

FIELD OF STUDY

Chemical Engineering

DISSERTATION TOPIC

Predicting Transport through Dermal Wounds via Analytical, Computational, and Physical Models: Steps towards the Development of Drug Delivery Techniques for Improved Wound Healing

EXAMINING COMMITTEE

Dr. Robby Sanders, Department of Chemical Engineering
(Major Advisor, committee Chair)

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ABSTRACT

Dermal wound healing is a natural process comprised of overlapping phases that are activated after wounding occurs in an attempt for the tissue to be reconstructed. While scarring is often a natural result of the wound healing process, abnormalities in the cascade of events that comprise the phases of wound healing (such as alterations in fibrinolysis, the degradation of fibrin fibers that construct a provisional matrix for healing, which occurs in the early phases of the healing process) can lead to excessive or protruding scars, such as keloids.

A review of mathematical models of wound healing has revealed gaps in the literature thus establishing opportunities for exploration specifically in the areas of early-phase wounds and with respect to facilitated closure such as might occur with sutures. To capitalize on these opportunities, a combination of analytical, computational, and experimental models has been developed to represent the early-phase wound environment, and transport studies and simulations performed to predict transport through a model of early-phase wound environments.

For one set of studies, diffusion of a fluorescent tracer through a fibrin-rich gel has been examined and combined with mathematical models to predict diffusivity and permeability characteristics of the tracer and gel. For a second set of studies, various suture designs each containing a model drug have been envisioned, and analytical and/or simulation-based studies have been completed. The results from these studies represent important steps towards the development of novel drug delivery strategies to minimize scarring from dermal wounds.

BIOGRAPHICAL SKETCH

Stephanie N. Jorgensen was born in Nashville, Tennessee, on October 19, 1990. She graduated as valedictorian from Smyrna High School in May 2009 and was enrolled in Tennessee Tech University's Chemical Engineering program the following August. Four years later, she graduated with honors and received her Bachelor of Science in Chemical Engineering with a concentration in Biomolecular Engineering. In August 2013, she was enrolled in the Direct-Admit PhD program in the TTU College of Engineering with a focus in Chemical Engineering and is a candidate for the degree with a projected date of graduation of August 2017.

EDUCATION

Ph.D., College of Engineering
Tennessee Tech University, 2013-2017

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College of Engineering

TENNESSEE TECH

The Department of
Chemical Engineering

Announces the Dissertation Defense

of

Stephanie N. Jorgensen

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Chemical Engineering

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1020 Stadium Drive

Tennessee Technological University

Cookeville, TN 38505