2015 Winter Biology 2171: Genetics Course Outline

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Lecture
Location: ATAC 2001
Time: Monday & Wednesday: 10: 00-11: 30 am
Duration: 2015/01/05 - 2015/04/07
Credits: 0.50

TA: Yagya Paudel
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Office Hours: CB4016, Monday, 11:30 am to 12:30 pm, or by appointment

Textbook: Genetics from genes to genomes, 4th Edition, by Leland Hartwell, Leroy Hood, Michael Goldberg, Anne Reynolds, Lee Silver (Required）

Schedule (January 5: Monday semester starts, April 7, 2014: Tuesday, semester ends)

January 5: Introduction and Chapter 1 Genetics: The study of biological information
January 7: Chapter 2: Mendel's principles of heredity
January 12: Chapter 2: Mendel's principles of heredity
January 14: Chapter 2: Mendel's principles of heredity
January 19: Chapter 3: Extensions to Mendel's Laws
January 21: Chapter 3: Extensions to Mendel's Laws
January 26: Chapter 3: Extensions to Mendel's Laws
January 28: Chapter 4: The Chromosome Theory of Inheritance
February 2: Chapter 4: The Chromosome Theory of Inheritance
February 4: Chapter 4: The Chromosome Theory of Inheritance
February 9: Chapter 5: Linkage, Recombination, and the Mapping of Genes on Chromosomes
February 11: Mid-term Exam One (Chapters 1-4) [25%] 75 minutes
February 16: Family Day, no class
February 18: February Break (February 17-20), no class
February 23: Chapter 5: Linkage, Recombination, and the Mapping of Genes on Chromosomes
February 25: Mid-term Exam Two (Chapters 1-4) [25%] 75 minutes
March 2: Chapter 5: Linkage, Recombination, and the Mapping of Genes on Chromosomes
March 4: Chapter 6: DNA: Structure, Replication, and Recombination
March 9: Chapter 6: DNA: Structure, Replication, and Recombination
March 11: Chapter 6: DNA: Structure, Replication, and Recombination
March 16: Chapter 7: Anatomy and Function of a Gene: Dissection Through Mutation
March 18: Chapter 7: Anatomy and Function of a Gene: Dissection Through Mutation
March 23: Chapter 7: Anatomy and Function of a Gene: Dissection Through Mutation
March 25: Chapter 8: Gene Expression: The Flow of Information from DNA to RNA to Protein
March 30: Chapter 8: Gene Expression: The Flow of Information from DNA to RNA to Protein
April 1: Chapter 8: Gene Expression: The Flow of Information from DNA to RNA to Protein
April 7: Last class: Questions and Answers in CB 4016

Additional Requirements: (1) Preview the textbook and think about the questions in the chapter(s) before the applicable class. (2) Review the textbook and try to answer the questions in the chapter(s) after the class. (3) Read the entire lectured chapters of chapters 1-8 for exams. (4) Students must understand well for all the solved problems questions in chapters 2-8.

Grading Scheme (Powerpoint slides do not cover all the information for exams, so intensive reading and understanding of the whole lectured chapters are necessary).

1. Two take home exams/homework assignments [30%]: 20 essay questions are listed below for chapters 2-7 (1.5% for each question). The deadline of Assignment One for chapters 2-4 is February 11, 2015 at 23:59 pm. The deadline of Assignment Two for chapters 5-7 is March 30, 2015 at 23:59 pm. A 25% deduction is applied to late submission of per day. The assignments should be placed in the lockable black mailbox outside Room CB 3037 (on the top of the white desk). Assignments must be printed. The standard answers may be provided after 4 days of the deadlines.
2. Mid-term exams [30%]: We will have two mid-term exams (one will be before the February Break and the other will be after the February Break, the two mix-term exams cover the same chapters 1-4 and takes 30% each, students can just write one or write both exams, your higher marks will be selected if you write both exams. Both exams may include (1) Fill in the blank questions, (2) Essay questions, (3) Multiple choice questions, (4) True/False questions, etc. TA will help administer and mark the exams. Duration is 80 minutes.
3. Final exam (Chapter 5-8) [40%]. Exam may include (1) Fill in the blank questions, (2) Essay questions, (3) Multiple choice questions, (4) True/False questions, etc. Duration is 3 hours.
4. Bonus points: Certain amount of bonus points will be awarded by pop quiz or class attendance.

Biology 2171 (Genetics) 2015 Winter Term Assignments

Two assignments (20 essay questions from chapters 2-7, 1.5% for each question) [30%]. The deadline of Assignment One for chapters 2-4 is February 11, 2015 at 23:59 pm. The deadline of Assignment Two for chapters 5-7 is March 30, 2015 at 23:59 pm. A 25% deduction is applied to late submission of per day. The assignments should be placed in the lockable black mailbox outside Room CB 3037 (on the top of the white desk). Assignments must be submitted by printed copies.

