01	38 ± 0.09
APL (Å²)	Average	47.9 ± 0.04	69 ± 0.37
	DOPE	53.7 ± 0.04	76.6 ± 0.37
	DPPC	51.1 ± 0.05	73.1 ± 0.35
	PEPS	50.7 ± 0.06	76.7 ± 0.55
	POPE	52.4 ± 0.04	74.6 ± 0.35
	SAPI	52.5 ± 0.06	77.8 ± 0.64
	CER180	48.5 ± 0.02	70 ± 0.20
	CHL1	26.7± 0.02	37.2 ± 0.37

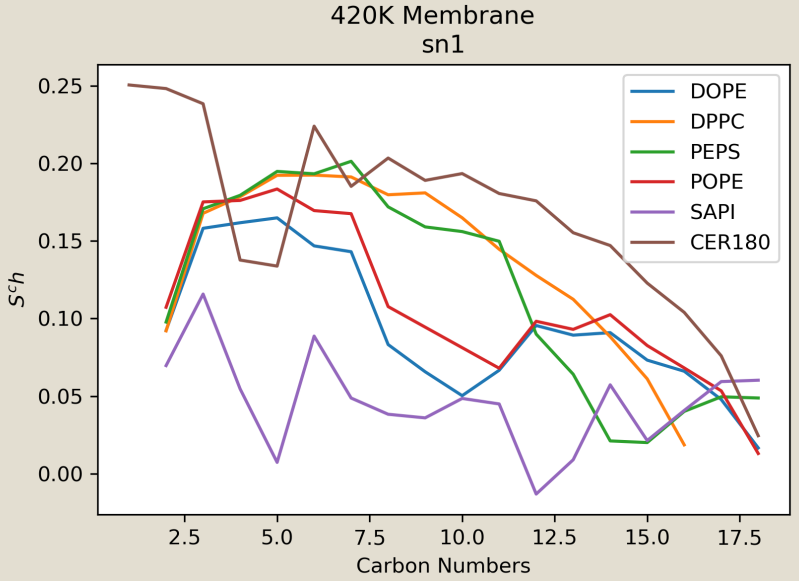


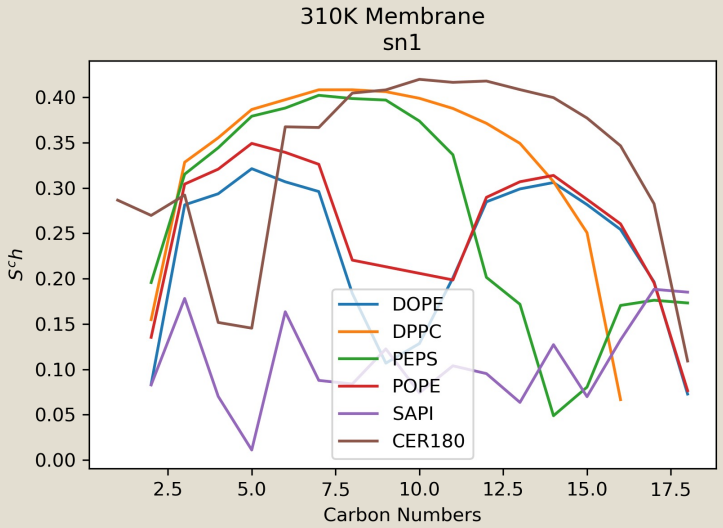


