COURSE SYLLABUS AND SCAFFOLDING ACTIVITIES

Syllabus: Developmental Neurobiology

BIOL 4389/6302 Fall 2021

Instructor: Dr. Anita Quintana **Phone:** (915) 747-8988 **Email:** aquintana8@utep.edu
Office: Biological Sciences Bldg. Rm: 5.150
Class Meets: TR 9-10:20 AM. LART 208
Office Hrs.: By appointment only.

Course Objectives:

1. **Understand the basic structure of the nervous system.**
2. **Understand how structure dictates/facilitates appropriate function.**
3. **Understand how nervous system design allow for communication across different anatomical regions.**
4. **Understand the signaling pathways that promote neural induction.**
5. **Describe the pathways that modulate neuronal differentiation.**
6. **Understand the developing neural crest and its contribution to nervous system development.**
7. **Describe the signals mediating axon growth and guidance.**
8. **Understand the function of apoptosis in the development of a functional nervous system**
9. **Describe synapse formation and synapse refinement.**

MASK POLICY: While masks cannot and will not be mandatory, I highly encourage the use of masks (cloth, surgical, or your choice) during the lecture and during group activities.

COVID-19 PRECAUTION STATEMENT

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit epstrong.org.

CURRENT COVID19 POLICY

The current University Policy is that all courses will be taught in person due to the high rate of vaccination amongst the El Paso and University community. The University is currently tracking

community rates of exposure and cases and will make changes relative to the severity of COVID19 in the community. Should there be a transition to virtual learning by the University I will notify you by blackboard with a link to a zoom course (synchronous) and zoom breakout rooms for group days. Should I get COVID19, we will perform zoom courses until I my quarantine is completed. I will make all efforts to record lectures via Blackboard during in person learning and post them to blackboard for those you that cannot come to class due to COVID19 or with family members at high risk.

Course Specific information

This course is a combination of lecture and active learning. Active learning will be performed in a group setting, but individual assignments will be graded to provide each individual appropriate feedback. During lecture based classes, I highly encourage your active participation and will encourage student participation in the form of active questions throughout the lecture. All group activities are an important component of your grade and assignments. As social distancing cannot be observed, I highly recommend the use of masks to limit the spread of COVID19. I also recommend vaccination for COVID19 to all of you, which you can get on campus at the Student Health Center. Group assignments will be graded in the form of a "NeuroNotebook" that is turned in periodically. In your notebook, you will answer prompts provided in class. Your notebooks will be self-graded according to a rubric that I will provide each of you for each assignment. Each graded assignment will be provided to me for my approval and for grade assignments. I will ensure that the self-grading procedure accurately reflects the rubric. In the event that you have inflated your grade and deviated from the rubric, I will have one of your peers (group members) provide a grade according to the rubric, and you will receive and average of the two scores, the one you provided and the score provided by your peer. I will not provide individual extra credit at any point in the semester.

Your course feedback can be submitted via websites such as http://www.ratemyprofessors.com/, and the University will invite you to submit an electronic feedback on this course by the end of the semester.

Required Materials:

Attendance

I will not take regular attendance, but if you miss a group activity then you could miss the information provided by your group and will have to make up for that before you turn in your regular notebook assignment, which accounts for the vast majority of the points in the course. There will be no make-up group activities, but given the severity and case count of COVID19, I will make all efforts to accommodate any absences. In addition, there will be a total of 5 quizzes during the semester. These will be scheduled on blackboard and can be completed outside of class.

Textbook (not mandatory)

Title**: **Foundations of Neural Development

***Editors**:* **Breedlove**

***Edition**: 1st*

Important – Announcements for this class will occur via Blackboard, please check it regularly.

Course Grading: *Final grades in the course will be determined by totaling the points associated with group projects, quizzes, assessment surveys, the course case study notebook, and 3 exams. No extra credit assignments be given (**please do not ask**). Final grades are generally not based on a curve. There is usually no need for a curve as most students pass with a C or better.*

I. ***Quizzes*:** There will be 5 quizzes. The dates of these quizzes are at my discretion. They will either test you on lecture material or assigned readings associated with lecture material. The dates will be announced by blackboard.

