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Reconstitution of collagen triple helix in physically crosslinked hydrogels and films

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The demand for viable materials to treat medical solutions such as tissue regeneration and bone regrowth in modern day medicine has not yet been met. Though there have been many breakthroughs, in recent decades the advances are unfortunately incremental. Collagen, being the most abundant protein found in the human extracellular matrix has been an attractive option for treatment in these fields. However, properties such as thermal stability, solubility, and reconstitution of hierarchical structure have proven to be challenging. Due to the poor solubility in standard solvents people have heated solution, used organic acids, or even electrospun collagen mats. These methods destroy hydrogen bonding, denaturing the collagen into random coil type polymers. The presented research highlights a benign solvent system that allows for an increase in collagen concentration levels orders of magnitude higher than previously cited in literature. At the same time the collagen solution only temporarily disrupts the hydrogen bonding making it possible to reconstitute the natural triple helix. This method is then used to form physical crosslinked hydrogels and dry films. For additional stability and comparison of mechanical properties, chemical crosslinking through known natural methods, such as genipin and riboflavin, were used. The fundamental understanding of collagen and how to mimic physiological conditions will bring forward new advances in medical applications.

Biography

Daniel Brannum is starting his 5th year in the Macromolecular Science and Engineering Department at Case Western Reserve University. He has 2 patents pending and multiple papers in preparation. During his time in graduate school, he has received the Bayer Award for excellence in research, dedication, and contribution to the scientific community and earned internship positions at 3 different Fortune 500 companies.

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