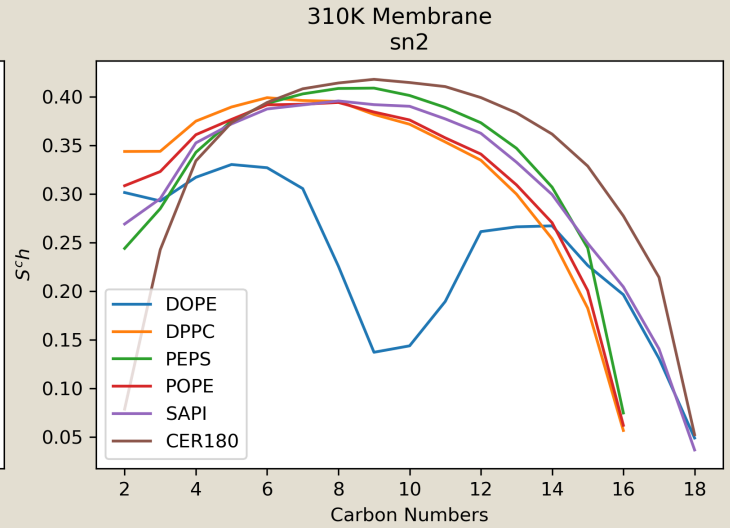
RESULTS

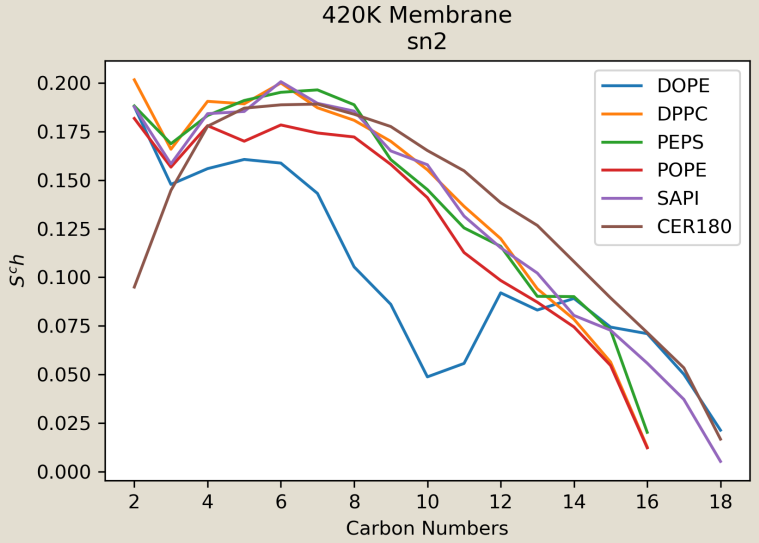
Lateral Diffusion & Lipid Order Parameter

Lipid Type	D (10 −8 cm 2 s −1)		% Difference
	310K	420K	
DOPE	0.56	76	99
DPPC	0.61	65	99
PEPS	1.3	41	97
POPE	0.81	72	99
SAPI	0.39	66	99
CER180	0.2	56	99
CHL1	0.38	97	99



