Optimizing Spider Silk Production and Improving Synthetic Spider Silk's Mechanical Characteristics Through Genetic Engineering and Expression Techniques | Biological Engineering

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Michaela Hugie

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Proposal Defense

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USTAR Bioinnovations Building 650
Room 205B

Advisors -
Randy Lewis | randy.lewis@usu.edu
Ron Sims | ron.sims@usu.edu

Downloadable PDF Flyer

Full Abstract

Spider silk has been widely lauded to be stronger than steel and as elastic as rubber, but spider silk’s mechanical characteristics are not the only novel features it possesses. Spider silk’s biocompatibility and biodegradability characteristics make it an ideal material for many medical materials. Due to orb weaving spiders’ cannibalistic and territorial nature it is impossible to successfully farm them to procure spider silk commercially. Therefore, a bioengineered synthetic process is necessary to efficiently produce spider silk. To date synthetic spider silk has been produced in E. coli, goats, yeast, plants, mammalian cells and silkworms, but none of these processes provided commercially viable yields or are able to express recombinant spider silk proteins (rSSPs) that can mimic the sizable natural silks.

The overall goal of this research aims is optimizing spider silk production in varying hosts to attain a commercially viable process and improving the synthetic spider silk’s mechanical characteristics through both genetic engineering and expression techniques. There are four different projects being employed for expressing and purifying spider silk in varying hosts: Escherichia coli, Medicago sativa (alfalfa) and Spodoptera frugiperda. These projects are being performed in an effort to address production issues, namely creating a yield capable of supporting commercialization and increasing the rSSPs molecular weight, and in a proportionate way the mechanical characteristics, to more closely mimic the native spider silk genes. By addressing these issues in multiple hosts both a short-term and a long-term approach to production can be established.