

ANTH 5543, FALL 2015
HUMAN VARIATION AND ADAPTATION

COURSE SUMMARY

COURSE INFORMATION: Mondays and Wednesdays 2:00 pm - 3:20 pm, ELA 229

COURSE INSTRUCTOR: Dr. Carrie Veilleux
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Phone: TBD Office: ELA 239
Office Hours: Wednesday 10:30-12:30 pm *and by appointment*

DESCRIPTION:

The goal of this course is to examine the biological variation present in human populations within an evolutionary framework. We will explore how the forces of natural selection and drift have influenced genetic and phenotypic differences within and between human populations. We will evaluate primary literature and identify the differing types of data and methods used to evaluate human variation. This course will be a combination of lecture and seminar formats. You will be required to critically read and evaluate assigned readings and arrive prepared to discuss these readings during class.

READINGS:

Textbook: Mielke JH, LW Konigsberg, JH Relethford (2011) Human Biological Variation. Oxford University Press, 2nd edition.

Other Readings: We will also be reading several scientific papers for each class period. I will post these to the course website on TRACs at least 1 week before the class.

Citation Manager: I suggest that you install a citation manager to help you organize papers and aid in writing (Zotero is my preferred one, cloud-based and free!, Mendeley is also cloud-based and free) or you can purchase EndNote - <http://www.endnote.com/>. These types of programs will be invaluable for your graduate and professional career.

ASSIGNMENTS:

Seminar coordination (15%): Each student will co-organize and lead two class periods during this semester. The student leaders are expected to (a) briefly summarize the readings (PowerPoint slides/handouts may be prepared if you think they would be helpful), and (b) prepare a set of topics or questions to facilitate discussion. You should consult with me in office hours or by email the week before you are scheduled to lead class.

Class participation (20%) - Each student is expected to (a) complete all assigned readings before class, (b) bring questions and comments to class, and (c) participate fully in all discussions.

Population genetics assignment (15%) - This assignment is designed to introduce students to some of the techniques used in population genetic research studies. Each student will be assigned a gene and 1-2 populations. Students will then download the collection of genes for their population from the 1000 Genomes Project and use an R program, Poppr, to collect standard population genetic statistics. Later, you will pair with another student examining the same gene, make inferences regarding your results, and present your findings. More detailed instructions will be provided separately.

Research proposal project (50%) - Each student will write a research proposal on any relevant human variation topic of your choice. The total grade for this proposal includes:

1. *Project Summary (5%)*: A 1-page overview of your proposal is due on Oct. 7. In this overview, you will summarize your research question within human variation, why it is interesting, and a rough idea of how you might collect data.
2. *Proposal Outline and Workshop Day (10%)*: After receiving feedback on your Project Summary, you will prepare a 3-5 page (double-spaced) proposal outline for a classroom workshop day on Nov. 11. This outline will include a well-thought out research question, which population(s) you would study and why they are appropriate for your research question, specific hypotheses you propose to test, and detailed descriptions of methods you would use. The Project Outline is due by Monday Nov. 9th to permit time to send to the rest of the class. We will meet on Nov. 11 and in groups, you will provide and receive feedback from other students on your proposal outline.
3. *Research Proposal (25%)*: This 10-12 page (double-spaced) research proposal will be in the format of a NSF Dissertation Improvement Grant proposal (guidelines will be distributed at a later date).
4. *Presentation (10%)*: On the day scheduled for final exams (Wednesday Dec. 9, 2:00-4:30pm), each student will give a 8-10 min presentation of their proposal.

COURSE OUTLINE

WEEK 1:

Aug 24 - Course overview and introduction

Aug 26 - History of human variation studies

HBV Ch1

Marks JA. 2012. The origins of anthropological genetics. *CurrAnthropol* 53 (S5):S161-S172.

WEEK 2:

Aug 31 - History of racial science and scientific racism

Gould SJ. 1981. American polygeny and craniometry before Darwin: Blacks and Indians as separate, inferior species. *The Mismeasure of Man*. New York: WW Norton and Co. pp 30-72.

Morning A. 2008. Reconstructing race in science and society: biology textbooks, 1952-2002. *American Journal of Sociology* 114:S106-S137.

Fullwiley D 2014. The "Contemporary Synthesis": when politically inclusive genomic science relies on biological notions of race. *Isis* 105: 803-814.

