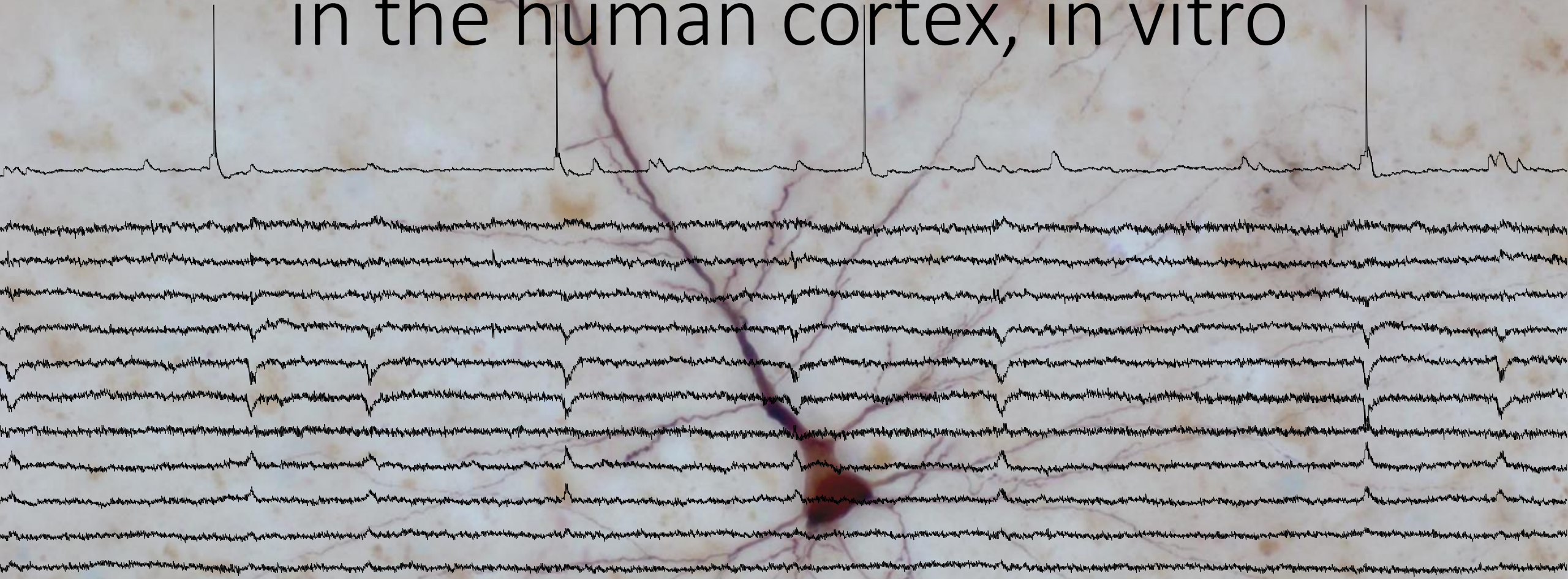
Investigation of epileptic activity in the human cortex, in vitro

