

An integrated hybrid biological-materials platform for portable production of biomacromolecules

Value Proposition

Bacteria are a common host to produce diverse biologics, accounting for ~30% of biopharmaceuticals. The industrial synthesis of recombinant proteins using bacterial hosts entails multiple steps that each require a sophisticated and delicate infrastructure to ensure efficiency and product quality. However, this format is inflexible and creates difficulties for producing or characterizing a diverse range of proteins in smaller amounts. Producing biologics on a small-scale is beneficial for initial activity screening and the short-shelf life can make larger-scale synthesis unnecessary. The short-shelf life of biologics also requires additional resources for transporting these molecules beyond the manufacturing site, affecting remote or undeveloped areas the most. Therefore, there is a critical need to develop technologies for versatile and scalable on-demand production of diverse biologics, as well as subsequent analysis and purification.

Technology

By exploiting cell-material feedback, Duke inventors have designed a concise single-use technology platform to achieve versatile production, analysis and purification of diverse proteins and protein complexes. Engineered bacteria that are programmed to produce a protein of interest are first encapsulated. As the bacteria population grows within this capsule, a chain of events is triggered that results in these capsules squeezing out the desired protein products. This process physically separates the byproducts associated with cell lysis from the protein of interest, eliminating the need for a centrifuge. The platform can be integrated with downstream modules including purification, the quantification of enzyme kinetics, qualitative control of protein interactions and assembly of functional protein complexes and multienzyme metabolic pathways.

Other Applications

- Could be used to biomanufacture proteins inexpensively in a range of settings including those with minimal infrastructure requirements
- Versatile production, analysis, and/or purification of diverse proteins, which can be extended to antimicrobial peptides and vaccines
- This platform could benefit biomanufacturers of engineered proteins as well as research scientists

Duke File (IDF)

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Links

- [From the lab of Dr. Lingchong You](#)

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Advantage

- Low-cost and can replace expensive infrastructure during biomanufacturing
- Has been demonstrated to produce over 50 different proteins so far on a small-scale
- Makes the optimization of metabolic pathways easier by adjusting ratio of capsules rather than controlling gene expression

Publications

- [Versatile biomanufacturing through stimulus-responsive cell-material feedback \(Nature Chemical Biology, 2019\)](#)