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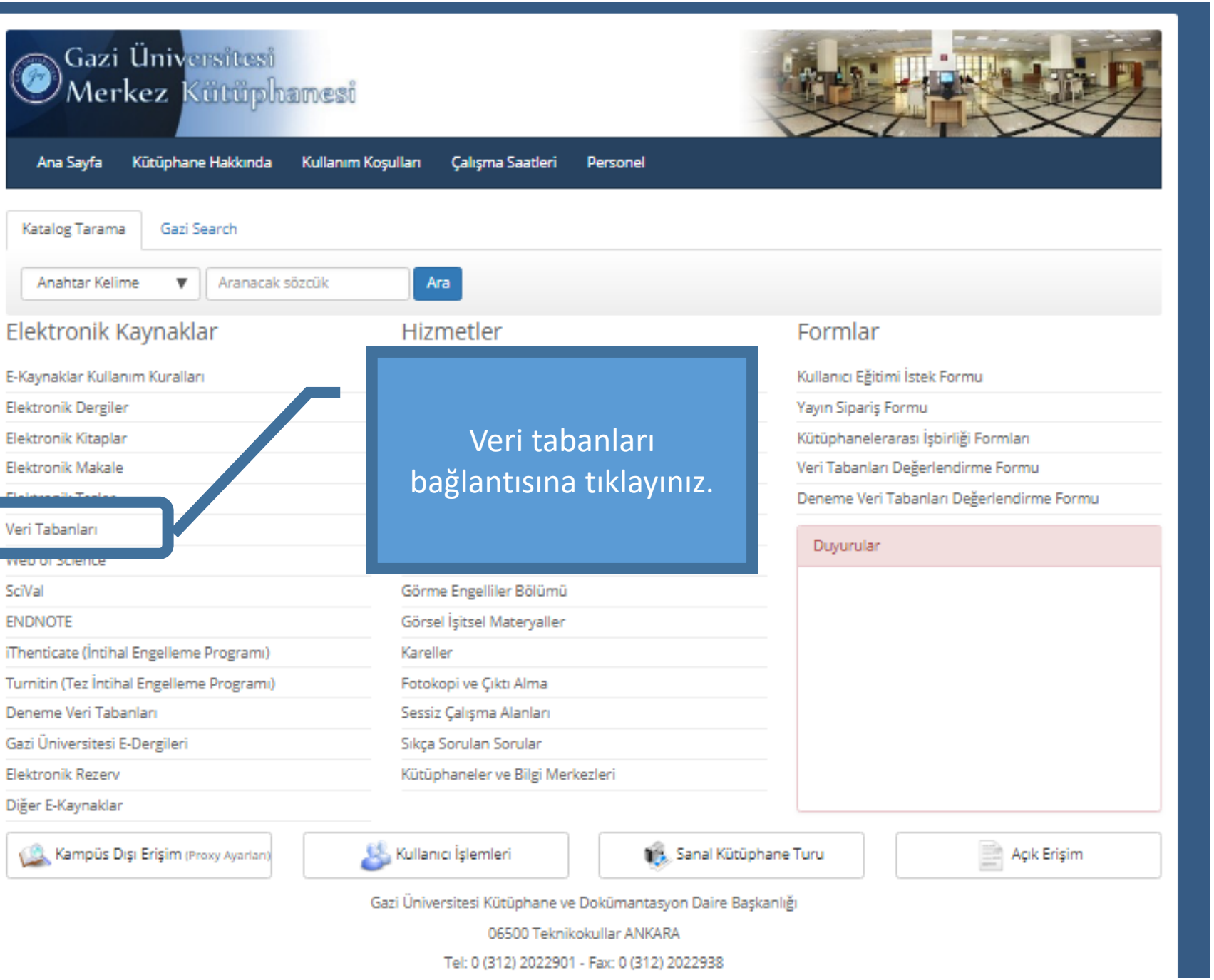
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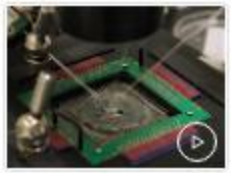

Gabriella Panuccio[1], Ilaria Colombi[1], Michela Chiappalone[1,2]

[1]Department of Neuroscience and Brain Technologies, **Istituto Italiano di Tecnologia**, [2]Rehab Technolo

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Emily D. Geyer*[1], Prithvi A. Shetty*[1], Christopher J. Suozzi*[1], David Z. Allen*[1,2], Pamela P. Benavidez*[1,2], Joseph Liu*[1,3], Charles N. Hollis[1], Greg A. Gerhardt[4], Jorge E. Quintero[4], Jason J. Burmeister[4], Emmett E. Whitaker[1,3]

