

ANBI 112: Methods in Human Comparative Neuroscience

Winter Quarter 2022

Lectures: TuTh 2-3:20 PM

Instructor:

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Office Hours: Tu 12-1 PM and by appointment; SSB 287

Course website: canvas.ucsd.edu/. All readings, lecture outlines, and other class material will be posted on this site.

Course overview: This course introduces students to the methods in human neuroscience. The emphasis is placed on the methods utilizing post-mortem brain tissue that were used in reconstructing human brain evolution. The methods discussed include structural, cellular, molecular, and hybrid techniques. An important component of the course includes topics on ethical standards applicable to the study of human and non-human primate brains. Students will learn about the principles of each method, its applications, and will be able to understand its strengths and limitations. The course has the format of a seminar, with visits to the laboratory in SSB 126 for students to examine selected techniques as presented in the readings.

Required Course Reading:

There is no textbook for this course. All readings as specified in the syllabus are available electronically on the course website.

Recommended Readings (posted on Canvas): In preparation for presenting and discussing scientific publications, it is recommended that you read Gastel, B. & Day, R. A. (2016).

Preparing the text & Preparing the Tables and Figures. In *How to Write and Publish a Scientific Paper*. Pp. 41-79 and 93-113.

Course Requirements:

Class attendance and participation (20%)

Presentation of assigned reading (20%)

Article critical review:

 Article selection and summary (10%)

 Paper presentation (15%)

 Critical review paper (35%)

To complete this course, you must satisfy all course requirements; i.e., you must present an articles and turn in all assignments. You are expected to complete assigned readings for the day of the lecture.

Requirements:

Your grade for this class will be based on your participation in the class, presentation of one scientific article assigned for the class, and a critical review of the article of your choice.

Class attendance and participation: This is a seminar-type class and students are expected to attend the class meetings and read assigned articles. For the class meetings which include presentations of assigned readings, students are expected to participate in the discussion: ask questions, share their thoughts on the article, and demonstrate their familiarity with the readings.

Presentation of assigned readings: Each student will present one article of their choice listed in the syllabus and lead a brief Q&A after the presentation. The paper presentation should consist of a critical summary of the main points of the paper, with a particular attention to the background of the research, research question and hypotheses, methods, and interpretation of the results. Please use the following link to sign up for the articles to present:

<https://docs.google.com/spreadsheets/d/1JnMTdMjbRiOHek8eGK-ES3aHoEnLI3-P6t9QHpj17xU/edit#gid=0>

Article critical review: In order to demonstrate familiarity with the methods discussed in the class and your understanding of the standards in scientific research/publishing, you will write a critical review of an article of your choice. Your write-up needs to objectively evaluate the article: strength of the hypotheses, suitability of the methods for the research questions addressed in the paper, correspondence between the results and the authors' interpretation, and the overall strengths and weaknesses of the research.

The article review grade consists of the article selection, including a summary of the main points discussed in the article and an objective description why you are interested in reviewing this particular work (10% of your grade; due November 1) and the final review (35% of your grade; due December 1). You will also present the article and your review to the class (15% of your grade). In writing the review – and for all other instances in this course when you need to consult a source -- do not use Wikipedia.

All information that is not your own original work must be cited. As of 2017, American Journal of Physical Anthropology (AJPA) requires references to be prepared according to APA style guidelines (see the References section at <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:

All assignments submitted for this class are expected to represent your own work. Violations of academic integrity will be taken seriously and reported to the Academic Integrity Office. It is your responsibility to know and observe all of the UCSD rules concerning academic integrity and plagiarism. You should familiarize yourself with your responsibilities and rights under the UCSD Policy on Integrity of Scholarship: <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, please contact me discuss this topic further.

Policy on an Incomplete (I) Grade:

According to the UCSD policy, an Incomplete can be awarded only when student's work is of passing quality, but the class assignments could not be completed due to circumstances beyond the student's control. In other words, to be eligible for an Incomplete you must have completed

all coursework except for the final exam or final paper. Further details on UCSD grading policy, including the Incomplete grade, can be found at:

<https://www.ucsd.edu/catalog/front/AcadRegu.html>

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) 858.534.9709 (TTY) - Reserved for people who are deaf or hard of hearing, email: osd@ucsd.edu . OSD Website: <http://disabilities.ucsd.edu> .

