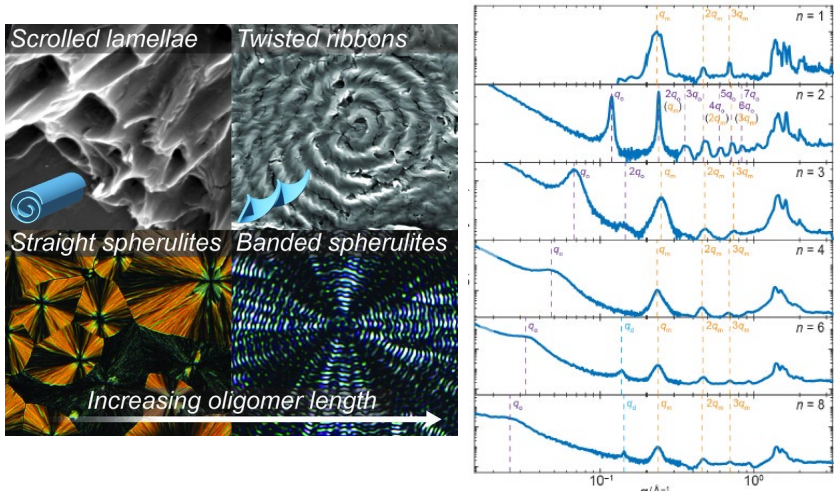
How Molecule Length Shapes Self-Assembling Materials



(Left) *Polarized optical and scanning electron micrographs showing changes in microstructure and spherulite type driven by increased oligomer length.* ***(Right)*** *X-ray scattering profiles of increasing oligomer length. P1 and P2 display a high degree of crystalline order, indicated by a large number of sharp peaks in the high-q regime. Beyond P2, the peaks broaden with fewer higher-order reflections, indicating that the degree of order decreases with increasing oligomer length.*

Chun Lam Clement Chan, Emily C. Ostermann, Shawn M. Maguire, Zachary Schmidt, Jacob S. Votava, Patryk Wąsik, Michael A. Webb, Emily C. Davidson, Supramolecular bending and twisting in the hierarchical self-assembly of monodisperse mesogenic oligomers.Sci. Adv. 11, eadw5327 (2025). DOI:10.1126/sciadv.adw5327

Work was performed in part at NSLS-II

Scientific Achievement

The length of liquid-crystal-like “mesogenic” oligomers can tune the curvature of the self-assembled material structures without changing their core chemistry.

Significance and Impact

Controlling the microstructure through molecular design can enable tailoring of self-assembled polymers for applications like optoelectronics and lenses with tunable refractivity.

Research Details

- Researchers created molecules with two- to eight-unit long chains using a stepwise “iterative exponential growth” method.
- Short chains tended to assemble into a structure that formed scrolled sheets, while long chains assembled to form twisted ribbons.
- X-ray micro-mapping was performed at the SMI beamline at NSLS-II, enabling the team to articulate the molecular alignment.