

HUMAN GENETICS AND MEDICINE - BIOL 72 - FALL 2023

LSB 105 - in person, in lab unless otherwise stated

ZOOM - synchronous meetings & TBD

Class and conference sessions using Zoom (or the equivalent) may be recorded

Tentative Lecture Schedule and Reading List

THIS SCHEDULE IS APPROXIMATE, AND SUBJECT TO CHANGE

dates	pre-Tuesday	topics
Aug. 24	CB: 1,3, 7.1 <i>for concepts</i>	Introduction to course - What is genetics? overview of genetic analysis, cell structure, reproductive strategies: sexual and asexual reproduction <i>*draw cell</i>
Aug 31	CB: 9-all; HG-1	Structure, synthesis, and function of genetic informational molecules: DNA, RNA, and protein; Genetic code & genetic information flow: DNA > RNA > protein <i>*debate I prep</i>
Sept. 7	CB: 9-all	DNA, RNA synthesis, replication, genetic information flow: DNA > RNA > protein genome structure; gene expression: mechanism and regulation <i>*debate I*</i>
Sept.10	LAST DAY TO DROP WITHOUT "W"	
Sept 14	EXAM I	
14	<i>*Coin flip I review math</i>	Techniques for investigating molecules of genetics; DNA sequencing; classic and modern approaches to gene mapping & characterization, prospective & retrospective analysis I
21	CB: 18-all; HG-2 ; HG-3	Reproduction and development: male & female human reproductive systems; development of ova & sperm; embryogenesis; chromosome structure & karyotype <i>draw mitosis& meiosis</i>
28	CB: 6-8 <i>*Coin flip II</i>	Heredity; classical (Mendelian) analysis & current interpretations; mapping genes I; analysis of crosses; pedigrees; prospective & retrospective analysis II
Oct. 5	CB:10-all HG-4	Investigating and manipulating molecules of genetics <i>* topics due *</i> DNA sequencing; modern approaches to gene mapping & characterization
Oct. 12	EXAM II	
12	CB: 10-all; HG-5 ; HG-6	Modern approaches to gene mapping & characterization: genomics; respective roles of experimental and computational genetics; mapping genes II
19	CB: 11	Mutation: what they are, their causes and their effects; variations in gene activity - regulation; human genetic defects; epigenetics; studying genetics in humans – beyond experimental systems <i>*outlines due*</i>
26	HG-7 ; HG-8	Producing large quantities of product (DNA, RNA, or protein); "genetic engineering" Manipulating DNA; DNA sequencing; human genome project; cutting and splicing
Nov. 2		Experimentally manipulated DNA; investigating gene function in development, disease, and inherited disorders; Interventive and forensic methodologies <i>* presentations*</i>
Nov. 9	EXAM III	
9	CB: 8-all	Extensions to Mendel: multiple genes, multiple alleles, sex-linkage, sexual dimorphism, etc.; pedigree analysis & heritability: using genetic approaches to predict risk <i>* presentations*</i>
16	HG-9 : select as needed	Measuring alleles & allele frequencies; future of human genetics analysis in medicine: DNA databases; legal & ethical considerations and concerns; cloning entire organisms & their parts; sharing organs & other body parts by transplantation <i>* presentations*</i>
Nov. 17	LAST DAY TO DROP WITH A "W"	
30		Preventing, curing, or reducing the impact of disorders; fertility and treating infertility; genetic counseling: what can we know, what can we predict; advice
Dec. 7		Biotechnology and society: genetic modifications in agriculture, environmental contexts, and medicine; computational genetics, proteomics; other "omes" <i>* "other paper" due *</i>
14	FINAL EXAM and discussion	

** see on-line syllabus and assignments in [Canvas](#) for explanations; assignments are for preparation for class; expect **quizzes** on readings or selected material as noted in class, and on [Canvas](#). See [website](#) for supplemental materials.
required: reading in on-line texts and other sources for class preparation & quiz assignments

please visit the [Canvas](#) site and Human Genetics [website](#)

Office Hours: **Th 10-11am, T-Th 10-11pm; MW 7-7:30 & 8:30-9 pm (on-line by arrangement) and by appointment**
Class and conference sessions using Zoom (or the equivalent) may be recorded

Quizzes, other assignments to be assigned, three midterm exams, and the final exam in this course will include problems, short answer and multiple-choice questions, and open-ended short essays. Each exam will be based primarily on the unit(s) covered since the last exam. However, the nature of this class, and our ability to discuss issues of human genetics is hierarchical and interdependent. Thus, to some extent, each exam is also cumulative as more is learned and students are able to re-examine earlier topics.