TENTATIVE SCHEDULE OF TOPICS:

Week 0

September 22:

Introduction/ Course Nuts and Bolts

Week 1

September 27:

Biological Anthropology and Neuroscience

Sherwood, C. C., Subiaul, F., & Zawidzki, T. W. (2008). A natural history of the human mind: tracing evolutionary changes in brain and cognition. *Journal of anatomy*, 212(4), 426-454.

Skim the following article and refer to it throughout the quarter as needed: Hecht, E., & Stout, D. (2015). Techniques for studying brain structure and function. In Bruner, E. (editor) *Human Paleoneurology* Pp. 209-224. Springer.

September 29:

Research Ethics: Non-Human Primates

Nash, L. T. (2005). Studies of primates in the field and in captivity: similarities and differences in ethical concerns. In Trudy R. Turner (editor) *Biological anthropology and ethics: From repatriation to genetic identity*, pp. 27-48

Padrell, M., Llorente, M., & Amici, F. (2021). Invasive research on non-human primates—time to turn the page. *Animals*, 11(10), 2999.

Week 2

October 4:

Research Ethics: Human Subjects

U. S. Department of Health and Human Services, Office for Human Research Protection. *Regulations*. <https://www.hhs.gov/ohrp/regulations-and-policy/regulations/index.html>

Neuroscience and Consent Capacity:

https://bioethicsarchive.georgetown.edu/pcsbi/sites/default/files/consent%20capacity%20primer%20-%20FINAL_0.pdf

October 6:

Ethics in Publishing

Gastel, B. & Day, R. A. (2016) What is a Scientific Paper? & Ethics in Scientific Publishing. In *How to Write and Publish a Scientific Paper* (8th Edition.) Greenwood Press. Pp. 18-23 and 24-29.

Week 3

October 11:

Reconstructing Brains of Extinct Species: Fossil Endocasts

Neubauer, S. (2014). Endocasts: possibilities and limitations for the interpretation of human brain evolution. *Brain, behavior and evolution*, 84(2), 117-134.

Carlson, K. J., Stout, D., Jashashvili, T., De Ruiter, D. J., Tafforeau, P., Carlson, K., & Berger, L. R. (2011). The endocast of MH1, *Australopithecus sediba*. *Science*, 333(6048), 1402-1407.

October 13:

Fossil Endocasts (Cont'd)

Falk, D. (1980). A reanalysis of the South African australopithecine natural endocasts. *American Journal of Physical Anthropology*, 53(4), 525-539.

Holloway, R. L. (1981). Revisiting the South African Taung australopithecine endocast:

The position of the lunate sulcus as determined by the stereoplotting technique. *American Journal of Physical Anthropology*, 56(1), 43-58.

Falk, D., & Clarke, R. (2007). Brief communication: New reconstruction of the Taung endocast. *American Journal of Physical Anthropology*, 134(4), 529-534.

Week 4

October 18:

Analysis of Post-Mortem Brain Tissue: Histological Techniques

Start reading on p. 17 (“B. The Tissue”) and skip everything related to invasive research on living animals: Blackstand et al. (1981) Experimental neuroanatomy: General approaches and laboratory procedures. In Heimer L. & Robards M. J. (Eds.) *Neuroanatomical Tract-tracing Methods*. Plenum Press, Pp. 1-53.

October 20:

Cellular Organization of the Brain: Cytoarchitectonics

Elston, G. N., & Garey, L. J. (2013). The cytoarchitectonic map of Korbinian Brodmann: arealisation and circuit specialisation. In Geyer, S. & Turner, R. (Eds.) *Microstructural parcellation of the human cerebral cortex*. Springer. Pp. 3-32.

Kaas, J. H. (2012). Evolution of columns, modules, and domains in the neocortex of primates. *Proceedings of the National Academy of Sciences*, 109(Supplement 1), 10655-10660.