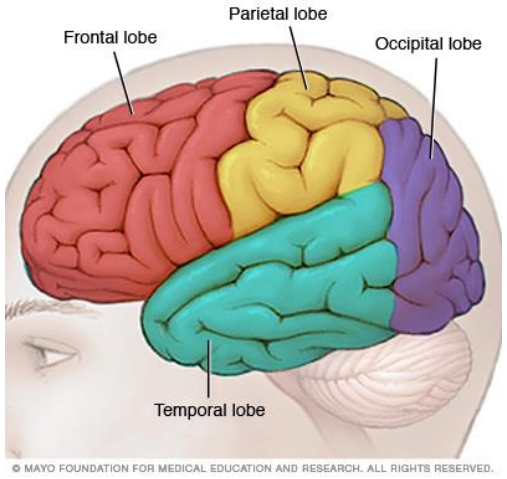


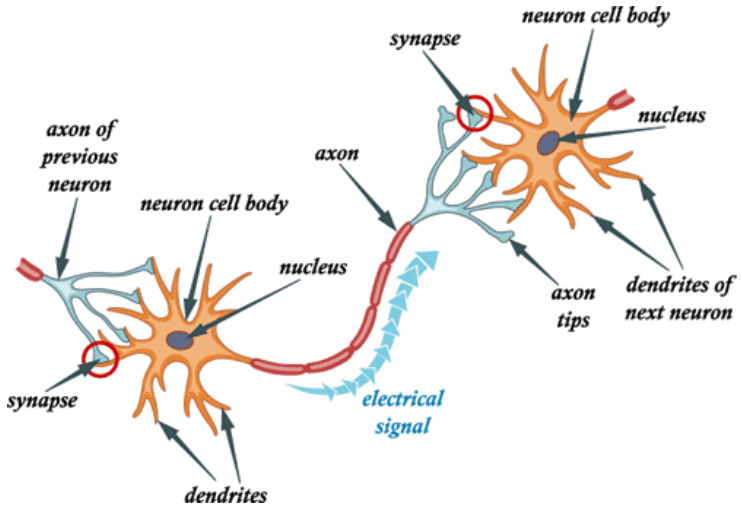
Lucia Wittner

Successful French-Hungarian projects, French Institute, Budapest

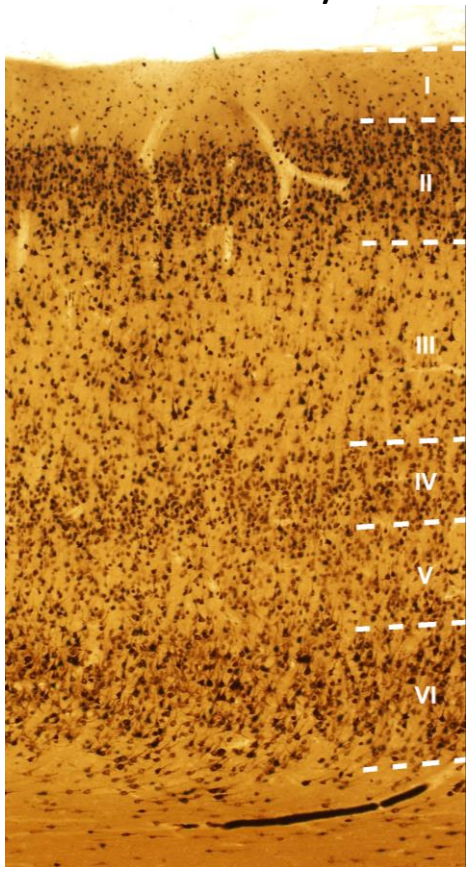
28/09/2018

Brain and neurons

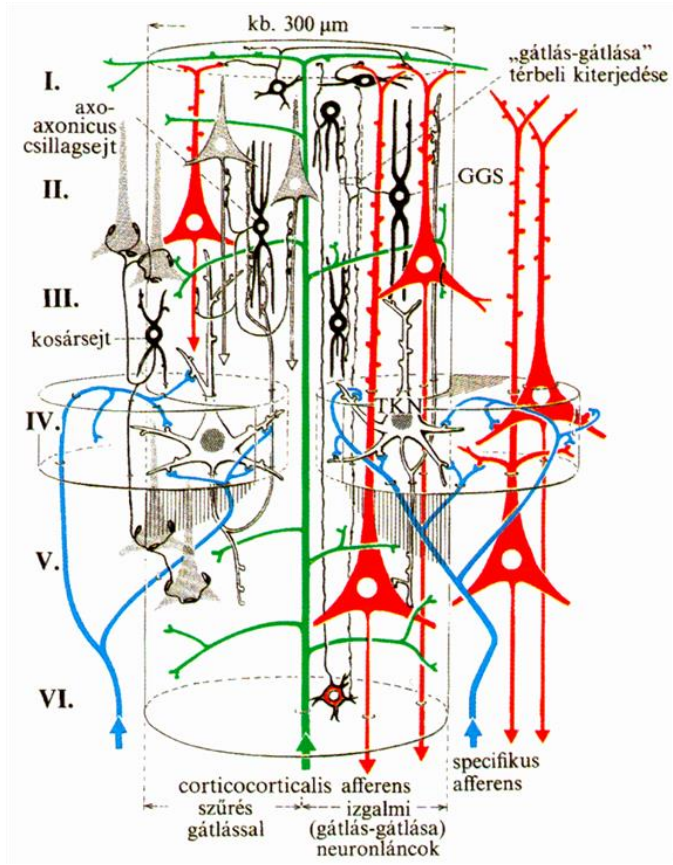




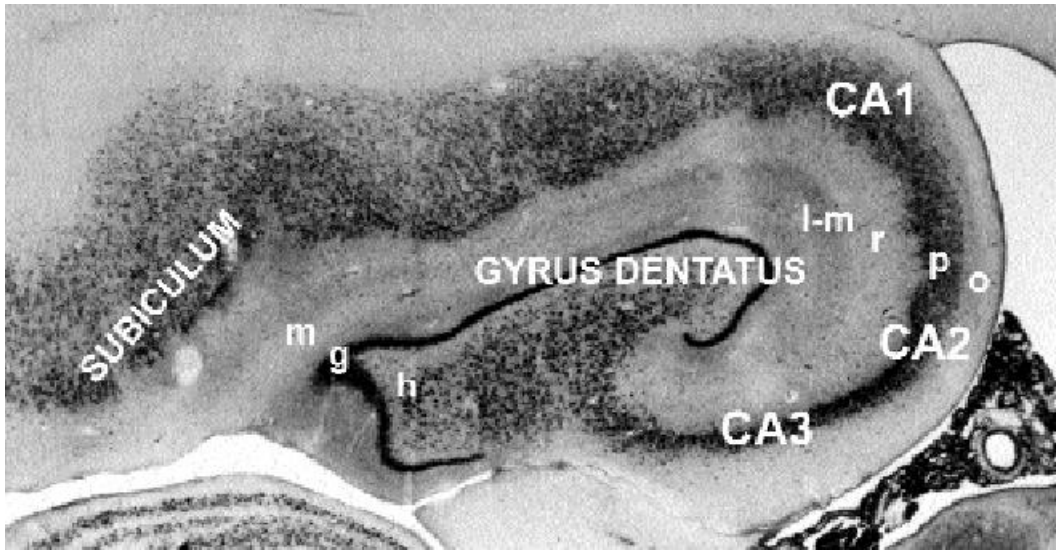
Neocortical layers



Neuron types of the neocortex



Hippocampus

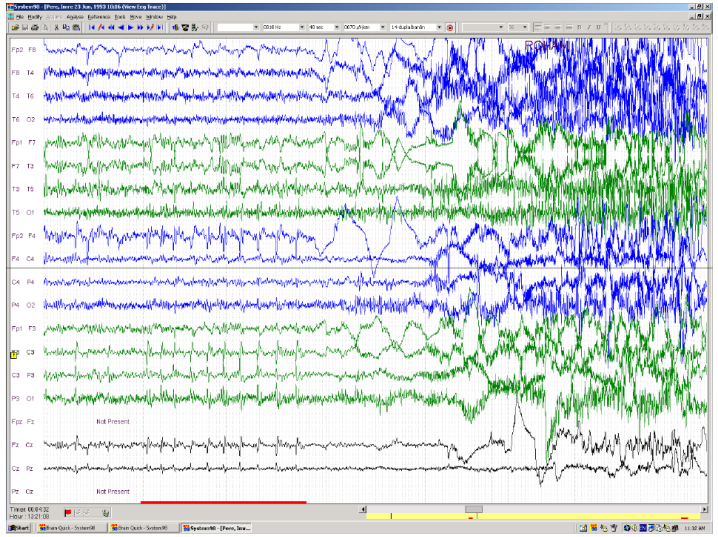


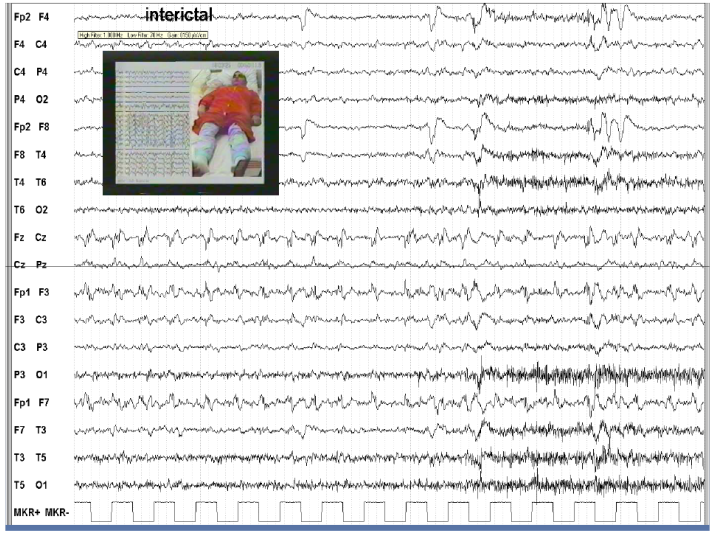
Excitatory pyramidal cells
Inhibitory interneurons

Halász, HIPPOCAMPUS, mint neuropszichiátriai betegségek közös nevezője, 2005

Szentágothai J. Funkcionális anatómia III. 2006

Epilepsy





Epilepsy is one of the most common neurogical diseases.

Seizures and epilepsy are not the same.

An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.

Epilepsy is a disease characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological, and social consequences of this condition.

Translation: a seizure is an event and epilepsy is the disease involving recurrent unprovoked seizures.

Interictal spikes: spike wave discharges detected on the EEG during the period between seizures.

