Anthropology 240
Introduction to Molecular Anthropology, 3 credits
Fall, 2016

Instructor: Dr. Erin R. Vogel
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Office Hours: Monday 2:30 - 4:00 or by appointment
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Class time: Monday/Thursday: 9:15-10:35 AM
Class Location: BIO 205
Final Exam: To be announced

PREREQUISITE: 01:070:102 OR 070:212 or permission of the instructor

COURSE DESCRIPTION AND OBJECTIVES:

This course consists of an in-depth look at the genetics of human evolution and human diversity. There will be two parallel themes that run throughout the course. One theme is simply the "facts" of genetics as they are used to study human diversity and evolution. In this regard, half of the course will consist of lectures that lay out the basic theory and methods used by geneticists to examine topics such as *the origin of modern humans*, *heritability of intelligence, levels of genetic diversity between chimps and humans, genetic patterns of disease resistance,* etc. The other theme of the course pertains to the fact that human genetics often intersects with social issues and thus one should not study human genetics without considering the wider social implications of the subject matter. For example, (unfounded) genetic studies have attempted to show that some ethnic groups are inferior to others, while other genetic studies attempt to show that some traits are more "genetically determined" than others (e.g., intelligence). These topics, and others like them, carry hefty social implications; therefore it is important to study human genetics in a wider historical, social, and ethical context.

To this end, we will cover two major themes in this course. One theme is a straight-up, nuts-and-bolts approach to the theory and methods of human genetics; this theme will be covered via powerpoint lectures, exams, assignments, and discussions. The other theme will be covered by reading scientific papers that are relevant to the topic under discussion. The first day of class you will sign up for a topic of discussion. You and the person (people) you are presenting with will select two articles that focus on the topic of the week that have been published in scientific journals. You will provide me with these articles the week before your assigned discussion date, and you will do a 30-40 minute presentation on the article. You will present the following: Introduction, summary of the methods used, results, and discussion. You will also prepare 4-5 questions to ask the class (each – so each group may have 10-15 questions).

Learning Goals:

1) Gain knowledge on principles of genetics and how molecular methods are used in the field of biological anthropology
2) Gain an understanding on how scientists apply these methods to research questions
3) Gain an understanding of the social context of human genetics

REQUIRED TEXTS

1) Jobling, M.A., Hurles, M.E., and Tyler-Smith, C. 2013. Human evolutionary genetics: origins, peoples and disease **2nd EDITION!!!!!** Garland Science Press. **Please purchase the second edition and not the first – this one is much more up to date!**

RECOMMENDED TEXTS

2) Stone, L. and Lurquin, P.F. 2007. Genes, Culture, and Human Evolution. Blackwell Publishing.

In addition to these textbooks, students will be occasionally asked to read relevant articles from scientific journals and book chapters from other text to support the topics discussed in class. **These articles will be announced during the week prior to the reading, and made available on SAKAI**. I will also use SAKAI to post lecture notes (before the lecture when possible), important notices for the class, and grades. Thus, it is YOUR responsibility to check SAKAI regularly for readings and announcements.

Additional Recommended Texts

• *Human Genetics,* 9e, by R Lewis, 2010
• *Genetics: Analysis of Genes and Genomes*, *8e*, by Hartl & Ruvolo 2011,

Grading

Your final grade depends upon three examinations plus a team, group led discussion, and a take home problem set. Each exam will require you to understand how and why primates evidence particular behaviors in varying environmental contexts.

Grading

- You are required to attend every class meeting and participate in discussions.
- You are required to co-lead at least one discussion
- You are required to take two exams during the course (2 midterms)
- You are required to take a final exam (testing you on the lecture material)
- You are required to complete one take home problem set

Exam 1	20%
Exam 2	20%
Participation/Discussion leader (team project)	20%
Final Exam	30%
Take Home Problem Set	10%

Classroom etiquette

Attend all lectures. Reading, talking, eating, text-messaging on cell phone, leaving or packing up to leave before the professor has dismissed the class are inappropriate classroom behaviors & disruptive to other students. If for some reason you know that you will need to leave lecture early, let me know before class begins, *sit near the door*, & leave quietly & unobtrusively. If you come to class late, be sure to enter quietly & take care not to disturb the class in progress. Also, please make sure that your watch alarms, pagers, & cell phones do not go off during class.

