



# MRSEC @ UC SAN DIEGO

The UC San Diego Materials Research Science and Engineering Center fosters research, education, and outreach across the disciplines of engineering, physical sciences, and biological sciences, with a focus on new materials and new materials properties. It is developing two major themes: using computational models to predict and guide the self-assembly of materials from the nano- to mesoscales; and deploying the tools of synthetic biology to create soft materials that incorporate living components.

**IRG1, PREDICTIVE ASSEMBLY**, shifts the paradigm of materials synthesis by creating a computation-driven framework for understanding, predicting, and designing how shaped nanocomponents (derived from polymers, proteins, nanocrystals) are used as building blocks for mesoscale matter. IRG1 couples experimental and computational tools and techniques in four research thrusts: (1) **Mapping Free Energy Landscapes**, (2) **Rational Building-Block Synthesis**, (3) **Exploring Mesophase Space**, and (4) **Characterizing Dynamics & Defects**. IRG1 connects theorists specializing in different length and time domains to employ the most advanced computational tools available to understand and design assembly processes that have to-date been intractable due to their complexity.



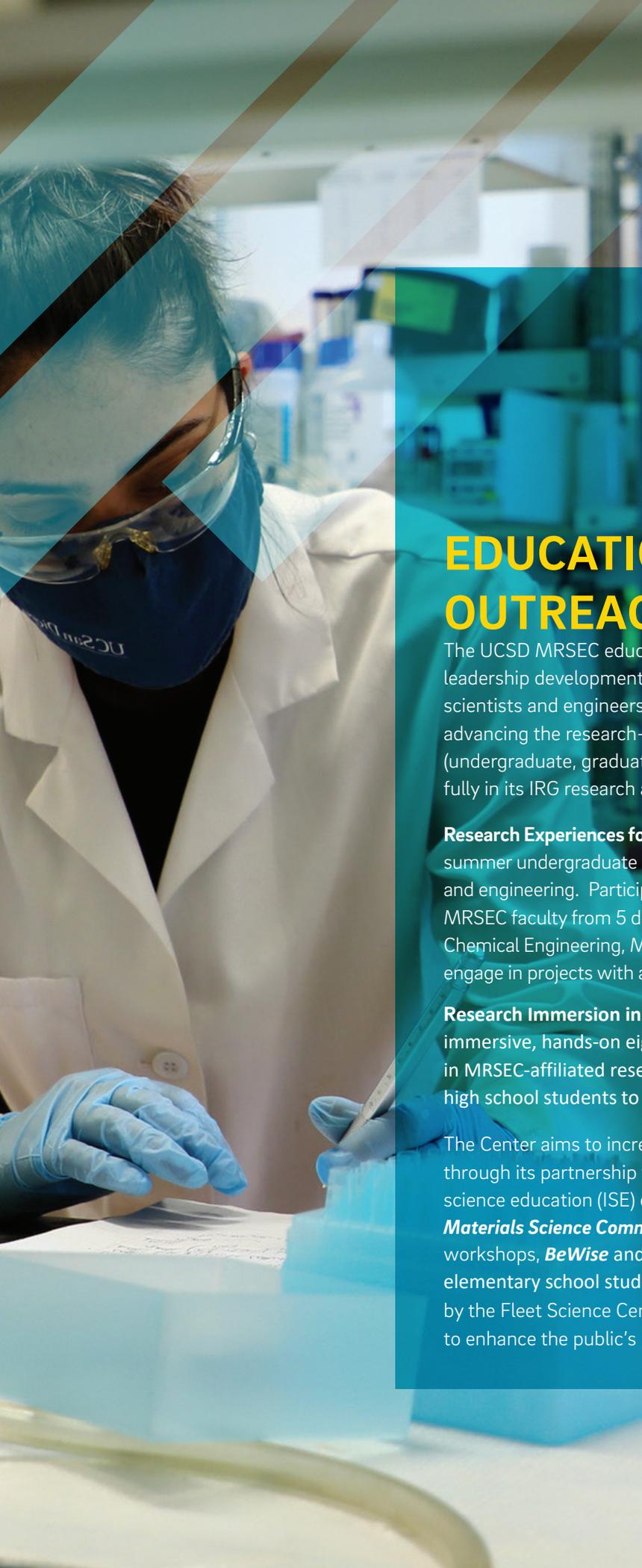
## **IRG2, STIMULI-RESPONSIVE LIVING POLYMERIC MATERIALS,**



integrates engineered living matter as essential building blocks into biological composites. Together, materials scientists and synthetic biologists enable living materials to respond to specific and diverse stimuli with a genetically encoded output. IRG2 harnesses photosynthetic organisms, such as plants and cyanobacteria, to generate chemical reagents and polymer feedstocks in response to a given stimulus or multiple stimuli. Fundamental questions regarding materials at the living/nonliving interface are being answered in three research thrusts: (1) **Stimuli-Responsive Biosynthetic Materials**: biological composites that respond to stimuli with a chemical output, (2) **Photosynthetic Electronic Materials**: living materials that can pattern and biosynthesize conducting polymers, and (3) **Auto-Regenerative and Shape-Shifting Materials**: polymer composites that can regenerate and whose shape is dynamically controlled by living matter.



[mrsec.ucsd.edu](http://mrsec.ucsd.edu)



## EDUCATION & OUTREACH ACTIVITIES:

The UCSD MRSEC education staff and researchers are proud to contribute to the leadership development of a new and diverse generation of materials research scientists and engineers. The Center's key education initiatives are aimed at advancing the research-related competencies of trainees at various levels (undergraduate, graduate, postdoctoral and faculty), enabling them to participate fully in its IRG research and beyond.

**Research Experiences for Undergraduates (REU)** program provides full-time summer undergraduate research opportunities at the forefront of materials science and engineering. Participants are fully immersed in the research laboratories of MRSEC faculty from 5 departments across campus (Chemistry and Biochemistry, Chemical Engineering, Molecular Biology, NanoEngineering, Physics), as they engage in projects with a focus in either or both experiment and theory.

**Research Immersion in Materials Science and Engineering (RIMSE) Schools** are immersive, hands-on eight-week programs meant to prepare trainees to work in MRSEC-affiliated research labs and engage a wide range of participants—from high school students to post-doctoral researchers and industry partners.

The Center aims to increase the reach and impact of MRSEC researchers through its partnership with the **Fleet Science Center**—a premier informal science education (ISE) organization in San Diego. Initiatives include the **Materials Science Communication**, and **Art of Inclusive Communication** workshops, **BeWise** and **SciTech** educational programs for high school/elementary school students, and **Sharp Minds** talks, a popular event organized by the Fleet Science Center that connects scientists and members of the public to enhance the public's understanding and appreciation of science.



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