Pick one:

*Gobineau A. 1853. *The Inequality of the Human Races*. London: Jonathan Cape. pp 97-145,162-176.

*Darwin C. 1871. On the races of man. *The Descent of Man, and Selection in Relation to Sex*. Chicago: Encyclopedia Britannica. pp 169-203.

*Hrdlicka A. 1930. Human races. In: Cowdry EV, editor. *Human Biology and Racial Welfare*. Paul B. Hoeber, Inc. pp 156-183.

*Grant M. 1916. *The Passing of the Great Race*. New York: Charles Scribner's Sons. pp 3-55, 83-94.

*Sinnott EW, Dunn LC. 1925. The problems of eugenics. In: *Principles of Genetics: An Elementary Text, with Problems*. New York: McGraw-Hill Book Co. pp 402-415.

*Boas F. 1940. *Race, Language, and Culture*. Chicago: University of Chicago Press. pp 28-59, 76-81.

*Hooton EA. 1946. *Up from the Ape*. Revised editor. New York: Macmillan Company. pp 439-455,

Sep 2 - Genetic basis of human variation: from DNA to phenotype

HBV Ch 2

Ramagopalan SV, Knight M, Ebers GC, Knight JC. 2007. Origins of magic: review of genetic and epigenetic effects. *British Medical Journal* 335:1299-1301.

Hurley D. 2013. Grandma's lousy childhood or excellent adventure might change your personality, bequeathing anxiety or resilience by altering the expressions of genes in the brain. *Discover Magazine* May 2013: 48-55.

WEEK 3:

Sep 7 - NO CLASS (LABOR DAY)

Sep 9 - class cancelled

WEEK 4:**Sep 14 - Population genetics**

HBV Ch3

Sep 16 - Problems with a racial view of human diversity

- Bolnick DA. 2008. Individual ancestry inference and the reification of race as a biological phenomenon. In: Koenig BA, Lee SS, Richardson SS, editors. *Revisiting Race in a Genomic Age*. New Brunswick, NJ: Rutgers University Press. Pp 70-85.
- Barbujani G. 2005. Human race: classifying people vs understanding diversity. *Current Genomics* 6:215-226.
- Gravlee CC. 2009. How race becomes biology: embodiment of social inequality. *American Journal of Physical Anthropology* 139:47-57.
- Relethford JH. 2009. Race and global patterns of phenotypic variation. *American Journal of Physical Anthropology* 139:16-22.
- Templeton AR. 1998. Human races: a genetic and evolutionary perspective. *American Anthropologist* 100:632-650.

WEEK 5:**Sep 21 - Population history and human variation**

Skim HBV Ch9 & Ch 13 if you need to refresh

- Veeramah KR, Hammer MF. 2014. The impact of whole-genome sequencing on the reconstruction of human population history. *Nature Reviews Genetics* 15: 149-162.
- Jobling MA. 2012. The impact of recent events on human genetic diversity. *Philosophical Transactions of the Royal Society of London B* 367: 793-799.
- Betti L, Balloux F, Amos W, Hanihara T, Manica A. 2009. Distance from Africa, not climate, explains within-population phenotypic diversity in humans. *Proceedings of the Royal Society B* 276:809-814.
- Henn BM, Cavalli-Sforza LL, Feldman MW. 2012. The great human expansion. *Proceedings of the National Academy of Sciences* 109: 17758-17764.
- Linz B et al. 2007. An African origin for the intimate association between humans and *Helicobacter pylori*. *Nature* 445: 915-918.

Sep 23 - Evolutionary forces and genetic variation: detecting selection and drift

HBV: review Ch 3 (68-85), Ch 9 for refresher

- Bamshad M, Wooding S. 2003. Signatures of natural selection in the human genome. *Nature Reviews Genetics*. 4:99-111.
- Hellenthal G et al. 2014. A genetic atlas of human admixture history. *Science* 343:747-751.
(6)
- Barsch GS & Andersson L. 2013. Detecting selection. *Nature* 495:325-326
- Lachance et al. 2012. Evolutionary history and adaptation from high-coverage whole-genome sequences of diverse African hunter-gatherers. *Cell* 150:457-469.