International League Against Epilepsy, 2014

History

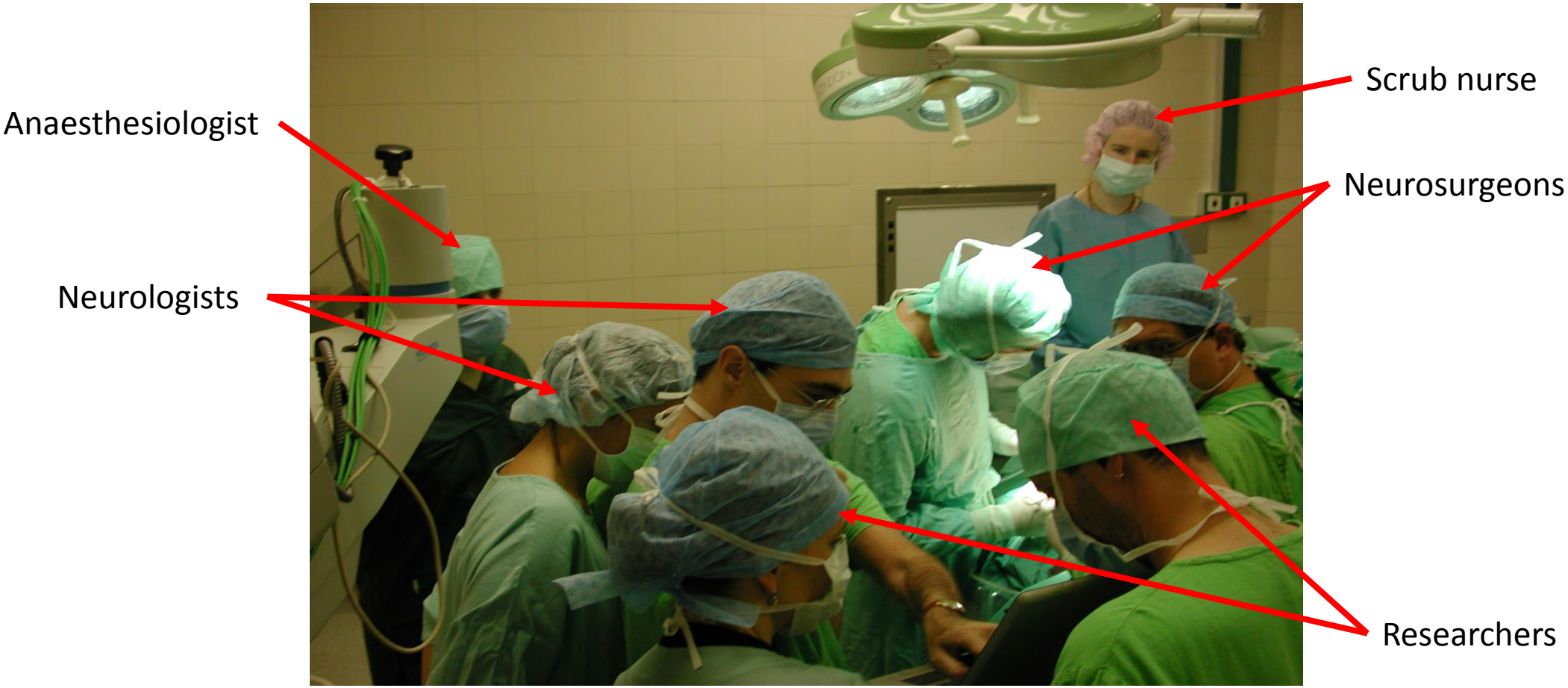
- PhD (2004): Hippocampal interneurons in human temporal lobe epilepsy: differentiated changes of perisomatic and dendritic inhibition

Supervisors: Tamás Freund and Zsófia Maglóczky

Institute of Experimental Medicine, Hungarian Academy of Sciences

History

- PhD (2004): Hippocampal interneurons in human temporal lobe epilepsy: differentiated changes of perisomatic and dendritic inhibition



