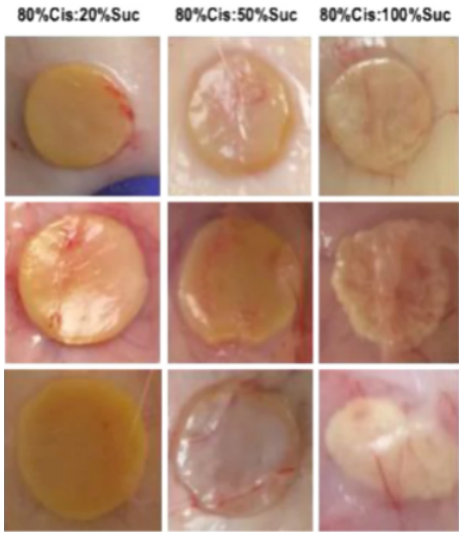
Tunable elastomer-like polymers for use in soft tissue regeneration and drug delivery

Unmet Need

Biodegradable synthetic polymers are often used as scaffolding or support materials in tissue engineering and regenerative medicine. However, many of the materials that have been used widely, such as PLLA and PCL, do not adequately mimic the highly elastic and dynamic qualities of native biological tissues. Additionally, biodegradable polymers are often limited to synthetic systems, which possess narrow thermal and mechanical property ranges. The ability to tailor properties like degradation is enticing because it enables one to specifically design a specific material that meets the needs of a specific device or application. There is a need for biocompatible materials that more closely resemble the qualities of biological tissue that also offer dynamic mechanical properties.

Technology

Duke inventors have reported materials intended to be used for soft tissue regeneration and drug delivery. These are resorbable elastomer-like polymers that incorporate degradable succinate-based monomer units. The mechanical and degradation properties of the biomaterial can be tuned independently by varying the ratios of *cis:trans* double bonds in the backbone or modified further by the stoichiochemistry of succinate incorporation. The inventors have successfully modified the material with an adhesion peptide post-polymerization and demonstrated increased cell adhesion, spreading and integrin-associated actin fiber formation. When the technology was implanted in rats subcutaneously for 4 months, limited inflammatory response was observed. Additionally, various levels of degradation were observed *in vivo* based on the installed stereochemistry. The variants containing 100%



succinate incorporation demonstrated degradation and replacement with mature and developing tissues after the 4-month period. Additional, application specific work is ongoing.

Advantages

- Mechanical and degradation properties can be easily tuned independently
- Can be decorated with drugs or other bioactive species for applications like drug delivery
- Non-toxic characteristics demonstrated with *in vivo* rat studies

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Publication(s)

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External Link(s)

• From the lab of Dr. Matthew Becker