Engineering the Genome
Session Co-chairs: Renee Wegrzyn, DARPA, and Charles Gersbach, Duke University

Genome engineering has become an ever-growing part of the news cycle as our understanding and capabilities with regard to DNA sequencing, synthesis, and modification continue to advance. However, as the tools of genome engineering, including the use of zinc fingers (ZFNs), TALENs, and CRISPR/Cas9 in research and clinical settings continues to grow, genome cleavage specificity and alternative methods to precisely control gene expression become increasingly important. If specificity and other challenges can be addressed, genome engineering has the potential to alter any DNA or RNA sequence, whether in a bacterium, plant, animal or human being, and could result in an almost limitless range of possible applications in living things. Development of programmable nucleases could eventually enable the broad application of these or other programmable nucleases to treat human genetic diseases, develop new industrial biotechnological products, improve crop and livestock productivity, and address conservation and invasive species challenges.

In this session, our first speaker, Kris Saha from University of Wisconsin, will introduce genome engineering and the rise of CRISPR-Cas9, and will explain the wide-ranging application areas available through this technology, including research and human therapeutics. Subsequent speakers will provide specific applications of this technology across species and industries. .Omar Akbari will discuss the impact of engineering on ecosystems, through the vignette of mosquito transmission of human diseases, including a discussion of the ethical, legal, and social implications considered by researchers in the field. Patrick Boyle of Ginkgo Bioworks will describe industrial scale-up and wide-ranging applications for manufacturing molecules through iterative design and development. Finally, Samantha Maragh (NIST) will collate all of these examples to illuminate the need for standards and data sharing, as this rapidly evolving field explores new applications, species, and ecosystems, and showcase the unique perspective and contribution the National Institute for Standards Technology to the conversation.