Электрофизиологические методы исследований

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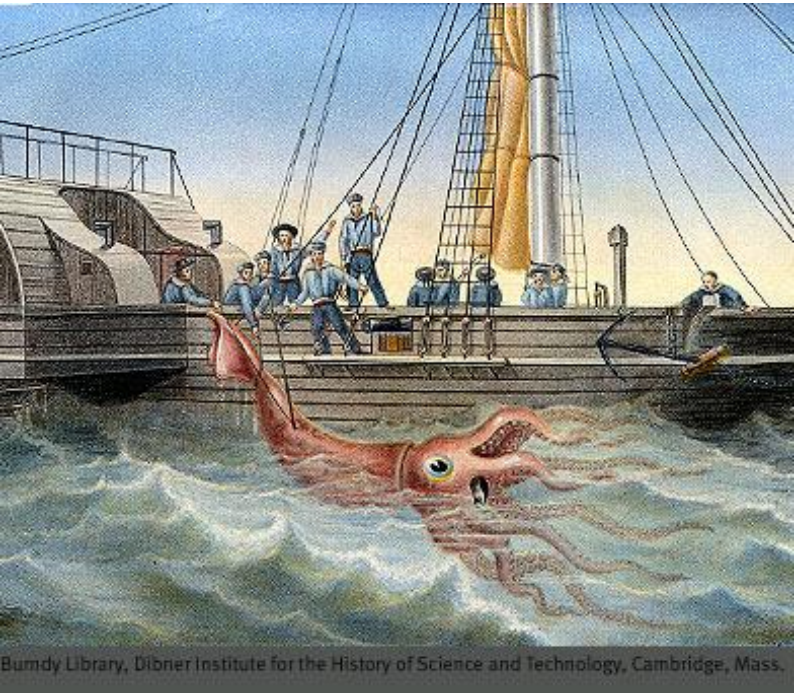
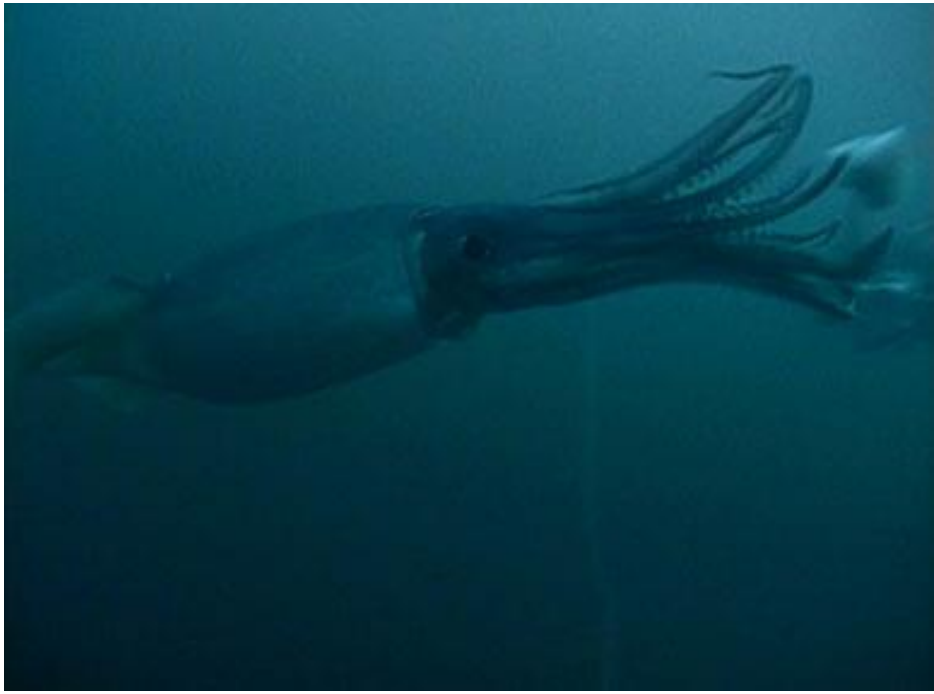
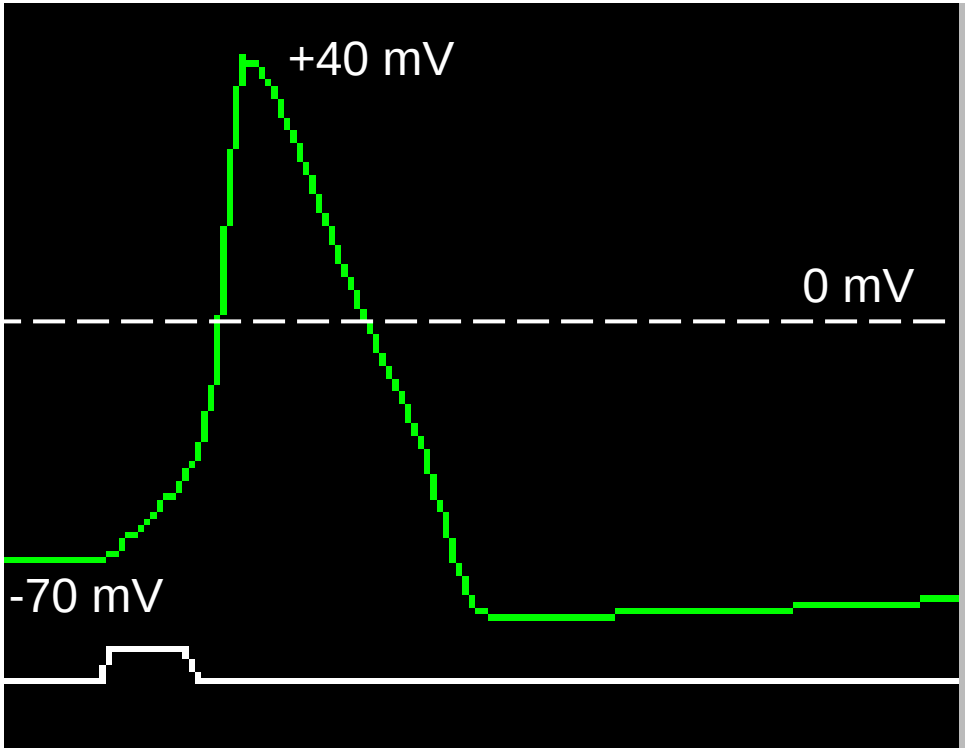
1. Микроэлектродная техника.
2. Метод «Patch-clamp».
3. Многоэлектродные камеры.
4. Флюоресцентные методы регистрации потенциала.