Policy Regarding Missed Exams
Generally, makeup examinations are not given. If you would like to be considered for a makeup examination, the following three conditions must be met:

1. You must have a legitimate excuse for missing the original exam, e.g., illness, family emergency.
2. You must inform me by phone or in person within **48 hrs** before or after the scheduled exam date that you cannot take the exam. My phone has voice mail, so you can leave a message.
3. Within a **week** of the missed examination, you must provide me with a Physician's letter (for cases of illness) or Dean's Letter of Absence (for other cases) confirming that you had a legitimate reason to miss the examination. Note: Deans do *not* provide letters for minor problems. Thus, you need to have a major reason for missing the exam.

If all 3 of the above conditions apply, then you can do a makeup exam (either written, oral, or both)

It's ***your* responsibility to *note the date & time of all exams, including the final, & to plan accordingly*.** The dates & times are on the University webpage for Schedule of Final Exams (http://scheduling.rutgers.edu/). If you miss the exam, or any part of it, because you thought it was given on a different day or at a different time, you will not receive extra time or a make-up exam. So, take note now & mark your calendar, iPod, Blackberry, mobile phone, etc.

My computer crashed and I lost my homework!
Computer glitches (such as computers that die, hard disks that crash, flash drives that are lost, etc) will *not* be accepted as excuses for failure to do assignments on time, to study for exams, etc. It is *your* responsibility to ensure that everything you do on a computer is ***properly & frequently backed up*** so that failure of a computer has *no* effect on your academic performance.

Cell Phones
Phones must be ***turned off before entering*** lecture & exams. Phones that are on during exams potentially constitute an academic integrity issue.

Academic Integrity (http://academicintegrity.rutgers.edu/)
Rutgers has zero tolerance for cheating, plagiarism, etc. Consult the above webpage to learn more about what constitutes a violation of academic integrity and what sanctions are taken against violators.

Violations of academic integrity include: cheating, fabrication, plagiarism, denying others access to information or material, and facilitating violations of academic integrity.

A. Cheating
Cheating is the use of impermissible and/or unacknowledged materials, information, or study aids in any academic activity. Using books, notes, calculators, conversations with others, etc. when their use is restricted or forbidden, constitutes cheating. Similarly, students may not request others (including commercial term paper companies) to conduct research or prepare any work for them. Students may not submit identical work, or portions thereof, for credit or honors more than once without prior approval of the instructor to whom the work is being submitted for the second or subsequent time.

B. Fabrication
Fabrication is the falsification or invention of any information or citation in an academic work. "Invented" information may not be used in any laboratory report or other academic work without authorization from the instructor. It is improper, for example, to analyze one sample in an experiment and "invent" data based on that single experiment for several more required analyses. Students must also acknowledge the actual source from which cited information was obtained. A student should not, for example, reproduce a quotation from a book review and claim that the quotation was obtained from the book itself.

C. Plagiarism
Plagiarism is the representation of the words or ideas of another as one's own in any academic work. To avoid plagiarism, every direct quotation must be identified by quotation marks, or by appropriate indentation, and must be cited properly according to the accepted format for the particular discipline. Acknowledgment is also required when material from any source is paraphrased or summarized in whole or in part in one's own words. To acknowledge a paraphrase properly, one might state: to paraphrase Plato's comment... and conclude with a footnote or appropriate citation to identify the exact reference. A footnote acknowledging only a directly quoted statement does not suffice to notify the reader of any preceding or succeeding paraphrased material. Information that is common knowledge, such as names of leaders of prominent nations, basic scientific laws, etc, need not be cited; however, the sources of all facts or information obtained in reading or research that are not common knowledge among students in the course must be acknowledged. In addition to materials specifically cited in the text, other materials that contribute to one's general understanding of the subject may be acknowledged in the bibliography.

Sometimes, plagiarism can be a subtle issue. Students should be encouraged to discuss any questions about what constitutes plagiarism with the faculty member teaching the course.

D. Denying others access to information or material
It is a violation of academic integrity to deny others access to scholarly resources or to deliberately impede the progress of another student or scholar. Examples of violations of this type include giving other students false or misleading information; making library material unavailable to others by stealing or defacing books or journals; deliberately misplacing or destroying reserve materials; and altering someone else's computer files.

E. Facilitating Violations of Academic Integrity
It is a violation of academic integrity for a student to aid others in violating academic integrity. A student who knowingly or negligently facilitates a violation of academic integrity is as culpable as the student who receives the impermissible aid, even if the former student does not benefit from the violations.

