In this talk I will discuss the molecular design of organic structural materials that mimic living systems’ abilities to protect, report, heal and even regenerate themselves in response to damage, with the goal of increasing lifetime, safety and sustainability of many manufactured items. I will emphasize recent developments in frontal ring-opening metathesis polymerization (FROMP) to manufacture composites with minimal energy consumption.

The talk will conclude by introducing the idea of morphogenic manufacturing in which we aim to achieve symmetry breaking in neat polymerization reactions through a coupled reaction-diffuse process; the long-term vision is self-patterned form and function in synthetic materials.