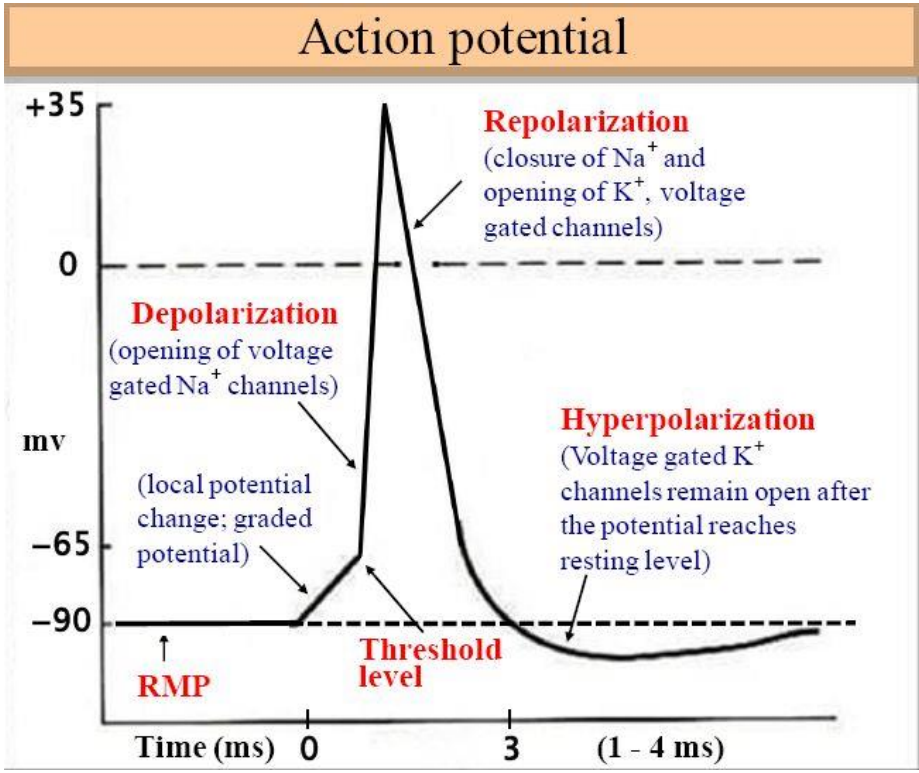
The squid and its giant axon

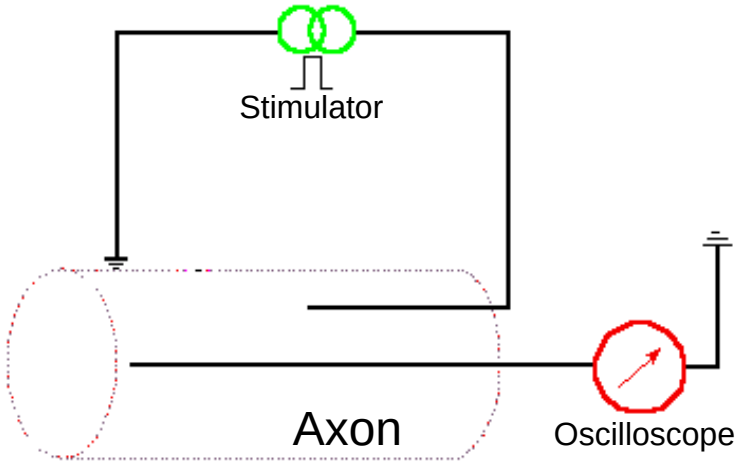




Action potential in squid axon



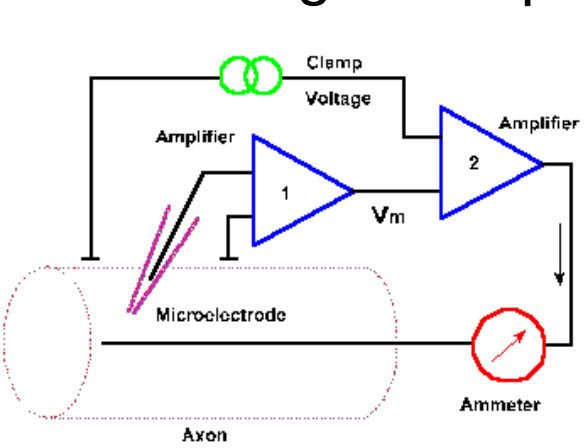


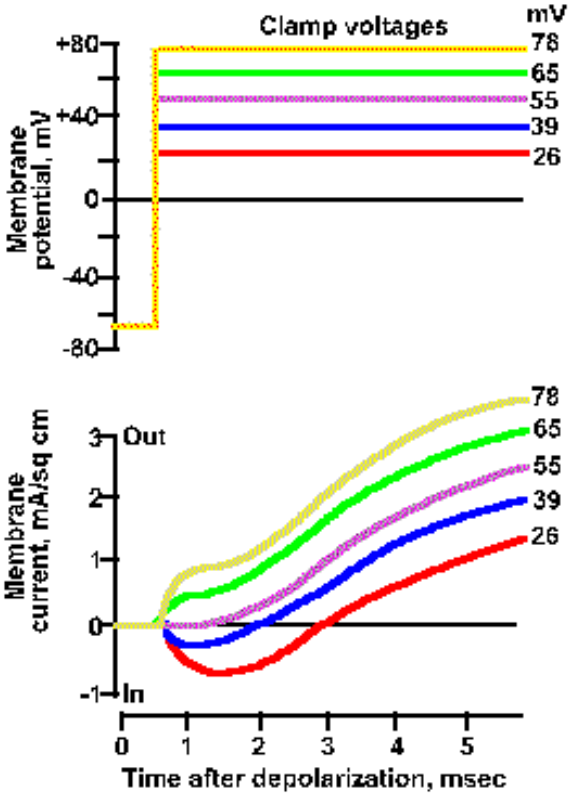


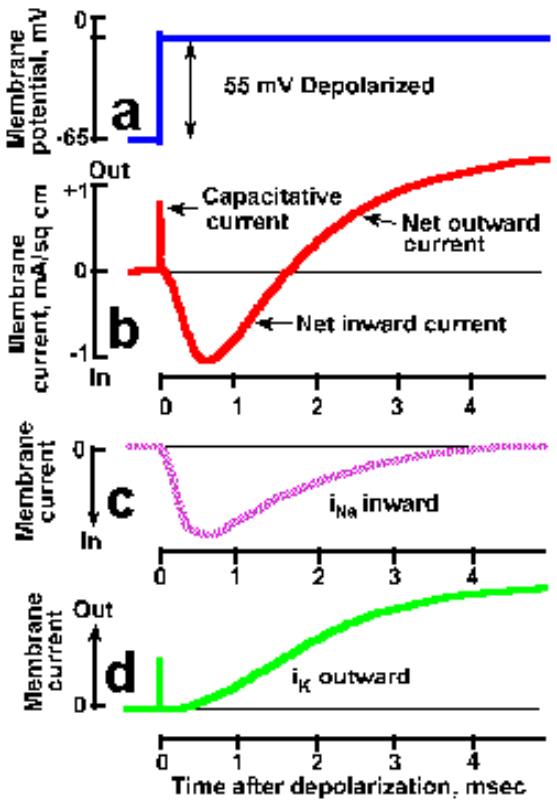
External solution:
Na+ 400 mM
K+ 10 mM

Internal solution:
Na+ 10 mM
K+ 400 mM

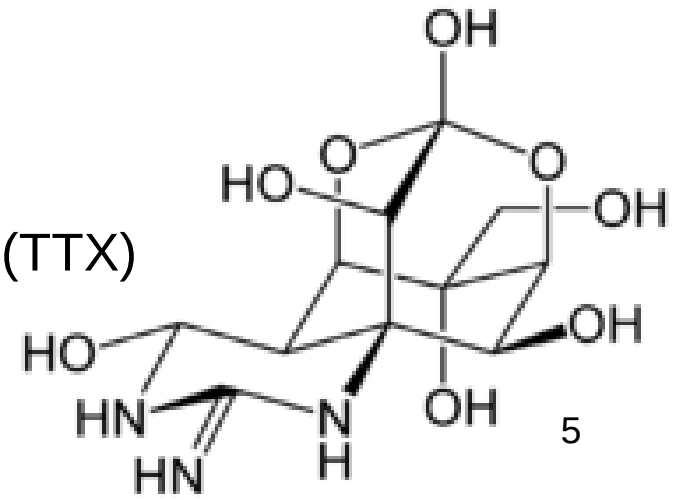
Voltage clamp of squid axon, tetrodotoxin and Na current





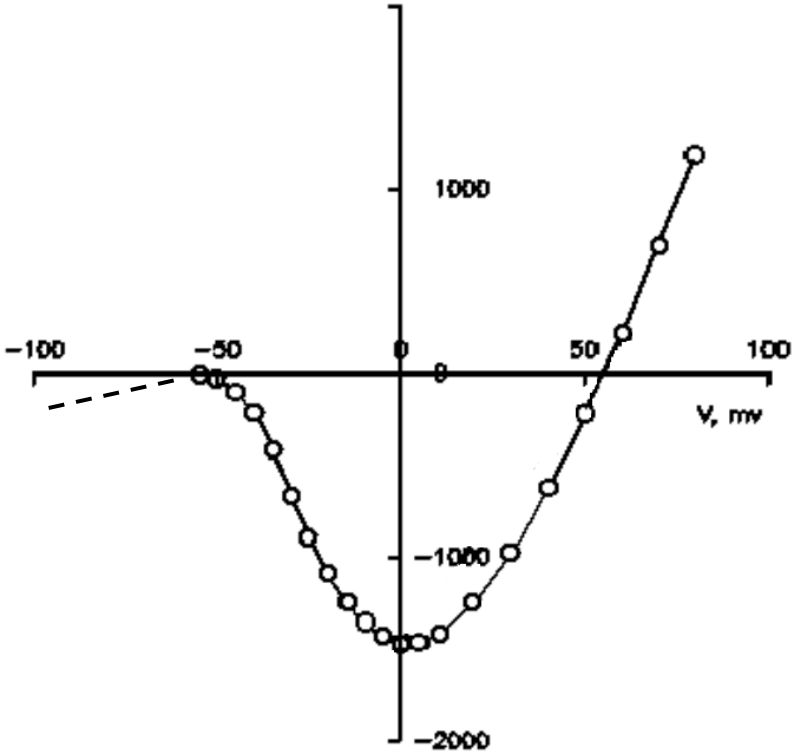


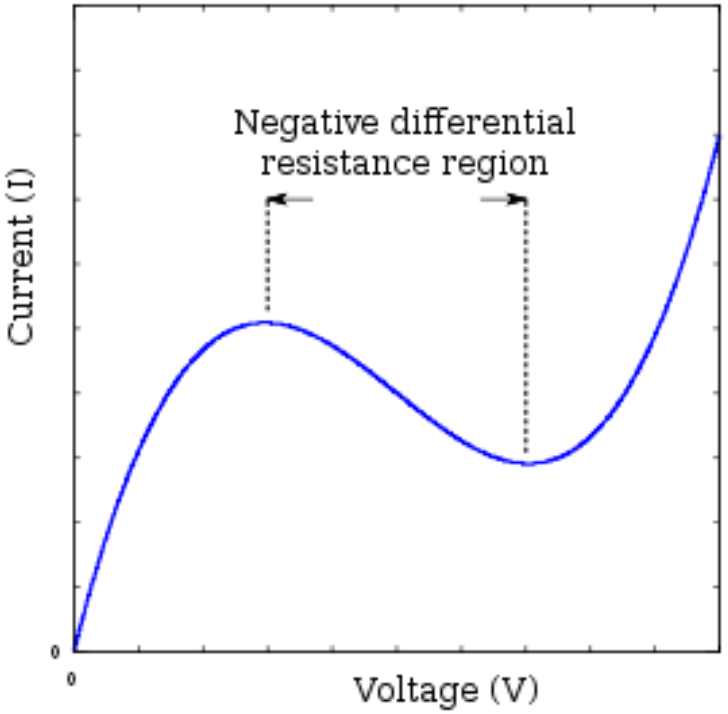
Tetrodotoxin (TTX)