II. ***Exams**:* ** NO ZEROES WILL BE DROPPED **
Three exams will be given. Each exam will cover specifically the topics dealt in the classes that preceded the test up to the previous test, but not including the material already tested. All exams are worth 100 pts. See the tentative class schedule for the precise date of all the exams. Exams will be performed on blackboard and will be multiple choice with 1 hour and 20 minutes duration (one class period). YOU MUST TAKE EVERY EXAM to pass the course. You will receive a zero for any missed exam. If an exam is missed for inevitable and justified reasons, a make-up will be granted on a case-by-case basis. Such reasons include military duties, severe illness of yourself or your child, or death of an immediate family member. Absences for illness will be excused for medical reasons explained in writing by a physician or college nurse. If you know ahead of time that you will not be available to take an exam, notify me and I will schedule you for a make-up exam. In order to be considered for a make-up exam you must inform me in writing of your absence. An email is appropriate. Should I grant a make-up exam you will have a different exam from that offered to the rest of the class. If you miss an exam and cannot provide justification, then you will get a zero in that exam.

Unfair or unjust questions: Should you or a group of classmates feel that a question on an exam is unfair or unjust and should be thrown out; you and/or your colleagues can provide me with a justification. However, I will only consider questions for which >75% of the class got incorrect. For each exam, I will perform and automatic Item Analysis to determine the percentage of students that answered each question individually. If that percentage is >90%, then I will automatically throw that question out. No more than 3 questions will be thrown out for each exam. Should you provide additional justification for a specific question and it meets the >75% rule, you will need to submit in writing to me the question, a paragraph (no longer or I will disregard) that explains what you believe is the correct answer and why what I said is the correct answer is wrong.

III. ***Review Sessions-*** There will be **NONE**. Questions should be addressed in class or during your scheduled office hours.

IV. ***Group Projects-*** There will be 2 group projects. They total 100 points of your grade, equivalent to an exam grade. These are in class assignments so they will be more difficult if you are not in class, but can be turned in later if absolutely necessary and you discuss with me by email.

V. ***Case Study Notebook-*** Throughout this class we will learn the mechanisms associated with neural development. Congenital disorders usually occur because of defects in these processes. For your notebook, I will provide you with a case study and you will propose the cellular and molecular mechanisms that are needed for normal development and then give me a putative reason for how this disorder arises at the molecular and cellular level. Each assignment will be graded based on a developed rubric. You will self-grade each notebook assignment. You will develop your hypotheses and mechanisms in a group but I expect your notebooks to be a reflection of your own thinking and not identical across your group. In other words, you must do your own work. Please do not share your notebook with any other individual. If I suspect that your notebook is a copy of someone else's work, I will report any cheating to academic services.

Course organization and grading

Attendance to lectures is highly recommended but not graded. Due to COVID19, if you are sick, you should stay home and we will make all efforts to accommodate you.

Notes:
1. Exams 1-3 are each 100 pts for a total of **300** points
3. Group Projects, 2 at 50 points each for a total of **100** points
4. Case Study Notebook is **200** points. You will turn it in to me a total of 4 times for grading. Each time the maximum number of points you receive will be 50 points for a total of 200 points.
5. Quizzes-there are 5 quizzes worth 10 points each for a total of **50** points.

Grading Scale

A= 585-650, B=520-584, C=455-519, D=390-454, F=<389

Class Policies:

I. **Exams:**
- ✓ Exams are provided via blackboard.
- ✓ Each exam will be timed.
- ✓ Please ensure that you take the exam within the allotted 48 hour period when the exam opens and closes. Dates will be outlined on blackboard.
- ✓ Please take the exams before 10PM on the due date so that if you have a problem I can ensure to respond to any emails you may need. I cannot guarantee that I will be

available to respond to problems with Blackboard after 10PM on the due date of the exam.

II. **Grading:** Exams will be graded on blackboard. You will receive your score immediately, but you will not receive the correct answers until after the due date of the exam. There is no final exam in this course. The final will be the fourth notebook as scheduled on the tentative schedule below. **DO NOT wait until the end of the semester when it is too late to come see me if you are having difficulties in any area of the course.**

III. **Attendance:** Class attendance is **HIGHLY RECOMMENDED, but not required. If you are sick please stay home.** Students are responsible for attending lecture regularly and knowing what takes place during classes. A version of the lecture may be available to you in the event that you cannot come to class. This includes: material covered during lecture, announcements, group projects, pop quizzes, handouts, changes in the syllabus, etc.. Also, keep in mind that exams will be based on the material covered in class. In addition there is no text, so the exams are entirely based on lecture/group activities.

