Programmable Assembly of Soft Matter
Research Triangle Materials Science and Engineering Center (RT-MRSEC)
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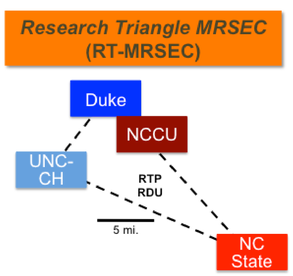
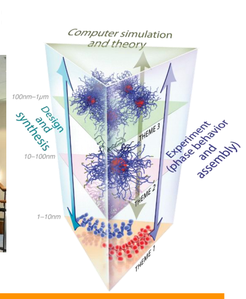
A National Resource for Research Education and Innovation in the Programmable Assembly of Soft Matter



The Research Triangle MRSEC provides an integrated, regional materials research hub focusing on research, education and innovation in the programmable assembly of soft matter— with spokes that extend globally through synergistic partnerships.

RT-MRSEC is a vital national resource for:

- Creating sophisticated new materials systems with useful functionality.
- Translating these materials and applications to industry.
- Educating and mentoring a new generation of researchers in an emerging area of materials science.



Education and Outreach

A major objective of the RT-MRSEC is to provide informal educational opportunities about soft matter and nano- materials science to the broader public.

North Carolina Science Festival

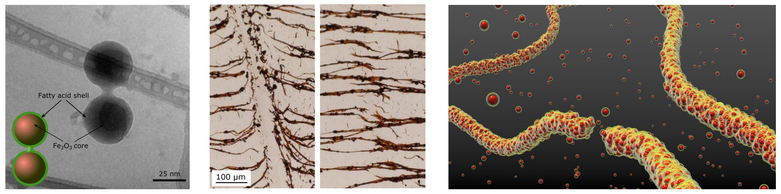
Nanodays at the North Carolina Museum of Life and Science

Duke Graduate School Dean's Award -Mentoring and Inclusive Excellence

Interdisciplinary Research Groups (IRGs)

IRG1: Multicomponent Colloidal Assembly by Comprehensive Interaction Design

Nanocapillarity-mediated magnetic assembly of nanoparticles into ultraflexible filaments and reconfigurable networks

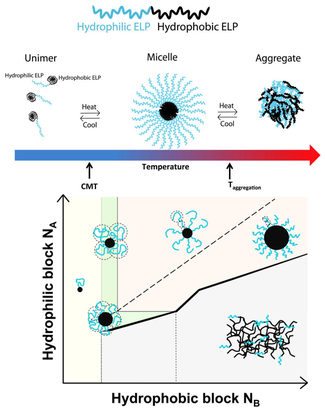


Nature Materials. 2015. DOI: 1038/nmat4364

- New principle of binding liquid-coated nanoparticles by nanocapillary bridges from oily fatty acids
- External magnetic field directs the Fe_2O_2 nanoparticles into linear filaments
- Filaments are highly responsive and ultraflexibilible due to liquid mediated particle linkages
- Temperature dependent fragmentation/reformation allows control of capillary bridges
- Mechanically damaged filament networks can be healed by external magnetic field

IRG2: Genetically Encoded Polymer Syntax for Programmable Hierarchical Self-Assembly

Biologically Synthesized Proteins that Spontaneously Self-Assemble into Nano-scale structures

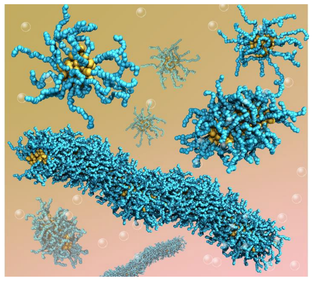


- We have developed biologically synthesized proteins that can form nano-scale structures of various sizes, shapes, and behaviors.
- These proteins, called elastin-like polypeptide (ELP) block copolymers, spontaneously self-assemble into different structures based on their interactions with other proteins and water. By changing their sequence, the researchers can control the shape and behavior of the structures that they form.
- The structure of the ELP repeat unit suggests that surface tension could be considerably reduced compared to conventional micelles formed by synthetic copolymers.

Nano Letters. 2014. DOI: 10.1021/nl503221p
Macromolecules. 2015. DOI: 10.1021/acs.macromol.5b00431

Supramolecular Materials by Nucleic Acid Block Copolymer Self-Assembly

- Our team developed a new method to synthesize high molecular weight, single-stranded DNA. This method, conceptually similar to controlled polymerization of synthetic polymers, yields polynucleotides with narrow molecular weight distributions.
- Using simulations, a library of copolymers that can self assemble into a broad range of morphologies was created. The ability to synthesize polynucleotides that form complex nano- to meso-scale morphologies has great potential for bionanotechnology and for drug delivery applications.



Advanced Materials. 2014. DOI: 10.1002/adma.201306049
Macromolecular Theory & Simulations. 2014. DOI: 10.1002/mats.201400043

Facilities

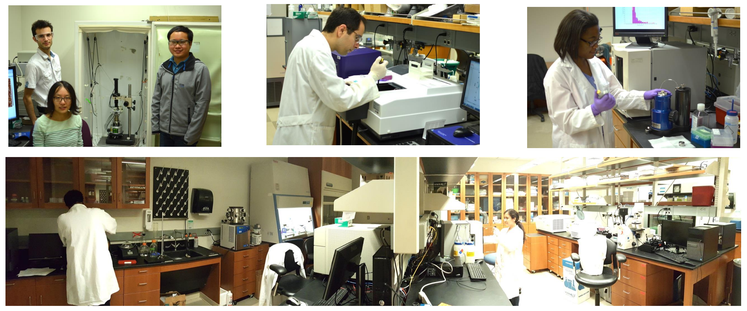
Small Angle X-Ray Scattering Facility

Materials Research Facilities Network

MRFN is a nationwide partnership of Shared Experimental Facilities created by NSF MRSECs, designed to support researchers and experimental facilities engaged in the broad area of Materials Research in academic, government and industrial laboratories around the world.

Soft Matter Characterization Lab

RT-MRSEC Soft Matter Lab contains instrumentation for synthesis of colloids and biopolymers and for characterization of their assemblies. These include capacity for synthesis and purification of recombinant biopolymers, microfluidic production of colloids, and high throughput production of nanoparticles.



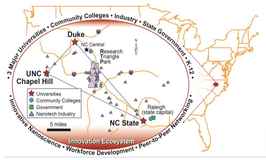
Partnerships

Industry Symposium

Texas State University-San Marcos PREM Partner

Partnerships for Research and Education in Materials

Research Triangle Nanotechnology Network



RTNN
RESEARCH TRIANGLE NANOTECHNOLOGY NETWORK