Triangle Soft Matter Workshop

Communication. Collaboration. Creation.

14th Annual Triangle Soft Matter Workshop

Monday May 9, 2022

8:00am – 5:00pm

Duke University

Fitzpatrick Center Schiciano A&B

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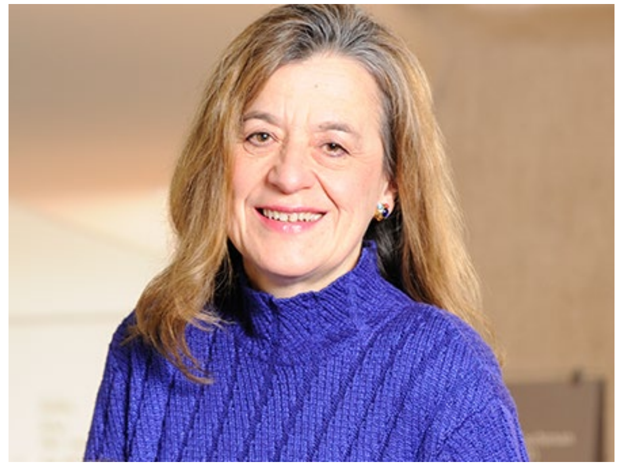
14^{th} Annual Triangle Soft Matter Workshop

Monday May 9, 2022

Duke University*, Fitzpatrick Center (Schiciano A&B)*

7:15-8:00	Registration, coffee, light breakfast, set-up posters
8:00-8:05	Welcoming remarks by organizers
8:05-8:55	Soundbites - Session 1
8:55-9:40	Posters - Session 1
9:40-10:30	Soundbites - Session 2
10:30-11:15	Posters - Session 2
11:15-12:05	Soundbites - Session 3
12:15-2:00	Lunch & Posters Session 3
2:00-2:30	Invited talk: **Alexander Zhukhovitskiy**, Assistant Professor, Department of Chemistry, University of North Carolina - Chapel Hill *Title: The logic of polymer synthesis and degradation*
2:30-3:00	Invited talk: **Po-Chun Hsu**, Assistant Professor, Department of Mechanical Engineering and Materials Science - Duke University *Title: Electrochemically dynamic materials for solar and radiative thermoregulation*
3:00-3:30	Invited talk: **Adriana San Miguel**, Assistant Professor, Department of Chemical and Biomolecular Engineering, North Carolina State University *Title: Worms, chips, and computer vision: unconventional tools to better understand aging, stress, and neurodegeneration*
3:30-4:00	Sweet treat & Coffee break – *Voting on your favorite posters closes at 4pm!*
4:00-5:00	Plenary lecture: **Anna Balazs**, Distinguished Professor, Department of Chemical Engineering, University of Pittsburgh *Title: Chemically Controlled Shape-morphing of Elastic Sheets*
5:00	Closing remarks by organizers

<u>**Plenary Lecture**</u>:



Anna Balazs
Distinguished Professor
Department of Chemical Engineering
University of Pittsburgh

Title: Chemically Controlled Shape-morphing of Elastic Sheets

Abstract:
Two-dimensional responsive materials that change shape into complex three-dimensional structures are valuable for creating systems ranging from wearable electronics to soft robotics. Typically, the final 3D structure is unique and predetermined through the materials' processing. Using theory and simulation, we devise a distinctive approach for driving shape changes of 2D elastic sheets in fluid-filled microchambers. The sheets are coated with catalyst to generate controllable fluid flows, which transform the sheets into complex 3D shapes. A given shape can be achieved by patterning the arrangement of the catalytic domains on the sheet and introducing the appropriate reactant to initiate a specific catalytic reaction. Moreover, a single sheet that encompasses multiple catalytic domains can be transformed into a variety of 3D shapes through the addition of one or more reactants. Materials systems that morph on-demand into a variety of distinct structures can simplify manufacturing processes and broaden the utility of soft materials

Bio:

Anna C. Balazs is a Distinguished Professor of Chemical Engineering and holds the John A. Swanson Endowed Chair in the Swanson School of Engineering at the University of Pittsburgh. She received her B.A. in physics from Bryn Mawr College in 1975 and her Ph.D. in materials science from the Massachusetts Institute of Technology in 1981. Her research involves developing theoretical and computational models to capture the behavior of polymeric materials, nanocomposites and multi-component fluids. Balazs is a Fellow of the American Physical Society, the Royal Society of Chemistry, and the Materials Research Society. She was a Visiting Fellow at Corpus Christi College, Oxford University. She has served on a number of editorial boards, including: *Macromolecules*, *Langmuir*, *Accounts of Chemical Research*, *and Soft Matter.* She was Chair of the American Physical Society Division of Polymer Physics in 1999-2000. She received a *Special Creativity Award* from the National Science Foundation. In 2003, she received the *Maurice Huggins Memorial Award* of the Gordon Research Conference for outstanding contributions to Polymer Science. Recently, she received the *American Physical*

Society Polymer Physics Prize (2016), the *Royal Society of Chemistry S F Boys-A Rahman Award* (2015), the *American Chemical Society Langmuir Lecture Award* (2014) and the *Mines Medal* from the South Dakota School of Mines (2013). She was elected to the *National Academy of Engineers (NAE)* (2022) and the *National Academy of Sciences (NAS)* (2021).

