Completing the laundry list of cell-to-cell signaling molecules used in the brain

Chemical

Temporal

Spatial
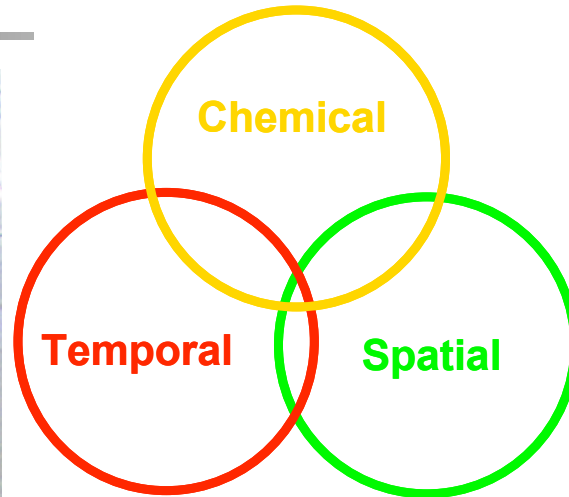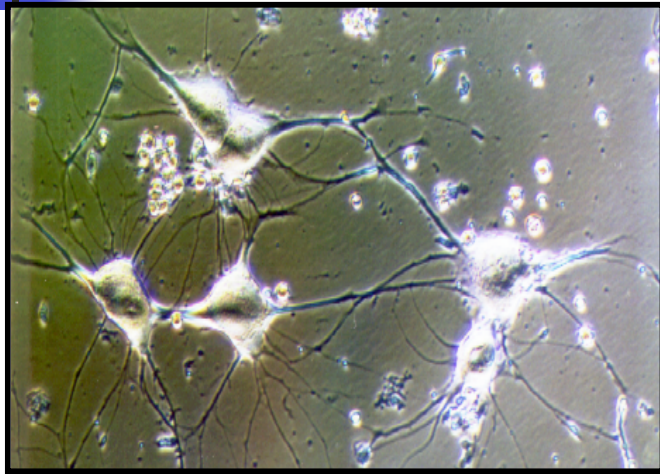
Currently, one must choose a tool that provides information across one or two information categories. How can we improve this?
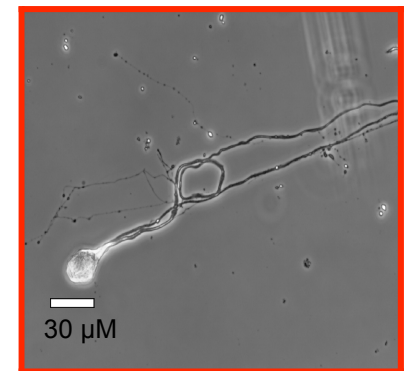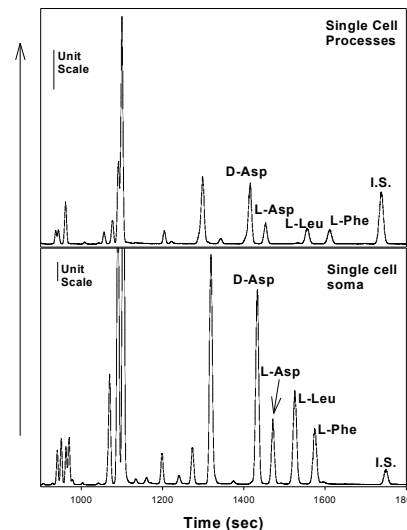
An example: is D-Asp a neurotransmitter?

Single Sensory Neuron from Pleural Ganglion

The Players

NO
Amino Acids
Indolamines
Catecholamines
Neuropeptides

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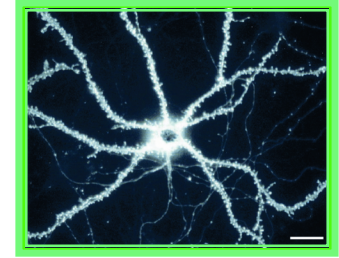## The Tools

