



Future of nanomedicine: Realizing the potential of targeted drug delivery

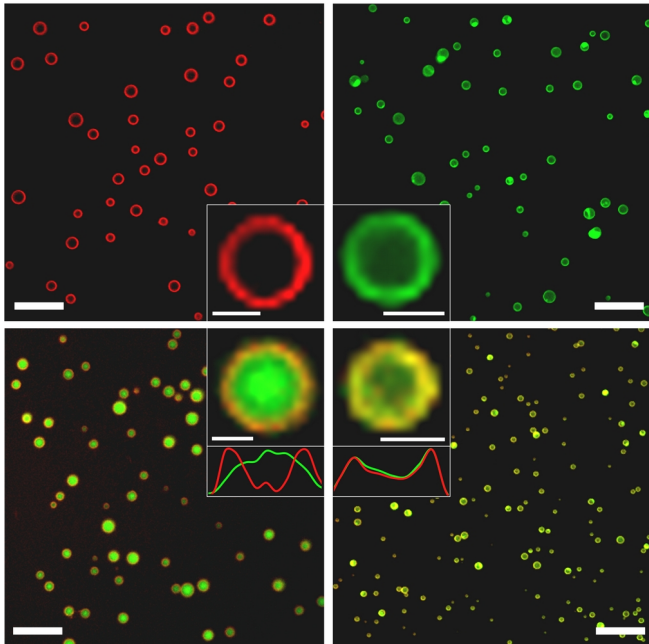
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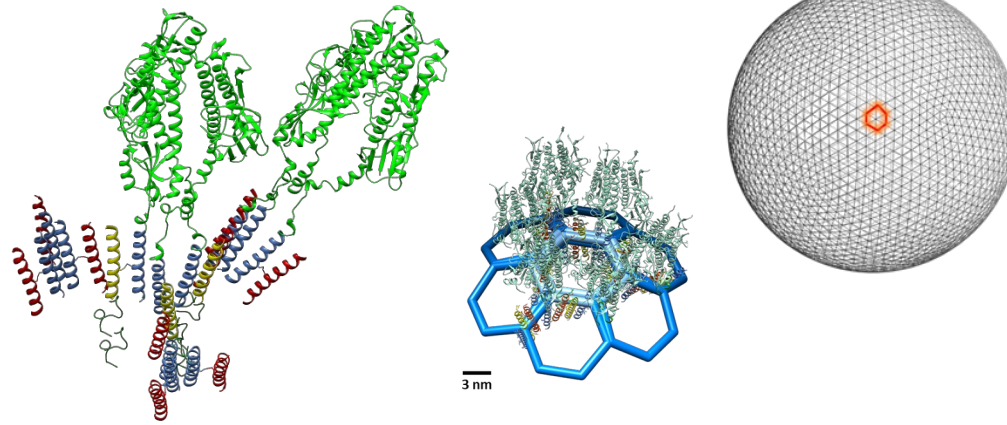
Georgia Institute of Technology



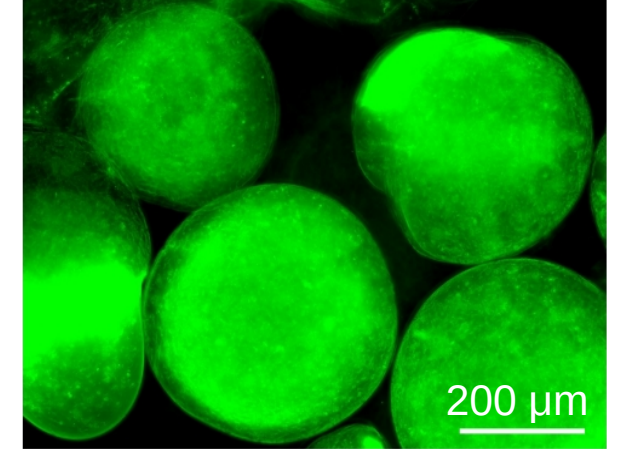
Functional Protein Materials: self-assembly to translation



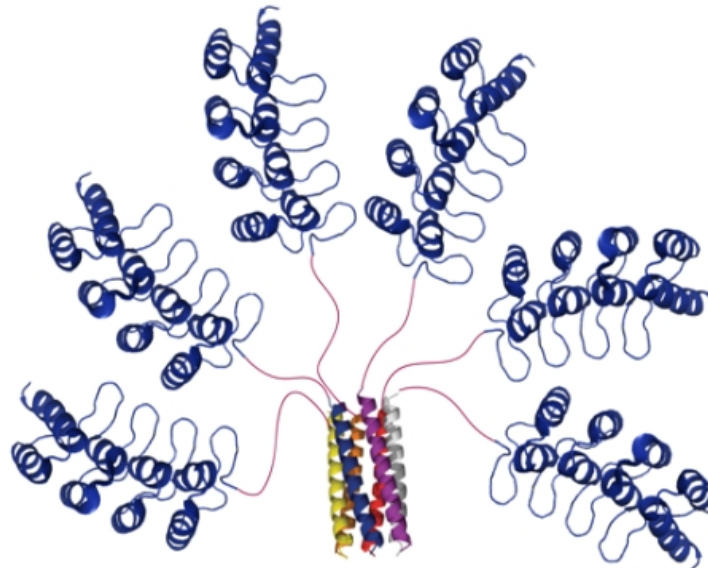
Globular protein vesicles for intracellular delivery, vaccines, and biocatalysis



