Some puzzles and research opportunities in soft matter

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A fundamental challenge of modern soft matter science is to form structure that is not frozen in place but instead reconfigures internally driven by energy throughput and adapts to its environment robustly. Predicated on fluorescence imaging at the single-particle level, this talk describes quantitative studies of how this can happen. With Janus colloidal clusters, we show the powerful role of synchronized motion in self-assembly. In living cells, we find that transportation efficiency problems bear a provocative parallel with polymer chain trajectories with their spatial extent, and with jammed matter in their time evolution. In organic LEDs, super-resolution spectroscopy reveals nm-sized defects within devices as they actually operate. A picture emerges in which simple experiments, performed at single-particle and single-molecule resolution, can dissect macroscopic phenomena in ways that surprise.

Steve Granick is director of a blue-sky research center in Korea. Previously he spent 30 years at the University of Illinois at Urbana-Champaign. He is a member of the U.S. National Academy of Sciences and the American Academy of Arts and Sciences. Among other awards, he is recipient of the APS Polymer Physics Prize (2009) and the ACS Colloid and Surface Chemistry Prize (2013).