Week 5

October 25 & 27: Class meets in SSB 126

Week 6

November 1: * Selection and summary of the article due *****

Cytoarchitectonics (Cont'd)

Semendeferi, K., Armstrong, E., Schleicher, A., Zilles, K., & Van Hoesen, G. W. (2001). Prefrontal cortex in humans and apes: a comparative study of area 10. *American Journal of Physical Anthropology*, 114(3), 224-241.

Semendeferi, K., Armstrong, E., Schleicher, A., Zilles, K., & Van Hoesen, G. W. (1998).

Limbic frontal cortex in hominoids: a comparative study of area 13. *American Journal of Physical Anthropology*, 106(2), 129-155.

Semendeferi, K., Teffer, K., Buxhoeveden, D. P., Park, M. S., Bludau, S., Amunts, K., ... & Buckwalter, J. (2011). Spatial organization of neurons in the frontal pole sets humans apart from great apes. *Cerebral cortex*, 21(7), 1485-1497.

November 3:

Immunohistochemistry

Forssmann et al. (1981) Immunohistochemistry and immunocytochemistry of nervous tissue. In Heym, Ch. & Forssmann, W.-G. (Eds) *Techniques in neuroanatomical research*. Springer-Verlag. Pp. 171-205.

Campbell, M. J., & Morrison, J. H. (1989). Monoclonal antibody to neurofilament protein (SMI-32) labels a subpopulation of pyramidal neurons in the human and monkey neocortex. *Journal of Comparative Neurology*, 282(2), 191-205.

Uylings, H. B., Sanz-Arigita, E. J., de Vos, K., Pool, C. W., Evers, P., & Rajkowska, G. (2010). 3-D Cytoarchitectonic parcellation of human orbitofrontal cortex: Correlation with postmortem MRI. *Psychiatry Research: Neuroimaging*, 183(1), 1-20.

Week 7

November 8:

Immunohistochemistry: Neurotransmitter systems

Raghanti, M. A., Edler, M. K., Stephenson, A. R., Munger, E. L., Jacobs, B., Hof, P. R., ... & Lovejoy, C. O. (2018). A neurochemical hypothesis for the origin of hominids. *Proceedings of the National Academy of Sciences*, 115(6), E1108-E1116.

Stephenson, A. R., Edler, M. K., Erwin, J. M., Jacobs, B., Hopkins, W. D., Hof, P. R., ... & Raghanti, M. A. (2017). Cholinergic innervation of the basal ganglia in humans and other anthropoid primates. *Journal of Comparative Neurology*, 525(2), 319-332.

Hof, P. R., Mufson, E. J., & Morrison, J. H. (1995). Human orbitofrontal cortex: cytoarchitecture and quantitative immunohistochemical parcellation. *Journal of Comparative Neurology*, 359(1), 48-68.

November 10: No class – Instructor at AAA meetings

Week 8

November 15:

Reconstructing Dendritic Morphology: The Golgi Methods

Morest D. K. (1981). The Golgi Methods. In Heym, Ch. & Forssmann, W.-G. (Eds.) *Techniques in neuroanatomical research*. Springer-Verlag. Pp. 124-138.

Jacobs, B., Schall, M., Prather, M., Kapler, E., Driscoll, L., Baca, S., ... & Trembl, M. (2001). Regional dendritic and spine variation in human cerebral cortex: a quantitative Golgi study. *Cerebral cortex*, 11(6), 558-571.

Bianchi, S., Stimpson, C. D., Bauernfeind, A. L., Schapiro, S. J., Baze, W. B., McArthur, M. J., ... & Sherwood, C. C. (2013). Dendritic morphology of pyramidal neurons in the chimpanzee neocortex: regional specializations and comparison to humans. *Cerebral cortex*, 23(10), 2429-2436.

November 17:

Student Presentations

Week 9

November 22:

Student Presentations

November 24: * Thanksgiving – no class *****

Week 10

November 29:

Student Presentations

December 1: * ARTICLE REVIEW DUE *****

Student Presentations & Course Wrap-Up