BIOLOGY 234
Fundamentals of Genetics
Monday-Friday, 11:00am to 1:00 pm
Rm 200 Wesbrook
June 4 – June 29, 2012

Instructors: **Dr. Pam Kalas** (kalas@zoology.ubc.ca BIOSCI 2506)
Dr. Jennifer Klenz (jklenz@mail.ubc.ca BIOSCI 1003)
Course Coordinator: Dr. Craig Berezowsky (craigber@mail.ubc.ca BIOSCI 2519)
Bring all administrative problems regarding exams and tutorials to Dr. Berezowsky.
Genetics Teaching Postdoc (from CWSEI): **Dr. Lisa McDonnell** (lmcdonne@zoology.ubc.ca BIOSCI 2071)
Teaching Assistants: Rachel BernelotMoens, Stella Chun, Yuanyuan Liu, Julie Yee-Law

The Major Theme:
This course examines fundamental genetic principles: mutation, phenotype, segregation, gene interaction and complementation as well as many applications of these fundamentals.

Text:
- **Griffiths, A.J.F., Wessler, S.R., Carroll, S.B. and Doebley, J.** 2011. **Introduction to Genetic Analysis, 10th Edition**. W.H. Freeman and Company, New York.
- Available at the UBC Bookstore in either looseleaf, hardcover, and/or as an ebook. (You can not sell softbound looseleaf copies back to the bookstore, but are free to sell them privately to other students as we will use the book again).
- Copies of texts are available for short term loan in the Genetics Help Office (Room 2521).

We will be piloting several chapters of another ebook for free. Your instructors will tell you how to access the free e-book chapters as necessary.

Vista: Course materials will be provided on-line using UBC's VISTA interface. You can use the VISTA discussion board to get assistance from your fellow classmates outside of class and tutorial

Tutorials: 1:00pm-3pm Mon-Thursday Attendance in tutorials is mandatory and vital to your success in this course.

Evaluation*: (sheet of notes allowed for examinations)

Intro Quiz	Fri June 8th 25 min	(5%)
Midterm 1	Fri June 15th 60 min	(15%)
Midterm 2	Fri June 22nd 70 min	(15%)
Final	Sat June 30th 3 hrs	(50%)
Tutorials, in-class activities, etc.		(15%)

* Tentative, and possibly subject to change

Missed quizzes and exams: Makeup tests will not be available for quizzes or the midterm; instead the missed marks will be transferred to the final exam. However students who do not fulfill the course requirements during the term (including not writing the midterm) and then miss the final exam will be deemed ineligible for a deferred final

DATE:	TOPICS	TEXT READINGS (Griffiths 10th ed.)**See Reading Assignment Package for more details**
WEEK 1	**PHENOTYPE (and genotype) – Reverse Genetics**	