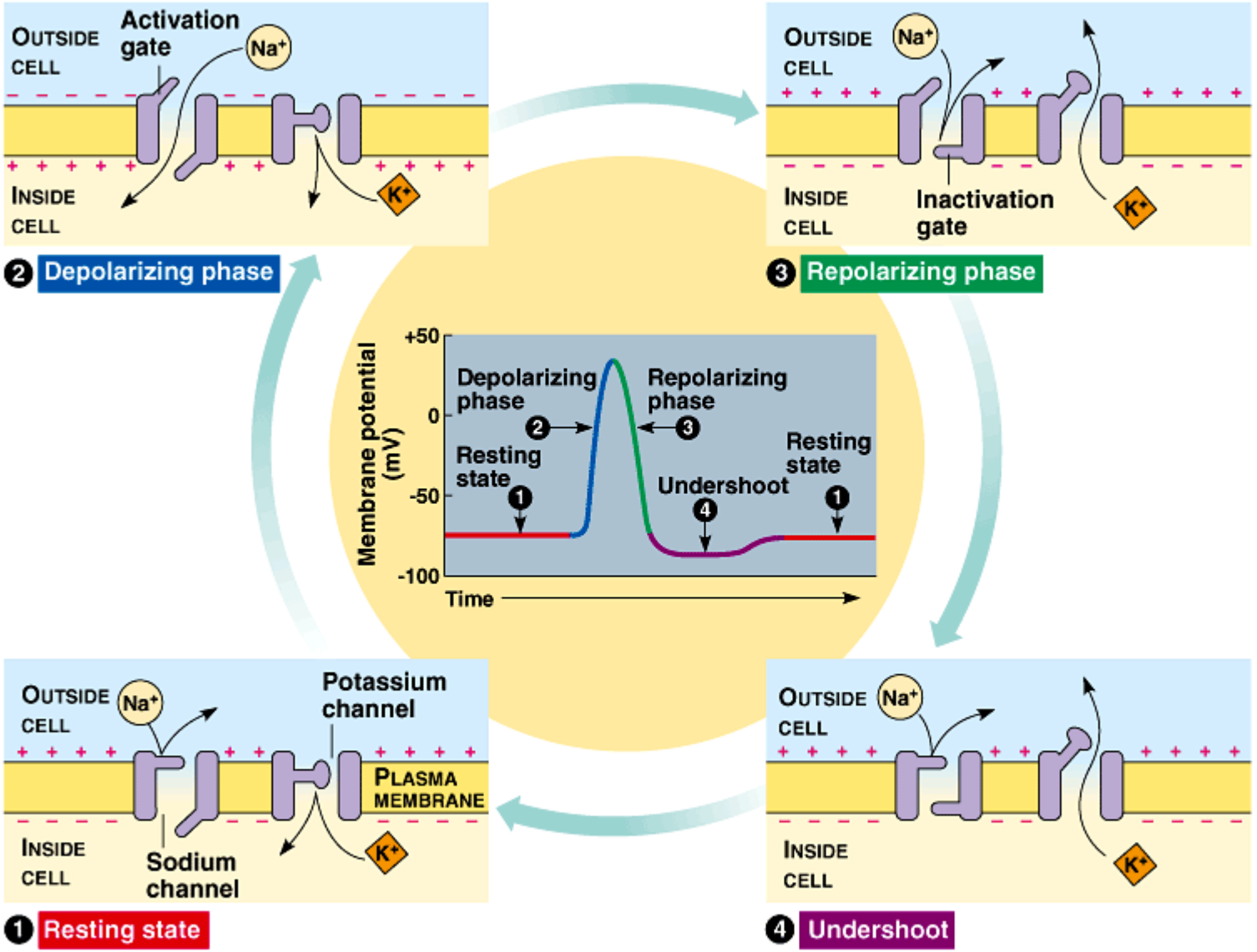
From 17

Negative resistance region, negative conductance, negative slope

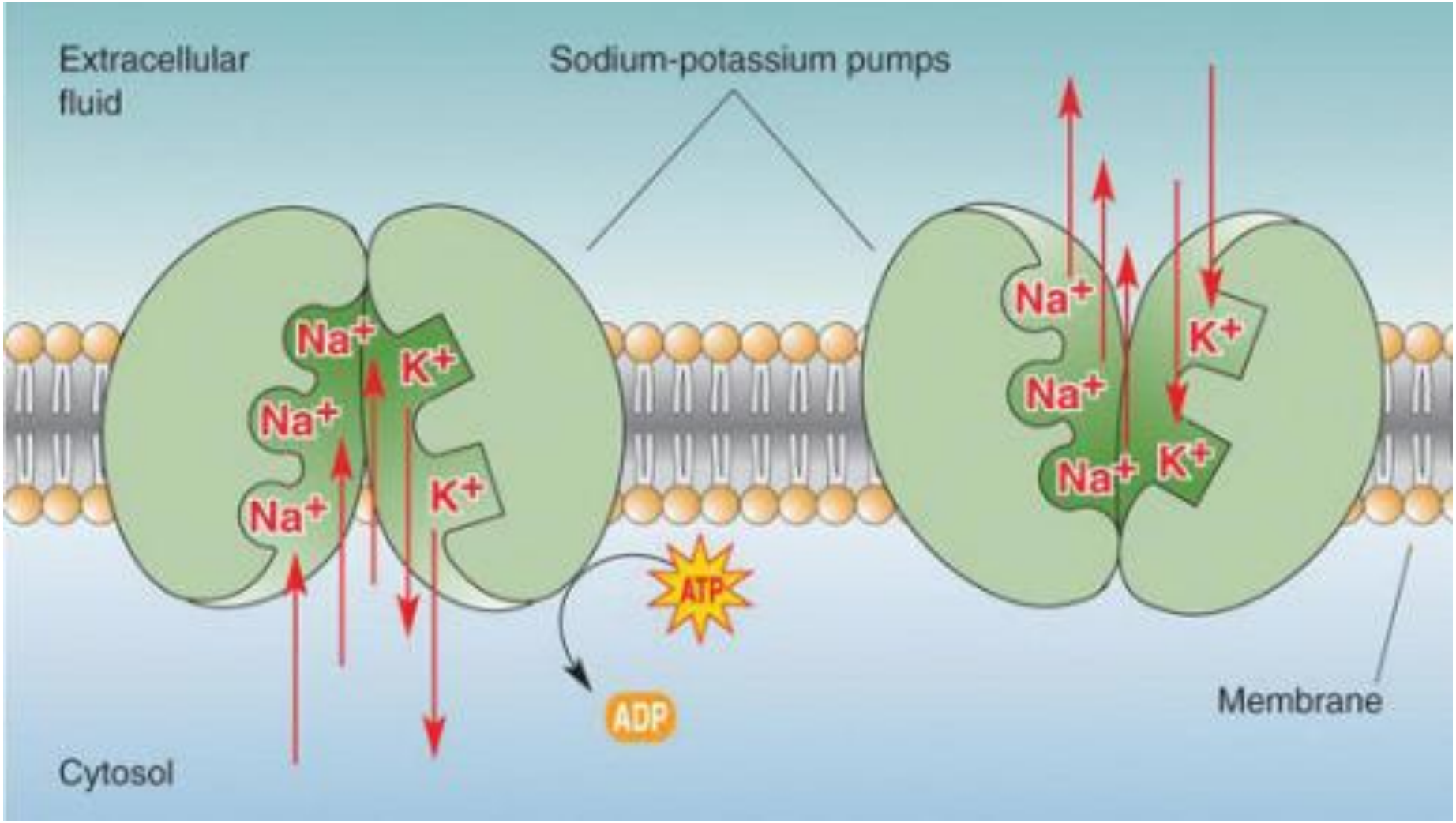




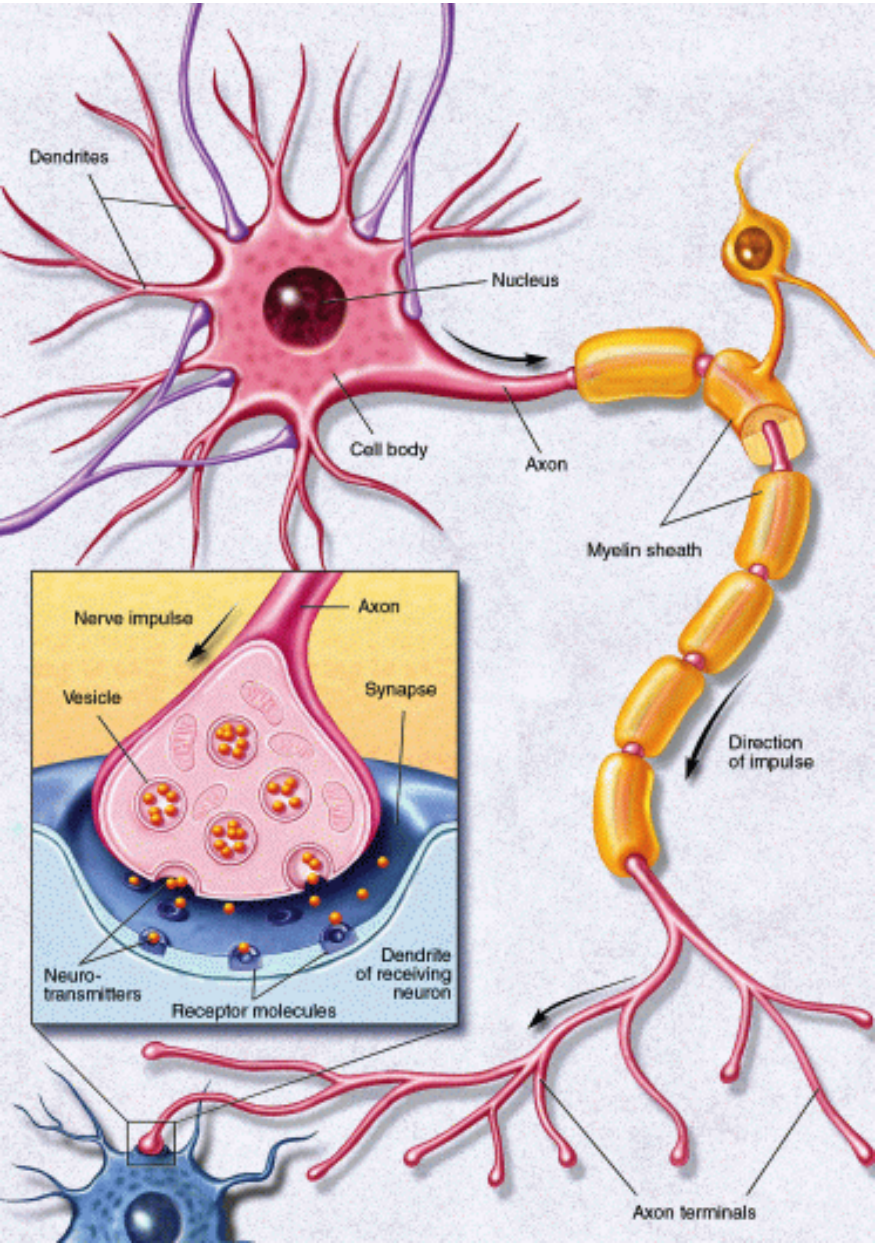
Sodium and Potassium channels and action potential

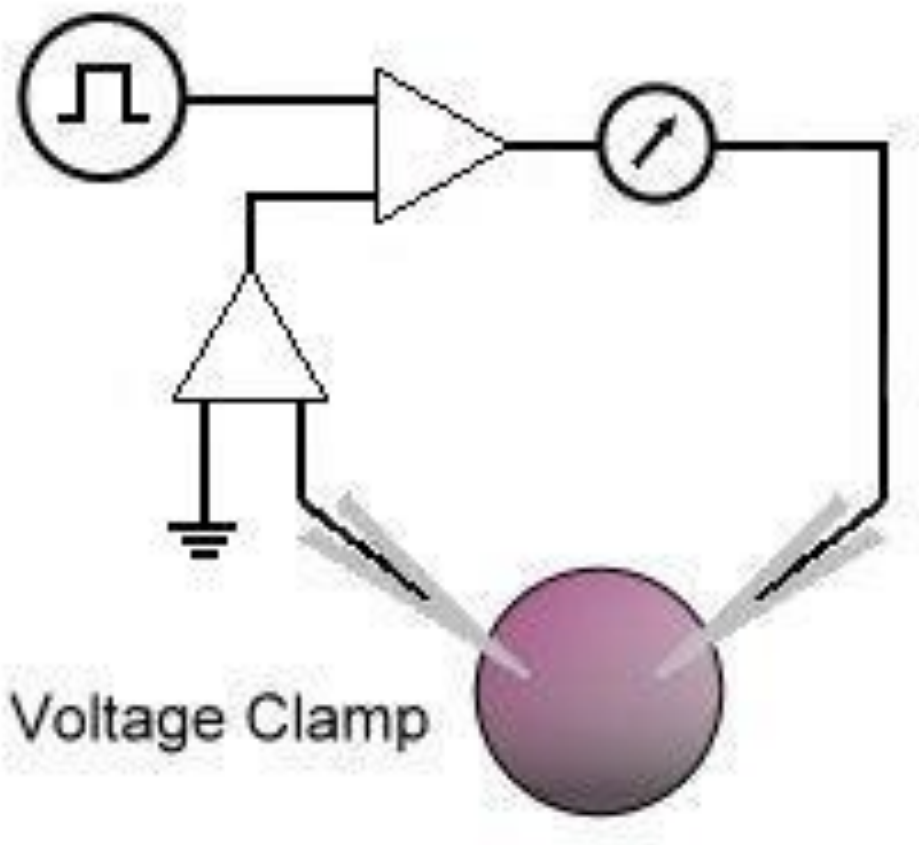


ATP and sodium-potassium pump (Na-K-ATPase)



