The human brain is an enormously complex system. It regulates all of our physical and mental functions and shapes who we are. This six-week course explores this remarkable organ: how it has evolved, how it works and how it changes over the course of our lives. Each week, participants will draw from essays, media resources, textbook readings and online discussion forums to explore aspects of brain function—from sensing to decision-making to expressing ourselves. A weekly case study, written by a specialized neuroscientist, will describe cutting-edge research in areas as wide-ranging as using functional MRIs as a diagnostic tool, the neurobiology of hearing and the evolution of mammalian brains. Students will complete the course with a solid grasp of how the brain works, how we know what we know and the exciting research prospects ahead.

Objectives

Students will emerge from the course with a basic understanding of the structure, function and evolution of the brain. They will be able to:

- Demonstrate a solid understanding of basic brain function and anatomy.
- Describe the evolution of the nervous system and brain through the tree of life.
- Discuss methods that scientists use to study the brain.
- Explain how the brain changes from birth to adulthood.
- Generate a plan for teaching neuroscience.

Class Schedule

This is a six-week online graduate course with an additional week for assignment completion. The course is asynchronous and does not have specific meeting times. Assignments and discussions change each week. Students are expected to complete work within the specific week it is assigned.

For the current schedule of offerings, please visit www.amnh.org/learn/calendar
Instructors

This graduate course is co-taught by an experienced educator along with a research scientist. For example, a prospective course offering might include:

Dr. Cate Starr  
American Museum of Natural History

Dr. Claudia Englbrecht  
American Museum of Natural History

For current instructor information, please contact seminfo@amnh.org.

Format

1. **The Brain: Structure, Function and Evolution** is a six-week online graduate course with an additional week for assignment completion. Enrollment is restricted to current or future educators. No prior course in neuroscience or evolutionary biology is required.

2. **Weekly activities** include written reflection on weekly essential questions and using computer interactives to gather data on how the brain works. Activities introduce the technology, tools, and processes that scientists use to study the brain, build models and evaluate evidence. Essays, image galleries and videos will help learners visualize and master the content.

3. **Online discussions** encourage reflection on course content, support and model the inquiry process, and sustain interaction between the offering scientists, seminar instructors and course members.

4. **Final course projects** support the creation of inquiry-based lesson plans focused on key course concepts that might be incorporated into teaching practice.

Required Textbook

This course requires the following textbook.

**The Brain: Big Bangs, Behaviors, and Beliefs**  
By Rob DeSalle, Ian Tattersall  
Hardcover: 368 pages  
Publisher: Yale University Press; (April 24, 2012)  
ISBN: 0300175221
Recommended Resources

The following resources are recommended as general references but are not required.

Books:

The Human Brain Book
by Rita Carter, Susan Aldrige, Martyn Page, Steve Parker
Hardcover: 256 pages; Dimensions (in inches): 1 x 9.8 x 11.7
Publisher: DK Adult (2009)
ISBN: 075664416

Support Services

Technical support is available Monday-Friday from 9:00-5:00 EST. Please call (800) 649-6715 or email seminfo@amnh.org.

Grading

Assessments are based on a detailed grading rubric developed for this course:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Course Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Course Participation &amp; Communication</td>
<td>40%</td>
</tr>
<tr>
<td>Final Project</td>
<td>30%</td>
</tr>
</tbody>
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1. **Course assignments** will include reflection questions and written assignments.

2. **Class participation** will be evaluated based on the quality and consistency of contribution to the discussion forums. The grades for participation will be posted two weeks after each discussion opens.

3. **Final Project**: This project allows learners to develop an application for teaching some aspect of the course content. The project may take the form of a classroom unit or a workshop plan (if used for professional development).

4. **Policy**: Everything submitted as an assignment, project or discussion post must be an original work. References to resource materials are expected and proper citation is required. Assignments are due on the dates specified. Late submissions will be penalized 10%. Revised assignments that incorporate your instructor’s feedback will be accepted until the course ends.