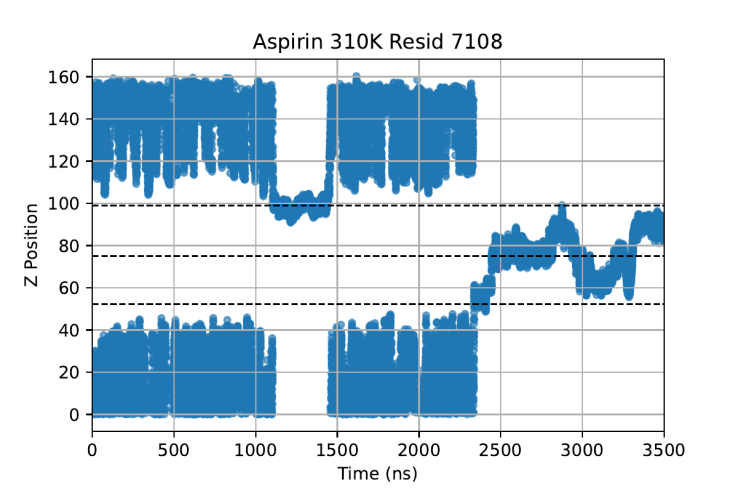


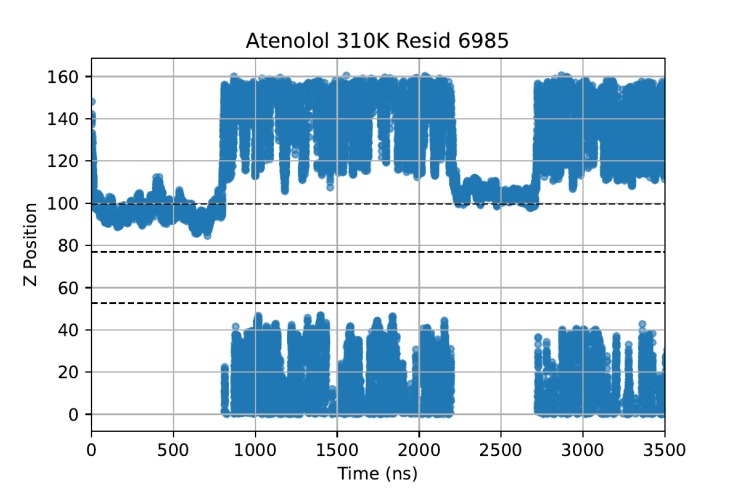


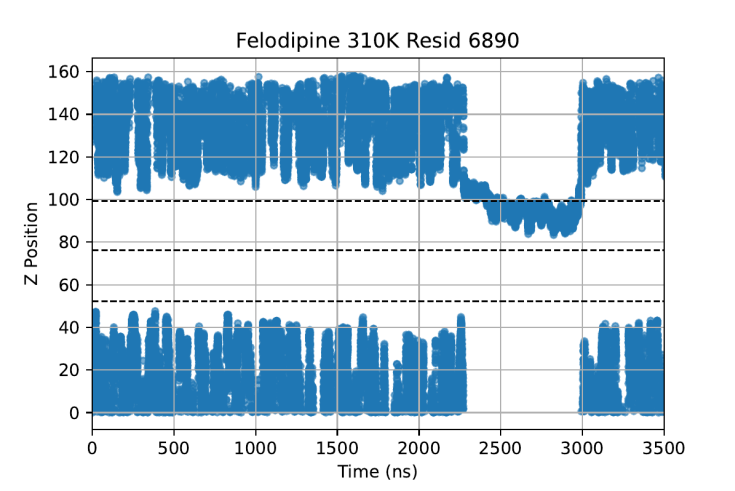


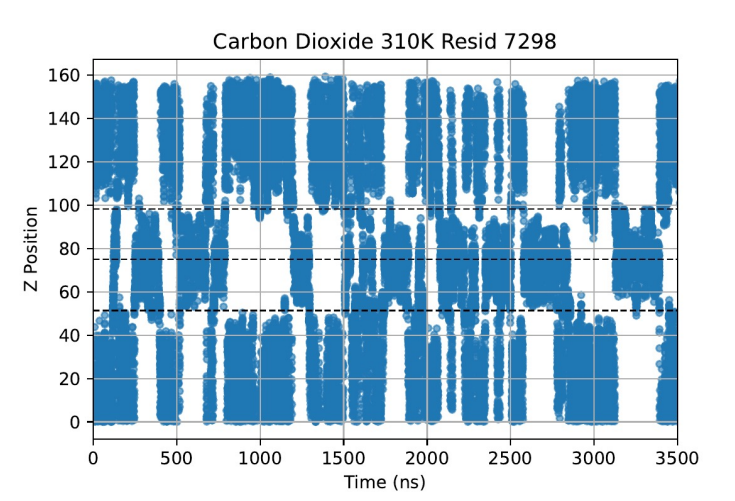
RESULTS

