BIOGRAPHICAL SKETCH

Bryan Evans Materi was born in Manchester, Tennessee in November of 1986. He attended elementary school in the Manchester City School District and graduated from Tullahoma High School in May 2005. The following August he entered Motlow State Community College and in August 2007 received the degree of Associate of Science in Biology. He entered Tennessee Technological University (TTU) in August 2008 and received a Bachelor of Science Degree in Chemical Engineering in August 2011. Entering the Graduate program in Chemical Engineering at TTU, he obtained a Master of Science Degree in May of 2014. He continued in the Graduate program at TTU to receive a Doctor of Philosophy in Engineering in August 2019.

EDUCATION

PhD, Engineering - Chemical Engineering, Tennessee Technological University, Tennessee, Cookeville, USA (2019).

M.S., Chemical Engineering - Chemical Engineering, Tennessee Technological University, Tennessee, Cookeville, USA (2014).

B.S., Chemical Engineering - Biomolecular Engineering, Tennessee Technological University, Tennessee, Cookeville, USA (2011).

A.S., Biology - Biology, Motlow State Community College, Tennessee, Tullahoma, USA (2007)

College of Engineering

TENNESSEE TECH

The Department of

Chemical Engineering

Announces the

Dissertation Defense

of

Bryan Materi

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy

Friday, June 7th, 2019, 9am - 11am

Held in

Prescott Hall, Room 203

FIELD OF STUDY

Chemical Engineering

DISSERTATION TOPIC

ADVANCES IN APPROACHES TOWARDS THE DEVELOPMENT OF NEW DIAGNOSTIC PROTOCOLS FOR THE DETECTION OF ALPHA-1-ANTITRYPSIN DEFICIENCY

EXAMINING COMMITTEE

Dr. J. Robby Sanders, Chairperson, Associate Professor
Chemical Engineering Department

Dr. Pedro Arce, Department Chair, Professor
Chemical Engineering Department

Dr. Cynthia Rice, Associate Professor
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ABSTRACT

Alpha-1-Antitrypsin (A1AT) Deficiency (A1AD) is a genetic condition that often leads to emphysema, liver disease, and other ailments. This condition is caused by mutations in the SERPINA1 gene resulting in amino acid substitutions in the A1AT protein sequence and misfolding of A1AT which in "normal" form is a potent inhibitor of human neutrophil elastase (HNE). This causes a reduction of the A1AT in the blood stream and ultimately the lungs and also may result in toxicity to the hepatocytes that may lead to liver damage.

Given that different forms of A1AT (of which more than 120 have been identified) may exhibit different inhibitory properties, a potential new method of diagnosis of A1AD might exploit differences in the inhibition kinetics of the different forms. Towards this end, experimentation and modeling of the reaction of porcine pancreatic elastase (PPE), a commonly used surrogate of HNE, and the normal form of A1AT were conducted by co-incubating these proteins with a synthetic substrate, and modeling of kinetics was completed. In an effort to produce stocks of different forms of A1AT that could subsequently be used in inhibition studies, bacterial plasmids were developed that contain the M, Z, and null Hong Kong (HK) forms of A1AT, and their sequences were confirmed. During the production of these plasmids, several potential problems associated with the recombinant techniques being used were identified, and based on these, new devices were designed/produced, and proof-of-concepts were demonstrated.

Through this work, the skills needed to develop recombinant DNA, produce protein, conduct enzyme inhibition studies, analyze and apply models to data, and explore new avenues of diagnostics were acquired. This significant groundwork has established a foundation upon which the group will continue to build and make contributions towards the advancement of new protocols for the detection of A1AD.