IV. **Courtesy:** Be respectful not only to your instructor, but to your fellow classmates as well. Please place all cell phones on vibration or silent mode prior to class and do not answer them while in class. Inappropriate behavior or threats to students or myself will be reported to the Office of Student Conduct and Conflict Resolution.

V. **Withdrawing from the course:** The last day for you to withdraw from any course with an automatic "W" is posted by the office of registrar https://www.utep.edu/student-affairs/registrar/**.** Please note that it is the student's responsibility to officially withdraw from a course before the drop deadline and to confirm that this is indeed the correct date. A grade of incomplete is issued by the instructor when a student has completed most of the course work, has a good reason for not completing the course work, has a good chance of passing, and the instructor agrees to the grade of I. A grade of "I" will never be given to "make-up" or repeat the entire course.

VI. **CONTESTING:** If anyone wants to contest the wording of a quiz question or of an exam question or contest that there could be more than one answer on a question, DO NOT contact me during class. E-mail me. If you can appropriately present your case, can rationally explain your point of view, I may give you credit (not guaranteed). If anyone wants to contest the scoring of an assignment, email me and I will review your argument for the assignment, however, this will entail an entire review of the assignment and could result in regrading, including earning a lower grade. Contested questions must be submitted (within 1 week/etc.), but not considered in the last week of class**.**

VII. **Academic Dishonesty:** Suspected cases or acts of alleged scholastic dishonesty (Cheating) will be automatically referred to the Dean of Students' Office. It is the policy of the University of Texas at El Paso that academic dishonestly is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonestly will be disciplined in accordance with University regulations and procedures.

VIII. Accessibility/Disabilities: If you have, or suspect you have, a disability and need accommodations you should contact The Center for Accommodations and Support Services at 747-5148 or at cass@utep.edu or go by Room 106 Union East Building. If you are a student with a disability (physical, learning, etc.), please notify me at the beginning of the semester so that accommodations can be made for you as soon as possible.

IX. MILTARY STATEMENT: If you are a military student with the potential of being called to military service and/or training during the course of the semester, you are encouraged to contact the instructor by phone and/or email at the earliest convenience.

Tentative Class Schedule: *Please be aware that this schedule is subject to change! Check the Blackboard regularly for updates or alerts.*

Date	Lecture
August 24	Syllabus/Introduction to Nervous System
August 26	Assessment-Dr. Jeff Olimpo
August 31	Gastrulation
September 2	Neural Induction
September 7	Formation of Brain Subdivision
September 9	Neural Crest, the fourth germ layer?
September 14	Neurogenesis/Migration Asymmetric/Symmetric Divisions
September 16	Cerebral Cortex Patterning Group Activity: Neuronal Birthdating
September 21	**Exam 1**
September 23	Group Activity: PubMed and PMC
September 28	Axon Growth and Guidance
September 30	Axon Growth and Guidance
October 5	**Group Day: Notebook 1**
October 7	Crossing the midline
October 12	**Exam 2**
October 14	**Group Day: Notebook 1**
October 19	Apoptosis during neural development Notebook 1 due
October 21	**Group Day: Notebook 2**
October 26	**Group Day: Notebook 2**
October 28	No Class
Nov. 2	Synapse Formation/Function
Nov. 4	Synapse Formation/Function Notebook 2 Due
Nov. 9	**Exam 3**
Nov. 11	**Group Day: Notebook 3**
Nov. 16	**Group Day: Notebook 3**
Nov. 18	Notebook 3 Self Grading Due

	Group Day: Notebook 4
Nov. 23	**Group Day: Notebook 4**
Nov. 25	Holiday
Nov. 30	**Group Day: Notebook 4**
Dec. 2	Assessment-Dr. Jeff Olimpo Notebook 4 Due by 5 PM at Bioscience 5.150

Note for graduate students enrolled in BIOL 4389:

At the end of the semester, you will have to turn a brief one-page synopsis of the course and how what you learned can impact your research/career.