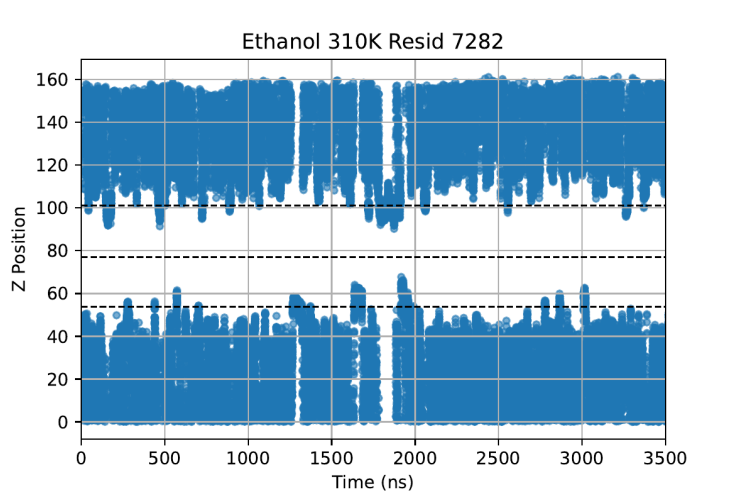
Z Positions





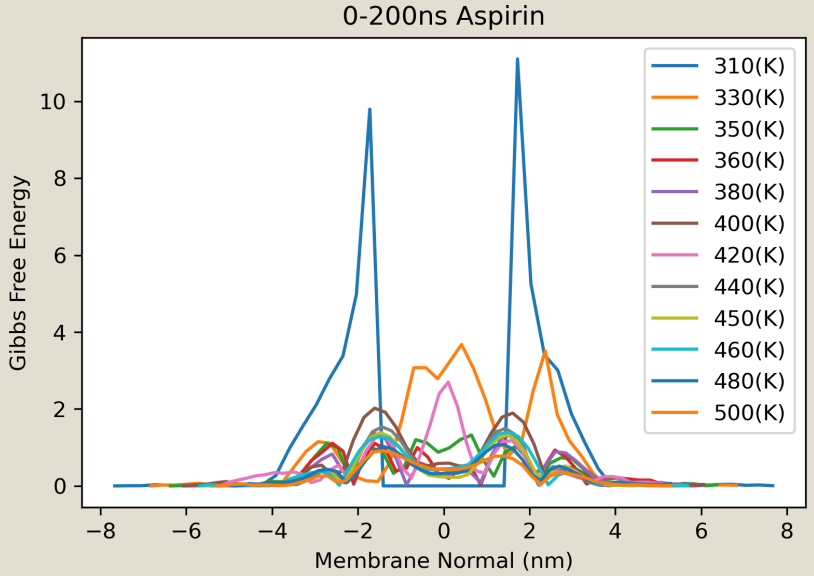


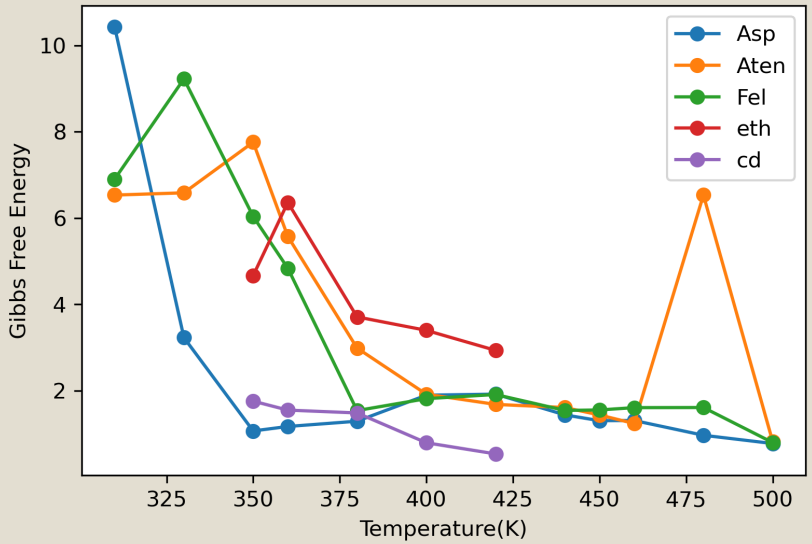


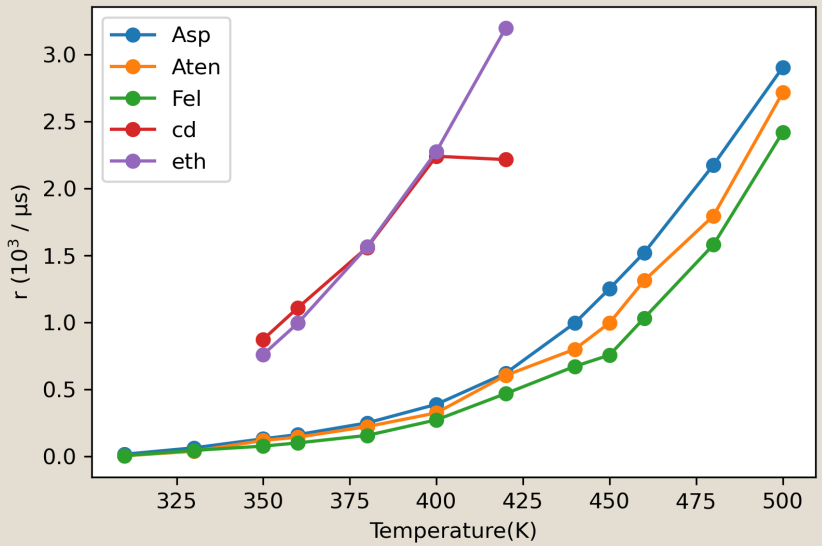