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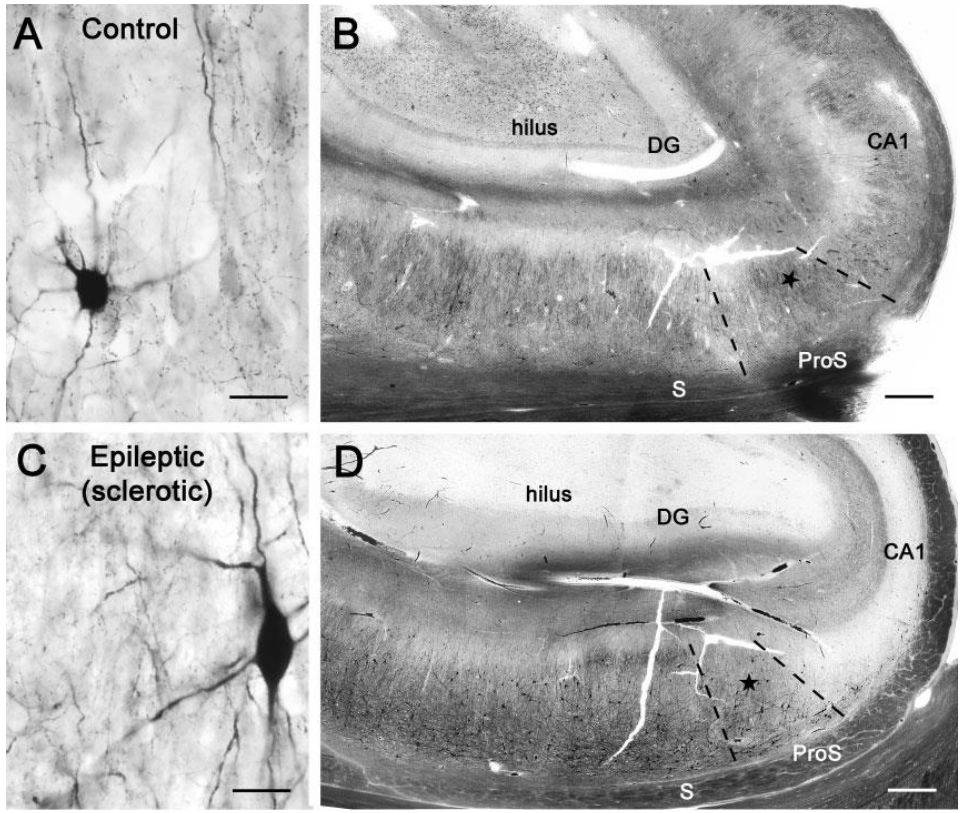
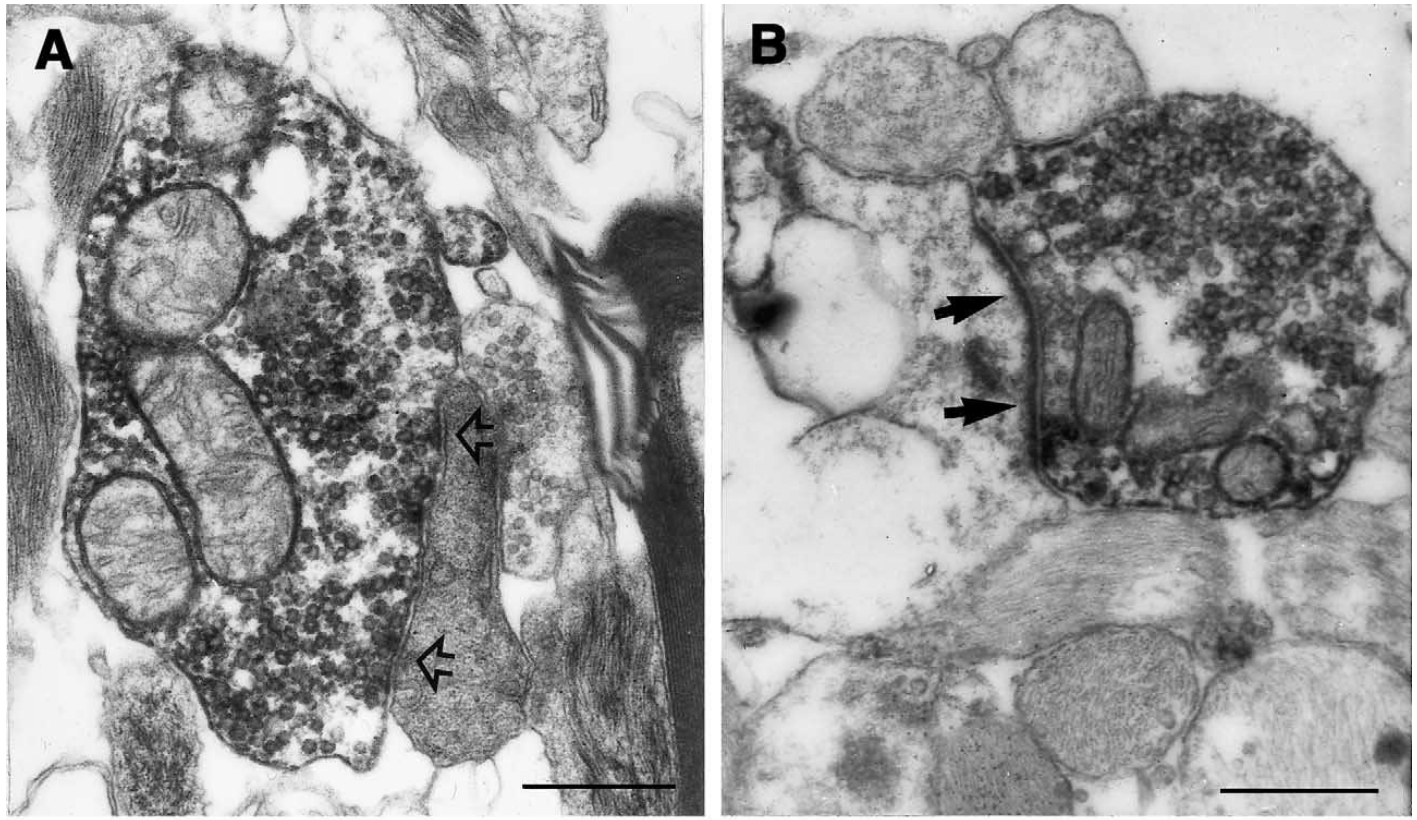


Wittner et al., Brain, 2005



Wittner et al., Neuroscience, 2002

History

- PhD (2004): Hippocampal interneurons in human temporal lobe epilepsy: differentiated changes of perisomatic and dendritic inhibition
- Postdoctoral position (2004-2006): Generation of interictal-like discharges in the human epileptic hippocampus, in vitro

INSERM Poste vert, Laboratory of Richard Miles, INSERM U739,
CHU Pitié-Salpêtrière, Paris