Neuron and voltage clamp of its membrane





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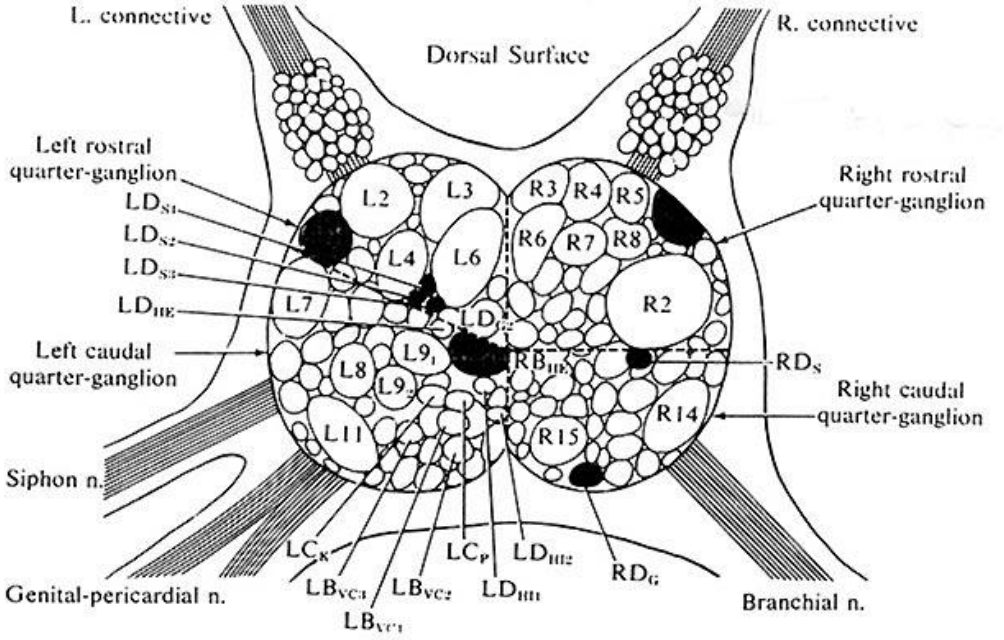
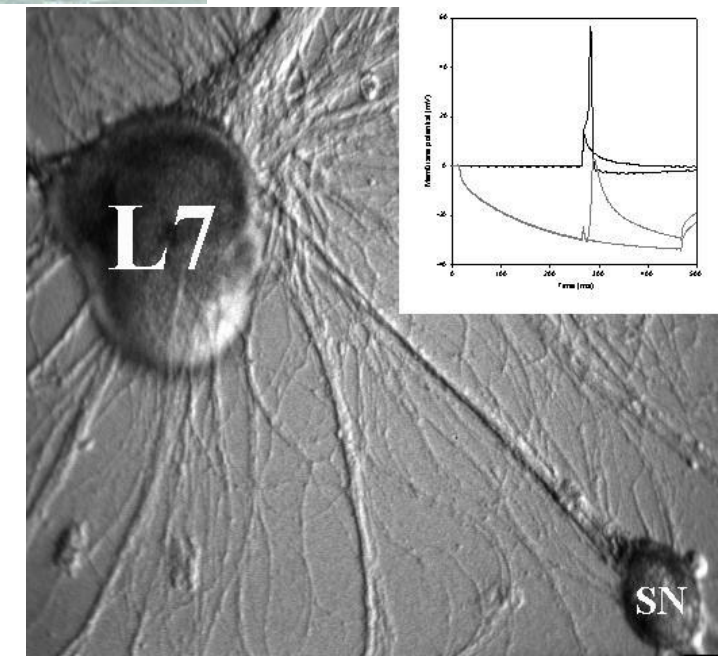
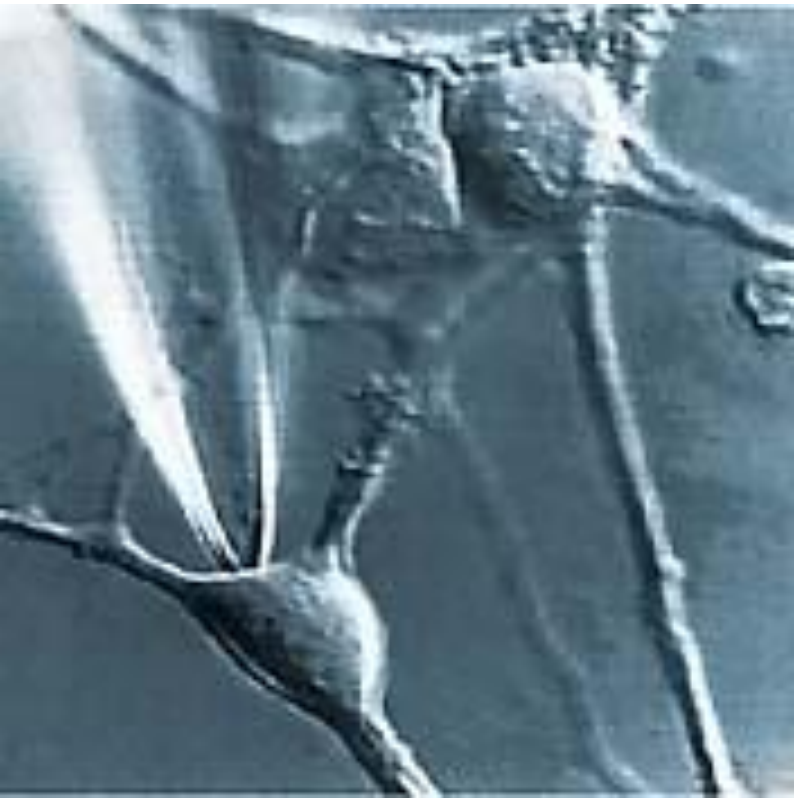
Aplysia and its giant neurons

