

Neuroscience BIO-311 - Mathis

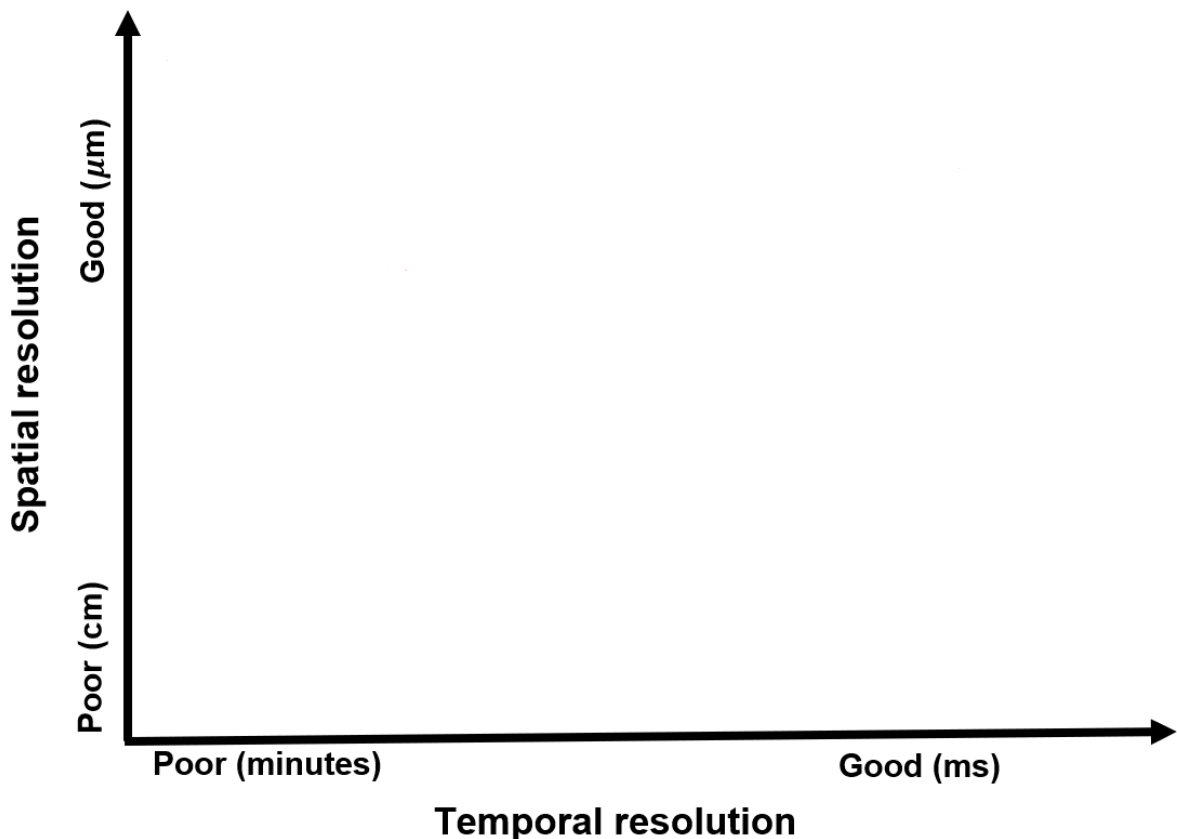
**Exercise: Techniques in neuroscience**

**Question 1 – Animal research in neuroscience:**

- i) List 3 advantages and 3 disadvantages of using an animal model rather than humans to investigate a neuroscience research question.
- ii) Why is it relevant to also use simple organisms (e.g. fruit fly) in addition to more complex animals (e.g. mouse, monkey, human) for neuroscience research? What is comparable in fruit flies and in mammals nervous systems?

**Question 2 – Neuroimaging methods:**

- i) Place the following neuroimaging modalities on the axis system below: CT-scan, MRI, electron microscopy, calcium imaging, fMRI, MEG, electrophysiology (single- or multi-unit recordings)
- ii) Draw a red circle around the invasive methods. What can you conclude from what you obtain?



**Question 3 – Optogenetics:**

- i) Your lab investigates motor control in fruit flies and discovered a specific neuron type called X that is active every time the fruit fly grooms its antennae. Is this observation enough to claim that the activity of X is required (*necessary*) for antennal grooming? Why or why not?**
- ii) To better understand the role of the X neurons, you decide to use optogenetics. How would you proceed if your goal would be able to selectively control the depolarization of the X neurons?**
- iii) Using optogenetics, you find that stimulating neurons X leads to antennal grooming. Can you now conclude that the activity of X is required (*necessary*) for antennal grooming? Why or why not?**
- iv) You decide to run one more optogenetic experiment, but this time using halorhodopsin. You add dust on fruit flies' head to force them to groom their antennae. You find that stimulating the halorhodopsin channels in the X neurons causes the flies to stop grooming. Explain what happens in the X neuron during optogenetic stimulation. Can you now conclude that X neuron activity is required (*necessary*) for antennal grooming?**
- v) What are the strengths of optogenetics compared to other techniques for testing causality?**