History

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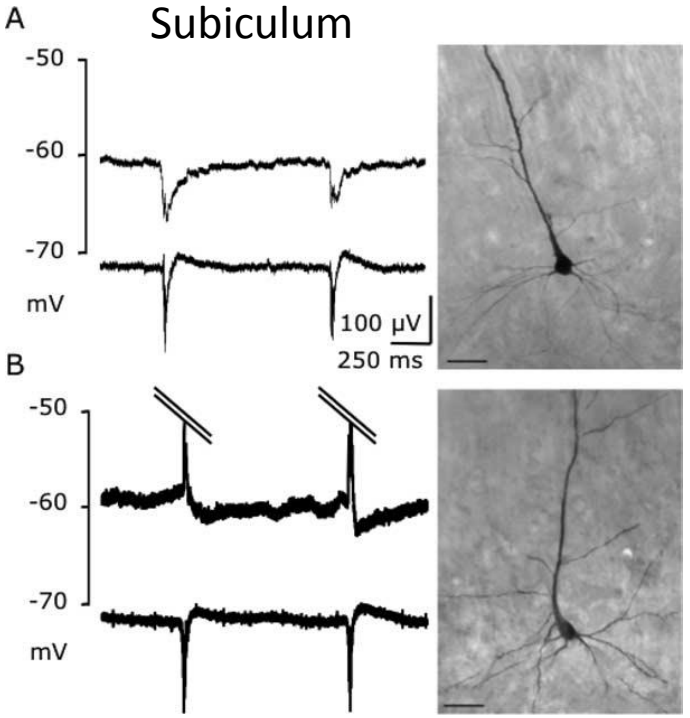
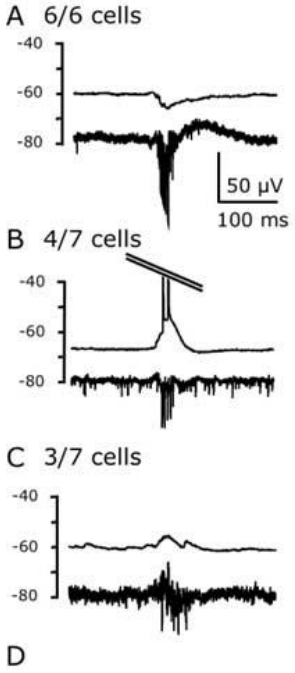
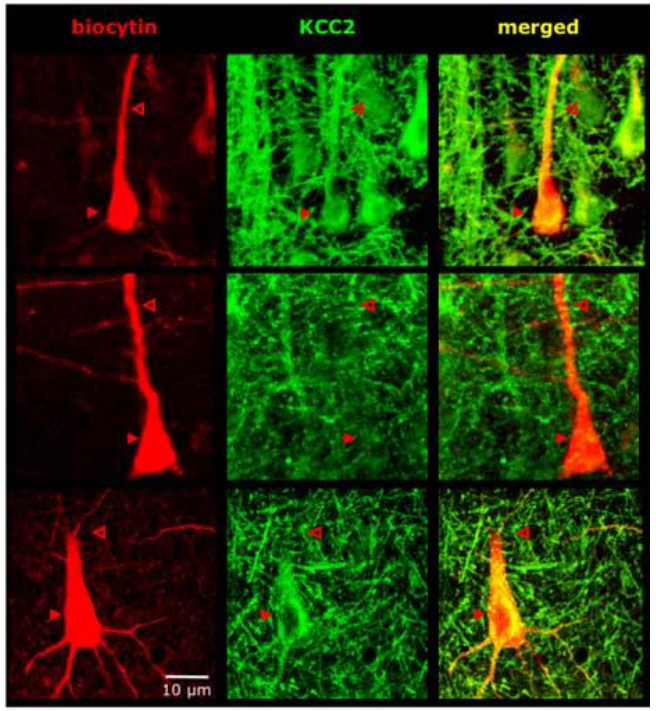
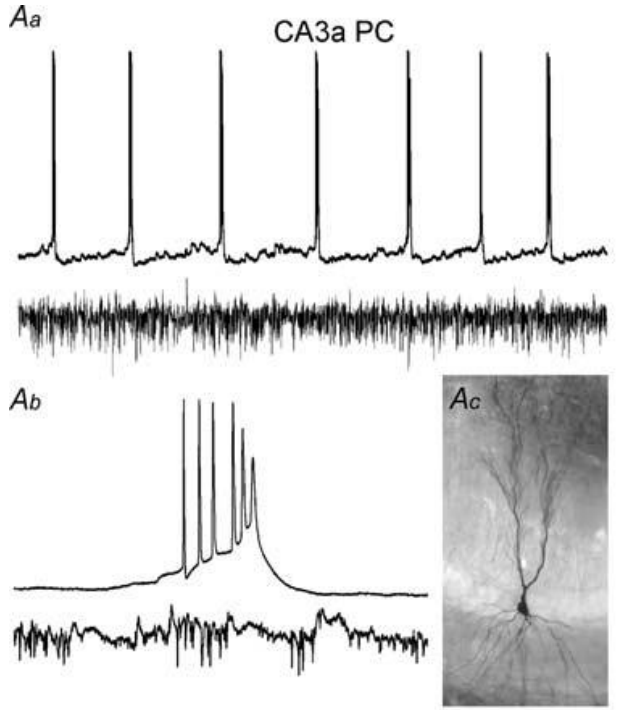