[1]Department of Anesthesiology, **Ohio State University College of Medicine**, [2]Medical Student Research Program, **Ohio State University College of Medicine**, [3]Department of Anesthesiology and Pain Medicine, **Nationwide Children's Hospital**, [4]Department of Neuroscience, **University of Kentucky Medical Center**

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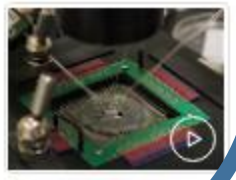

Isabella Panuc[1,2]

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Time-dependent Increase in the Network Response to the Stimulation of Neuronal Cell Cultures on Micro-electrode Arrays

Monica L. Gertz[1], Zachary Baker[2], Sharon Jose[3], Nathalia Peixoto[4]

[1]Krasnow Institute for Advanced Study, **George Mason University**, [2]Neural Engineering, Bioengineering, **George Mason University**, [3]Neural Engineering, Computer Science, **George Mason University**, [4]Electrical and Computer Engineering, **George Mason University**

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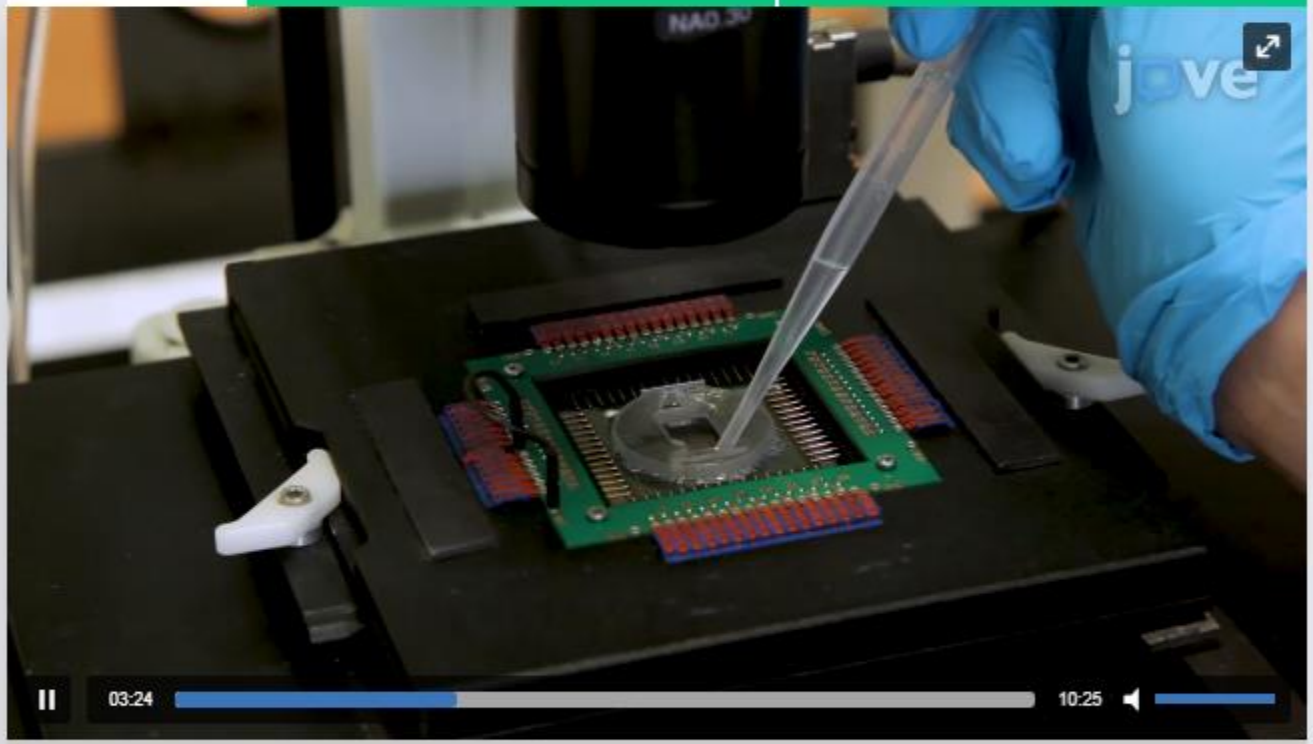

