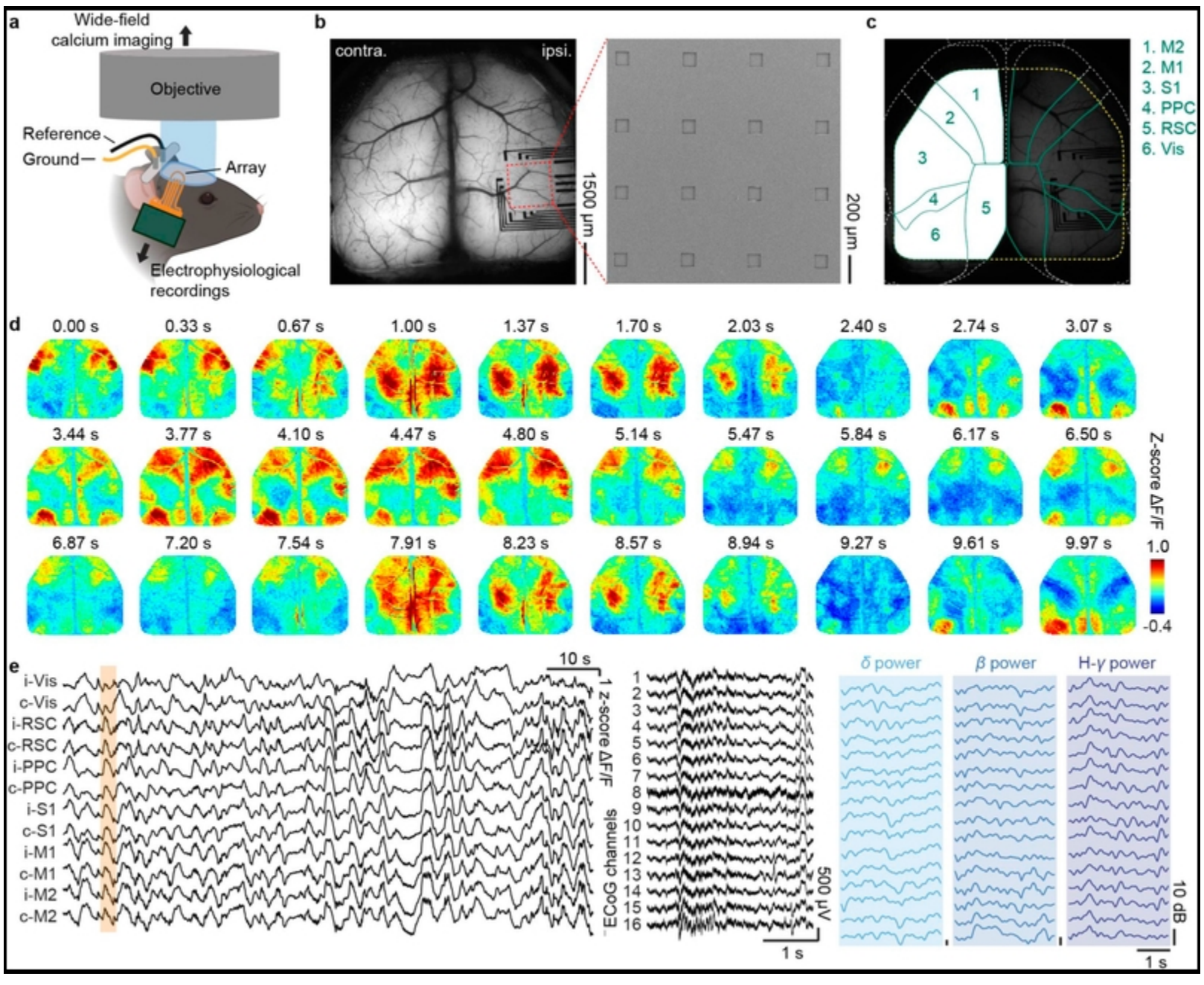
(SD2022-177) Flexible, insertable and transparent microelectrode array to detect interactions between different brain regions

Tech ID: 33395 / UC Case 2021-Z08-1

ABSTRACT

Researchers from UC San Diego's Neuroelectronics Lab invented an implantable brain electrode technology which allows recording interactions between different cortex regions or interactions of cortex with other subcortical structures. The technology is called Neuro-FITM. Flexibility and transparency of Neuro- FITM allow integration of electrophysiological recordings with any optical imaging (such as high resolution multiphoton imaging) or stimulation technology (such as optogenetics).

TECHNOLOGY DESCRIPTION



APPLICATIONS

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OTHER INFORMATION

KEYWORDS

Brain machine interfaces, implantable medical devices, electrophysiology, large-scale brain activity, neural decoding, neural network, wide-field imaging

CATEGORIZED AS

- **Medical**
  - Disease: Central Nervous System
  - Research Tools
- **Nanotechnology**
  - Electronics

RELATED CASES

2021-Z08-1

ADVANTAGES

1) Transparency: Optical transparency is important for seamless integration of electrophysiological recordings and optical imaging in multimodal experiments. That integration allows recording brain activity across very large areas in multiple spatial and temporal scales.

2) Flexibility: The high flexibility of Neuro-FITM allows bending of the probe shank away to lower the microscope objective for two-photon imaging, whereas the rigid shanks of the state of the art neural electrodes such as Neuropixel and NeuroNexus probes prevent lowering of the microscope objective to its working distance. Wide-field microscope images show that NeuroNexus and Neuropixel probes block the field of view and generate shadows.

3) Shuttle-free implantation: Vertical implantation of Neuro-FITM arrays is critical for not blocking the light pathway during optical imaging and minimizing implantation damage. To implant Neuro-FITM arrays vertically without using a rigid shuttle or adding a bioresorbable stiffening layer, we carefully engineered the geometry and length of the microelectrode array by performing mechanical analysis to prevent buckling during insertion. Furthermore, the probe was designed to include additional micromanipulator pads to maximize insertion force against buckling.

STATE OF DEVELOPMENT

INTELLECTUAL PROPERTY INFO

Patent-pending: US Patent Application No.18,063,040 on 12/07/2022 FLEXIBLE, INSERTABLE, TRANSPARENT MICROELECTRODE ARRAY FOR DETECTING INTERACTIONS BETWEEN DIFFERENT BRAIN REGIONS

RELATED MATERIALS

▶ Transparent Brain Implant Can Read Deep Neural Activity From the Surface (News Release. January 11, 2024) - 01/11/2024

▶ Liu X, Ren C, Huang Z, Wilson M, Kim JH, Lu Y, Ramezani M, Komiyama T, Kuzum D. Decoding of cortex-wide brain activity from local recordings of neural potentials. J Neural Eng. 2021 Nov 15;18(6). - 11/15/2021

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