Huberfeld et al., J Neurosci, 2007



Wittner et al., J Physiol, 2007

History

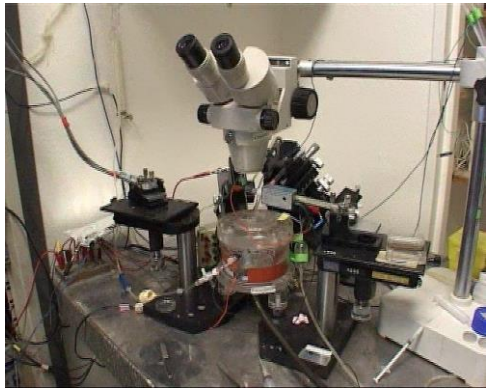
- PhD (2004): Hippocampal interneurons in human temporal lobe epilepsy: differentiated changes of perisomatic and dendritic inhibition
- Postdoctoral position (2004-2006): Generation of interictal-like discharges in the human epileptic hippocampus, in vitro
- Research fellow (2006-): Generation of physiological and pathological synchronies in the human cortex, in vitro

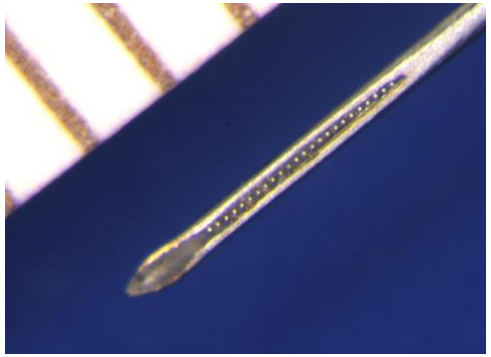
Research Center for Natural Sciences, Institute of Cognitive Neuroscience and Psychology (former Institute of Psychology), Budapest, and

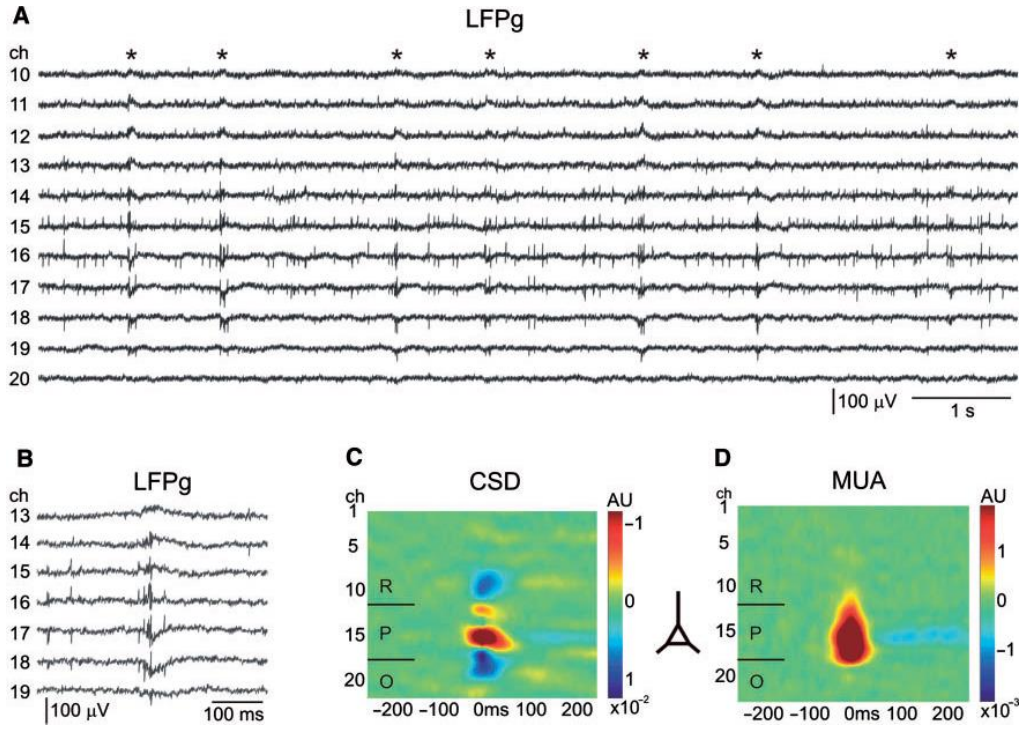
National Institute of Clinical Neuroscience, Budapest

