

## **ANBI 140: Evolution of the Human Brain Spring Quarter 2023**

**Lectures:** MWF 12-12:50    SEQUO 147

**Instructor:**

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Office Hours: W 1-3 PM and by appointment, SSB 287

**Course website:** canvas.ucsd.edu. All lecture outlines and review guides will be posted on this site.

**Course overview:** This course is designed to provide an overview of the major concepts and themes related to evolution of the human brain. The course examines neuroanatomical specializations of the human brain, direct evidence of brain evolution based on endocasts of fossil hominins, and functional correlates of the brain organization as inferred from disorders and lesion studies. Emphasis is placed on brain structures and behaviors thought to be under selective pressure during the evolution of the human lineage.

**Required Readings:**

All required readings listed in the syllabus are available electronically on the course website.

**Recommended Readings:**

Schneider, G. E. (2014). *Brain structure and its origins in development and in evolution of behavior and the mind*. MIT Press. A copy of the book is held on reserve at the Geisel library.

**Course Requirements:**

Midterm examination (25%)

Class paper (40%)

Final examination (35%)

To pass the course, you must satisfy all course requirements, i.e., you must take all exams and turn in all assignments. You are expected to complete assigned readings for the day of lecture.

**Examinations:**

There will be one midterm exam in this course and a final exam. The examinations will be designed to assess your grasp of the readings and lectures. Each will consist of a variety of objective questions, so if you attend lectures consistently and complete the readings, you can expect to do quite well on these assessments. The final exam will be cumulative, with the emphasis on the material covered since the midterm. You will be given the list of terms/concepts for the cumulative part of the final exam.

Make-up exams will only be granted in extreme and exceptional emergencies, in which case, valid documentation will need to be provided. Makeups will be given in a different format and include different content.

**Writing Assignments:** To further develop your interest in a particular topic related to brain evolution, you will write an 8–10-page paper on the topic of your choice. The topic should be related to one of the topics discussed in lectures/readings but, beyond that, you can decide to write on anything that ties the class material to your educational or research interests. Some examples of topics include – but are not limited to – variations of a specific neuroanatomical structure across species and their evolutionary significances, the connection between brain and cognitive evolution in fossil hominins, sex differences in the brain, the ethics of using non-human primates in research, etc. Or, you can focus on a specific disorder and examine it from neuroanatomical and functional perspectives. The paper grade consists of the paper proposal and annotated bibliography (**10% of your grade; due April 24**) and the final paper (**30% of your grade; due June 9**). The paper proposal should clearly identify the topic you are exploring and its significance for understanding human or non-human primate behavioral, cognitive, or anatomical specializations, and at least four scholarly sources (journal articles/edited books) which you will use in writing the paper. Both paper proposal and the final paper need to be uploaded to Canvas before the beginning of the class (12 PM) on the day they are due.

All information that is not your own original work must be cited. As of 2017, American Journal of Biological Anthropology (AJBA) requires references to be prepared according to APA style guideline (<https://onlinelibrary.wiley.com/page/journal/10968644/homepage/forauthors.html>), but you can use Chicago, MLA, CBE, or any other recognizable citation style.

#### ***Academic Integrity:***

It is your responsibility to know and observe all the UCSD rules concerning academic integrity and plagiarism. You should familiarize yourself with your responsibilities and rights under the UCSD Student Conduct Code (<https://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2>)

Any student found to have committed a substantial violation of the University rules concerning academic integrity will fail the entire course and will be reported to the Academic Integrity Office for academic misconduct. In order to avoid charges of academic misconduct, follow these basic guidelines:

- 1) When using another person's ideas, always cite the source.
- 2) Avoid direct quotes; if you do use verbatim text, enclose it in quotation marks and cite the source.
- 3) Do not present another student's work as your own.
- 4) Do not misrepresent information obtained from a source.
- 5) Do not attribute information obtained from one source to a different source.
- 6) Avoid copying whole blocks of text from a source, even if the source is cited.

Further information on how to avoid plagiarism can be obtained by completing UCSD Library plagiarism tutorial: <https://libraries.ucsd.edu/assets/elearning/plagiarism/prevent/story.html>. If you have any questions about what constitutes plagiarism, how to credit the work and ideas of others properly, how to evaluate sources for quality and reliability, or any other related issues, please contact me to discuss this topic further.

#### ***Students with Disabilities:***

Students requesting accommodations and services due to either a short or long term disability for this course need to provide a current [Authorization for Accommodation \(AFA\) letter](#) issued by the Office for Students with Disabilities (OSD), prior to eligibility for requests. Receipt of AFAs in advance is necessary for appropriate planning for the provision of reasonable accommodations. For additional information, contact the Office for Students with Disabilities: 858.534.4382 (V), email: [osd@ucsd.edu](mailto:osd@ucsd.edu). OSD Website: <http://disabilities.ucsd.edu>.