Monday June 4th	**Introduction/ Representation in Genetics** *Fun Quiz* Administrative details *Concept Inventory Quiz* (counts for marks) Anatomy of chromosomes and genes Ways of representing chromosomes, interpreting drawings of chromosomes Relationships between genes, chromosomes and DNA Genome organization in eukaryotes (vs. prokaryotes)	**Complete the Day 1 reading and the online quiz on VISTA by Sunday June 3, 11:59pm** Introduction to Genetic Analysis, Chapter 1 pg 1-14 Logon to Mastering Genetics e-text and read Sections 1.2 and 1.3 of Chapter 1
Tuesday June 5th	**Phenotype** What is phenotype? → many examples, not limited to macroscopic traits Phenotype =Genotype + environment → examples of environmental influences Experimentally determining whether a phenotype is due to environment or genetics Anatomy of a gene Review different types of mutations	**Complete the pre-reading assignment and the online quiz on VISTA by Monday June 4th, 11:59pm** Review mutations on pg 12-14, 40 Review Figure 9.2 (pg 300) in the e-text from Mastering Genetics Chapter 19 pg 683-685 interaction between genetics and environment More on the role of genes and environment: http://www.nature.com/scitable/topicpage/phenotypic-range-of-gene-expression-environmental-influence-581
Wednesday June 6th	**Reverse Genetic Analysis** Predicting functional effects of various mutations in various parts of a gene at the RNA and protein levels (eg. Loss of function) Effects on phenotype of combinations of alleles from a known gene in diploid cells → predict dominance/recessiveness.	**Complete the pre-reading assignment and the online quiz on VISTA by Tuesday June 5th, 11:59pm** Chapter 2, Page 44-46 "Alleles at the molecular level" Chapter 6, page 211-214 "Interactions between the Alleles of a Single Gene…" Chapter 16 pages 553-558 and pg 560-562
Thursday June 7th	**Allele relationships** More on dominance/recessiveness Incomplete dominance, co-dominance and more complex phenotypes Verifying predictions of allele relationships empirically	**Complete the pre-reading assignment and the online quiz on VISTA by Wed June 6th, 11:59pm** Chapter 6, page 214-218
Friday July 8th	**QUIZ 1 (5%)** (on the material until the end of Thursday June 7th) **Mitosis** What happens to chromosomes during the cell cycle and mitosis	No reading quiz.
WEEK 2	**Segregation and genetic analysis Part I (Forward genetics)**	
Monday June 11th	**Meiosis** All you really need to know, and never forget, about meiosis	
Tuesday June 12th	**Extensions of mitosis and meiosis** Follow alleles on the same or different chromosomes; in a multiply heterozygous cell through the cell cycle and meiosis Mutation in somatic vs. germ cells Crossovers in meiosis and consequences to genotypes of gametes	
Wednesday June 13th	**Mendel and Meiosis** Mendel's laws are a consequence of meiotic events Law of segregation: compare and contrast the possible outcomes of one meiosis vs. many meioses (with and without crossing over) Predict genotypic frequencies of gametes from parents' genotypes (and the reverse)	
Thursday June 14th	**Part I of genetic analysis** One gene, two alleles simple dominance/recessiveness inheritance (P, F1, F2, testcross) One gene, two alleles with non-simple relationship Two genes (one controlling each trait, unlinked One sex-linked gene Two genes, one sex-linked, one autosomal….	Ch 2 sections 2.4 and 2.5 p 46-54
Friday June 15th	**MIDTERM 1 (15%)** (on the material from Friday June 8th to the end of Thursday June 14th) Introduction to pedigrees	

Please note this schedule is tentative and subject to change.

WEEK 3	**Genetic Analysis Part II, Complementation and Gene Interaction (Forward Genetics)**	

Monday June 18th	**Linkage** Recognize non-Mendelian segregation in test crosses and dihybrid crosses Connect segregation of linked genes to crossing over Relationship between map distance, chance of crossing over and expected frequency of gamete genotypes Importance of allelic configuration (cis vs. trans) if a heterozygote to predict gamete frequencies Use empirical data to determine map distance vs. when given map distance predict the outcome of a given cross (ie. proportion of progeny with each genotypic/phenotypic combination)	

Tuesday June 19th	**Complementation and Gene interaction** Determining how many genes control a particular trait How the complementation test works including mechanistically/molecular level When two mutants with similar phenotypes complement each other in the F1, we often see modified 9:3:3:1 in the F2 =genetic interaction	
Wednesday June 20th	**Gene Interaction Continued** Examples of genetic interactions (expected outcomes from genetic crosses and examples of underlying molecular mechanisms. Predict the outcome knowing what the mechanism is and conversely propose a mechanism when given the outcome of a cross	
Thursday June 21st	**Further pedigree analysis and Review** More sophisticated pedigree analysis In-class genetic analysis problems to tie it all concepts together and prepare for Midterm 2	
Friday June 22nd	**Midterm 2 (15%)** Midterm 2 debriefing	
WEEK 4	**Special Topics (Extensions of previous ideas)**	
Monday June 25th	**PCR and Forensics** Introduction to Polymerase Chain Reaction Considering Allele frequencies in a population Forensic Analysis	
Tuesday June 26th	**Cancer** The genetics of somatic cells and how somatic mutations can lead to cancer (two-hit hypothesis) Types of mutations leading to cancer in oncogenes vs tumour suppressor genes	
Wednesday June 27th	**Issues of ploidy** (in plants and animals) Changes to the number of chromosome sets (=euploidy) Aneuploidy as a consequence of nondisjunction When is aneuploidy tolerated Gene balance	
Thursday June 28th	**Fun phenotypes and Gene Regulation** Different types of genes and mutations in those genes that lead to the fun phenotypes (introduced on Day 1) Introduction to gene regulation	
Friday June 29th	**Review** for final exam	
Saturday June 30th	**Final Exam (50%)**	