WEEK 6:**Sep 28 - Evolutionary forces and genetic variation: selection and drift**

- Coop et al. 2009. The role of geography in human adaptation. *PLOS Genetics* 5: e1000500
- Ackermann RR & Chevereud. 2004. Detecting genetic drift versus selection in human evolution. *Proceedings of the National Academy of Sciences* 101:17946-17951.
- Bolnick DA, Halverson MS. 2009. An ancient DNA test of a founder effect in Native American ABO blood group frequencies. *Am J Phys Anthropol.* 137:342-347.
- von Cramon-Taubadel N et al. 2013. Skull and limb morphology differentially track population history and environmental factors in the transition to agriculture in Europe. *Proc R Soc B* 280: 20131337

Sep 30 - Archaic human populations

1. Liang M, Nielsen R. 2011. Q&A: Who is *H. sapiens* really, and how do we know? *BMC Biology.* 9:20
2. Disotell TR. 2012. Archaic human genomes. *Yearbook of Physical Anthropology* 55:24-39.
3. Ermini et al. 2015. Major transitions in human evolution revisited: A tribute to ancient DNA. *Journal of Human Evolution* 79: 4-20.
4. Moro Abadia O & Gonzalez Morales MR. 2010. Redefining Neanderthals and art: an alternative interpretation of the multiple species model for the origin of behavioural modernity. *Oxford Journal of Archaeology* 29:229-243.

WEEK 7:**Oct 5 - Modern human migration patterns**

1. Veeremah KR, Novembre J. 2014. Demographic events and evolutionary forces shaping European genetic diversity. *Cold Springs Harbour Perspect Biol.* 6:a008516.
 2. Skoglund et al. 2012. Origins and genetic legacy of Neolithic farmers and hunter-gatherers in Europe. *Science* 336: 466-469.
- Bollongino et al. 2013. 2000 years of parallel societies in Stone Age central Europe. *Science* 342: 479-481.
- Bentley RA et al. 2012. Community differentiation and kinship among Europe's first farmers. *PNAS* 109:9326-9330.
- Oota et al. 2001. Human mtDNA and Y-chromosome variation is correlated with matrilineal versus patrilineal residence. *Nature Genetics* 29:20-21.

Oct 7 - Craniometric Variation

HBV: Ch 10

- Relethford JH. 2009. Population-specific deviations of global human craniometric variation from a neutral model. *American Journal of Physical Anthropology* 142:105-111.
- Betti L et al. 2010. The relative role of drift and selection in shaping the human skull. *American Journal of Physical Anthropology* 141:76-82.
- Noback ML, Harvati K. 2015. The contribution of subsistence to global human cranial variation. *Journal of Human Evolution* 80:34-50.

Rae T et al. 2011. The Neanderthal face is not cold adapted. *Journal of Human Evolution* 60: 234-239.

WEEK 8:

Oct 12 - Adaptations: Pigmentation

** HBV: Ch 12 this is the review this week**

2. Wilde S et al. 2014. Direct evidence for positive selection of skin, hair, and eye pigmentation in Europeans during the last 5,000 y. *PNAS* 111: 4832-4837.
3. Lalueza-Fox et al. 2007. A melanocortin 1 receptor allele suggests varying pigmentation among Neanderthals. *Science* 318: 1453-1455.
4. Greaves M. 2014. Was skin cancer a selective force for black pigmentation in early hominin evolution? *Proceedings Biological Sciences* 281: 20132955.
5. Jablonski N, Chaplin G. 2014. Skin cancer was not a potent selective force in the evolution of protective pigmentation in early hominins. *Proceedings Biological Sciences* 281: 20140517.

Oct 14 - Adaptations: Climate

HBV: Ch 11

- Foster F, Collard M. 2013. A reassessment of Bergmann's Rule in modern humans. *PLoS One*. DOI: 10.1371/journal.pone.0072269
- Balloux F et al. 2009. Climate shaped the worldwide distribution of human mitochondrial DNA sequence variation. *Proceedings Biol Sci* 276:
- Eisenberg DTA et al. 2010. Worldwide allele frequencies of the human apolipoprotein E gene: climate, local adaptations, and evolutionary history. *Am J Phys Anthropology* 143:100-11.
- Turchin MC et al. 2012. Evidence of widespread selection on standing variation in Europe at height-associated SNPs. *Nature Genetics* 44: 1015-1021.

WEEK 9:

Oct 19 - Adaptations: Altitude

HBV Ch11, p 286-289.