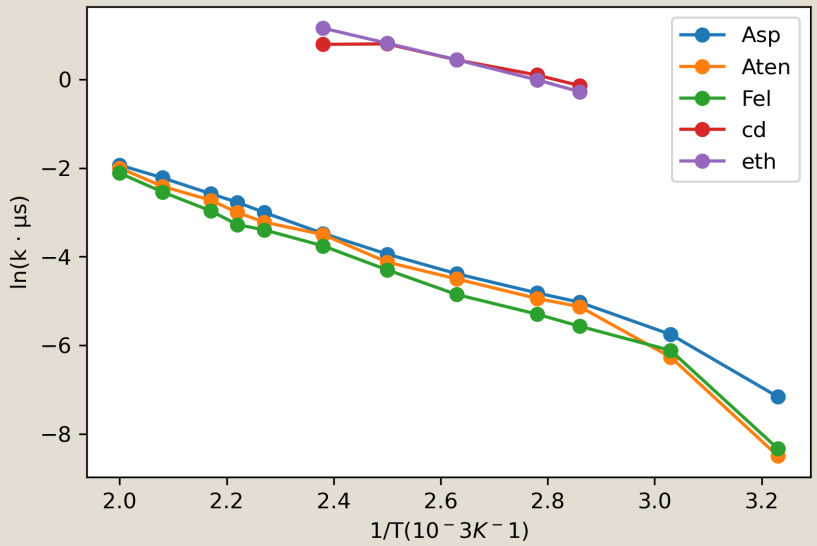
RESULTS

Gibbs Free Energy



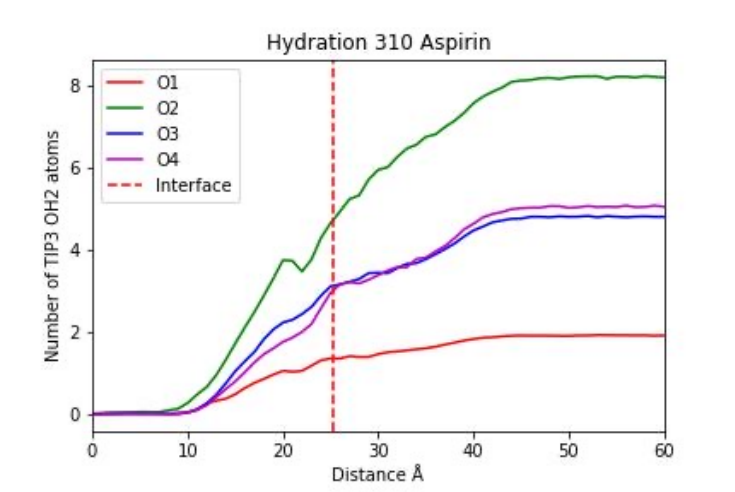


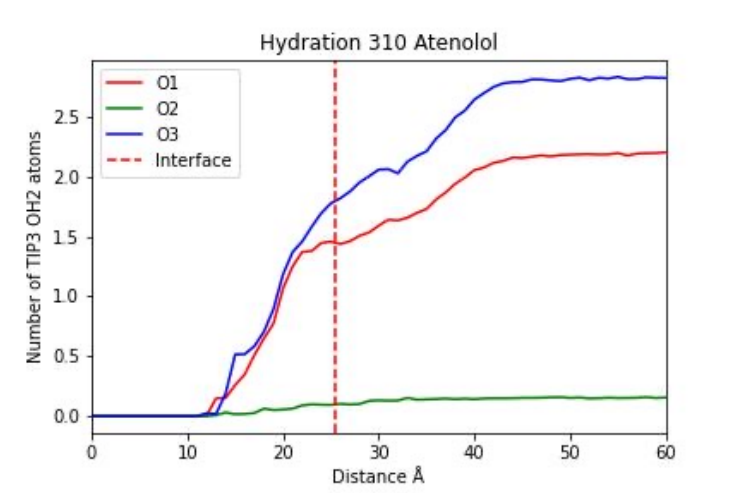


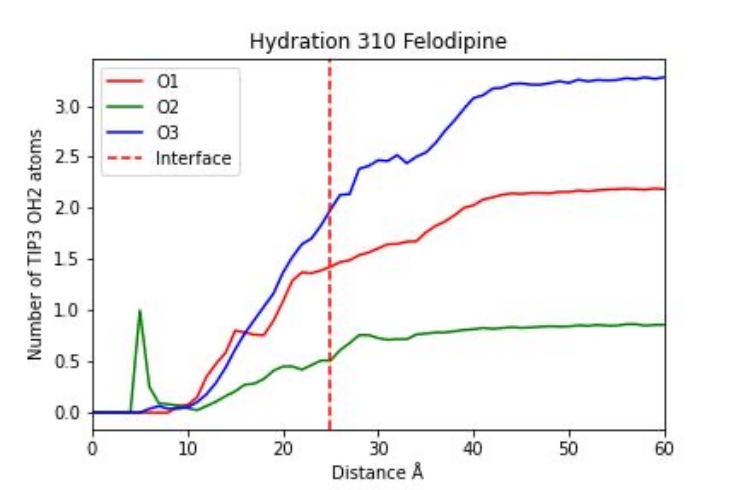