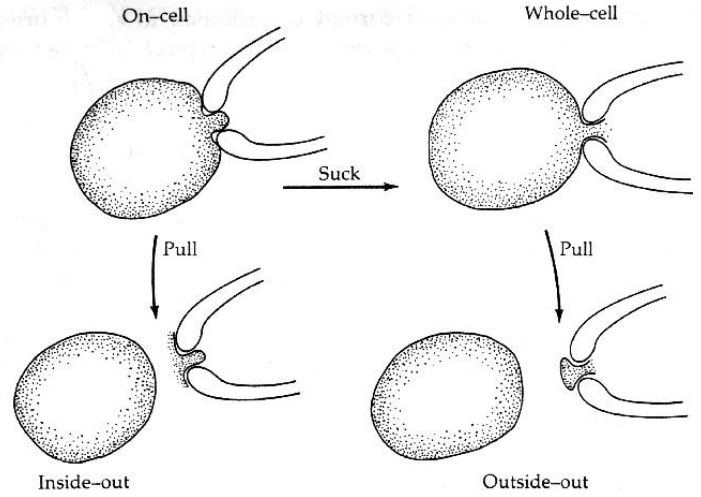




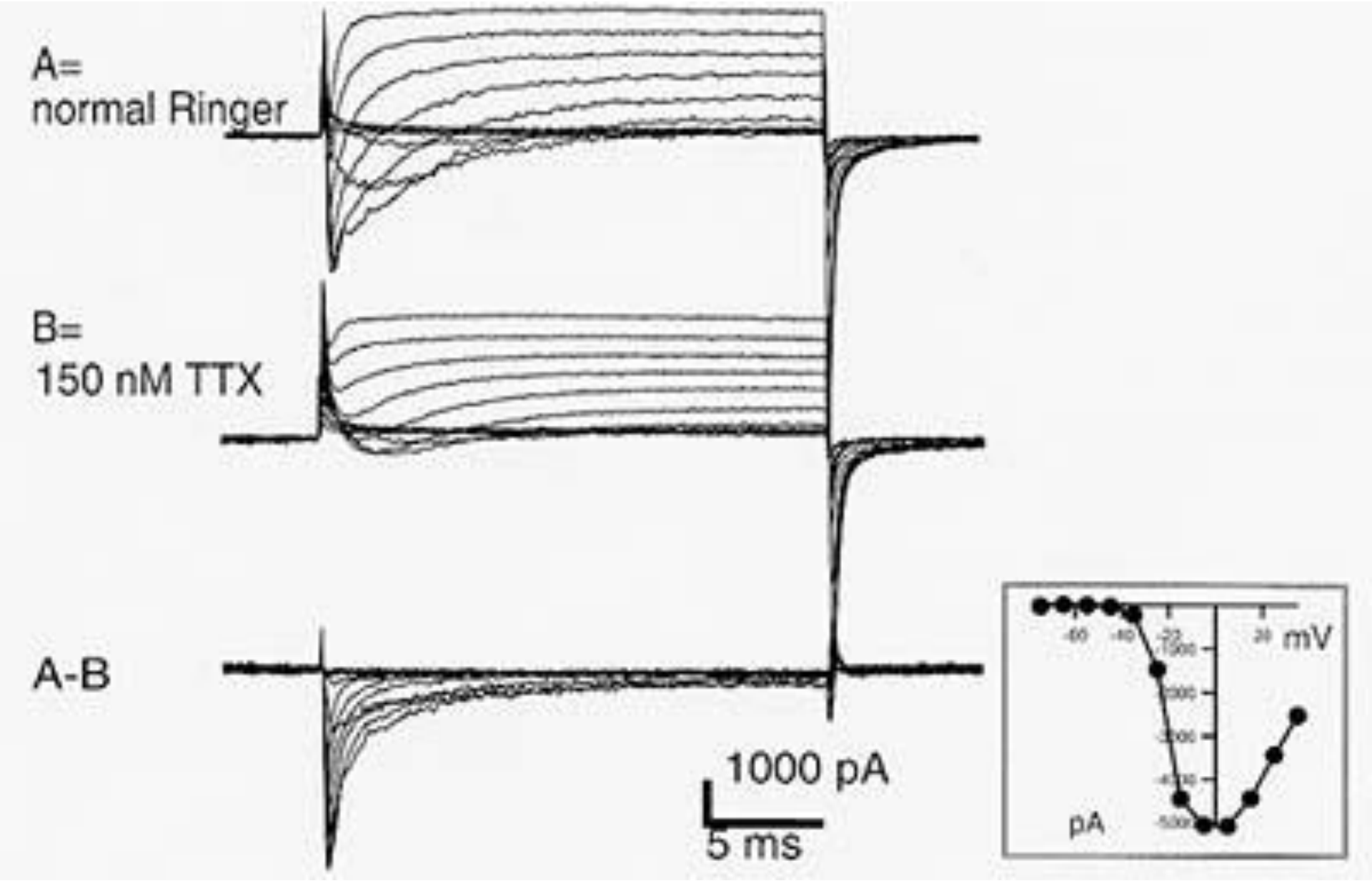
Three modes of patch clamping



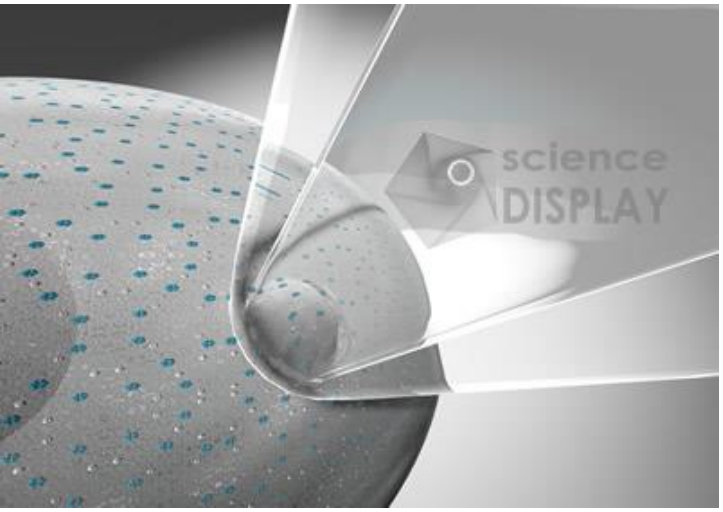
Patch clamp recording

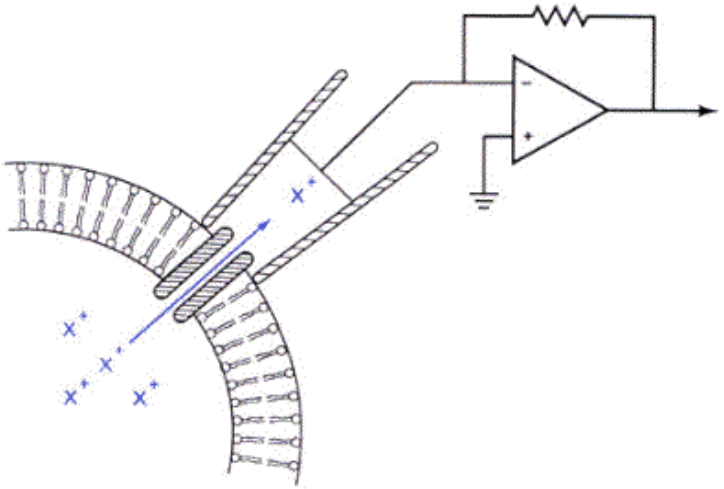


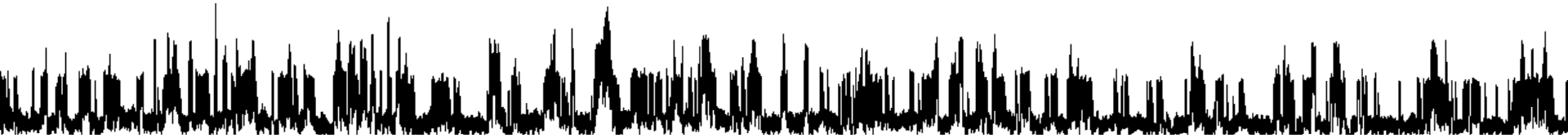
Patch clamp recording of somal sodium currents from Purkinje neurons in slice preparation.