The (tentative) class schedule includes suggested reading for each week. This reading assignment is not exclusive, and is intended as a guide ONLY. Relevant material may be found elsewhere in the text, and other outside reading may also be assigned. Students are responsible for material included in assigned reading and all topics covered in class. ***Expect quizzes on weekly reading assignments or other topics as discussed in class, ordinarily during weeks without exams.*** Failure to complete any assignment (or arranged substitute assignment) will result in a ***failing grade for the course.***

Upon completion of this course, the student will be able to:

1. Describe the molecules involved in genetic information storage and utilization: DNA, RNA, and protein. **
2. Compare the structure and function of genetic information molecules. **
3. List several human genes and their functions.
4. Relate gene structure in mutated and wild-type forms to the effects of the mutation, for several representative human genes.
5. Describe and compare different approaches and methods for mapping human genes. **
6. Describe, and analyze strengths and limitations, of technologies for analyzing human genetic systems, including the Human Genome Project. **
7. Describe, and analyze strengths and limitations, of technologies for manipulating genetic systems that relate to human medical conditions. **
8. Propose and assess ethical arguments relating to the use of genetic manipulation in human medical practice.
9. Propose and assess ethical arguments relating to the use of human genetic analysis, for example its use in criminal investigation (forensic use), hiring practices, use by insurance companies to estimate risk.
10. Analyze genetic map information, pedigrees, and hereditary relationships.

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ACADEMIC HONESTY: IVC Regulations and guidelines regarding academic honesty will be followed and enforced. Cheating or plagiarism may result in an F on the assignment involved, the entire course, or, in even more serious cases, College disciplinary action may be taken. If you have any questions or confusion about what is considered honest (and what is ***not***) be sure to clarify these definitions right away! There are no “second chances”.

On all exams, quizzes, and other assessments for which “open resources” are not permitted, **ALL VOCABULARY TERMS AND CONCEPTS MUST BE THOSE USED IN THIS COURSE** – use of terminology from other sources will be interpreted as having come from sources found during the assessment and thus ***evidence of academic dishonesty.***

DO NOT CHEAT – DO NOT COPY FROM A BOOK OR THE WEB OR FROM EACH OTHER OR FROM A FRIEND – THIS MUST BE IN YOUR OWN WORDS – any suspicious work will earn zero (0) points which can only be earned back in a zoom oral conference to demonstrate that you have the information clearly in your own mind.

All IVC and SOCCCD regulations and guidelines will be followed and enforced.

See the [IVC Catalog](#) and [MySite](#) for details

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GRADING SYSTEM:

3 midterm exams @ 80 pts each	240	
comprehensive final exam @ 100 pts	100	
homework assignments, class-work, and quizzes	360	Total = 700 points

Final letter grades are assigned according to the following standards:

≥90% = A; 80-89% = B; 66-79% = C; 55-65% = D; <55% = F

If you miss a lecture exam, a make-up exam will be arranged, probably during final exam week. Be warned, this exam may be more difficult than the class exam. You may only make up one exam!

To receive **academic accommodations**, students need to privately present to me an Accommodation Form from the Disability Support Programs and Services (DSPS), per published college procedures. To obtain the Accommodation Form, please contact the DSPS office at (949)451-5630 or at ivcdsps@ivc.edu DSPS is located at SSC 171

NOTE: all papers including exams will be returned to student, or made available after grading, if possible. IVC regulations state that paperwork will be held for 3 months after the end of a semester. After that period, all uncollected work will be discarded. Please note that it is your responsibility to retain all of your records. No reconsideration of any grade is possible without evidence, and it is the student's responsibility to demonstrate the basis for any grade change request. **IT IS THE STUDENT'S RESPONSIBILITY TO RECOVER & RETAIN THESE MATERIALS!!**

IT IS THE STUDENT'S RESPONSIBILITY TO DROP A COURSE OFFICIALLY IF THE STUDENT WISHES TO AVOID AN "F". The instructor *may* drop students for non-attendance, but this is discretionary. **STUDENTS WHO DO NOT DROP, BUT DO NOT COMPLETE THE REQUIRED WORK, WILL RECEIVE "F".**

Students who are still officially enrolled past the Drop with a "W" Grade deadline and who have been excessively absent per the attendance policy may be assigned a FW grade. The FW counts the same as a F grade in the grade point average, but denotes you stopped attending class and did not fail due to lack of mastery of the course material.

**** The FW grade may impact eligibility for some types of financial aid.**

See the Financial Aid Office for more information. ***

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This is a "hybrid" class which means that some class sessions will be held on-campus, "in-person" while others will be "remote", ordinarily using ZOOM or a similar program. Dates for remote sessions are indicated on schedule; more remote sessions will be announced as determined to enhance instruction.