Note Regarding Scheduling of NeuroNotebook Sessions: *After the group activities outlined in the syllabus and described below have been completed, the NeuroNotebook project is assigned. Each of the four notebook prompts are provided to students at least 48 hours in advance of the first in-class activity associated with the given prompt, with delivery occurring via the Blackboard Learning Management System (LMS) Assignments feature. As described in the main text, students work in teams to complete the exercise associated with each prompt. A minimum of two, 80-min. class periods are allocated for completion of each NeuroNotebook prompt, with the timing being delineated as follows: a) 20 min. introduction, including goals and aims, provided by the course instructor; b) 120 min. of time for groupwork, distributed across the two sessions; and c) 20 min. at the end of the last session for whole-group debriefing and wrap-up. Note that the fourth prompt includes an extra day devoted to groupwork given the complexity of the assigned tasks.*

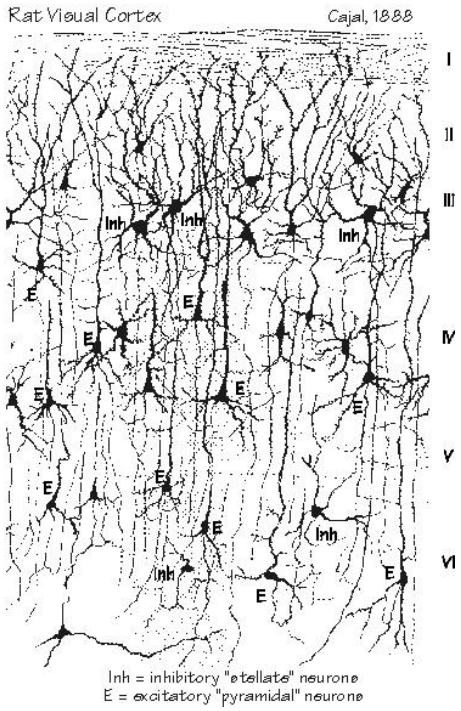
Group Activity #1 (10 Questions/5 pts. each): Cerebral Cortex Histogenesis

Background:

The mammalian cerebral cortex has six different layers of neurons. It is not a homogeneous structure; instead, there are unique regions, each with its own dedicated function. Across these unique regions, the number of cells in each layer can vary significantly. However, each of these layers is derived from the progenitor/precursor cells that form in the early neural tube. How these cells become fated to become specific subtypes of neurons in a given area is not fully understood. For example, do all of the neural precursors differentiate into different subsets of neurons at the exact same time? If so, how do they decide where to take up residence? Alternatively, are neurons from different areas born at different times? If so, are there temporal mechanisms regulating the layer that they ultimately reside in?

Cerebral Cortex:

The layers of the cerebral cortex can be thought of as either superficial or those that are deeper. Layer 1 is the most superficial layer. Layers 5 and 6 are deeper.



Experimental Design:

Question 1: Develop a hypothesis as to how neurons are formed. For example, whether neurons from different subtypes are formed at the same time or at unique points in

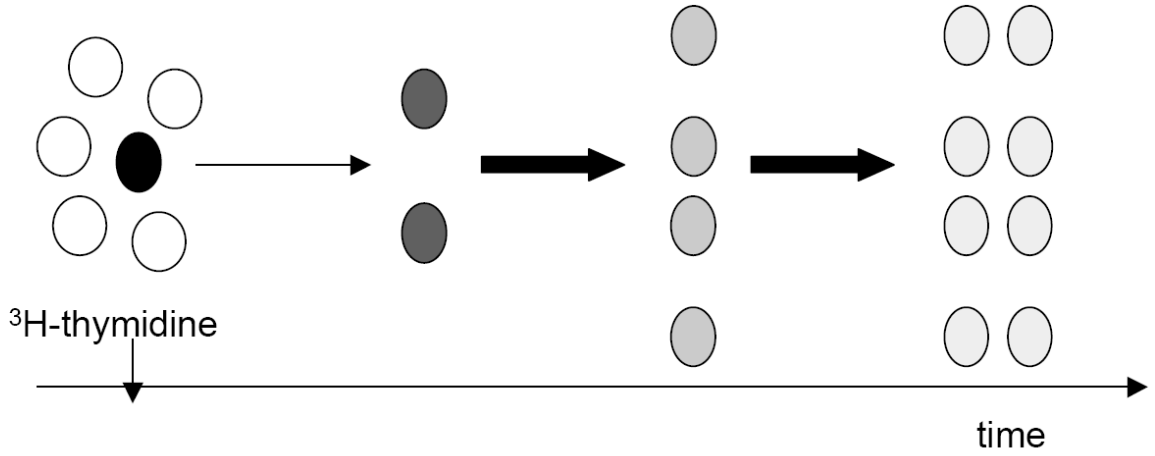
development. (Note: your hypothesis can be different then your group's overall hypothesis, but you must be able to answer all questions associated with the hypothesis. If you are the only one supporting a hypothesis, the group will not facilitate your progress, and that would defeat the purpose of this activity. So, taking a vote on an agreed hypothesis would be beneficial).

