DISTINGUISHED STAFF FELLOWS AT ORNL

Jeff Foster

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned my PhD in chemistry from Virginia Tech in 2017.

What was the subject of your dissertation?

For my dissertation, I developed a methodology to leverage gaseotransmitters, specifically hydrogen sulfide, for human therapy. Gaseotransmitters have interesting physiological actions: they dilate blood vessels, promote blood vessel growth, help to regulate heart rate, and mediate ROS response and inflammation.

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

I developed chemistry to generate hydrogen sulfide on-demand in response to an exogeneous trigger (e.g., cysteine or other biological nucleophiles). This class of compounds, known as thiooximes, exhibited structure-dependent hydrogen sulfide generation and could be easily attached to polymers and other materials to facilitate targeting and delivery. Using this technology, our research group showed that hydrogen sulfide exhibits selective anticancer activity and may represent a promising cancer therapy for drug-resistant phenotypes.

Who is your ORNL mentor and which group and division are you working in?

My ORNL mentor is Tomonori Saito, a synthetic polymer chemist. I work in the Soft Matter Group within the Chemical Sciences Division.

What will your fellowship research focus on?

My fellowship research will focus on the development of homogeneous, stimuli-responsive catalysts to precisely control the incorporation of monomers during polymerization. The proposed methodology will enable kinetic control over polymer sequence, providing a tool to create polymers with intentionally designed sequences.

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

Using the technology developed during my fellowship, scientists can begin to understand how the sequence of monomers influences the behavior and properties of synthetic polymer materials. Fundamental sequence–structure–property relationships discovered during this investigation will provide a framework for the design of future sustainable materials for packaging, construction, energy storage, and medicine.

What are your research interests?

My research interests leverage a framework of synthetic methodology, homogeneous catalysis, and organic material science to uncover structure–property relationships, create novel materials with emergent functionality, and develop efficient and sustainable manufacturing processes.

What led you to science and your specific discipline?

My path to science and research was initially coincidental. I began my undergraduate education as a computer scientist, then transitioned to pre-med (biochemistry), and finally stumbled into polymer science out of necessity: Polymers and Coatings Science was the only MS degree offered at my undergraduate university, and I was strongly motivated to stay for another 2 years! It was during my master's project that I cultivated a love for laboratory research.

What did you do before coming to ORNL?

Prior to ORNL, I was first a postdoc and group leader at the University of Birmingham in the UK for 3 years. I was then a postdoc at Sandia National Labs for a year and a half and, briefly, a staff member there until my transition to ORNL.

Could you share an interesting fact or two about yourself?

I am a published science fiction author.

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

I have two young daughters that occupy most of my time away from work. I am an avid basketball fan and player. Please contact me if you have a vacancy on your team! I also enjoy cooking and home DIY. (The latter has generated outcomes of varying levels of success!)