1. Beall C. 2014. Adaptation to high altitude: phenotypes and genotypes. *Annu Rev Anthropol.* 43:251-72.
 2. Yi et al 2010. Sequencing of 50 human exomes reveals adaptation to high altitude. *Science* 329:75-78.
- Huerta-Sanchez E et al. 2013. Genetic signatures reveal high-altitude adaptation in a set of Ethiopian populations. *Mol Biol Evol* 30: 1877-1888.
- Vemot B, Akey JM. 2015. Human evolution: genomic gifts from archaic hominins. *Current Biology* 24: R846.

Oct 21 - Adaptations: Diet

Review: HBV Ch 8

1. Luca F et al. 2010. Evolutionary adaptations to dietary changes. *Annual Reviews Nutrition* 30:291-314.
2. Tishkoff S et al. 2007. Convergent adaptation of human lactase persistence in Africa and Europe. *Nat Genet* 39:31-40.
3. Perry GH et al. 2007. Diet and the evolution of human amylase gene copy number variation. *Nat Genet* 39:1256-126.
4. Perry GH et al. 2015. Insights into hominin phenotypic and dietary evolution from ancient DNA sequence data. *Journal of Human Evolution* 79:55-63.
5. Campbell MC et al. 2014. Origin and differential selection of allelic variation at *TAS2R16* associated with salicin bitter taste sensitivity in Africa. *Mol Biol Evol* 31:288-302.

WEEK 10:

Oct 26 - Effects of diet on human variation and health

- Lumey et al. 2011. Prenatal famine and adult health. *Annu Rev Public Health* 32:237-262.
- Bygren et al. 2014. Change in paternal grandmothers' early food supply influenced cardiovascular mortality of the female grandchildren. *BMC Genetics* 15:12
- Clemente et al. 2012. The impact of gut microbiota on human health: an integrative view. *Cell* 148:1258-1270.
- Hehemann et al. 2010. Transfer of carbohydrate-active marine bacteria to Japanese gut microbiota. *Nature* 464: 908-912.
- Boix C, Rosenbluth F. 2014. Bones of contention: the political economy of height inequality. *American Political Science Review* 108:1-22.

Oct 28- Adaptations: disease

DUE: Population Genetics

HBV Ch 5 (pp123-137), Ch 7

- Karlsson et al 2014. Natural selection and infectious disease in human populations. *Nature Reviews Genetics* 15:379-393.
- Fumagalli et al. 2009. Parasites represent a major selective force for interleukin genes and shape the genetic predisposition to autoimmune conditions. *J Exp Med*. 206:1395-1408
- Hodgson et al. 2014. Natural selection for the Duffy-null allele in the recently admixed people of Madagascar. *Proceedings Biol Sci* 281: 2014093.

WEEK 11:

Nov 2 - Effects of disease/stress on human variation and health

HBV Ch 6,

2. Havlicek J, Roberts SC. 2009. MHC-correlated mate choice in humans: a review. *Psychoneuroendocrinology* 34:497-512.
3. Marmot MG, Sapolsky R. 2014. Of baboons and men: social circumstances, biology, and the social gradient in health. In *Sociality, Hierarchy, Health: Comparative Biodemography: Papers from a Workshop*. Weinstein M, Lane ME, editors. pp. 365-388.

4. Gravlee CC et al. 2009. Genetic ancestry, social classification, and racial inequalities in blood pressure in southeastern Puerto Rico. *PLoS One* 4(9): e6821
5. Thayer ZM, Kuzawa CW. 2011. Biological memories of past environments: epigenetic pathways to health disparities. *Epigenetics* 6:798-803.

Nov 4 - Grant writing

Read the following blogs and articles, and the sample grants posted in Dropbox.

<http://web.stanford.edu/~jhj1/grant-advice.html>

<http://web.stanford.edu/~jhj1/teaching/grant.html>

useful: <http://iis.berkeley.edu/node/304>

<http://blog.wennergren.org/category/how-to-write-a-grant-proposal/>

List of anthropology grants:

<http://clas.wayne.edu/multimedia/Anthropology/files/Anthro%20Grad%20Student%20Funding%20Opps.pdf>

WEEK 12:

Nov 9 -

Domestication

DUE: Project Outlines

1. Wilkins et al. 2014. The "domestication syndrome" in mammals: a unified explanation based on neural crest cell behavior and genetics. *Genetics* 197:795-808
2. Montague et al. 2014. Comparative analysis of the domestic cat genome reveals genetic signatures underlying feline biology and domestication. *PNAS* 111: 17230-17235.
3. Axelsson et al. 2013. The genomic signature of dog domestication reveals adaptation to a starch-rich diet. *Nature* 495:360-364.
4. Wang et al. 2014. Genetic convergence in the adaptations of dogs and humans to the high-altitude environment of the Tibetan Plateau. *Genome Biology Evol* 6:2122-2128.
5. Freedman et al 2014. Genome sequencing highlights the dynamic early history of dogs. *PLoS Genetics*. 10(1): e1004016. doi:10.1371/journal.pgen.1004016

Nov 11 - Research project workshop day

WEEK 13:

Nov 16 - Sex and gender

1. Eliot L. 2011. The trouble with sex differences. *Neuron* 72:895-898.
2. Ingalhalikar et al. 2014. Sex differences in the structural connectome of the human brain. *PNAS* 111:823-828.
3. Joel D, Tarrasch R. 2014. On the mis-presentation and misinterpretation of gender-related data: the case of Ingalhalikar's human connectome study. *PNAS* 111:E637.
4. Ingalhalikar et al. 2014. Reply to Joel and Tarrasch: on misreading and shooting the messenger. *PNAS* 111: E638.
5. Fine C. 2014. His brain, her brain? *Science* 346:915-916.
6. O'Connor C, Joffe H. 2014. Gender on the brain: a case study of science communication in the new media environment. *PLoS One* 9:e110830.

7. Deaner et al. 2012. A sex difference in the predisposition for physical competition: males play sports much more than females even in the contemporary US. *PLoS One* 7:e49168.

Nov 18 - Sex and Gender Part II

- Geller PL. 2005. Skeletal analysis and theoretical complications. *World Archaeology* 37:597-609.
- Hines M. 2011. Gender development and the human brain. *Annu Rev Neuroscience* 34:69-88.
- Sitek et al. 2012. Biometric characteristics of the pelvis in female-to-male transsexuals. *Arch Sex Behav* 41:1303-1313.
- Ainsworth, C. 2015. Sex redefined. *Nature* 518:288-291.
- Sapolsky R. 2015. Caitlyn Jenner and our cognitive dissonance. *Nautilus* 020: 2050. September 3 2015. <http://nautil.us/issue/28/2050/caitlyn-jenner-and-our-cognitive-dissonance>

WEEK 14:

Nov 23 - Ethics

- Sterling RL. 2011. Genetic research among the Havasupai—A cautionary tale. *AMA Journal of Ethics* 13: 113-117.
- Isherwood C. 2015. Review: 'Informed Consent' tests the ethics of genetic research. *New York Times* Aug 18, 2015. http://www.nytimes.com/2015/08/19/theater/review-informed-consent-tests-the-ethics-of-genetic-research.html?_r=0
- "Havasupai Tribe and the lawsuit settlement aftermath." <http://genetics.ncai.org/case-study/havasupai-Tribe.cfm> Also look at the "How do we decide?" section.
- Berryessa CM, Cho MK. 2013. Ethical, legal, social, and policy implications of behavioral genetics. *Annu Rev Genomics Hum Genet* 14:515-34.
- Vitti JJ et al. 2012. Human evolutionary genomics: ethical and interpretive issues. *Cell* 148:137-145.

Nov 25 - NO CLASS - THANKSGIVING -

WEEK 15:

Nov 30 - Personality and Genopolitics

- Chiao JY, Blizinsky KD. 2010. Culture-gene coevolution of individualism-collectivism and the serotonin transporter gene. *Proceedings Biol Sciences* 277:529-537.
- Eisenberg DTA, Hayes MG. 2011. Testing the null hypothesis: comments on 'Culture-gene coevolution of individualism-collectivism and the serotonin transporter gene'. *Proc Biol Sci* 278:329-32.
- Charney E, English W. 2012. Candidate genes and political behavior. *American Political Science Review* 106:1-34.
- Fowler JH, Dawes CT. 2013. In defense of genopolitics. *American Political Science Review*. 107:362-74.

Charney, E, English W. 2013. Genopolitics and the science of genetics. *American Political Science Review* 107:382-395.

Dec 2 - Intelligence?

Rushton JP et al. 2007. No evidence that polymorphisms of brain regulator genes *Microcephalin* and *ASPM* are associated with general mental ability, head circumference or altruism. *Biology Letters* 3:157-160.

December 9: FINAL EXAM PERIOD 2:00-4:30pm

Due: Final Presentations