Microscopes & Mouse Brains/

In this lab, students will explore the incredible complexity of the brain by examining thin, stained mouse brain sections under a light microscope. Students will compare two staining techniques, then use the Allen Mouse Brain Atlas to identify neuroanatomical structures and explore patterns of gene expression in the brain. Students will apply these skills to investigate where dopamine is produced in the brain and predict how it may be affected in conditions such as Parkinson's Disease.

This lesson can be adapted for students at any level, from no neuroscience or anatomy background to advanced courses. No prior experience with microscopes is required. ***Please describe your group's background in your application so we can tailor the experience to your needs.***



Exploring real brain tissue at the Allen Institute education lab

Grade levels/ 9th – 12th grade

Total field trip time/ 3 hours 15 minutes

Recommended pre-lab teaching/

- Basic overview of neuron structure (cell body, dendrites, and axon)
- Basic overview of gene expression (DNA → RNA → Protein)
- Optional: basic overview of using a light microscope

Learning Objectives/

- **Describe** how brains can be sectioned and stained to reveal new information
- **Compare and contrast** two common stains used to study brains
- **Apply** reference and gene expression atlases to interpret mouse brain slides
- **Practice** microscope skills

Lab Skills/

- **Operate** a light microscope
- **Calculate** total magnification
- **Apply** open data tools used by professional neuroscientists to interpret samples
- **Observe** structures under a microscope and record findings

Next Generation Science Standards (NGSS)

Science and Engineering Practices/	**Analyzing and interpreting data** Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. **Constructing Explanations** Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review).
Disciplinary Core Ideas/	**LS1.A: Structure and Function** Systems of specialized cells within organisms help perform essential functions of life. Any one system in an organism is made up of numerous parts. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)
Cross Cutting Concepts/	**Patterns** Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Structure and Function** Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. **Scale, Proportion, and Quantity** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.