INTRODUCTION: DNA MESSAGING

ICR: Interconnected Communication
- Intercommunication in nature enables coordinated population-level behaviour and complex responses to environmental stresses.
- Synthetic biology aspires to replicate nature’s cell-to-cell communication systems.
- Traditional engineered cell-to-cell communication uses modulated quorum sensing signals and detection of the small molecule AIA is utilized.

DNA Messaging
- Principle: DNA-based signaling allows information to be transmitted and detected over a period of time.

DNA Message Transmission
- DNA is carried between cells by helper M13 bacteriophage particles, which are secreted without lysis and can package DNA of arbitrary length.

We identified three areas for advancement of DNA messaging. DNA messaging should be:
1. CONTROLLABLE: Transmission of DNA message in response to stimuli.
2. MODIFIABLE: Incorporate recent advances in DNA memory storage and logic (currently in the works by the Endy lab).
3. RETRANSMITTABLE: Retransmit message by receivers after modification.

MODIFIABLE DNA MESSAGING

• Serine Integrase (Int) catalyzes site-specific recombination between attP and attB sites. This is the key enzyme used to alter gene expression in complex mammalian systems to produce a desired phenotype.

CONTROLLABLE DNA MESSAGING

• Transient DNA messaging from sender to primary receiver to secondary receivers in co-culture. The message is packaged in a virus (e.g., M13), which is co-injected with the desired DNA message and the viral packaging sequence. The virus is then expressed within cells, and the message is released into the cell culture.

RETRANSMITTABLE DNA MESSAGING

• Use of temporary integrases (e.g., Int) to control the expression of donor DNA sequences introduced into specific locations within the genome.

ACKNOWLEDGEMENTS

REFERENCES

ACCOMPLISHMENTS

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Human Practices

Evaluate T.I.I Synthentic Biology

- The goal is to create a platform that can be used for a variety of research and applications. The system can be used for tasks such as monitoring and controlling cell behavior, as well as for applications such as gene therapy and drug delivery.

Quick Tips

1. Submit a Biodevise to the Parks Registry
2. Characterized a BioBrick
3. Modeled the qualitative difference in the dynamics of Bxi-based and PhiC31-based integrase systems
4. Modeled a system of DNA message retransmission into co-culture and identified potential modes of behavior
5. Created an educational series called T.I.I Synthentic Biology, successfully hosted an event entitled "Invent Yourself," and launched a sandbox based specifically for biotechnology start-ups called VeloCity Science.

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