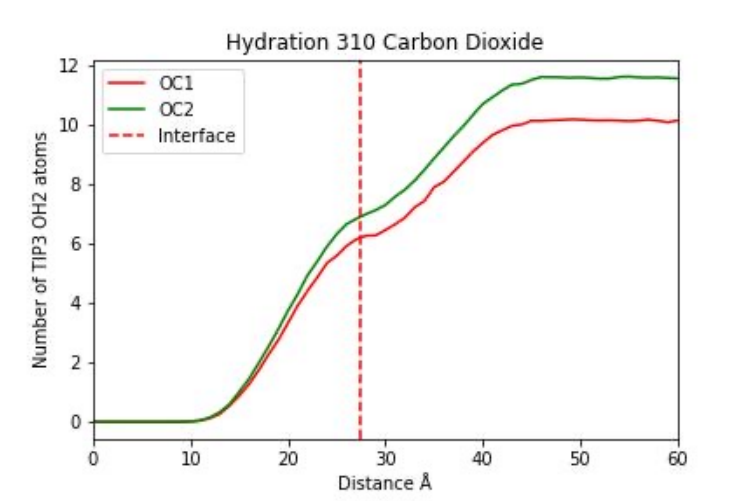
RESULTS

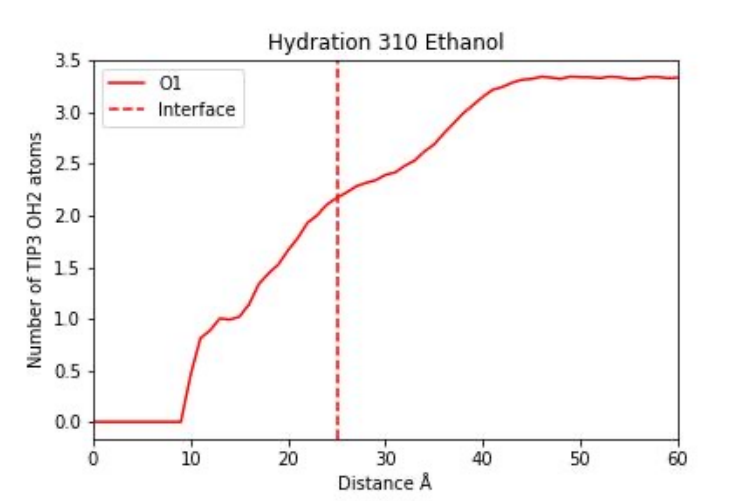
Hydration





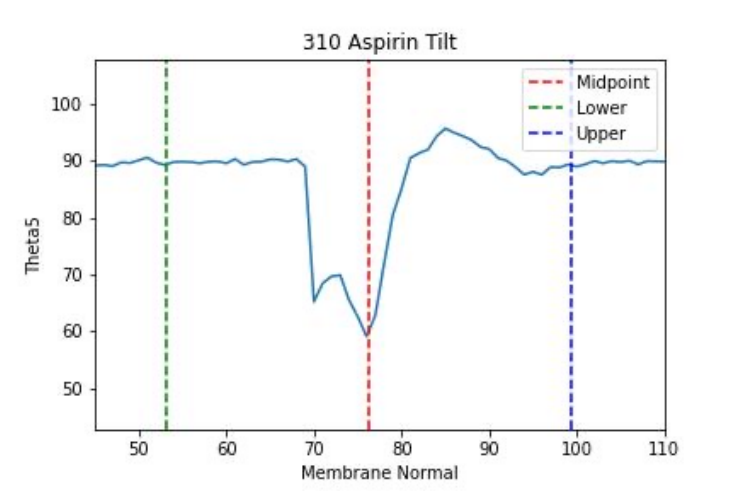


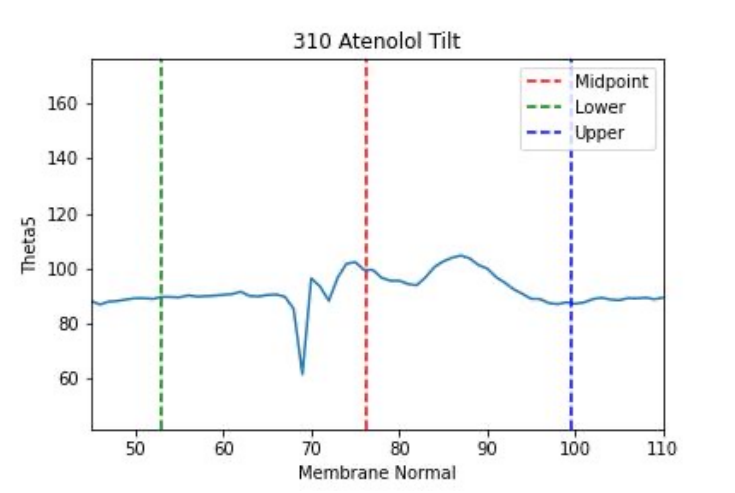