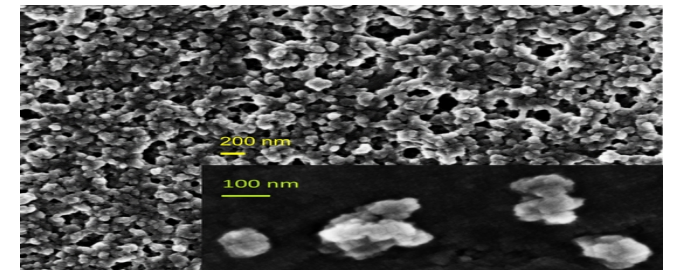
Coiled coil nanocages for universal flu vaccines



Salmonella protein nanoparticles in microparticles for IBD



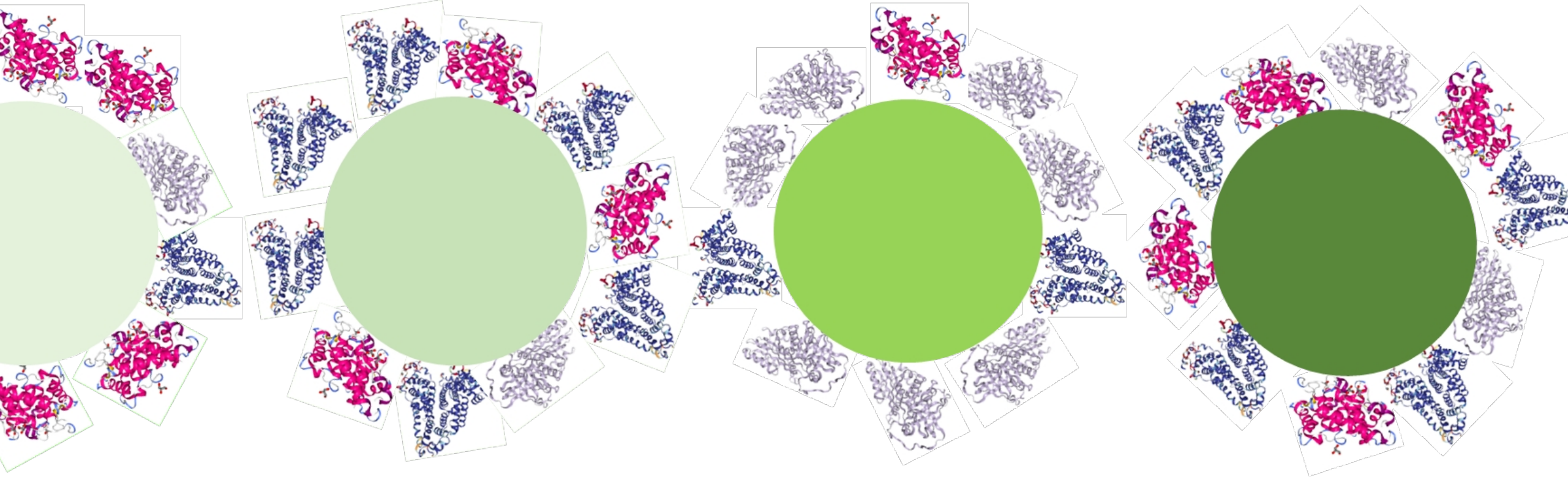
Coiled coil hexamers for delivery of intracellular binding proteins



Crosslinked protein nanoparticles for universal flu & typhus vaccines

From rational targeting to “natural” targeting

- **Now: design & engineer targeting via specific ligand-receptor interactions**
- **Future: work with natural tropism of nanocarriers**
 - Screen carriers and work with those that have innate tropism for tissue relevant diseases
 - There are plenty of diseases to go around!
 - Need funding agency support (not just “fishing”!)
 - Harness directed evolution
 - Static synthetic libraries $O(100s)$ have identified targeting hits
 - Using the body as selection pressure for genetically sourced nanocarriers (protein, peptide, DNA)
 - Greatly expands library size $O(>1,000,000)$
 - “You get what you screen for...” Frances Arnold; mouse nanomedicines?



Can we finally exploit the protein corona?

- There is LOTS of data characterizing the protein corona of various nanoparticles – what is the value?
- There is EVEN MORE biodistribution data of many kinds of nanoparticles
- Can this data be mined (ie with AI language models) to find corona fingerprints that bias nanocarriers to certain tissues/cell types?
- Can ML predict a biodistribution from a corona?

Steps to take now

Utilize more routes of administration, including mucosal

Simplify formulation (1 ingredient + cargo)

Measure **functional** biodistribution, not just biodistribution

Increase sensitivity of detection