Polymer-Driven Aggregation in the Gut

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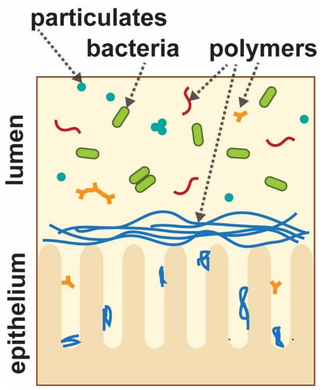
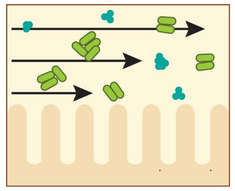
Aggregation in the small intestine (SI)

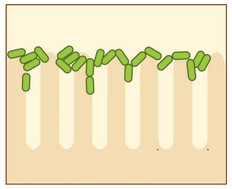
SI microenvironment



clearance

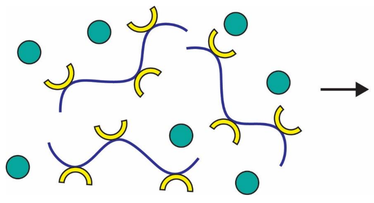


colonization



Polymers can aggregate particles

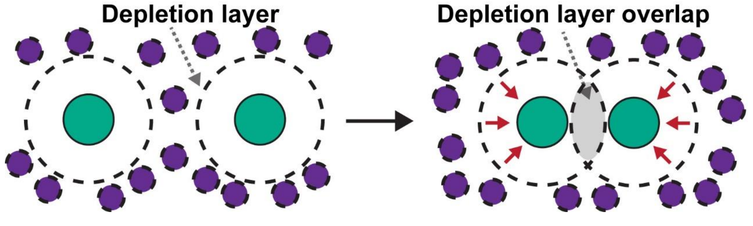
Chemical Agglutination



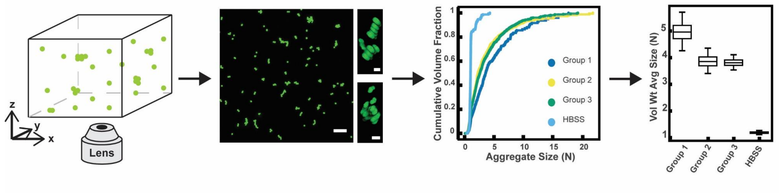
Proteins that agglutinate:

- Mucins
- Immunoglobulins (Igs)

Depletion Interactions



Quantification of aggregate size distribution



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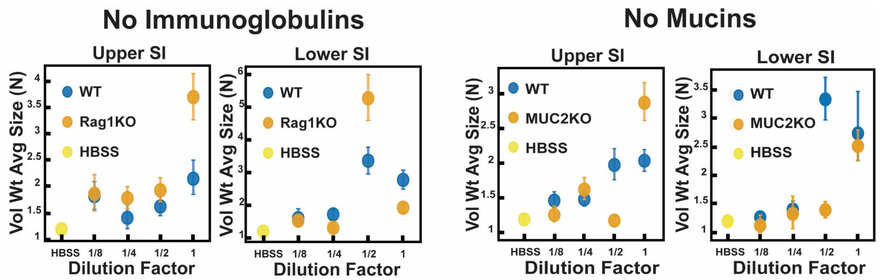
Mucins and IgAs are not required for aggregation



PEGylated particle aggregation was measured in mouse SI fluid lacking either MUC2 or IgA

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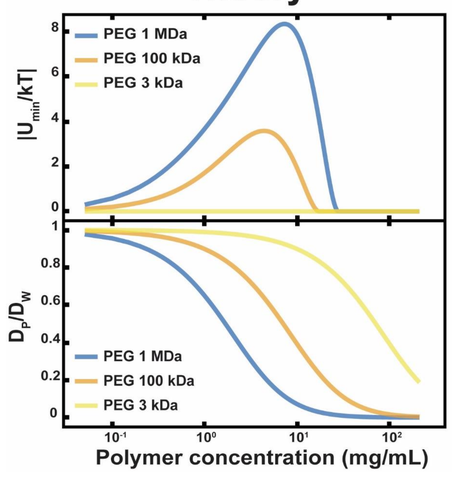
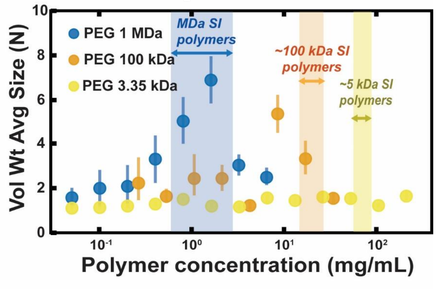
Can we control aggregation in the gut?

