

3rd AfroBiotech Conference

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Abstract

The 3rd AfroBiotech Conference brought together African American, and other underrepresented minority, leaders and future generations to discuss recent advancements in biotechnology. The conference included various session topics, including Regenerative Engineering, Microbiome and Immuno-engineering, Metabolic Engineering, Synthetic Biology, Chemical Biology, and Mathematical and Computational Modeling. The conference included various other events, including a Bioengineering and Our Community Funding Forum, networking sessions and rapid fire poster presentations. This paper will highlight the topics of discussion from select sessions and select talks from the Conference. Each session ended with a panel discussion with the session speakers. This white paper also includes feedback we have received from attendees who were supported by a grant from the National Science Foundation.

Keynote Presenters

Dr. C. LaShan Simpson, from Mississippi State University discussed her path to becoming a professor and the challenges she has overcome. Her talk covered not only her individual experiences, but also the overall research environment of STEM related to underrepresented minorities.

Dr. Kandice Tanner, a Senior Investigator at the National Cancer Institute presented on the metastasis of cancer and the microenvironmental cues that regulate it. The goals of Dr. Tanner's work include incorporating physiologically relevant forces/dynamics; multiplexed measurements, intravital coupled with systems level "omics *in vivo*"; creating modular platform of human derived tumors with an intact human immune system; and controlling stoichiometry in an organ specific manner.

Session 1: Regenerative Engineering

Dr. Catherine Whittington, an Assistant Professor of Biomedical Engineering from Worcester Polytechnic Institute presented on tissue engineering approaches applied to disease modeling. Her talk covered her educational background and career path, and how her research has continued to develop throughout it. One area of Dr. Whittington's current research at Worcester that she discussed focused on how developing more accurate models of pancreatic cancer *in vitro* can help to advance treatment.

Dr. Joseph Freeman, from the Department of Biomedical Engineering at Rutgers University discussed his lab's work on fabrication and evaluation of a growth factor free bioactive bone implant. His talk covered the motivation and significance of the work, *in vitro* and *in vivo* analyses of the bone scaffold and future directions for the work.

Dr. Tayloria Adams, Assistant Professor in the Chemical and Biomolecular Engineering Department at UC Irvine delivered a presentation on dielectrophoresis – insights into mesenchymal stem cells' heterogeneity.

Dr. Anjelica Gonzalez, Assistant Professor of Biomedical Engineering at Yale University closed out the session with a talk on regeneration and repair – human biomimicry for the investigation of inflammation and fibrosis. The presentation discussed building engineered systems that more accurately resemble human tissues than existing models.

Session 2: Microbiome and Immuno-engineering

Dr. Jamal Lewis, an Associate Professor at UC Davis started the session with a presentation on advances in engineering particles for autoimmune disease therapy. Dr. Lewis' lab has three primary focuses: particulate-based immunotherapy for autoimmunity and allergy; deciphering vomocytosis in phagocytic cells; and understanding biomaterial-innate immune cell interactions. The presentation focused on two studies. The first was related to his laboratory's work on reducing arthritis in mice using combinatorial, microparticle-based delivery of immune modulators. The second study he discussed was related to addressing maternal autoantibody-related autism using a nanoparticle-based prophylactic.

Dr. Gianna Hammer from Duke University discussed the cellular, molecular and epistatic control of microbiota, pathogens and colorectal cancer. Her talk focused on battling colorectal cancer by leveraging dendritic cells, particularly DC1.

Session 3: Metabolic Engineering, Synthetic Biology and Chemical Biology

Dr. Carl Denard, Assistant Professor of Chemical Engineering at the University of Florida started the second day of the conference with a presentation on reprogramming and profiling protease substrate specificity with the goal of developing next-generation proteome editors. His research has led to a platform for engineering, profiling and modulating post-translational modifying enzymes, which can increase catalytic activity for already efficient enzymes, isolate highly active human protease substrates and evolve a human protease towards a therapeutically relevant target.

Dr. Corey Wilson, an Associate Professor in the School of Chemical & Biomolecular Engineering and the Georgia Institute of Technology discussed using biomolecular system engineering to unlock the potential of biological programming. Dr. Wilson's lab has worked to develop the field of biomolecular systems engineering, which is the convergence of biological, chemical and electrical engineering. Integrating these disciplines related to protein engineering, metabolic engineering and genetic engineering can be applied to creating intelligent biological systems related to transcriptional programming, next-generation biological programming and advanced signal processing filters.

Dr. James Carothers, from the Department of Chemical Engineering and Bioengineering at the University of Washington, Seattle delivered a presentation on challenges and opportunities with CRISPR activation in bacterial and cell-free pathway engineering. The talk covered novel tools for CRISPRa at synthetic promoters, emerging capabilities for CRISPRa at endogenous promoters and integrating CRISPRa with CRISPRi for dynamic expression programs.

Dr. Gregg Duncan, Assistant Professor at University of Maryland's Fischell Department of Bioengineering closed out the session with a talk on nanoscale viral particle dynamics in the mucosal barrier to infection. The presentation focused on how viruses cause lung infections by looking at the processes they use to bypass mucus.

Session 4: Mathematical & Computational Computing

Taylor Ferebee, a PhD. Candidate from Cornell University discussed cross-species prediction of angiosperm gene expression profiles using graph neural networks. The focus of the research is to apply mathematics and computational genetics techniques to well-studied plant species with the goal of advancing plant breeding. Creating more resilient plants helps to overcome many of the agricultural challenges presented by climate change.

Dr. Michelle Mayalu from Stanford University presented control theory applications for biomedical therapeutics. Dr. Mayalu's talk focused on her use of control systems to model a synthetic cell robust population controller.

Dr. Belinda Akpa has roles at both the University of Tennessee and Oak Ridge National Laboratory. Her work focuses on multi-scale modeling with 'tiny data'. The presentation discussed using computational models to develop experimental protocols and analyze data to maximize learnings from the experiment. Dr. Akpa's research applies this method to biological systems, such as the regulatory mechanisms that govern plant 'breathing' and how they respond to environmental signals.

Bioengineering and Our Community: Funding Forum

This panel discussion featured Johnna Frierson (Duke University), Lola Eniola-Adefeso (University of Michigan), Lystranne Maynard-Smith (National Institute of Health), David Rockcliffe (National Science Foundation) and Tracey Hermanstyne (Washington University in St. Louis). The panel provided insights into the funding process related to constructing an idea, receiving feedback, applying to various agencies and seeding a project).

Testimonials from Attendees

"AfroBiotech was a great opportunity to meet other black scientists in the field. I learned a lot from the experiences of senior scientists and I was able to connect with some great mentors who I still keep in touch with." – Papa Kobina Van Dyck, University of Notre Dame

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