If need any additional information regarding Rutger's academic integrity policy, please visit the following links:

http://academicintegrity.rutgers.edu/integrity.shtml

ASSIGNMENTS and DUE DATES:

GCHE= Genes, Culture and Human Evolution (Stone and Lurquin)
HEG = Human Evolutionary Genetics (Jobling, M.A., Hurles, M.E., and Tyler-Smith)

WEEK 1 (Sept 8)

Lecture 1: *Introduction to Molecular Anthropology- Why study human evolutionary genetics? (GCHE: Introduction and HEG: Chapter 1)*

WEEK 2 (Sept 12, 15)

Lecture 2: *Foundations of classical and molecular genetics* (GCHE: Ch 3; HEG: Chapter 2)

Lecture 3: *Foundations of classical and molecular genetics* (GCHE: Ch 3; HEG: Chapter 2) (continued)

Readings:

- Peruse "DNA from the Beginning": http://www.dnaftb.org, especially the sections on "Classical Genetics" and "Molecules of Genetics"
- Background information: Lewis R (2010) *Human Genetics* Chapters 5, 9, 10 (on Sakai)
- Roseboom TJ et al. (2011) Hungry in the womb: what are the consequences? Lessons from the Dutch famine. Maturitas 70(2):141-5.
- Supplementary; primary research reference: Heijmans BT, et al. (2008) Persistent epigenetic differences associated with prenatal exposure to famine in humans. PNAS 105:17046–17049.

- Complete the following "Virtual Labs":
  http://learn.genetics.utah.edu/content/labs/**extraction**/
  http://learn.genetics.utah.edu/content/labs/**pcr**/
  http://learn.genetics.utah.edu/content/labs/**gel**/
  http://learn.genetics.utah.edu/content/labs/**microarray**/

WEEK 3 (Sept 19, 22)

Lecture 4: *Discovering and assaying genome diversity* (GCHE: Ch 4; HEG: Ch 4)

Readings:

- Mardis ER (2011) A decade's perspective on DNA sequencing technology. Nature 470: 198-203

Sept. 22 Discussion/Group Presentation

- Hardy J & Singleton A (2009) Genomewide association studies and human disease. New England Journal of Medicine. 360:1759-68.
- Gurwitz D & Bregman-Eschet (2009) Personal genomics services: whose genomes? European Journal of Human Genetics. 17:883-889

WEEK 4 (Sept 26, 29)

Lecture 5: *Processes shaping genetic diversity: mutation and natural selection* (GCHE Ch 5; HEG Ch 5)

Readings:

- Lewis R (2010) *Human Genetics* Chapters 14-15
- Chaix R, Cao C, Donnelly P (2008) Is mate choice in humans MHC-dependent? PLoS Genet 4(9): e1000184.
- Piel FB, et al. (2010) Global distribution of the sickle cell gene and geographical confirmation of the malaria hypothesis. Nature Communications 104: doi:10.1038/ncomms1104

Lecture 6: *Processes shaping genetic diversity: drift, migration, and quantitative analysis of human genetic diversity* (GCHE Ch 6; HEG Ch 5)

WEEK 5 (Oct 3, Oct 6)

Lecture 7: *Making Inferences from Diversity (understanding prehistory via genetics)* (GCHE: Ch 4; HEG: Ch. 6)

readings

- Bradley BJ. (2008) Reconstructing phylogenies and phenotypes: A molecular view of human evolution. *Journal of Anatomy*. 212:337-353
- Cavalli-Sforza L.L. and Feldman, M.W. 2003. The application of molecular genetic approaches to the study of human evolution. *Nature Genetics* 33: 266-275.

Lecture 8 (Oct 1): *Humans as apes* (GCHE: Ch 12, section 12.1; assigned readings below)

- Gibbs RA, Rogers J (2012) Genomics: *Gorilla gorilla gorilla Nature* 483, 164–165
- Supplementary; primary research reference: Scally et al. (2012) Insights into hominid evolution from the gorilla genome sequence. Nature 483: 169–175

- Patterson, N. et al. 2006. Genetic evidence for complex speciation of humans and chimpanzees. *Nature* 441: 1103-1108.

- Prufer, K. et al. 2012. The bonobo genome compared with the chimpanzee and human genome. *Nature* doi 10:1038/nature11128.

WEEK 6: (Oct 10, 13)

★★★FIRST EXAM OCT 10 ★★★

Oct 13. Discussion/Group Presentation – Humans as apes? What distinguishes humans?

- Pollard KS (2009) What makes us human? *Scientific American*

- McLean CY, et al. Human-specific loss of regulatory DNA and the evolution of human-specific traits. *Nature*, 471, 216-219

- See also: Corbyn (2011) How the penis lost its spikes. Nature doi:10.1038: http://www.nature.com/news/2011/110309/full/news.2011.148.html

WEEK 7: (Oct 17, 20)

Lecture 9: *Human evolution and modern human origins* (GCHE: Ch 2, 9; HEG: Chapter 8)

Oct. 20 Discussion/Group Presentation – Out of Africa vs Multi-regionalism – what is the debate?