There are three (3) poster sessions today. Vote for your top 3 choices!
Click below to complete the voting survey.

Poster Session Survey.

Or you can find the QR code on the home page: trianglesoftmatter.com under Downloads or at the bottom of the Poster Schedule.

Voting closes at 4:00pm

Consider the following questions when judging:

- Was a clear problem stated, justifying the research? Did the presenter show a strong conceptual understanding of their research and how it fits into the "big picture"?
- Was a clear research design given, with particular emphasis on methods, data, results and interpretation, problems, and conclusions? Did the results clearly address or solve the problem?

Invited Talks:

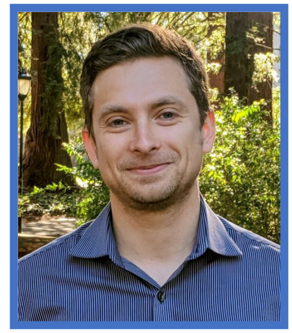
Adriana San Miguel
Assistant Professor
Department of Chemical & Biomolecular Engineering
North Carolina State University

Title: Worms, chips, and computer vision: unconventional tools to better understand aging, stress, and neurodegeneration

Abstract:
The fraction of older adults in the global population is projected to increase substantially in coming decades, while aging is the main risk factor for a large number of diseases. Revealing the molecular underpinnings of aging and longevity, and its impact on cellular, tissue, and organismal morphology and function are thus critical questions. In our work, we use the nematode *C. elegans* to better understand aging, stress, and neurodegeneration. We develop and apply key technologies that enable quantitative, high-content analysis of the effects of aging on cells, neuronal connections, protein stability, and gene activity. Aging induces high levels of heterogeneity, and complex morphological changes in cellular and subcellular structures. Thus, their analysis requires large sample numbers and quantitative approaches to describe them. In this talk, I will present several approaches that rely on microfluidic tools, high-content phenotyping aided by machine and deep learning, and CRISPR/Cas9 genetic engineering to study aging and stress in *C. elegans* at the molecular, cellular, and organismal level. This work has enabled quantitative analysis of key aging molecular components and phenotypes that enable lifespan prediction, identification of aging-relevant genes, and the identification of aging-specific degenerative changes in neurons.

Bio:
Adriana San Miguel is an Assistant Professor in the Department of Chemical & Biomolecular Engineering at NC State University. She is also part of the University's Synthetic and Systems Biology Cluster. Her work combines engineering and biology, and focuses on developing tools to perform high-throughput automated experiments with the model organism *C. elegans.* This tools are used to better understand aging, stress, and neurodegeneration.
She received a BS in Chemical Engineering at the Monterrey Institute of Technology in Mexico and obtained a PhD in Chemical Engineering Georgia Tech, where she worked with Sven Behrens. She trained as a Postdoctoral Fellow with Hang Lu at Georgia Tech and with Marc Vidal at the Dana-Farber Cancer Institute. She has received several awards, which include the NIA K99/R00 Pathway to Independence Award, DOD New Investigator Award, and the AMED Interstellar Initiative on Healthy Longevity.

Aleksandr (Alex) V. Zhukhovitskiy
Assistant Professor
Department of Chemistry
University of North Carolina-Chapel Hill



Title: The logic of polymer synthesis and degradation

Abstract:
Retrosynthetic analysis is a central chemistry concept formalized by E. J. Corey that has empowered organic chemists to build remarkably complex natural and "unnatural" products. Polymers are, in a sense, similarly complex as a consequence of the potential for structural, sequence, architectural, and stereochemical isomerism. Yet, retrosynthetic analysis remains underutilized in polymer synthesis; instead, design of polymeric targets is usually constrained by forward-synthetic considerations of established monomer pools and polymerization methods. Consequently, our ability to further innovate and problem-solve in the polymer space—in particular, to address the global challenge of polymer sustainability—depends on our ability to dismantle these constraints. My talk will focus on new strategies and tactics in retrosynthetic analysis applied to polymers, with a focus on rearrangements of polymer backbones, generation of nitrogen-rich polymer backbones, and applications in polymer sustainability.