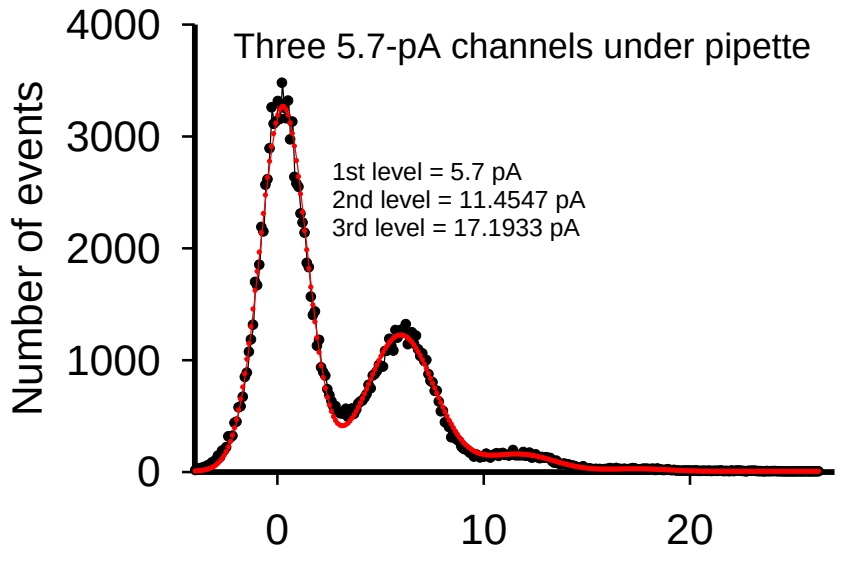


On-cell recording of single channels



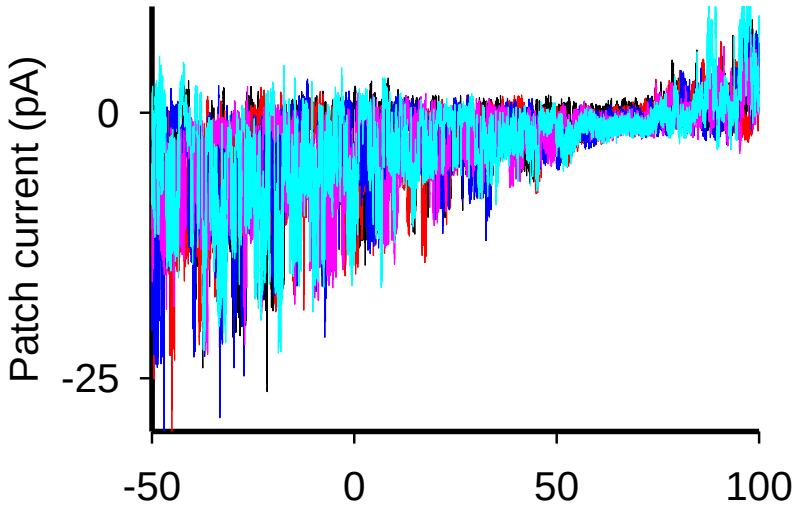




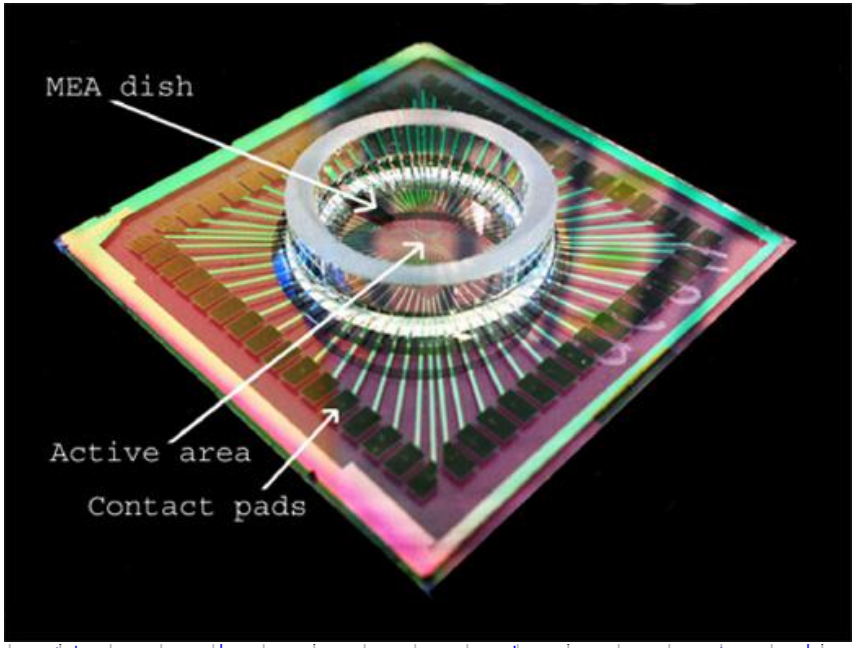


From 17

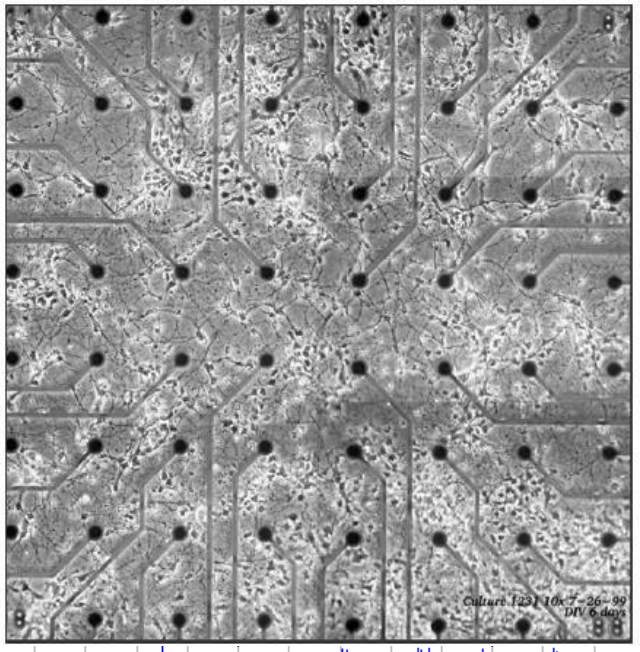
Rat CA1 neuron

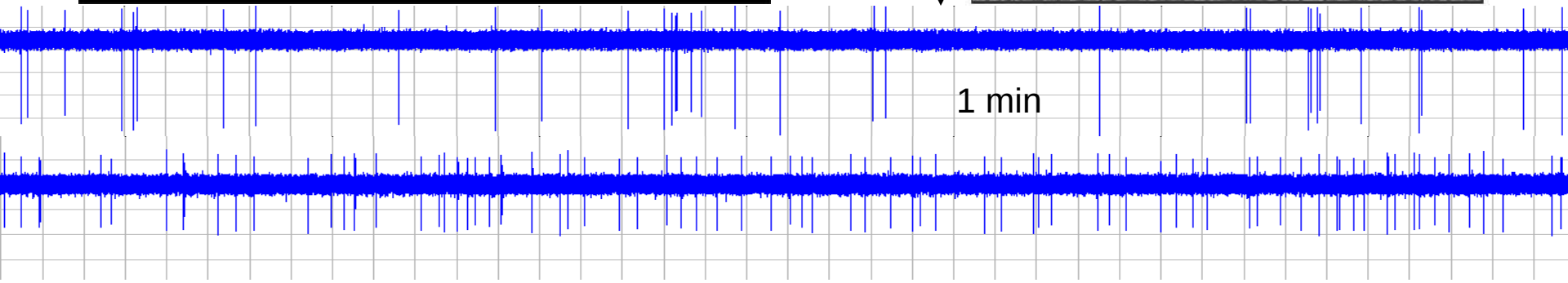


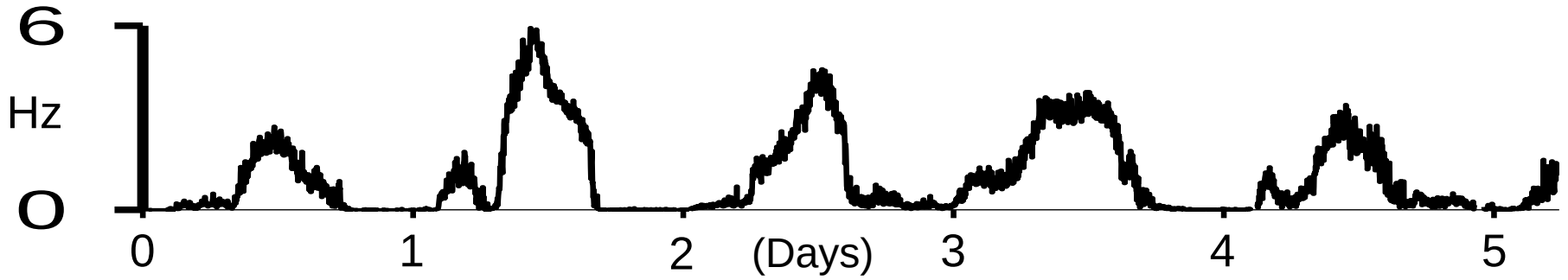
Multielectrode array dish (MED)