Assignment #1 from chapters 2-4

[1] In corn liguleless, (l^1) is recessive to ligules (L^1) and a green leaf (G) is dominant to the normal non-green (g). If a testcross is performed with a plant heterozygous for ligules and green leaves, what would be the phenotypes and genotypes of the progeny? (Chapter 2)

[2] Short hair in rabbits is produced by a dominant gene (l^+) and long hair by its recessive allele (l). Black hair results from the action of a dominant gene (b^+) and brown hair from its allele (b). Determine the genotypic and the corresponding phenotypic ratios of the F_2 offspring, beginning with a parental cross of a female rabbit with brown hair and a male rabbit with long hair. Assume that the P female is homozygous for short hair and the P male is homozygous for black hair. (Chapter 2)

[3] In corn, three dominant genes are necessary for aleurone color. The genotype B__D__R is colored. Any homozygous recessive for one gene is colorless. Predict the genotypes and phenotypes of the offspring of the cross BbDdRr × BbDdRr. (Chapter 3)

[4] In rats, the gene for the pigment (P) is dominant to no pigment (p). The gene for black (B) is dominant to the gene for cream (b). If a pigment gene (P) is absent, genes B and b are inoperative. Predict the genotypes and phenotypes of the F_2 of a parental cross between a homozygous black rat and an albino homozygous for cream. (Chapter 3)

[5] You have obtained an interesting flower for your garden from your neighbor. The neighbor has given you two pure lines of the plant, one with red flowers and one with yellow flowers. You decide to cross them and find that you obtain all orange flowers. The curious molecular geneticist in you decides to test two independent hypotheses: Hypothesis 1: Incomplete Dominance; Hypothesis 2: Recessive Epistasis. The first step in your test is to self the F_1 orange plants, which you complete only to find that the results do not statistically distinguish the two hypotheses. a) What ratio of yellow, orange, and red would you expect in the F_2 population for each hypothesis and b) what crosses would you complete next to definitively test your two hypotheses? (Chapter 3)

[6] Bridges crossed white-eyed female and red-eyed male fruit flies and recovered rare exceptional white-eyed females and red-eyed males in addition to the usual red-eyed females and white-eyed males. How did Bridges' observations lend support to the chromosome theory of inheritance? (Chapter 4)

[7] In Drosophila, white eyes (w) and yellow body (y) are both recessive X-linked mutations. The wild type alleles, w+ and y+, control red eyes and dark body color, respectively. If a homozygous yellow body, red-eyed female is crossed with a dark body, white-eyed male, and F1 progeny are interbred, what will the phenotypes and ratios of the F1 and F2 be? (Chapter 4)

[8] In crosses of white-eyed *Drosophila* females with red-eyed males, Bridges recovered white-eyed daughters and red-eyed sons at a rate of around one per 2,000 offspring. (Most of the offspring were white-eyed males and red-eyed females.) He hypothesized that these exceptional progeny resulted from nondisjunction of the X chromosomes in meiosis in the female. Why did he suspect that nondisjunction was occurring in the female parent? What types of progeny would result from nondisjunction in the male parent? (Chapter 4)

Assignment #2 from chapters 5-7

[9] C. Stern studied recombination between two homologous X chromosomes in *Drosophila* in which one chromosome had two cytologically visible abnormalities at opposite ends. What did he find? (Chapter 5)

[10] When setting up crosses to determine map distances, why do geneticists prefer to cross the hybrid individuals to individuals homozygous for the recessive alleles in the cross? (Chapter 5)

[11] The Holliday model of recombination has been modified. The current model, termed the consensus model, is now consistent with current research. What are the five properties of recombination, as they are now understood? (Chapter 6)

[12] What are the eight steps of recombination (crossing over)? (Chapter 6)

[13] How is it possible for an individual to be XX male or XY female? (Chapter 6)

[14] Griffith found that smooth (S) forms of *S. pneumoniae* have a polysaccharide capsule and rough (R) forms do not. Only S forms cause infection. Briefly describe how Griffith demonstrated transformation using live R form and heat-killed S form bacteria. (Chapter 6)

[15] When Meselson and Stahl performed the experiment that showed that replication is a semiconservative process, they utilized E. coli, and various isotopes of nitrogen (15N and 14N). Explain briefly what their results would have been if DNA replicated conservatively (Chapter 6)

[16] You are a researcher at a new Biotech company. You have been asked to devise a scheme to use bacteria to produce protein X, which has been found important in cancer treatment in humans. Protein X is not a native bacterial protein. Briefly describe your scheme. (Chapter 6)

[17] How is DNA altered by hydrolysis, radiation, UV light, and oxidation respectively? (Chapter 7)

[18] What technique would you use to test the hypothesis that multiple drug resistant bacterium exists in a heterogeneous population? (Chapter 7)

[19] Chemical X has just been screened using the Ames test. A total of 5,000 bacteria were tested against 0.001 M, 1 M, 0.1M, and 1M concentrations for which 4, 1, 0, and 200 colonies grew respectively. Control plate of minimal media supplemented with histidine had 5,000 colonies while minimal media alone had only two. Interpret these data. (Chapter 7)

[20] The local pet store received several shipments of albino ferrets. You choose two males and two females as pets one breeding pair from the same litter, one from two different litters. When your ferrets' litters are born, one litter has normally pigmented offspring. State which offspring are albino and which are pigmented and explain why? (Chapter 7)