Scripps Research

Re-engineering a sustainable world

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ABOUT THE LECTURE

With humanity's overuse of fossil fuels, the planet's atmospheric balance has shifted, and nature is poorly equipped to correct it. In his lecture, Ahmed Badran shared how his lab is developing strategies inspired by plants to help mitigate rising levels of carbon dioxide in the atmosphere. He discussed how these synthetic biology breakthroughs at Scripps Research have the potential to make a lasting impact on the environment and agricultural food systems.

TOP TAKEAWAY POINTS

1. The temperature of the planet has continued to increase over the last century, due to overuse use of fossil fuels. Burning fossil fuels leads to an accumulation and abundance of greenhouse gases—carbon dioxide, methane and nitrogen dioxide—in the earth's atmosphere. **This global warming effect is impacting everything** from increased antibiotic resistance and rising sea levels to worsening droughts and food scarcity.

2. Ahmed Badran and his lab are developing **novel, sustainable approaches to capture excessive carbon dioxide from the atmosphere**. Plants and other photosynthetic organisms, which grow by feeding on carbon dioxide from the air and building sugars from those molecules, have inspired the Badran lab's innovative research.

3. Specifically, Badran is investigating an enzyme called **RuBisCO: a molecular machine made by plants that actively sequesters atmospheric carbon dioxide molecules**. However, RuBisCO is slow and inefficient at capturing carbon dioxide, in addition to being burdensome to the plant.

4. To speed up this process, Badran and his colleagues are re-engineering the active site on RuBisCO—the component that provides energy for the enzyme to work. Using synthetic biology techniques, he and his colleagues are modifying its DNA "blueprint" and then analyzing which DNA sequences best improve RuBisCO's ability to capture carbon dioxide. They continually repeat this process, which is completed at **an unprecedented pace due to the advanced technologies and capabilities in Badran's lab**. With this approach, Badran and his team are conducting evolution nearly a million times faster than what nature is capable of.

5. As Badran continues to optimize RuBisCO, he believes they could be **creating plants with enhanced carbon dioxide-capturing abilities in as little as a few years**. This project holds the potential to create an extremely impactful, sustainable strategy to affect climate correction and produce more food.