**Universidad de Puerto Rico**
**Recinto Universitario de Mayagüez**
**Colegio de Artes y Ciencias**
**Departamento de Biología**
**Programa de Biología, Pre-médica, Microbiología Industrial**

# Oficial Syllabus

# Advanced Genetics
# BIOL 6617

| **Credit hours:** 3 | **Contact hours:** 5 |
|---|---|
| **Prerequisites:**<br>Biol 3300 | **Corequisites:**<br>None |
| **Course description in Spanish:** | |
| **Course description in English:**<br>"Discussion of selected topics in genetics."<br>This course provides exposure to advanced topics in the field of genetics which are not otherwise covered in departmental courses. An emphasis is given to the area of complex genetic interactions between genes and their environment, and how these interactions produce their resultant phenotypes in Eukaryotes. | |
| **Objectives:**<br>The student will learn the different modes of inheritance and the kinds of interactions that occur between them. They will describe and discuss this material in detail on two essay lecture exams, demonstrating their mastery of the material. Laboratory reports will briefly explain the background of the experiment, give the materials and methods, results, and a discussion and analysis of those results. The student may write in English, Spanish or French. | |

**Outline of content:**

| ***Topics to be covered*** | ***Contact hours*** |
|---|---|
| 1. Interactions between genes: complete dominance, incomplete dominance, epistasis, $F_1$ and $F_2$ ratios, developmental and biochemical pathways and their implications, typical genetic crosses (Punnett squares, algebra, probabilities). Examples from domestic organisms: (a) eye pigments in Drosophila (brown ommochrome and red drosopterin pathways), (b) detailed genetics of mammalian coat colors with an emphasis on cats and mice (agouti series "A", brown series "B", tyrosinase series "C", dilution series "D", extension series "E", melanin inhibitor "I", orange "O", piebald spotting "S", dominant white "W"). Developmental and biochemical mechanisms are emphasized. | 12 |
| 2. Polygeny: introduction, multiple factor inheritance, human skin color, medical examples, variable gene pools. | 1 |
| 3. Genetic control of development and differentiation: emphasizes critical periods of development, triggers (inducers), canalization, threshold effects, phenocopies. | 4 |

| | |
|---|---|
| 4. Biochemistry of allozyme variations | 0.5 |
| 5. The problem of selection for desired traits and inbreeding depression: Why inbreeding leads to increased homozygosity. Why increased homozygosity (reduced genetic variability) leads to inbreeding depression. | 2 |
| 6. Genetics of Domestication: Genetically determined behavior of domesticated mammals, evolution of biochemical, physical and behavioral traits (cats, dogs, horses, Siberian foxes, mice). | 3.5 |
| 7. Genetics of human personality, behavior and intelligence | 1 |
| 8. Duplicate genes: origin, adaptive and evolutionary importance. Consider the hemoglobin family in detail. | 1.5 |
| 9. Genetic control of sex determination (5 hrs.): single locus systems, polygenic and multiple allelic systems, sex chromosomes, haplo-diplo system. | 5 |
| 10. Polyploidy in evolution: definitions, Cytogenetic observations in meiosis, fertility, chromosome homology, homeology. Physiological effects - cell surface/volume ratios, cell number, size. Biochemical plasticity - increased dosage, gene control of expression, alleles with increased range of effects, diploidisation. Polyploidy in plant evolution and systematics. Polyploidy in animal evolution and cytogenetics. Time varies according to the interests of the class. | 3 |
| | |
| Laboratory Exercises: (the number of hours is very approximate, as the two experimwents are run some what silmultaneously, with two weeks needed between generations of flies. The students will come in early in some mornings to clear the culture vials in order to collect virgin females.) | |
| 1. The biology and culture methods of Drosophila melanogaster. | 3 |
| 2. Phenocopy experiment. The environment in manipulated in order to induce phenotypic changes which mimic the effects of mutant genes. In lecture, this environment-gene interaction is related to threshold effects and the availability of genes to selection. | 15 |
| 3. Mating preference experiment. Demonstration of mate selection in Drosophila, and its potential effect on gene frequencies. | 18 |
| The two lecture exams are given during the laboratory periods. | 6 |
| | |
| **Total hours: (should be equivalent to the contact hours of the course)** | 75 |

**Instructional strategies**:

☒lecture ☐discussion ☐computation ☒laboratory

☐seminar with formal presentation ☐seminar without formal presentation ☐workshop

☐art workshop ☐practicum ☐trip ☐thesis ☐special problems ☐tutorial

☐research ☐other (specify):

**Minimal resources available:**

Transparency projector, over-head projector, Drosophila culture media, vials, and plugs, constant temperature chamber, refrigerator, chemical reagents, chemical balance, glassware.

**Evaluation strategies and their relative weight:**

| | **Percentage** |
|---|---|
| ☒written exams | **67.7** |
| ☐oral reports | |
| ☐monographs | |
| ☐portfolio | |
| ☐reflexive diary | |
| ☒other (specify): laboratory reports and work | **33.3** |
| | |
| **TOTAL: 100%** | **100** |

**Grading system:**
☒quantifiable (letter grade) ☐ not quantifiable

**References:**

The professor has prepared an extensive set of lecture notes on the topics. He gives a master set to the students, which they have photocopied for their own use. These notes are drawn from textbooks, reference books and original journal articles. Some of it is necessarily old, and some of it is very recent. New material is added each time the course is given. Representative journals include: Journal of Heredity, Genetics, Trends in Genetics, Nature, Nature Genetics, Nature Reviews Genetics, Evolution, Bioessays, Current Opinions in Genetis & Development, and Genetica, all of which the professor has as hard copies and internet access. Annual Review of Genetics is also used.

Después de identificarse con el profesor y la institución, los estudiantes con impedimento recibirán acomodo razonable en sus cursos y evaluaciones. Para más información comuníquese con Servicios a Estudiantes con Impedimentos en la Ofician del Decano de Estudiantes (Q-019), 787-265-3862 ó 787-832-4040 x 3250 ó 3258.

Attachments included:
Yes ☐
No ☒