Docket #: S19-530

Genetically-Targeted Chemical Assembly: Building Functional Structures and Materials in Living Cells, Tissues, and Animals

Researchers have developed a method for synthesizing functional materials in living cells using a genetically-targeted approach. Material building blocks are first assembled in genetically-targeted cellular and subcellular compartments, then assembled via an enzyme triggered initiation onto the plasma membrane. The enzyme triggered, water-based synthetic process is compatible with both conductive and insulating polymers, allowing researchers to modulate electrical conduction of the target tissue. Isolated neurons, active brain slices as well as intact living organisms (C. elegans) are all viable targets for in situ and in vivo synthesis respectively. Applications of this technology include building wiring between neurons and nerve cells, converting cells into antenna for electrical stimulation therapeutics, or encapsulation of diseased cells.

Stage of Research

- in vivo

Applications

- Genetically-targeted, biocompatible, in situ and in vivo synthesis of functional materials
- Alter capacitance, conductance or insulation properties
    - Applicable to any surface, subcellular membrane or subcellular compartment
    - Electrochemical property modulation of multimodal cellular membrane

- Form pathways for external information to be routes to specific cells and networks
- Form bridges for damaged or healthy tissue
- Long-term, cell-type-specific, bimodal neuromodulation and bimodal animal behavior remodeling

Advantages

- Biocompatible, in vivo synthesis
- Genetically-specific cellular and subcellular component reaction sites
- Assembly within targeted cells of any initiator, reaction surface, reactant or reaction condition regulator
- Reaction site targeting via variety of methods including genetics and anatomy

Publications

- Liu et al. Science (2020) " Genetically targeted chemical assembly of functional materials in living cells, tissues, and animals"

Patents

- Published Application: 20230096053

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