Supplementary Material 1 for Meuler M, Casimo K (2024) A Case for the Use of Open Data as a Tool to Incorporate Socioscientific Topics into Neuroscience EducationJ Undergrad Neurosci Educ 22(2):A90-A98.

Instructor Guide:

Brain Donation and Bioethics

Estimated Lesson Timeline:

55 minutes total + 20 minute optional add-on

- 5 minutes: Introduction
- 30 minutes: What it means to donate your brain to science
- 20 minutes: Bioethics policy evaluation activity
- (Optional) 20 minutes: Debate on policies of expressed vs. presumed consent

Prior knowledge needed: This lesson does not require a background in biology in order to complete it. This lesson is suitable for students from a variety of disciplinary backgrounds including philosophy, psychology, science and technology studies, and any of the life sciences.

Learning Objectives:

- Students will reflect on the importance of bioethics within biomedical research
- Students will describe the process of both living and post-mortem brain donation, and how these types of donations provide different biological data
- Students will appreciate and be able to articulate why some people may choose to not donate their brain to science
- Students will articulate the importance of neurodiversity within brain science
- Students will reflect on the ethical implications of policies of expressed vs. presumed consent
- Students will articulate the importance of consent within biomedical research

Using this lesson:

There are two (suggested) ways that this lesson can be used in your classroom.

1. Independent assignment: This lesson can be assigned to students for them to complete outside of class on their own. If you chose to use the lesson as an individual assignment, students can download the lesson and fill it out on their own as-is.

2. Classroom setting: If you chose to use this lesson in class rather than independently assigning it to students, you can choose to facilitate a class debate between the bioethics policies of presumed consent vs. expressed consent. See a suggested guide for how to facilitate this debate below.

Optional Add-On: Bioethics Policy Debate

Step 1: Divide the class into two groups.

Step 2: Group 1 will take on the position of supporting the model of "presumed consent." Group 2 will take on the position of supporting "expressed consent."

Step 3: Each group will take 15 minutes to research their assigned position as a team and fill in their activity sheet. The table students will fill out in their worksheets is featured below.

	A policy of presumed consent	A policy of expressed consent
Pros		
Cons		

Step 4: Suggested structure for a 20 minute debate

Debate: A policy of expressed vs. presumed consent	
3 minutes	Group 1 opening remarks
3 minutes	Group 2 opening remarks
2 minutes	Group 1 rebuttal/response
2 minutes	Group 2 rebuttal/response
3 minutes	Group 1 asks questions to Group 2
3 minutes	Group 2 asks questions to Group 1
2 minutes	Group 1 closing remarks
2 minutes	Group 2 closing remarks

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Instructor Guide:

The Importance of Basic Research in Brain Science

Estimated Lesson Timeline:

60 minutes total

- 20 minutes--Activity 1: Evaluating funding decisions between basic and applied research proposals
- 10 minutes--Activity 2: Learning how and why dendrograms are constructed
- 10 minutes--Activity 3: Using heatmaps to visualize gene expression between cell types
- 20 minutes--Activity 4: Students analyze real basic transcriptomic data gathered from healthy brain tissue

Learning Objectives:

- Students will be able to articulate what transcriptomic data is and how it is gathered
- Students will be able to articulate how dendrograms and heatmaps can be used in conjunction with transcriptomic data in order to further differentiate cell types from one another
- Students will be able to apply basic principles of interpreting data visualization to complex transcriptome datasets
- Students will explore the nuanced differences between basic and applied research
- Students will be able to defend the importance of both basic and applied research within the field of biomedical science

Using this lesson:

This lesson can either be assigned as an independent assignment for students or as an in-class lesson where students work in groups. Activity 1 encourages students to debate with one another the potential benefits of different research proposals. Activity 2 explains to students what dendrograms are and how they can be interpreted. Activity 3 introduces students to heat maps and how they can be used in conjunction with dendrograms to differentiate cell types. Activity 4 walks students through the Allen Institute for Brain Science's Brain Cell Atlas and its associated data tools. Students have the opportunity to interact and interpret the data available through this resource.

Teachers are welcome to adapt the lesson to suit their classes and curricula. Teachers must indicate if changes were made to the lesson materials and may share their adap-tations with attribution under the same license as this lesson, but may not use adapta-tions for commercial purposes.

If you develop your own lesson plan using Allen Institute resources, we invite you to share your experience with us at communications@alleninstitute.org. Teachers are also encouraged to publish original lessons using our open data, tools, and other re-sources, and to share those lessons with us.

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Instructor Guide:

Societal and Biological Perspectives on Alzheimer's Disease

Estimated Lesson Timeline:

90 minutes total

- 5 minutes: Introduction
- 25 minutes: Activity 1 Biomedical Research and Demographics
- 15 minutes: Activity 2 Exploring the Donor Index
- 45 minutes: Activity 3 Neuropathology Image Analysis

Prior knowledge needed:

- Students should be able to describe the basic parts of neurons and their functions
- Students should be able to describe what proteins are and how they function

Learning Objectives:

- Students will be able to evaluate what research questions can and cannot be answered via certain datasets based on the demographic composition of the study cohort
- Students will be able to evaluate the known risk factors for Alzheimer's disease
- Students will be able to analyze immunolabeled brain tissue for known biomarkers of Alzheimer's disease pathology
- Students will be able to assess what steps the NIH has taken to increase diversity in biomedical research
- Students will be able to propose possible ways the diversity of biomedical research cohorts can be improved in future research endeavors

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Instructor Guide:

Analyzing Transcriptomic Data to Explore Alzheimer's Disease Pathology

Estimated Lesson Timeline:

90 minutes total

- 20 minutes: Review of transcriptomics
- 40 minutes: Guided Tour of CZ cellxgene database
- 30 minutes: Students perform a differential gene expression analysis using the SEA-AD cellxgene database and the NIH gene database

Learning Objectives:

- Students will be able to articulate how transcriptomic data is collected and processed
- Students will be able to interpret transcriptomic data visualized within Uniform Manifold Approximation and Projections (UMAPs)
- Students will be able to navigate the Seattle Alzheimer's Disease Brain Cell Atlas (SEA-AD) database in order to interpret transcriptomic data
- Students will be able to filter data based on specific biomarker and/or demographic characteristics they are interested in exploring
- Students will be able to independently perform an analysis of transcriptomic data using the cellxgene interface
- Students will be able to compare gene expression between cell types using the cellxgene interface
- Students will be able to navigate the NIH gene database to explore the known functions of genes

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