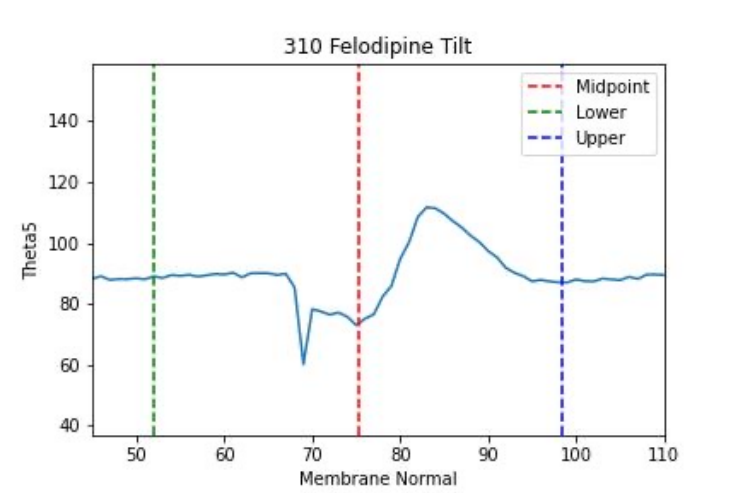


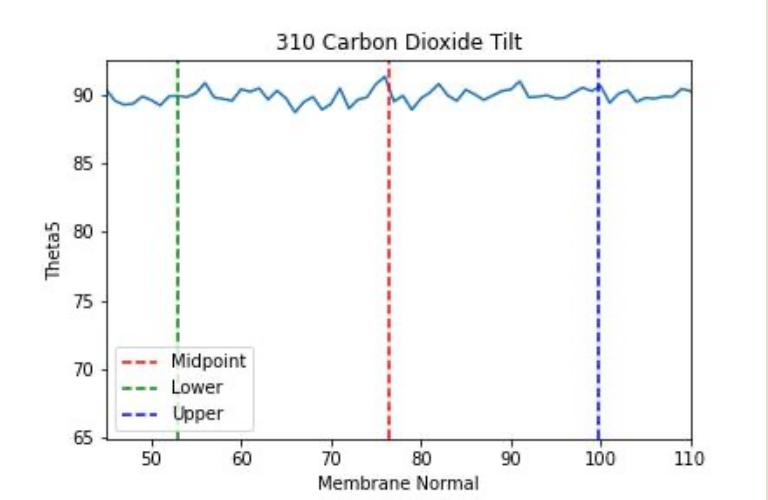
RESULTS

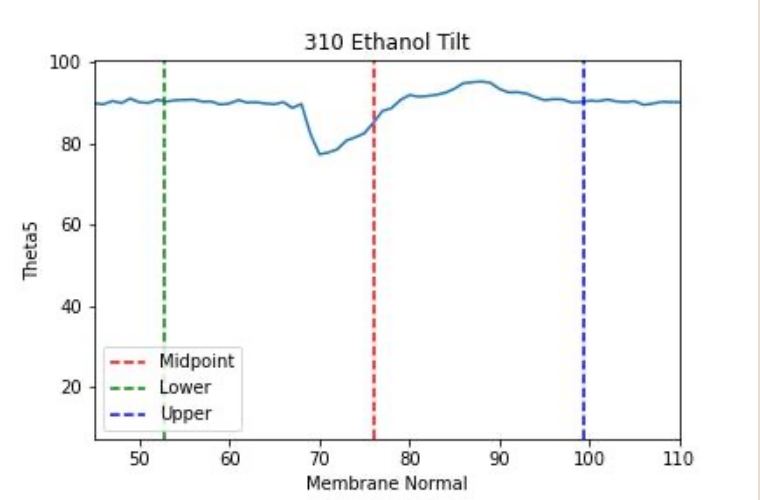
Orientation

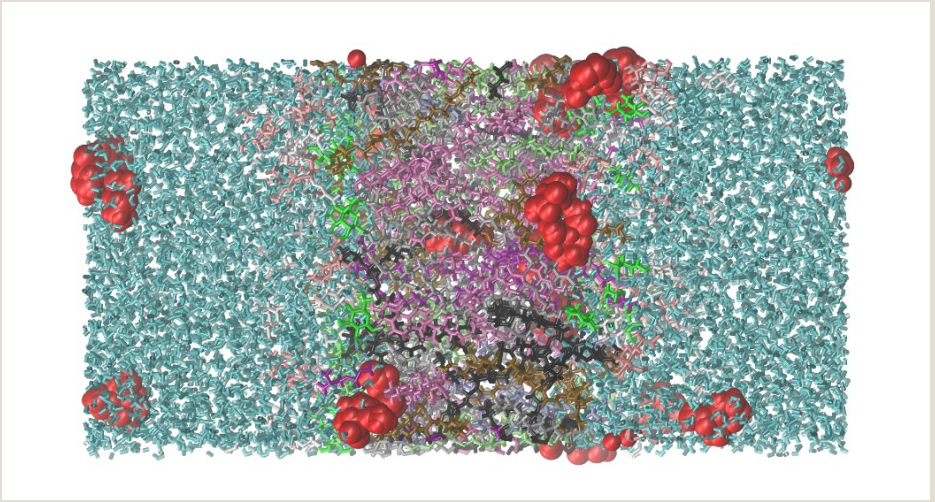












Conclusion

- Membrane Structure Properties
- Permeability & Transport Rates
- Paper Submitted
- Investigating Different Model Membranes Oral delivery
- Investigating Different Drugs Molecules