Immunohistochemistry
Optical microscopy
Mass Spectrometric Imaging
Microseparations
Electrochemistry
and others . . .
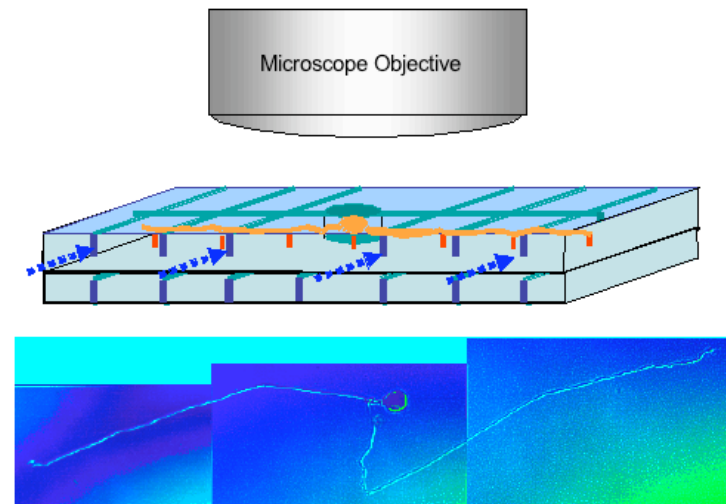
Neural Repair in the Nano-Domain

Goals:

➤ New devices to control the development of neuronal circuits – from two neurons to networks

➤ New measurement technology to analyze cellular interactions at the molecular level

➤ Integrate in synthetic format → interesting & predictive qualities

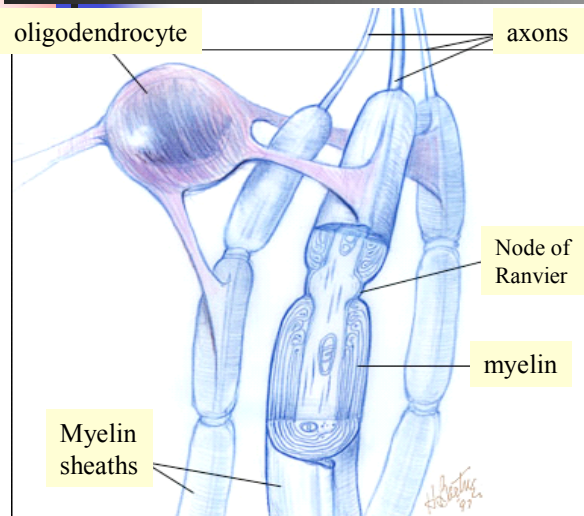➤ Discover natural repair signals and test efficacy

Outcome:

New machine / biology interfaces bridging man-made and natural worlds, a portal to *a new pharmacology*

Microscope Objective

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Neurons and Glia

>80% of the cells in the brain are glia but they are mostly ignored

oligodendrocyte

axons

Node of Ranvier

myelin

Myelin sheaths

http://members.tripod.com/blustein/Oligodendrocytes/oligodendrocytes.htm

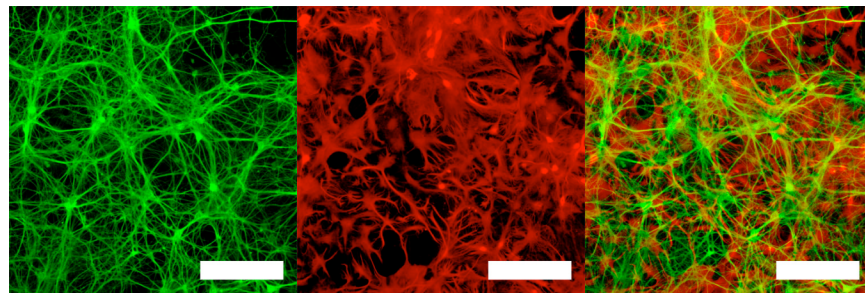Network of interspersed neurons and glia in a dissociated rat hippocampus culture.

What is needed? Studies of Neuron / Glia interactions: across time scales, length scales, and chemical cues… from myelination, neuron survivability and targeting, to glia transmission

Example Questions:

What is the function and behavior of glia at individual synapses?

In networks composed of glia cells and neurons?

What are the interactions between network topology and the dynamics of individual elements in complex networks?

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