Question 2: Design an experiment whereby you can track the birthday and destination of a particular neuron in a unique site of the developing cerebral cortex.

Technological Approach:

You propose your experimental approach to your mentor, but after some long hours, you both decide that the best approach would be Thymidine Birthdating, a procedure that can be used to trace the lineage of cells. Thymidine can be radioactively labeled (3H). If you inject radiolabeled thymidine into cells or into a mouse, it will be incorporated into the DNA during cell division. Only mitotic cells will incorporate the radiolabeled thymidine. After incorporation, the thymidine will become a stable part of the DNA, but subsequent cell divisions will dilute the signal.

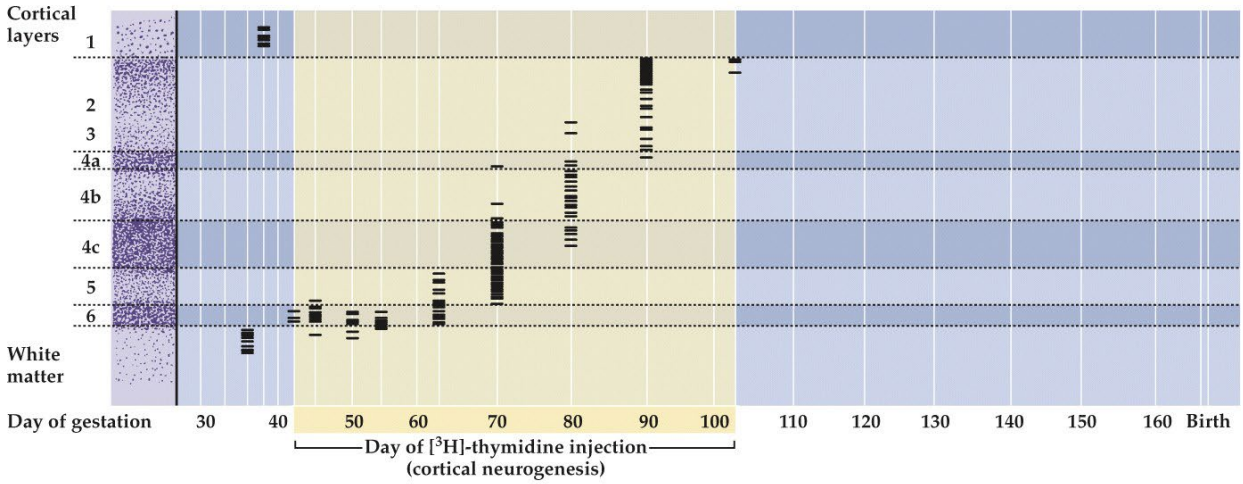
Summary of Thymidine Birthdating:



Question 3: During what phase of the cell cycle would a cell incorporate thymidine?

Question 4: During neural development, which cells (neurons, glia, or precursors) are likely to incorporate the thymidine? In what region of the neural tube would you expect to find these cells?

You perform the experiment by injecting thymidine into a Rhesus monkey. You inject thymidine at different developmental time points so that you can determine if neurons have different birthdays. Remember, the point of this experiment is to determine whether neurons in each independent layer are formed at the same time. Below is a summary of the results.



***NEUROSCIENCE 5e*, Figure 22.8**

Note: black lines indicate the birthday of a single neuron on the day of gestation indicated on the horizontal axis. The Y axis is the layer being analyzed.