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ABSTRACT

Temporal lobe epilepsy (TLE) is the n
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observation points and a known inter-
However, tissue oxygenation may be
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making it difficult to pursue prolonged
specific structures/pathways within th
Here, we illustrate how to perform the
slices using planar MEAs. We show t
experiments. This protocol guarantee
electrophysiological features observe
stimulation for prolonged epochs. Tis
chamber allowing for laminar flow an
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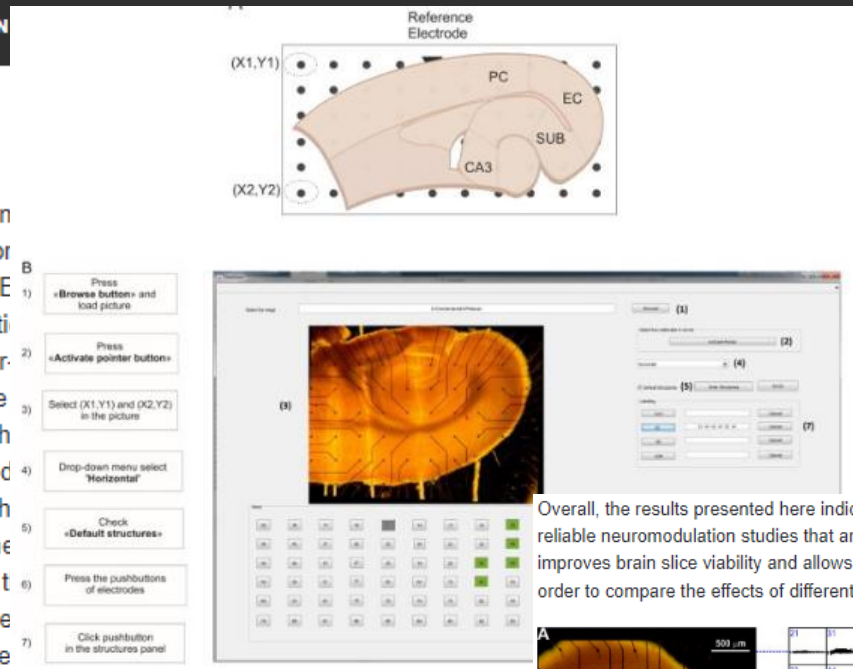

Fig 2: GUI for live *MEA electrode mapping.* (A) Schematic
The default structures used for this protocol are cornu ammor
The reference electrode is schematized as a triangle marker.

Overall, the results presented here indicate that mouse brain slices coupled to MEAs are valuable tools for epilepsy research and to perform reliable neuromodulation studies that are relevant to advance the field of DBS for epilepsy treatment. In addition, the protocol described here improves brain slice viability and allows pursuing experimental sessions for several hours (**Figure 6**), which may be required, for example, in order to compare the effects of different electrical stimulation paradigms.

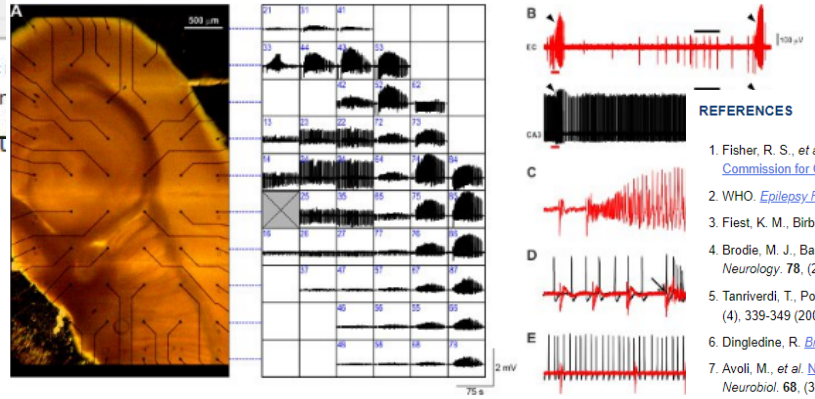

Figure 3: Typical 4AP-induced epileptiform pattern visualized with planar MEAs (electrode spacing: 500 µm) and side-by-side overview of the 4AP-induced epileptifo
the grid accommodates the activity recorded at the corresponding location within the
for more clarity. The recording electrode number is identified in blue at the upper-left
represents the reference electrode. (**B**) Representative trace segments of EC and C
indicate ictal events. In the EC trace it is possible to appreciate the occurrence of slo

