TECHNOLOGY

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Novel 3-Dimensional Microelectrode Arrays For Enhanced Neural Recording of Tissues

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Background

University of Calgary researchers have developed reusable 3-dimensional microelectrode arrays that permit high-resolution, long-term recording with minimal tissue invasion. This new design offers a significantly higher signal-to-noise ratio (SNR), 300% better than commercially available devices that use traditional planar micro-electrodes for tissue recording. In-vitro testing using mammalian tissues (acute hippocampal brain slice) shows consistent recording of neural activity at multiple electrode sites (Figure 1), and can be used to track high frequency bursting activity between different areas of a brain slice and analyze its overall excitability. These new electrodes offer an average noise reduction to 20µV (compared to 40-60µV for traditional planar micro-electrodes). The highest recorded field potential activity peak-to-peak was in the mV range (3.2 mV), compared with signals of < 1mV with traditional planar micro-electrodes (Figure 2).

These electrodes present new opportunities to record neural network phenomena across and within brain slices with increased resolution of SNR, prolonged recording capabilities, and enabling the analysis of neural networks events, like seizures. Also, they can be implanted in living organisms to record or stimulate brain activity in-vivo.

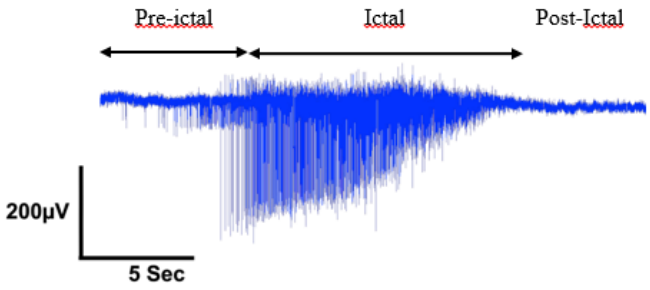

Figure 1. Example of bursting neural field potential recorded with the three-dimensional micro-electrodes (high 8.5mM K+). Various type of activity were recorded, including pre-ictal and ictal-like events.

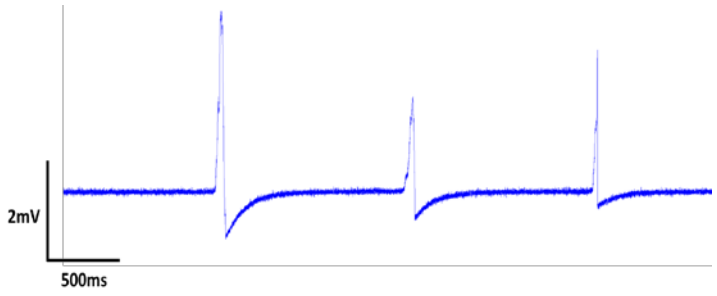

Figure 2. Neural activity from mammalian tissue was recorded up to 3.2mV peak-to-peak, with an average noise reduction to 20µV. This represents a significantly higher signal-to-noise ratio than reported signals in the current literature, with amplitudes <1mV, with the noise at 40-60µV.

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Technology Advantages

- High signal-to-noise ratio
- High signal amplitude
- Higher resolution (300% higher than traditional devices)
- Recording over an extended period of time
- Can be integrated within a flexible membrane, and implanted in living organisms (in-vivo)

Applications

- Drugs Screening
- Neural system activity mapping
- Discovery of anti-seizure compounds in brain slices
- In-vivo brain stimulation

Stage of Development

- Prototype was fabricated using standard techniques and the design is fully customizable
- This technology has been tested *in vitro*, can also be used *in vivo*

Intellectual Property Status

- Patent Pending