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Athma Pai makes presentation on RNA

by Owen Llodra

Scientists have been working on the development of RNA therapies since the late 1970s, but the rapid deployment of mRNA vaccines in the face of the global threat of COVID brought a new awareness of the potential of the RNA molecule. RNA therapies look to dramatically advance treatments for a wide range of afflictions such as cancer, sickle cell anemia, hepatitis C, and more.

Dr. Athma Pai of the University of Massachusetts Chan Medical School addressed this topic when she presented a talk on "RNA Therapeutics: Recoding Drug Design, One Gene at a Time" as the sixth Telluride Science Town Talk of 2023 on Tuesday, 18 July, at the Telluride (CO) Conference Center. She is an RNA systems geneticist who works at the interface of RNA biology, functional genomics, and computational biology. Her lab develops and applies methods to study the kinetics of RNA processing and understand the various steps in RNA maturation.

RNA is part of the central dogma of biology: it helps code for specific proteins that are essential for all human biological functions. RNA-based therapy works by using its molecules to target specific genes and their expression in DNA. With the nucleic acid chemistry and delivery method in place, RNA-based drugs can be readily adapted to new targets. The use of RNA therapies is likely to grow in the coming years due to this flexibility and efficiency.

Beyond the use of RNA therapeutics for targeting specific diseases, it also has the potential to lessen the percentage of mistakes that occur during the body's process of gene-splicing. As Pai explained, "Every gene that is made into RNA, every process of transcribing RNA molecules has some 'noise.' There is a low level of mistakes or 'noise' that occurs when making RNA molecules." This noise can result in errors in proteins or waste cellular energy with non-productive mRNA molecules and so part of the goal of RNA therapeutics is to lessen the degree to which these mistakes occur.

Yet, there are many challenges involved in these treatments, such as keeping RNA molecules stable at very low temperatures (even as low as -112 degrees Fahrenheit). "Some of the larger challenges [include] delivering and stabilizing molecules," said Pai. "The cell doesn't like it when we input foreign RNA, and it actually kicks off an immune response, which is problematic."

Pai was recently awarded a highly prestigious CAREER grant from the National Science Foundation to support her work on mRNA splicing. "Understanding the molecular logic behind how genes are regulated can result in unexpected and exciting discoveries that may result in new ways to improve human health," she said.

Pai's presentation was generously sponsored by Alpine Bank with additional support from the Telluride Mountain Village Owner's Association.

(*Editor's Note*: Owen Llodra was a Telluride Science Intern in summer 2023 and is now a senior at The Calhoun School in New York City.)