Trevor
Aguirre

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned a PhD in mechanical engineering from Colorado State University in August 2020.

What was the subject of your dissertation?

My research investigated the architecture of biomechanically adapted unique porous bone structures, focusing on two areas: the trabecular architecture in the hindlimbs of large body mass extant and extinct animals, and the velar bone located in the bony horncore of Rocky Mountain bighorn sheep. Extinct animals studies included one mammoth and several species of dinosaur.

What was your dissertation's major contribution to your field?

My dissertation delivered two insights.

Dinosaurs increase trabecular connectivity while mammals increase trabecular thickness, to modulate strains to low levels in response to increased body mass (i.e., more force acting on the limbs). Furthermore, the trabecular architecture in dinosaurian trabecular bone was found to limit strains to values below 3,000 micro-strain, which is the same level observed during mammalian routine activities such as running, jumping, and walking.

The unique architecture in the bighorn sheep horncore can be made into biomimicked structures that are capable of reducing impact forces during dynamic impact tests.

Who is your ORNL mentor?

My mentor is Vlastimil Kunc, Advanced Composites Manufacturing Group leader, in the Manufacturing Science Division.

Which Lab organization are you part of?

I am working in the Manufacturing Science Division in the Energy Science and Technology Directorate

What will your fellowship research focus on?

My fellowship research will focus on (1) additive manufacturing (AM) of complex geometry heat exchangers composed of refractory and ultrahigh-temperature ceramics materials and (2) mechanical, oxidation, and thermomechanical testing of these materials.

What is your project's expected contribution to your field?

My project will develop new methods to obtain robust and complex heat exchangers using AM. It also aims to provide better understanding of how AM ceramic components perform in high-temperature environments.

What are your research interests?

My research interests include understanding how we can tailor the microstructures of AM ceramics to withstand harsh environments necessary for efficient power generation.

What led you to science and your specific discipline?

The short answer is I found science interesting. Throughout my career as a student and scientist/engineer, I have always targeted working on things that I have found interesting.

What did you do before coming to ORNL?

Primarily, I was a student but have had internships in the railroad industry. In these roles, I was part of R&D departments helping metallurgists better understand the mechanical behavior of novel rail steels.

Could you share an interesting fact or two about yourself?

I suppose the most interesting fact about me is that I come from a small town in eastern Colorado with a population of about 100 people. I grew up working on farms and ranches before engineering school. Another interesting fact is that I was a ski-lift operator in southern Wyoming during the last year of my PhD program.

What nonscience topic or activity is important to you and why?

Being outside! During my free time, I like to hike, camp, and ski. Skiing is harder to find in Knoxville–Oak Ridge, so I have switched hobbies and now spend time on a kayak, exploring the many rivers, lakes, and reservoirs that east Tennessee has to offer.

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