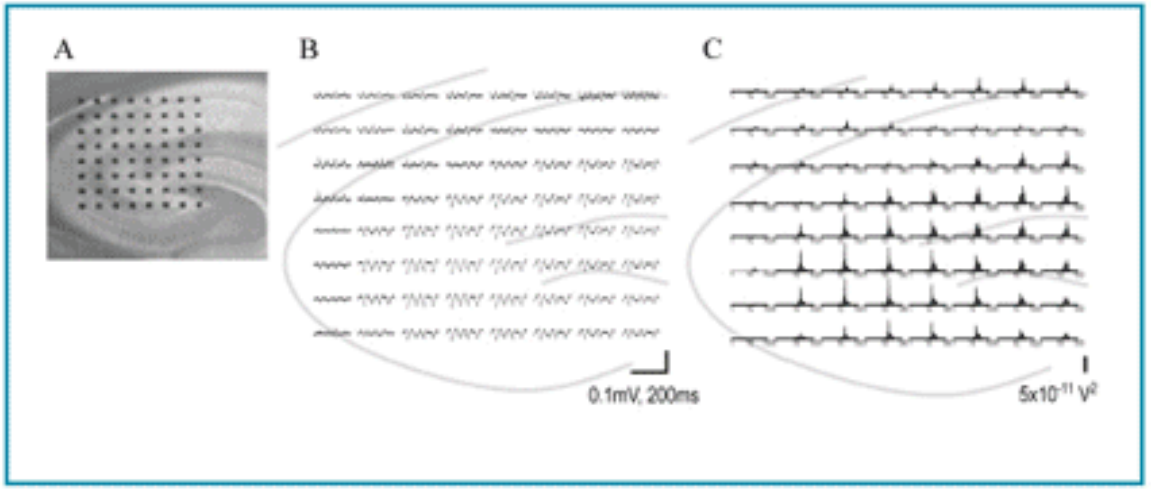
1 mm

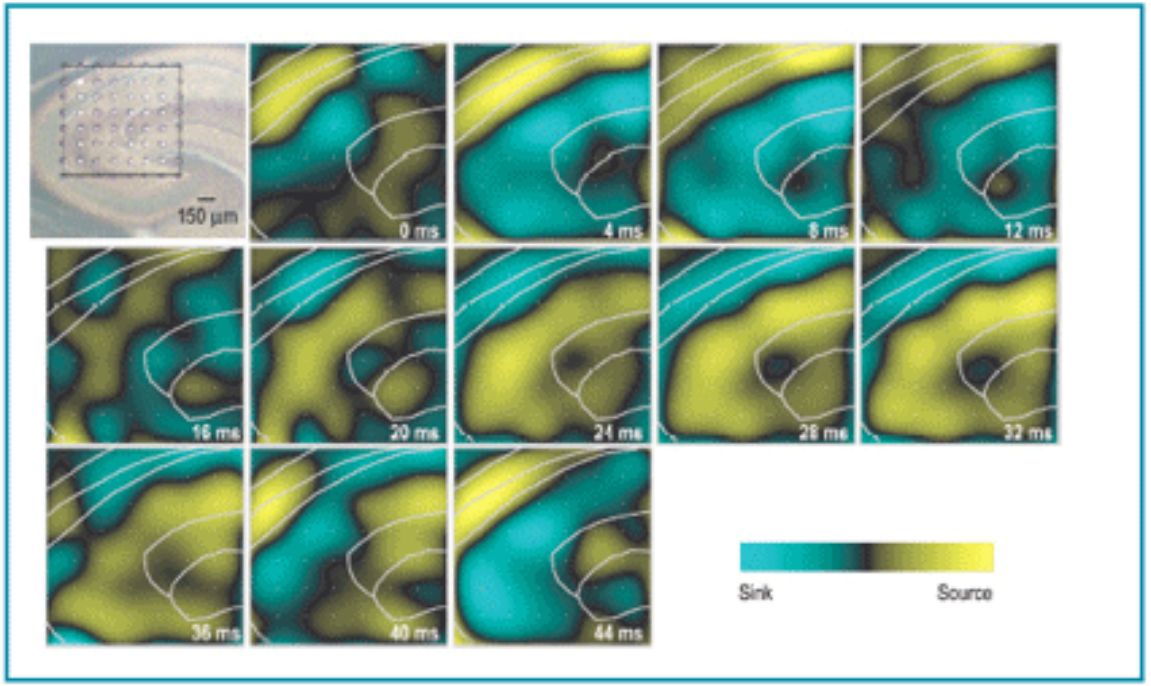






50 μM carbachol-induced rhythmic activity in the hippocampus

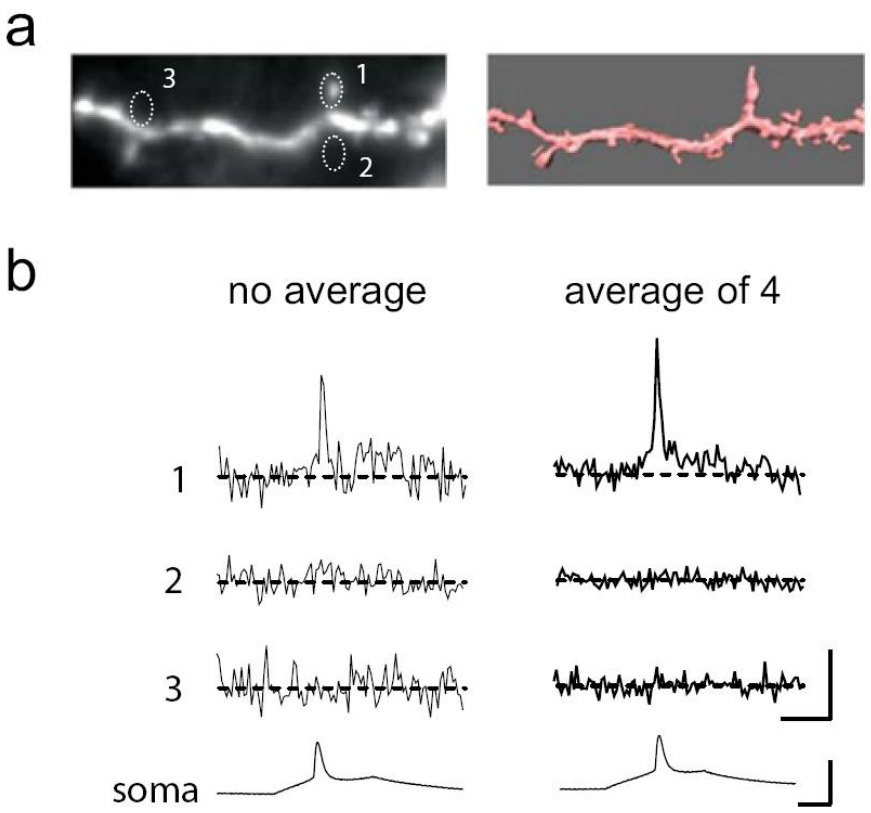




From 17

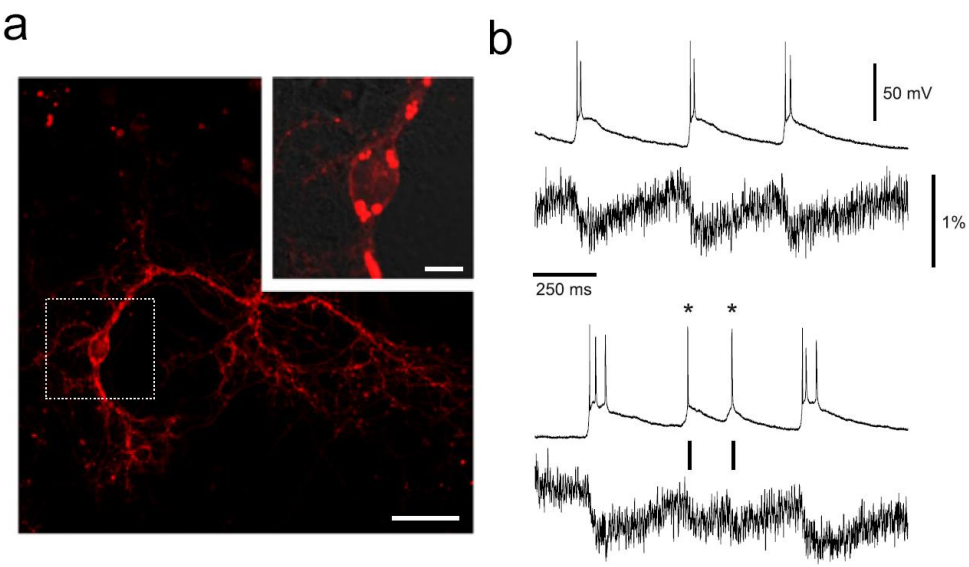
Imaging voltage in neurons

A



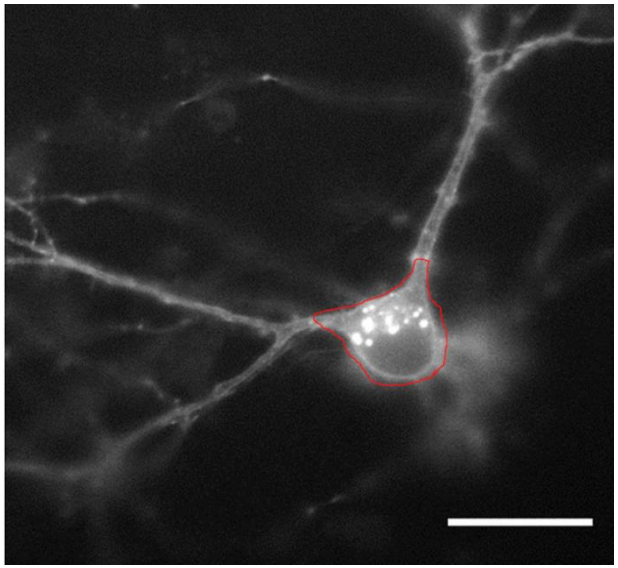
One-photon voltage imaging in individuals dendritic spines of rat neurons with organic voltage-sensitive dye.

B



VSFP3.1_mOrange2 transfected into a cultured hippocampus neuron and expressed in the soma, axon, and dendrites

The latest success in imaging voltage in neurons



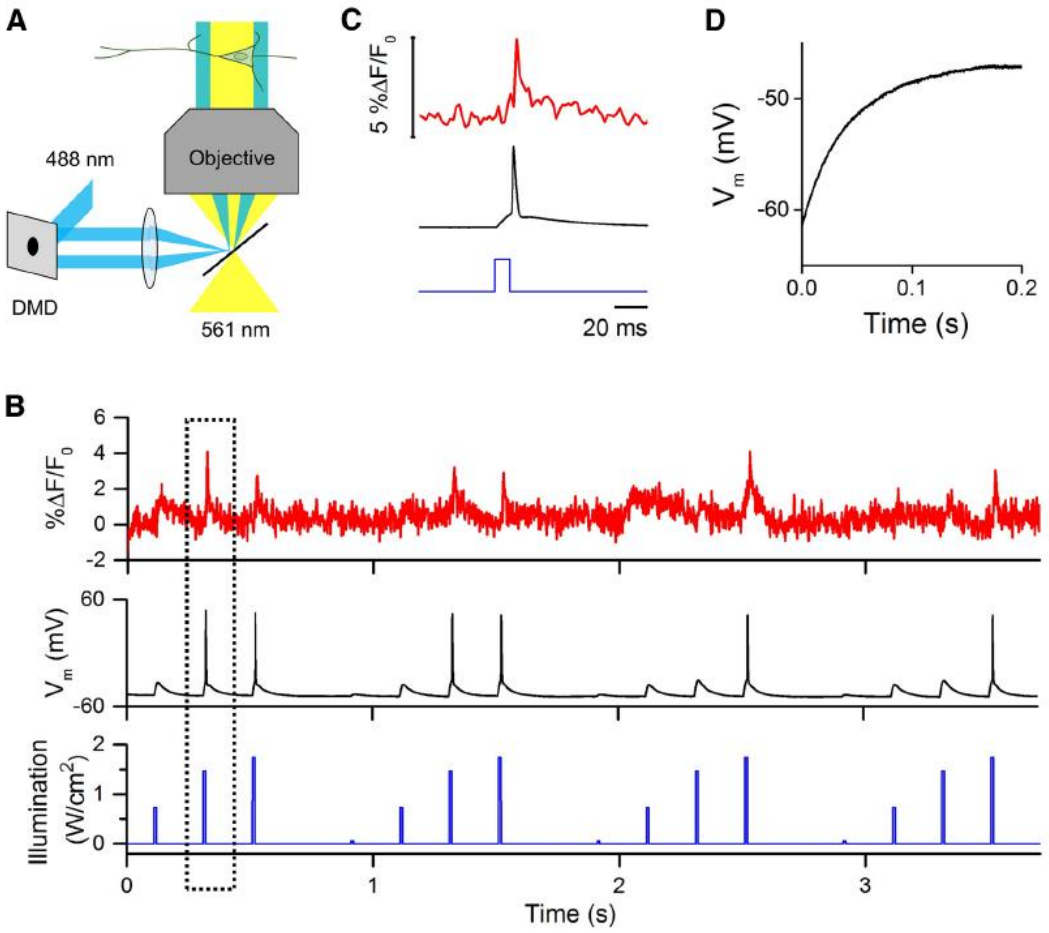


Figure 8. All-optical electrophysiology using FlicR1 in cultured hippocampal neurons. ***A***, Diagram showing experimental setup using a digital micromirror device (DMD) to target the blue light to the neuronal processes. ***B***, Red, FlicR1 fluorescence readout from single-trial optical recording of single action potentials initiated by pulses of blue light illumination using the experimental setup shown in ***A***. Yellow illumination to image FlicR1 was 10 W/cm ^{2}. Black, Patch-clamp recording. Blue, 488 nm illumination (10 ms, 0.5–2 W/cm ^{2}). ***C***, Magnification of traces in ***B*** marked with black borderline. ***D***, Patch-clamp recording of neuron expressing PsChR when exposed to 561 nm laser (10 W/cm ^{2}). This illumination depolarized the cell by 14 mV, but did not induce action potentials on its own. All fluorescence traces are bleach corrected. Fluorescence trace was collected at a frame rate of 500 Hz using an EMCCD camera. Fluorescence trace in ***C*** is filtered with Savitzky–Golay smoothing (5 points).