Aggregation with synthetic polymers is depletion driven

Theory



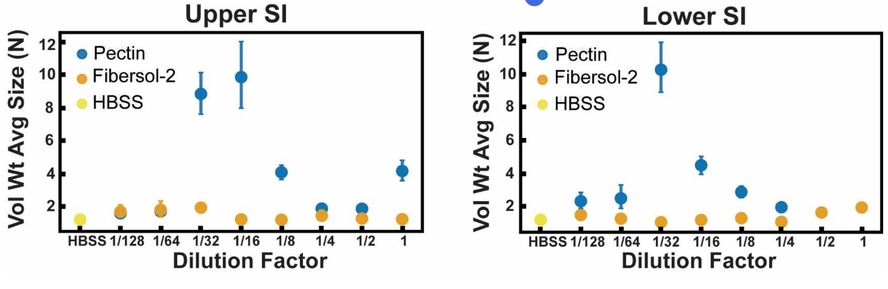
Experiment



Dietary fibers control aggregation by “depletion-like” mechanism

Apple Pectin
(MW ~230 kDa)

Fibersol-2
(MW ~3500 Da)



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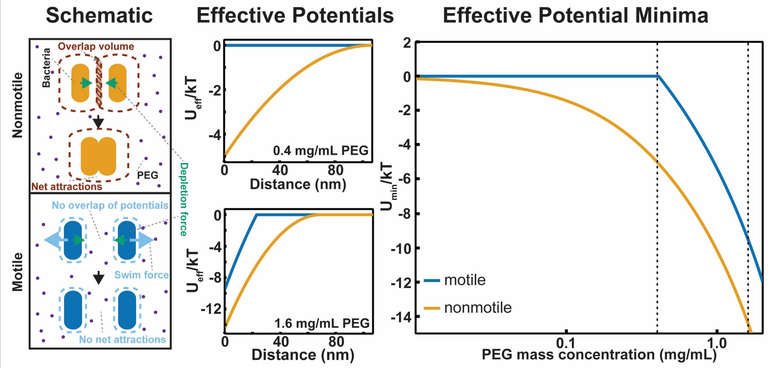
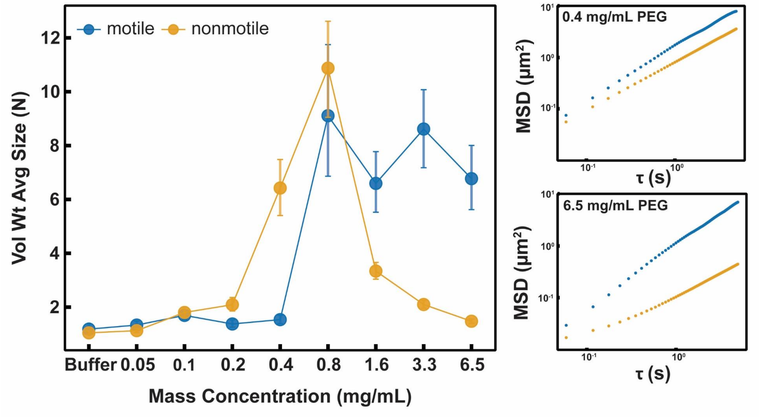
Role of bacterial motility in aggregation

Interplay of swim and depletion forces



Effective potential does not capture experiments



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Future Directions

- Can dietary fibers control bacterial aggregation?
- Are there differences in aggregation between commensals and pathogens?
- How does shear affect aggregation of microbes and particulates in the gut?

Funding and Acknowledgements

DARPA (HR0011-15-C-0093)
ARO (W911NF-17-1-0402)
CEMI
NSF (DGE-1144469)
JIMEM

Caltech Beckman Imaging Facility (BIF)
Caltech animal facilities