

**Bones to Biomaterials and Back Again – 20 Years of Taking Cues from Nature to Engineer
Synthetic Polymer Scaffolds**

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For biomaterials scientists focusing on tissue engineering applications, the gold standard material is healthy, autologous tissue. Ideal material properties and construct design parameters are thus both obvious and often times unachievable; additional considerations such as construct delivery and the underlying pathology necessitating new tissue yield additional design challenges with solutions that are not evident in nature. For the past nearly two decades, our laboratory and collaborators have aimed to develop both new biomaterials and a better understanding of the complex interplay between material and host tissue to facilitate bone and cartilage regeneration. Various approaches have ranged from mimicking native tissue material properties and architecture to developing systems for bioactive molecule delivery as soluble factors or bound directly to the biomaterial substrate. Such technologies have allowed others and ourselves to design synthetic biomaterials incorporating increasing levels of complexity found in native tissues with promising advances made towards translational success. Recent work focuses on translation of these technologies in specific clinical situations through the use of adjunctive biomaterials designed to address existing pathologies or guide host-material integration.