Bio:
Born in Dnipro, Ukraine, Alex moved to the U.S. at the age of 11. Alex completed his undergraduate education at Northwestern University, earning a bachelor of arts in mathematics and the integrated science program and a joint BA/MS in chemistry. During that time, Alex carried out research in the group of Prof. Tobin Marks and Prof. SonBinh Nguyen in the department of Chemistry. From 2011 to 2016, Alex conducted doctoral research with Prof. Jeremiah Johnson in the department of Chemistry at MIT: his work there was focused on the surface chemistry of N-heterocyclic carbenes and the development of polymer networks cross-linked with metal-organic cages. For his work, Alex was recognized with the Henkel Award and the Nobel Signature Award. Subsequently, Alex was a Life Science Research Foundation postdoctoral fellow at UC Berkeley in the organometallic and catalysis group of Prof. F. Dean Toste.
Now Alex is an Assistant Professor and William R. Kenan Jr. Faculty Fellow in the Department of Chemistry at UNC-Chapel Hill. Alex's group is focused on addressing fundamental challenges in polymer chemistry and physics to advance the functionality and sustainability of soft materials. For their work, the Zhukhovitskiy group has recently been awarded the NSF CAREER grant and the 3M Non-Tenured Faculty Award

Po-Chun Hsu
Assistant Professor
Department of Mechanical Engineering and Materials Science
Duke University

Title: Electrochemically dynamic materials for solar and radiative thermoregulation

Abstract:

Solar energy has been one of the most important renewable sources of heat. On the other hand, radiative cooling uses the sky as the cold source to reduce the energy consumption for refrigeration and space cooling. While both technologies were significantly advanced by recent research in photonics and thermal science, most works still address only one of them separately, which is limited to specific climate zones and seasons of the year. In this talk, I will introduce our works that use reversible metal electrodeposition to dynamically switch between a plasmonic selective solar absorber and a mid-infrared-emitting solar mirror. Because of the dual-band synergistic heat management, the dynamic device can be used as smart building envelopes for all-weather, year-round HVAC energy saving. Furthermore, the electrochemically variable emittance concept is also applied to ultralow-energy personal thermoregulation, bringing new opportunities in the human-building-energy nexus.

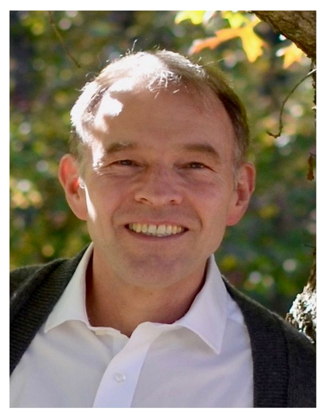
Bio:

Dr. Hsu is an Assistant Professor at Duke University in the Thomas Lord Department of Mechanical Engineering and Materials Science. His research focuses on innovative dynamic materials for light and heat management. By utilizing fundamental principles of materials science and photonic engineering, his group aims to boost the thermoregulation performance and functionality for applications in wearable technology, net-zero energy buildings, electrochromic display/camouflage, spacecraft thermal control, and beyond. He earned his PhD degree in Materials Science and Engineering and postdoctoral research in Mechanical Engineering, both at Stanford University. His research in cooling textile was selected as Top Ten World-Changing Idea by Scientific American. He is an awardee of NSF CAREER Award, Ralph E. Powe Junior Faculty Enhancement Awards, MIT Technology Review Innovators Under 35 (China), Sony Faculty Innovation Award, and Clarivate Analytics Highly Cited Researchers.

Organizing Committee:

Stefan Zauscher is the Sternberg Family Professor of Mechanical Engineering and Materials Science at Duke University. He received his Ph.D. in Materials Science from the University of Wisconsin-Madison in 2000. Professor Zauscher is an expert in (bio)surface and interface science, where his research is broadly focused on fabrication, manipulation and characterization of surface-confined biomolecular and polymeric micro- and nanostructures.

Steve Craig did his Ph.D. work at Stanford on mechanistic chemistry involving quite small (100 Da) molecules and postdoctoral work at Scripps on moderately sized (few kDa) molecules and supramolecular assemblies. At Duke, his group has focused on coupling reaction chemistry to the behavior of materials made of quite large (100 kDa to pseudo-infinite) molecules, with an interest in creating new properties and probing fundamental behaviors. He realizes with great regret that he is nowhere near cool enough to pull off Tim Lodge's glasses, and now regrets letting Jan Genzer write his bio for him.



Christoph Schmidt is the Hertha Sponer Professor of Physics at Duke University. After a PhD in Physics at the Technical University of Munich, he worked as a postdoc at Harvard and the Rowland Institute for Science in Boston, started his own lab at the University of Michigan, and then headed groups at the Vrije Universiteit Amsterdam, Netherlands and the University of Göttingen, Germany, before joining Duke University in 2018. His interests are in experimental soft matter physics and biophysics, and the group currently works on active materials, polymer networks, cell and tissue mechanics, as well as on mechanosensory processes in biology.

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