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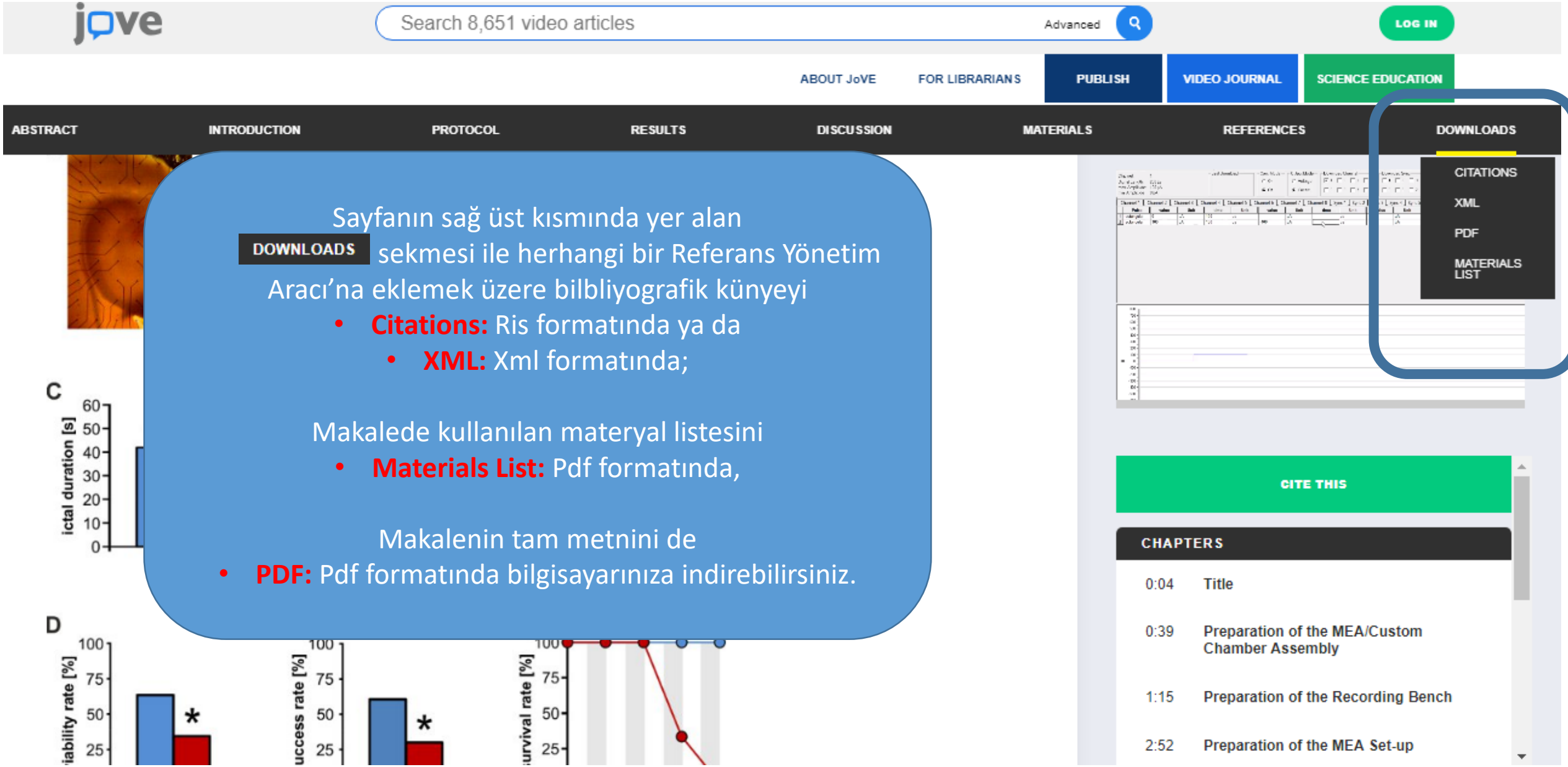
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Recording and Modulation of Epileptiform Activity in Rodent Brain Slices Coupled to Microelectrode Arrays

Gabriella Panuccio[1], Ilaria Colombi[1], Michela Chiappalone[1,2]

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Keywords: Epilepsy, 4-aminopyridine, brain slice, mouse, multielectrode array, neuromodulation

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Abstract

Temporal lobe epilepsy (TLE) is the most common partial complex epileptic syndrome and the least responsive to medications. Deep brain stimulation (DBS) is a promising approach when pharmacological treatment fails or neurosurgery is not recommended. Acute brain slices coupled to microelectrode arrays (MEAs) represent a valuable tool to study neuronal network interactions and their modulation by electrical stimulation. As compared to conventional extracellular recording techniques, they provide the added advantages of a greater number of stimulation points and a known inter-electrode distance, which allow studying the propagation path and speed of electrophysiological signals. However, tissue oxygenation may be greatly impaired during MEA recording, requiring a high perfusion rate, which comes at the cost of decreased signal-to-noise ratio and higher oscillations in the experimental temperature. Electrical stimulation further stresses the brain tissue, making it difficult to pursue prolonged recording/stimulation epochs. Moreover, electrical modulation of brain slice activity needs to target specific structures/pathways within the brain slice, requiring that electrode mapping be easily and quickly performed live during the experiment. Here, we illustrate how to perform the recording and electrical modulation of 4-aminopyridine (4AP)-induced epileptiform activity in rodent brain slices using planar MEAs. We show that the brain tissue obtained from mice outperforms rat brain tissue and is thus better suited for MEA experiments. This protocol guarantees the generation and maintenance of a stable epileptiform pattern that faithfully reproduces the electrophysiological features observed with conventional field potential recording, persists for several hours, and outlasts sustained electrical stimulation for prolonged epochs. Tissue viability throughout the experiment is achieved thanks to the use of a small-volume custom recording

Teşekkürler…