Students are expected to attend class regularly, whether remote or on campus.

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Required and optional reading [other sources may be used for specific assignments - TBA]:

- general resource - Schmeidler webpage: <https://anatandmore.us/kts-web/index.html>
- general resource - optional - <https://geneed.nlm.nih.gov/index.php>
- [CB] Concepts of Biology (2021) <https://openstax.org/details/books/concepts-biology>



General Background

- National Human Genome Research Institute, NIH: <https://www.genome.gov/about-genomics/fact-sheets/A-Brief-Guide-to-Genomics>
 - National Institute of General Medical Sciences, NIH: “genetics”: <https://nigms.nih.gov/education/fact-sheets/Pages/genetics.aspx>
 - Progress Educational Trust (PET); 140 Gray’s Inn Road London WC1X 8AX www.progress.org.uk
 - American Society of Human Genetics: <https://www.ashg.org/>
 - MedlinePlus: “genetics”: <https://medlineplus.gov/genetics/>
 - Centers for Disease Control and Prevention, CDC: “genetics”: <https://www.cdc.gov/genomics/about/basics.htm>
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- [HG-1]: listen to two (2) segments of Airtalk from April 23, 2018: Twins: <https://www.kpcc.org/show/airtalk/2018-04-23/two-sets-of-identical-twins-swapped-at-birth-reunited-25-years-later> and DNA sequencing: <https://www.kpcc.org/programs/airtalk/2018/04/23/62694/the-impending-ubiquity-of-dna-sequence-for-infants/>
 - [HG-2]: Effects of woman’s age: (a) <https://www.stanfordchildrens.org/en/topic/default?id=pregnancy-over-age-30-90-P02481> (b) <https://www.npr.org/sections/health-shots/2014/07/07/328132687/with-gene-disorders-the-mothers-age-matters-not-the-eggs> (c) <https://www.medicalnewstoday.com/articles/317861> & follow links within the articles; also find your own sources for further reading
 - [HG-3]: Effects of man’s age: & follow links within the articles; also find your own sources for further reading (a) <https://fivethirtyeight.com/features/are-older-mens-sperm-really-any-worse/> (b) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7006092/#:~:text=Paternal%20age%20increases%20the%20frequency,frequently%20in%20advanced%20father's%20age> and/or <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7006092/#:~:text=Paternal%20age%20increases%20the%20frequency,frequently%20in%20advanced%20father's%20age>
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Probability & Statistics [HG-9 – use as needed]

- <http://journal.frontiersin.org/article/10.3389/fgene.2014.00136/full>
 - <https://www.frontiersin.org/research-topics/1325/dna-statistics-and-the-law-a-cross-disciplinary-approach-to-forensic-inference>
 - or <http://www.e-booksdirectory.com/details.php?ebook=11122>
 - Probability resources (just a start): - optional - <https://www.mathsisfun.com/data/probability.html>
 - Simple probability <http://gel.msu.edu/DNAroulette/more.html> DNA roulette game
 - Griffiths AJF, Miller JH, Suzuki DT, et al. An Introduction to Genetic Analysis. 7th edition. New York: W. H. Freeman; 2000. <http://onlinebooks.library.upenn.edu/webbin/book/lookupname?key=Griffiths%2C%20Anthony%20J%2E%20F%2E>
 - **Chi-square test.** available from (for example): (a) https://www.jmp.com/en_be/statistics-knowledge-portal/chi-square-test.html (b) <https://soc.utah.edu/sociology3112/chi-square.php> (c) <https://www.khanacademy.org/math/ap-statistics/chi-square-tests> (d) <https://www.shmoop.com/study-guides/biology/genetics/chi-squared-test>
 - Using genetic ratios (a) <https://www.biologyonline.com/dictionary/phenotypic-ratio> (b) <https://sciencing.com/determine-genotypes-5328829.html>
 - <https://www.shmoop.com/study-guides/biology/genetics>
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Methods

- [HG-7]: DNA cloning <https://www.nature.com/scitable/topicpage/the-biotechnology-revolution-pcr-and-the-use-553/>
- [HG-8]: PCR <https://www.genome.gov/genetics-glossary/Polymerase-Chain-Reaction>

CRISPR/Cas9

- [HG-4]: Doudna interview <https://www.ibiology.org/bio-films/conversations-in-science-with-jennifer-doudna.html>
- [HG-5]: Jennifer A. Doudna and Charles A. Gersbach. 2015. Genome editing: the end of the beginning. *Genome Biology* 16:292 <https://rdcu.be/b597x>
- [HG-6]: <https://www.nbcnews.com/mach/science/gene-editing-breakthrough-could-change-life-earth-ncna772521>

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