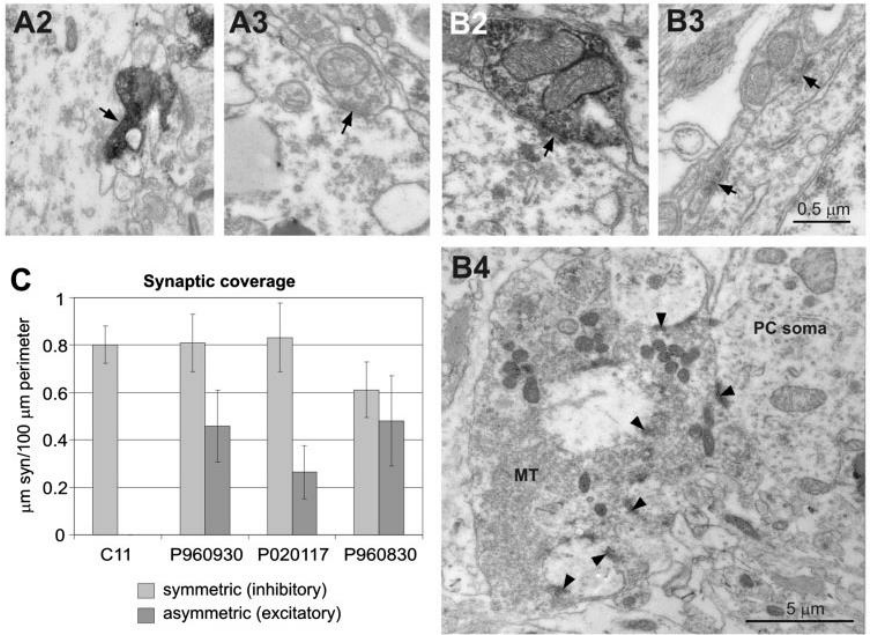
Projects F38/2006 and F16/2008

1. Spontaneous interictal-like activity and the impaired balance of excitation and inhibition in the human hippocampal CA2 region







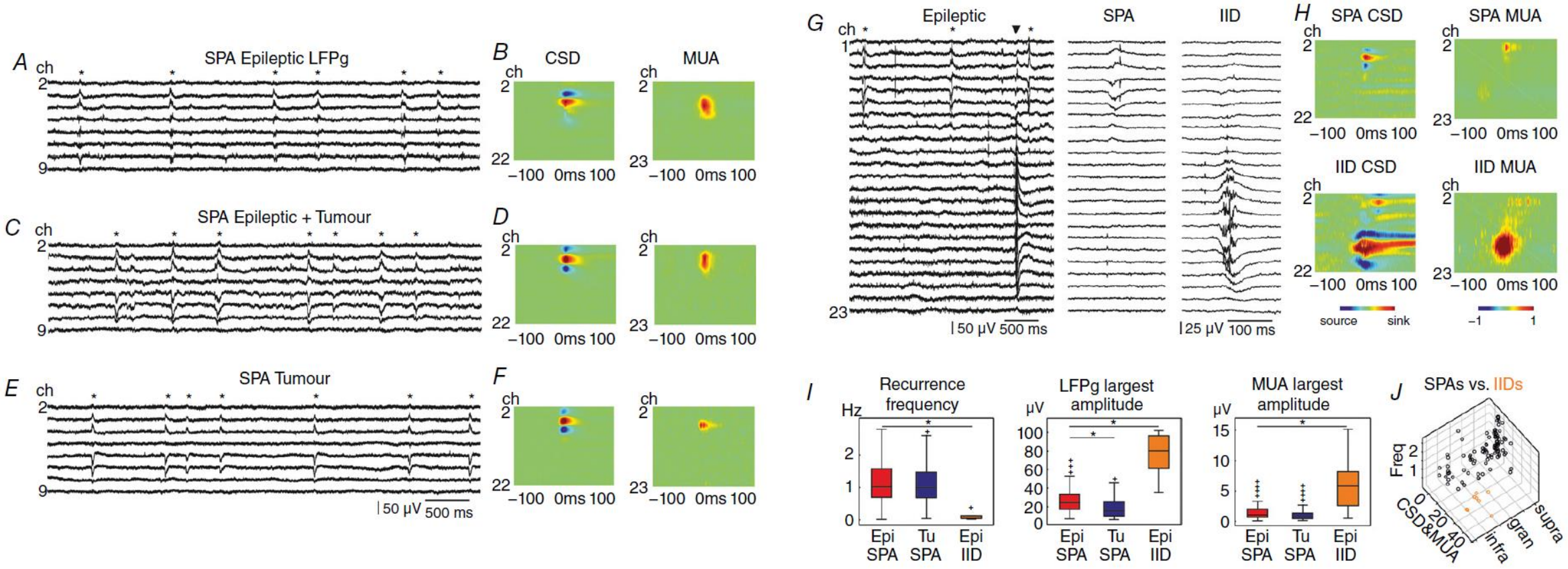


Wittner et al., Brain, 2009

The hippocampal CA2 region generates spontaneous interictal-like activity
Inhibition is preserved, but modified, and excitation is increased

Projects F38/2006 and F16/2008

2. Physiological and pathological synchronies in the human neocortex, in vitro



Tóth et al., J Physiol, 2018

The human neocortex generates two types of synchronies:
1) Spontaneous population activity (SPA) - physiological
2) Interictal-like discharge (IID) - pathological

Summary and conclusions

- We successfully developed a complex electrophysiological and anatomical method to investigate human epilepsy, in vitro
- The techniques include:
  - Light- and electron microscopy (IEM HAS, Hungary)
  - Simultaneous intra- and extracellular recordings (INSERM U739, Paris)
  - Multiple channel linear recordings (RCNS HAS, Hungary)

Thanks and future

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Ivan Cohen
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Future new collaboration

with Jean Christophe Poncer
(Institut du Fer à Moulin, Paris)

On human organotypic slice culture and multiple channel electrophysiology