Center for Entrepreneurship and Innovation
THE UNIVERSITY OF CHICAGO

Silicon Nanomaterials for the Activation of Neuronal Cells

SUMMARY

Amorphous silicon-based nanomaterials provide a support that better conforms to the lipid-bilayer of cellular surfaces that would enable improved cellular activation, such as the activation of neurons.

KEY RESULTS

Dr. Bozhi Tian and his group have engineered deformable, amorphous silicon material for the development of biomaterial and devices in small scale. The materials adopt a unique structure and flexibility that allows for better contact with cellular surfaces to provide uniform delivery of drugs or electrical conductivity for cellular activation. The materials have been tested on root ganglia neurons for activation and safety and biodegradation in mouse models.

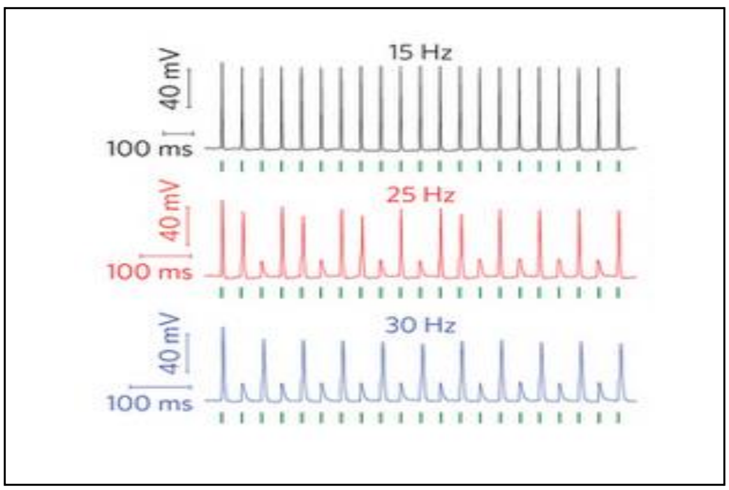
ADVANTAGES

- Deformable for better attachment to biosurfaces.
- Produces fast photothermal effect across the cell.
- Thermally stable.
- Electrically conductive.

APPLICATIONS

- Neuron activation
- Muscle cell activation

Action Potentials Across Neuronal Cells Using Amorphous Silicon Particles



Action potentials were measured across neurons by illuminating a single silicon particle attached to a cell with different laser intensities (top, middle, bottom). Green bars indicate laser pulses delivered.

TECHNICAL DESCRIPTION

Silicon is a widely used material in biomedical applications due to its biocompatibility and biodegradable properties. Additionally, silicon has electrical, optical, thermal and mechanical properties that make it attractive for device manufacturing. Existing silicon biomaterials are typically crystalline and do not exhibit the deformability or degradability desired by biomaterials, while synthetic polymers provide neither biodegradability nor fast photothermal dynamics. Dr. Tian and his group tested the ability for the new materials to activate cells by depositing the amorphous silicon materials on neuronal cells and pulsing with different laser intensities. Administration of the laser light caused a change in the membrane potential across the cells as the amorphous silicon activated ion channels to open and depolarize the lipid bilayer. The design of the amorphous silicon provides a new building block for future medical devices and nanotechnology, for example to aid in tissue engineering for muscle and neuron growth.

REFERENCE
UCHI 2545

DEVELOPMENT STAGE
Proof-of-concept
Small scale

THERAPEUTIC AREAS
Neurology
Muscle

PUBLICATION
Jiang et al., 2016, *Nature Materials* 15:1023-1030.

INTELLECTUAL PROPERTY
Patent Pending

LEAD INVESTIGATOR
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Dr. Tian is an assistant professor in chemistry focusing on nanowire materials and devices for tissue engineering and regenerative medicine.

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