IOWA STATE UNIVERSITY
Department of Mechanical Engineering

An Experimental Study and Numerical Modeling of Biomechanical Properties of Corneal Extracellular Matrix

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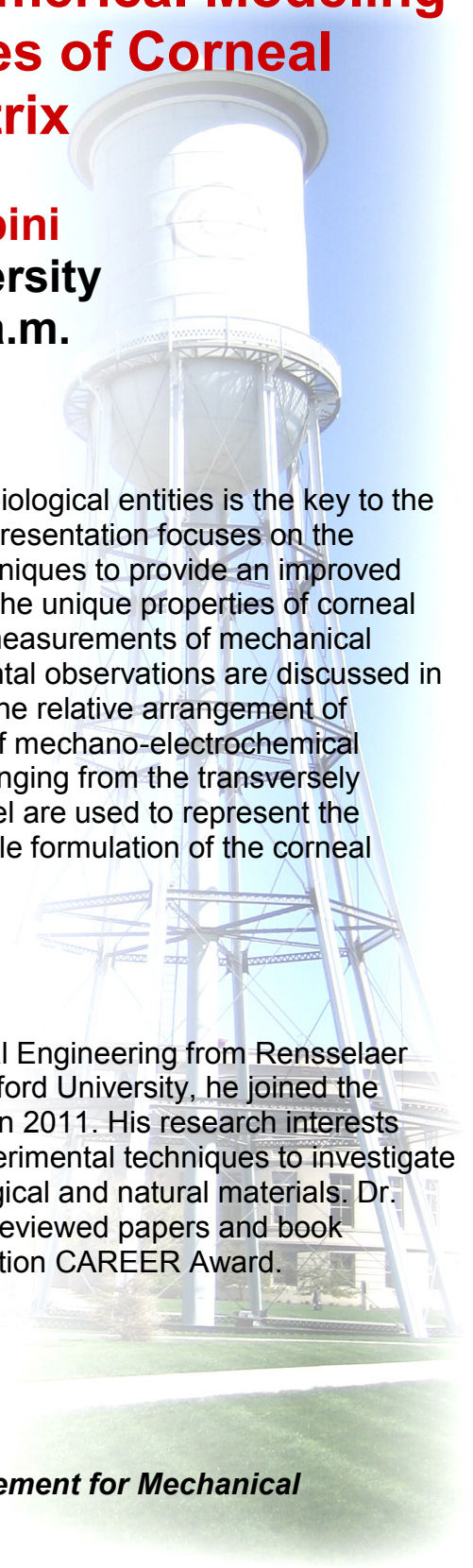

Abstract
A fundamental understanding of the structure and function of biological entities is the key to the design of new biologically-inspired composite materials. This presentation focuses on the application of experimental and computational mechanics techniques to provide an improved understanding for the underlying mechanisms responsible for the unique properties of corneal extracellular matrix. In this seminar, the in vitro experimental measurements of mechanical behavior of the corneal tissue are presented. These experimental observations are discussed in terms of microstructural properties and changes that occur in the relative arrangement of collagen fibrils and proteoglycans. Furthermore, an overview of mechano-electrochemical mixture theories is given and different mathematical models ranging from the transversely isotropic biphasic material model to a composite material model are used to represent the experimental measurements. Finally, a computational multiscale formulation of the corneal mechanics is proposed.

Biography
Hamed Hatami-Marbini received his PhD degree in Mechanical Engineering from Rensselaer Polytechnic Institute in 2009. After a postdoctoral work at Stanford University, he joined the Mechanical Engineering faculty at Oklahoma State University in 2011. His research interests primarily include multiscale computational mechanics and experimental techniques to investigate molecular origins of the structure-function relationship of biological and natural materials. Dr. Hatami-Marbini has authored and co-authored about 30 peer-reviewed papers and book chapters and was awarded the 2014 National Science Foundation CAREER Award.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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