INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Flexible Microfluidic Apparatus for Focal Brain Temperature Management

TECHNOLOGY NUMBER: 2024-167

OVERVIEW

Flexible microfluidic probe for precise brain temperature control during research

- Reduces tissue damage while offering improved cooling efficiency
- Applicable in research on neural activity, epilepsy, and stroke treatment

BACKGROUND

Precise brain temperature management is crucial for modulating neural activity and potentially treating neurological conditions. Traditionally, Peltier devices have been used for this purpose, leveraging their ability to provide localized cooling. However, these devices are often bulky and rigid, leading to uneven heat distribution and significant brain tissue damage upon implantation. Their limited efficiency and size further constrain their application, especially in animal research, where minimizing tissue damage is essential. The Peltier devices rely heavily on metal-based heat conduction, which enhances rigidity and risks further tissue damage due to their poor flexibility and high Young's modulus. With existing devices hampered by these issues, there is an urgent need for innovative solutions that can offer better temperature control with reduced physical invasiveness, thereby enabling detailed study of brain function and improved therapeutic potential.

INNOVATION

Researchers at the University of Michigan have developed, FlexThermo probe, for focal brain temperature modulation. It employs a flexible microfluidic channel-based design, significantly minimizing probe size and utilizing flexible materials such as PDMS and polyimide. This allows for a six-fold reduction in brain tissue damage and better contouring to the brain's surface. By integrating advanced neural interface technology with an external cooling source, the probe enhances cooling performance and offers finer control of temperature distribution. The innovative use of low Young's modulus materials improves compatibility with sensitive neural environments and provides a broader area of influence. Practical applications include refined studies in rodent models focused on the role of brain temperature in neural activity modulation, as well as potential applications in epilepsy and stroke research. With demonstrated success in reducing the brain's temperature by up to 14 degrees Celsius, this technology promises to redefine current approaches in research and therapeutic practice.

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Category

Medical Devices
Life Sciences
Semiconductor, MEMS, and Electronics

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ADDITIONAL INFORMATION

INTELLECTUAL PROPERTY

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