***Title IX Statement:***

The Office for the Prevention of Harassment and Discrimination (OPHD) is the Title IX Office for UC San Diego and investigates reports of sexual harassment, sexual violence, dating and domestic violence and stalking. You may file a report online with the UC San Diego Office for the Prevention of Harassment and Discrimination (OPHD). For further information about OPHD, please visit <http://ophd.ucsd.edu/> Or you may call OPHD at 858-534-8298.

Please note that University employees (including all faculty and teaching and research assistants), who are not confidential resources, are designated Responsible Employees. Responsible Employees are required to report any incidents of sexual violence or sexual harassment to OPHD. If you are not ready to file a report, but wish to receive confidential support and advocacy, please contact CARE at SARC: <http://students.ucsd.edu/sponsor/sarc/> CARE at SARC provides violence prevention education for the entire UCSD campus and offers free and confidential services for students, staff and faculty impacted by sexual assault, relationship violence and stalking. Accessing resources at CARE at SARC will not constitute a report to the University.

***Counseling and Psychological Services (CAPS):*** College life can be stressful, and it is normal to feel overwhelmed at times. UCSD has a staff of professionals who are available for confidential meetings to discuss any personal concerns you might have. Feel free to contact CAPS at any time to set up an appointment: <https://caps.ucsd.edu/>

TENTATIVE SCHEDULE OF TOPICS:

**Week 1**

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**April 3:**

Introduction/ Course overview

**April 5:**

Evolutionary Theory and Brain Evolution

Butler, A. B. & Hodos, W. (2005). Evolution and adaptation of brain, behavior, and intelligence. and Theories of brain evolution. In *Comparative Vertebrate Neuroanatomy*. Pp. 93-122.

**April 7:**

Brain and Intelligence in Comparative Perspective

Roth, G., & Dicke, U. (2005). Evolution of the brain and intelligence. *Trends in cognitive sciences*, 9(5), 250-257.

Robin, E. D. (1973). The evolutionary advantages of being stupid. *Perspectives in Biology and Medicine*, 16(3), 369-380.

## **Week 2**

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### **April 10:**

#### Organization of the Nervous System

Purves, D. et al. (2004). Studying the nervous systems of humans and other animals. In *Neuroscience (3<sup>rd</sup> ed)*, pp. 1-28.

Recommended: Schneider Chapter 1: Getting ready for a brain structure primer (3-28) and Chapter 2: Methods for mapping pathways (29-52)

### **April 12:**

#### Brain Organization in Primates

Allen, J. S. (2009). Chapter 2: The human brain in brief. *The Lives of the Brain*. Harvard University Press. Pp. 6-35.

Recommended: Schneider Chapter 5: The Ancestors of Mammals... (89-103) and Chapter 7: The Components of the Forebrain... (117-135)

### **April 14:**

#### Brain Organization in Primates (Cont'd)

## **Week 3**

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### **April 17:**

#### Evolutionary Principles: Evolution of Brain Size

Holloway, Ralph L. (2009). Brain Fossils: Endocasts. Squire, Larry R. (ed.) *Encyclopedia of Neuroscience* (Vol. 2, pp. 353-361). Oxford: Academic Press

Du, A., Zipkin, A. M., Hatala, K. G., Renner, E., Baker, J. L., Bianchi, S., ... & Wood, B. (2018). Pattern and process in hominin brain size evolution are scale-dependent. *Proc. R. Soc. B*, 285. <http://doi.org/10.1098/rspb.2017.2738>

### **April 19:**

#### Evolutionary Principles: Evolution of Brain Size (cont'd)

### **April 21:**

#### Evolutionary Principles: Brain Reorganization

Striedter, Georg F. (2005). Chapter 5: Evolutionary changes in brain region size. *Principles of Brain Evolution* (pp. 137-176). Sinauer Associates.

Recommended: Schneider Chapter 24: Forebrain origins (449-463)

## Week 4

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### April 24:

Evolutionary Principles: Reorganization (Cont'd) \*\* PAPER PROPOSAL DUE\*\*

### April 26:

Human Brain and Primate Brain Evolution

Barton, R. A. (2006) Primate brain evolution: integrating comparative, neurophysiological, and ethological data. *Evolutionary Anthropology* 15:224-236.

### April 28:

Human Brain and Primate Brain Evolution (Cont'd)

Rilling, James K. (2006). Human and nonhuman primate brains: are they allometrically scaled versions of the same design? *Evolutionary Anthropology* 15(2), 65-77.

## Week 5

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### May 1:

The Evolving Cortex: Gross Features

Allen, J. S. (2009). Chapter 4: The Functional Evolution of the Brain. *The Lives of the Brain*. Harvard University Press. Pp. 82-85 and 99-109.