WEEK 8: (Oct 24, 27)

Lecture 10: *Ancient DNA: The Neanderthal and Denisovan genomes* (HEG Ch. 9 – starting on page 307)

Readings:

- Green R, et al. (2010) A draft sequence of the Neandertal genome. *Science*.710-722.
- Disotell (2012) Modern and archaic human genomics. *Yearbook of Physical Anthropology*.
- Gibbons (2012) A crystal-clear view of an extinct girl's genome. *Science* 337:1028-1029.
- Gibbons (2010) Close encounters of the prehistoric kind. *Science* 328:680-684.

DISCUSSION: Group Presentation Oct 27: *what can we learn from the Neandertal genome? **The Neanderthal and Denisovan genomes***

WEEK 9: (Oct 31, Nov 3)

Lecture 11: *Understanding Phenotypic variation: Heritability and selection* (HEG Ch 15)

DISCUSSION: Group Presentation Nov 3: *Does race exist?*

- Marks, J. 2009. Racist and Racial Anthropology. *Human Biodiversity.* Pp. 99-135.
- Jablonski NG & Chaplin (2010) Human skin pigmentation as an adaptation to UV radiation *PNAS* 107:8962-8968.
- Bamshad MJ & Olson SE (2003) Does Race Exist? *Scientific American*
- Supplementary; primary research reference: Lewontin RC (1972) The apportionment of human diversity. *Evolutionary Biology* 6: 381-398.

WEEK 10: (Nov 7, 10)

Lecture 12: *Human Origins and the Prehistory of Human Genes* (GCHE Ch 9; HEG: Ch. 9)

Lecture 13: *Genetic differences between human populations* (GCHB Ch 8; HEG Ch 10)

Readings:

- Tishkoff, S. A., et al. 2006. Convergent adaptation of human lactase persistence in Africa and Europe. Nature Genetics 39: 31-40.
- Perry, G.H. et al. 2007. Diet and the evolution of human amylase gene copy number variation. Nature Genetics 39: 1256-1260.
- Stix G (2008) Traces of a Distant Past. *Scientific American*
- Gibbons A (1997) Y chromosome shows that Adam was an African. *Science 278*: 804-805. http://www.sciencemag.org/content/278/5339/804.full
- Explore the Genographic Project Education site:
- http://education.nationalgeographic.com/education/collections/genographic/?ar_a=1

Exam review and catch up

WEEK 12: (Nov 14, 17)

★★★SECOND EXAM: Nov 14 ★★★

November 17: GUEST LECTURER: Dr. Jinchuan Xing, Department of Genetics, Rutgers University "Human variation and the genetic basis of high altitude adaptations in Tibetan populations".

WEEK 13: (Nov 21, THANKSGIVING)

Lecture 14*: Using genetics to understand prehistoric human expansions* (GCHE Ch 10, 11; HEG Ch 9-10) (continued)

WEEK 14: (Nov 28, Dec 1)

Lecture 15: *Evolutionary Medicine* (GCHB Ch 14; HEG Ch. 16)

Readings*:*

- Stearns et al. (2010) Evolutionary perspectives on health and medicine. *PNAS* 107: 1691-1695.
- Green ED & Guyer MS (2011) Charting a course of genomic medicine from base pairs to bedsides. *Nature* 470, 204–213
- Pritchard JK (2010) How we are evolving. *Scientific American.*

- Nesse RM & Williams GC (1998) Evolution and the origins of disease. *Scientific American.*
- Gibbons (2010) Tracing evolution's recent fingerprints. *Science* 329 (5993): 740-742

DISCUSSION: Group Presentation Dec 1: *Evolutionary medicine – what can we learn from an evolutionary perspective to medicine?*

★★★PROBLEM SET DUE: Nov 28 ★★★

WEEK 15: (Dec 5, Dec 6)

Lecture 16: *Identity and Identification* (HEG Ch. 18)

Lecture 17 Nov 26: *Molecular Ecology 1: Behavioral Ecology* (readings to be announced)

WEEK 16: (Dec 12)

Lecture 18: *Conservation Genetics: Applying molecular techniques to primate conservation biology (Readings: To be announced)*

OPEN for review or discussion (genes and culture)

Dates of topics, exams and discussions are subject to change if needed.