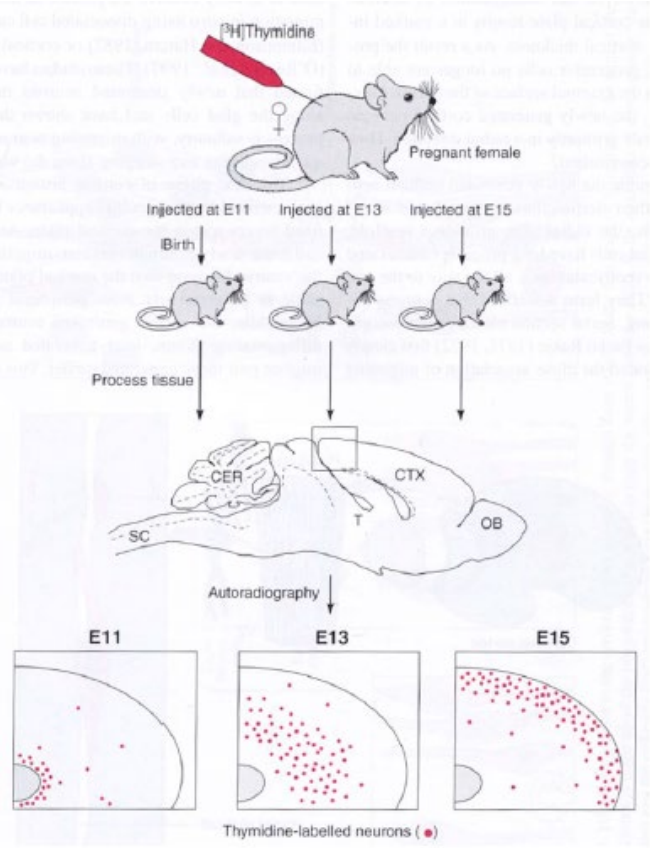
Question 5: When is the first differentiation of the cell within the white matter region?

Question 6: At what point do the earliest neurons form and to which layer do they belong? Is it a superficial or deep layer?

Question 7: Which layer is formed last? Is it a superficial layer?

Question 8: Based upon your results, what do you predict about the birthday of neurons in the deepest layer of the cortex? The most superficial layer of the cortex?

As you are interpreting your results, a manuscript observing the birthday of neurons is published. They claim that the following experiment supports a so called "inside out" pattern of neurogenesis.



Note: Each dot represents a neuronal birthday.

Question 9: Based upon their data, please briefly describe what the "inside out" pattern of neurogenesis is.

Question 10: Does *your* data fit the "inside out" hypothesis of neurogenesis? Why, or why not?

Implementation Note: *This group activity is intended to orient students to the experimental design process and content focus (neuronal birthdating) undergirding the NeuroNotebooks project. Following a brief (25-min.) lecture on the topic delivered by the course instructor (lecture content not included here), students are divided into teams of five (two graduate students + three undergraduate students, if possible) and tasked with completing the exercise. The class period concludes with student-instructor dialogue regarding the answers to each question.*

Homework Assignment/Group Activity #2 (5 Questions/10 pts. each): Introduction to PubMed and PMC

1) The U.S. National Library of Medicine provides two different literature databases detailing publicly funded research efforts. They include PubMed Central and PubMed. How does the U.S National Library of Medicine describe the difference between PubMed Central (PMC) and PubMed? Please use the answers provided by the National Library of Medicine sponsored by the National Institutes of Health.

2) Please visit the following website: https://www.ncbi.nlm.nih.gov/pmc/. It will take you to the PMC central website. Please answer the following questions.

    a) Click on PMC overview. Describe how journal articles are provided to PMC.

    b) What is the PMC definition of free access?

3) Migrate to Journal list and answer the following questions.

    a) Is the Journal of Developmental Biology represented in PMC? If not, what alternatives are present?

4) Now visit the PubMed database at https://www.ncbi.nlm.nih.gov/pubmed/ and answer the following questions. Visit Journal in NCBI Databases.

    a) Is the Journal of Developmental Biology listed?

b) Now, migrate back to PMC by changing the dropdown list that says NLM Catalog to PMC. In the search bar, type in Sox2.
   i) What is the first item that is listed in the search results?

   ii) Click on the first result listed. Read the Abstract Summary of the manuscript and, in your own words, summarize it here. The entire manuscript will be available, as PMC is entirely freely accessible.

   iii) Now, migrate to PubMed by changing the dropdown menu from PMC to PubMed. What is the first result listed?

   iv) Are there any listed objects under Full Text Links?

   v) If you click on the Full Text Link, are you able to download the full text of the article?

5) Which database do you think will be the most useful to freely access what is known about a human disease? Why?

Implementation Note: *This assignment/group activity is intended to familiarize students with the PubMed and PMC databases as well as enhance their ability to identify and read primary literature in the field. These skills are essential to completion of the NeuroNotebook prompts, which require that students support their responses with information from peer-reviewed articles.*