Recommended: Schneider Chapter 33 Basic neocortical organization (617-643)

### May 3: The Evolving Cortex: Gross Features

Aldridge K (2011) Patterns of differences in brain morphology in humans as compared to extant apes. *J Hum Evol* 2011:94-105

### May 5:

Evolution of Language Networks

Schenker, N. M., Hopkins, W. D., Spocter, M. A., Garrison, A. R., Stimpson, C. D., Erwin, J. M., ... & Sherwood, C. C. (2009). Broca's area homologue in chimpanzees (*Pan troglodytes*): probabilistic mapping, asymmetry, and comparison to humans. *Cerebral Cortex*, 20(3), 730-742.

## Week 6

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### May 8:

\*\*\* Midterm examination \*\*\*

Covers the material from April 3 until (including) May 3

### May 10:

Evolution of Language Networks (cont'd)

Aboitiz, F., & Garcia, R. (1997). The evolutionary origin of the language areas in the human brain. A neuroanatomical perspective. *Brain Research Reviews*, 25(3), 381-396.

### May 12:

Evolution of Language Networks (cont'd)

Stout, D., & Chaminade, T. (2009). Making tools and making sense: complex, intentional behaviour in human evolution. *Cambridge Archaeological Journal*, 19(1), 85-96.

Decety, J. (2011). The neuroevolution of empathy. *Annals of the New York Academy of Sciences*, 1231(1), 35-45.)

## **Week 7**

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### **May 15:**

#### The Limbic System and Social Brain Networks

Lew, C. H. & Semendeferi, K. (2017) Evolutionary specializations of the human limbic system. Kaas, J. (ed.) *Evolution of Nervous Systems* (2nd edition, p 277–291). Elsevier

Recommended: Schneider Chapter 25: Regulating the internal milieu and the basic instincts (465-479) and Chapter 26: Core pathways of the limbic system (483-499)

### **May 17:**

#### Social Brain Networks (cont'd)

Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature reviews neuroscience*, 9(2), 148.

### **May 19:**

#### Evolution of the Social Brain

Shultz, S., & Dunbar, R. I. (2012). Social cognition and cortical function: an evolutionary perspective. Schulkin, J. (ed.) *Action, perception and the brain: adaptation and cephalic expression*. New York:Palgrave Macmillan.

Recommended: Schneider Chapter 29: The limbic striatum (537-557)

## **Week 8**

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### **May 22:**

#### Evolution of the Social Brain (Cont'd)

### **May 24:**

#### Microstructural specializations

Hrvoj-Mihic, B., Bienvenu, T., Stefanacci, L., Muotri, A. R., & Semendeferi, K. (2013). Evolution, development, and plasticity of the human brain: from molecules to bones. *Frontiers in human neuroscience*, 7, 707

### **May 26:**

#### Microstructural specializations (cont'd)

Sherwood, C. C., Bauernfeind, A. L., Verendeev, A., Raghanti, M. A., & Hof, P. R. (2016). Evolutionary specializations of human brain microstructure. In *Evolution of Nervous Systems: Second Edition* (pp. 121-139). Elsevier Inc.

Recommended: Schneider Chapter 17: Widespread changes in brain state (311-320).

**Week 9**

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**May 29:**

**\*\*\* Memorial Day – No Class \*\*\***

**May 31:**

Evolution and Brain Development

Leigh, S. R. (2004). Brain growth, life history, and cognition in primate and human evolution. *American Journal of Primatology* 62(3), 139-164.

Recommended: Schneider Chapter 34: Structural change in development and in maturity (645-665) and Neurogenesis in mature brains (589-590).

**June 2:**

Evolution and Brain Development

Barrickman, N. L. (2016). Energetics, Life History, and Human Brain Evolution. *Evolution of Nervous Systems: Second Edition* (pp. 51-62). Elsevier

**Week 10**

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**June 5:**

Disorders/Lesion Studies (cont'd)

Hanson, K. L., Hrvoj-Mihic, B., & Semendeferi, K. (2014). A dual comparative approach: integrating lines of evidence from human evolutionary neuroanatomy and neurodevelopmental disorders. *Brain, behavior and evolution*, 84(2), 135-155.

Petanjek, Z., & Kostović, I. (2012). Epigenetic regulation of fetal brain development and neurocognitive outcome. *Proceedings of the National Academy of Sciences*, 109(28), 11062-11063.

**June 7:**

Disorders/Lesion Studies (cont'd)

Kapp, S. K., Gillespie-Lynch, K., Sherman, L. E., & Hutman, T. (2013). Deficit, difference, or both? Autism and neurodiversity. *Developmental psychology*, 49(1), 59-71.

**June 9: \*\*\* FINAL PAPER DUE \*\*\***

Course wrap-up

**\*\*\*\*\* FINAL EXAMINATION: WEDNESDAY JUNE 14, 11:30-2:30 PM \*\*\*\*\***