Annotated bib

**Andersen M., Christensen K., Badolo L., et al. 2018. Parkinson’s disease-like burst firing activity in subthalamic nucleus induced by AAV-a-synuclein is normalized by LRRK2 modulation. Neurobiology of Disease, 116: 13-27.**

PD is characterized by a-synuclein over-production which was induced with AAV vectors. This caused an aberrant firing pattern in subthalamic neurons. Leucine-Rich Repeat Kinase 2 (LRRK2) is correlated with PD patients. Genetic ablation and pharmacological block of LRRK2 restores subthalamic firing patterns but does not improve motor behavior. LRRK2 may be a therapeutic target for PD patients.

**Broussard J., Yang K., Levine A., et al. 2016. Dopamine Regulates Aversive Contextual Learning and Associated In Vivo Synaptic Plasticity in the Hippocampus. Cell Reports, 14(8): 1930-1939.**

It was first shown that dopamine neurons innervated the hippocampus, and long-term potentiation was observed in CA1 following inhibitory avoidance learning. Using ChR2 and halorhodopsin, dopamine neurons were either stimulated or inhibited during inhibitory avoidance training or re-exposure. This showed that dopamine activation during the inhibitory avoidance training (room that gave a foot shock) caused the mice to not learn inhibitory avoidance (they didn’t avoid the footshock when tested again).

**Destexhe A., Rudolph M., Pare D. 2003. The high-conductance state of neocortical neurons *in vivo*. Nature reviews Neuroscience, 4: 739-751.**

In slice electrophysiology as well as during anesthesia, neuronal activity is greatly reduced compared to native conditions wherein neurons are subjected to “intense synaptic bombardment.” This group combines EEG recordings with slice and in vivo electrophysiology in order to generate computational models that they claim can most closely describe the true “high conductance” state of these neurons in vivo.

**The Editorial Board of Journal of Neuroscience. 2018. Recommendations for the Design and Analysis of *In Vivo* Electrophysiology Studies. Journal of Neuroscience, 38(26): 5837-5839.**

This is one of a series of articles aimed to enhance experimental design. This addresses several areas that the editorial board feel is not given enough consideration before beginning in vivo ephys experiments such as defining sample size, single vs multiunit recordings, etc.

**Haumesser J., Kuhn J., Guttler C., et al. Acute *In Vivo* Electrophysiological Recordings of Local Field Potentials and Multi-unit Activity from the Hyperdirect Pathway in Anesthetized Rats. 2017. J. Vis. Exp., 124: e55940.**

This article states the experimental power of in vivo recordings and includes an incredibly detailed video of the procedure of implanting the electrode and recording the results.

**Lima S., Hromadka T., Znamenskiy P., Zador A. 2009. PINP: A New Method of Tagging Neuronal Populations for Identification during *In Vivo* Electrophysiological Recording. Plos One, 4(7): 1-10.**

Photostimulation-assisted Identification of Neuronal Populations is an application of traditional optogenetic techniques. Using transgenic cre lines specific to neuronal populations, a floxed ChR2 is transduced into these neurons and in vivo recordings are performed with light activation. This serves to limit the recordings to specific neuronal populations.

**Stanfa L, Dickenson, A. 2004. In vivo electrophysiology of dorsal-horn neurons. Methods Mol Med, 99: 139-153.**

This is a methods paper outlining the way in which dorsal-horn neurons of the spinal cord can be characterized in anesthetized rats. This method was used to examine both the native activity and pharmacological modulation of these neurons with in vivo electrophysiology.

**Vahle-Hinz C., Detsch O. 2002. What can *in vivo* electrophysiology in animal models tell us about mechanisms of anaesthesia? British Journal of Anaesthesia, 89(1): 123-142.**

Safer anesthetic agents are always needed, and designing new drugs is difficult given the current level of understanding. This article makes a case for using in vivo electrophysiology to uncover the mechanisms of anesthesia so that new drugs can be designed efficiently.

**Walsh D., Klyubin I., Fadeeva J., et al. 2002. Naturally secreted oligomers of amyloid B protein potently inhibit hippocampal long-term potentiation *in vivo.* Nature, 416: 535-539.**

This is a classic landmark paper wherein the first proposed mechanism of amyloid beta neural degradation is outlined. Using in vivo electrophysiology and direct injections of different beta amyloid states it was shown that AB oligomers inhibit hippocampal long-term potentiation at concentrations found in human brain and CSF.

**Witten I., Lin S., Brodsky M., et al. 2010. Cholinergic Interneurons Control Local Circuit Activity and Cocaine Conditioning. Science, 330(6011): 1677-1681.**

The causal role of cholinergic neurons isn’t fully understood, so this group used optogenetics to probe their functions with regards to cocaine conditioning. Cholinergic neurons were either inhibited or excited during a two-chamber paradigm, and the group concluded that inhibiting the function of cholinergic neurons optogenetically decreased the mice’s preference for cocaine.

Electronic Resources

<https://www.youtube.com/watch?v=tInqGXWTD8I>

An excellent video by Dr. Carl Petersen titled in the series “Cellular Mechanisms of Brain Function.”

<https://www.researchgate.net/topic/In-Vivo-Electrophysiology>

Research-gate is an online forum where researchers at all levels come together to ask questions and share resources.

<https://en.wikipedia.org/wiki/Electrophysiology>

 As always, Wikipedia is the best place to start for a foundational understanding of a topic.

<https://www.jove.com/video/51757/a-guide-to-vivo-single-unit-recording-from-optogenetically-identified>

 Jove is a video platform for scientific methods.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2574934/>

“Recombinant Adeno-associated Virus Transduction and Integration.” Pubmed is a tremendous online resource for review articles such as this.

<https://www.addgene.org/viral-vectors/aav/aav-guide/>

 The AAV Guide from Addgene.

<https://www.addgene.org/viral-vectors/lentivirus/lenti-guide/>

 The Lentiviral Guide from Addgene

<https://www.genecopoeia.com/resource/aav-vs-lentivirus-choosing-for-dna-delivery/>

 A comparison article for different viral vector designs.

<https://www.youtube.com/watch?v=wqCnbCDmDKc>

A bit of an infomercial, “Wireless Technologies for in vivo Electrophysiology in Conscious, Freely Behaving Non-Human Primates”

<https://www.janelia.org/open-science/rodent-vivo-electrophysiology-targeting-system-rivets%C2%AE-and-rivets-360%C2%AE>

A vendor page for electrophysiology equipment, a good resource for understanding the fundamentals of the rig.