Emulsions have long been a foundational technology for the solution-phase synthesis of functional particles and materials. More recently, methods to create emulsions with multi-phase droplet structure have opened up an entire new design space of complex droplets and particles with potential advantages for foods, consumer products, medicine and nanotechnology. These applications have yet to be realized due to significant challenges with current emulsification methods for multi-phase droplets, which are mostly limited to large sizes, poor stability and low throughput. Nanoemulsions – metastable suspensions of nanoscale droplets – overcome these limitations through their scalable processing and metastability. However, their engineering is complicated by emergent behavior when droplet sizes are driven to the nanoscale. In this seminar, I will summarize our recent efforts to understand this behavior, and exploit it for the creation of complex nanodroplets and nanoparticles using relatively simple design principles. In particular, we have demonstrated the synthesis of novel nanogel particles with independent control of particle size, internal composition, and mechanical properties that provide unique opportunities for nanoencapsulation and nanomedicine. As a demonstration of their utility, we show how nanoemulsion-templated complex nanogels can be used for a number of fundamental studies and functions in nanobiotechnology.