Weekly Overview and Expectations

**Week 1: How Does the Brain Work?**
We begin with the nervous system, exploring the basic anatomy of nerve cells and the breathtaking speed and complexity with which they communicate. Then we take a tour of the main components of the brain and their primary functions. In the case study, neuroscientist Dr. Joy Hirsch describes looking inside the living brain with functional MRI, what we can (and can’t) learn in the process, and how it can be used to diagnose and treat disease.
Expectations
- Review the course orientation.
- Learn how the nervous system operates.
- Explore the anatomy of the brain.
- Reflect on how brain activity is studied using fMRI.
- Participate in the Icebreaker Discussion.
- Engage in the Discussion: Brain Imaging

Week 2: How Do We Sense?
How do our brains transform a barrage of sensory input into what we experience as vision, smell, taste, hearing, and touch? The week starts with the sense organs themselves, which are remarkably different from one another, and goes on to examine how and where in the brain the information gets processed. The case study by neuroscientist and surgeon Dr. Dylan Chan is an in-depth look at the mechanisms of hearing and deafness.

Expectations
- Learn which parts of the brain are associated with different senses.
- Explore ways that the brain processes information from the outside world.
- Discover how scientists study sensing.
- Complete the Assignment: Can you hear this?
- Engage in the Discussion: Using your senses

Week 3: How Do We Feel?
Looking beyond the concepts of short- and long-term memory, scientists have discovered that different kinds of memory involve different parts of the brain, and also play a part in how we express emotions. The anatomy of emotions is complex as well, involving the limbic system along with complex connections to the rest of the brain. The case study, by Dr. Gabriel Corfas, explains what can be learned about social interactions and learning by studying model organisms.

Expectations
- Explore what is known about how the brain works to create different types of memory.
- Examine emotions in the context of neuroscience and evolution.
- Reflect on how scientists study the ways that the brain creates memories.
- Complete the Assignment: Explore your own brain
- Engage in the Discussion: Emotions on the tree of life

Week 4: How Do We Think?
From imaging studies, scientists have learned that most people have a primary language area on the left side of the brain that processes the literal meaning of words. Split brain studies, however, tell us that both sides of the brain need to communicate in order to correctly interpret complex sensory stimuli like language and integrate words with our emotions and memories. This week we discuss these and other processes unique to the human brain: planning, problem solving, and decision-making. The topic of this week’s case study by Dr. Paul Glimcher is “neuroeconomics”: an interdisciplinary approach to understanding the neural events that underlie behavioral decision-making. An interactive explores the structures and neurotransmitters involved in different emotions and how that influences our decision-making.

Expectations
- Examine how the brain works to create and interpret language.
- Learn how scientists study decision-making.
- Complete the Assignment: To eat or not to eat (a cookie)
- Engage in the Discussion: Decision-making
Week 5: How Do Our Brains Change?
While the number of neurons in our brains is essentially fixed at birth, the number of connections between them grows over the course of our lives. This means that our brains are profoundly affected by our experiences, and also that we have the ability to recover from trauma. Late in life, certain brain cells start to deteriorate, although physical and mental activities can help compensate. Dr. Michael Merzenich explains how appropriate training can drive plasticity processes to help people recover normal function.

Expectations
- Understand how our brains change from birth to adulthood.
- Consider the implications of ageing on the brain.
- Explore how different activities influence how the brain ages.
- Engage in the Discussion: Our developing brain.
- Submit a draft of the final project.

Week 6: How Has The Brain Evolved?
In the final week we’ll start with a tour of the nervous system through the tree of life, and then focus on one extraordinary human attribute: the capacity for abstract thought. Anthropologist Dr. Ian Tattersall discusses how at some point in our evolutionary past, humans developed the ability to use symbols to represent our interior and exterior experiences. We’ll look at the evidence for when these capacities arose, and paleontologist Dr. John Flynn will take us back into the early mammalian record to explain how brain size evolved.

Expectations
- Understand the different levels of cellular communication across the tree of life.
- Explore the evolution of human cognition.
- Understand how scientists use fossils to study brain evolution.
- Submit the final project.