

# **Genetics PCB 3063 – B51**

## **Florida International University**

### **Fall 2015**

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#### **Where do we meet?**

**Course:** Tuesday and Thursday, 9:30 AM – 10:45 AM, Glen Hubert Library 265

**Office hours:** Office hours (ACI 383A):

Mon/Wed 11:00 AM – 1:30 PM

Tue/Thur 2:00 -4:00PM (except for the 2nd Thursday of the month) or by the appointment

#### **What will you learn in this course?**

Have you ever thought about what determines who you are, how do you look, diseases you might be predisposed to? Why do you look like your brother, but not your sister? What is heredity and how are certain traits passed from generation to generation? You are hearing about genetics and genes almost every day in TV, news papers, science fiction movies, but do you really know what genes are? How do they work? Is who you are and how do you look determined just by your genes? Do genes shape populations? How can we study them? How can we harness genes to design new drugs, develop new diagnostic methods, or generate specific tissue from stem cells? Are you curious what the answers might be? If yes, you are in the right place, since in this course we will begin to explore questions such as these. We will also focus on the development of practical skills that will allow you to predict outcomes of various genetic crosses, develop analytical skills, and apply practical wisdom in your everyday life.

#### **What are the major goals of this course and how can they help you?**

After completing this course you will be able to answer the outlined questions and to:

**1. Define the mechanisms by which genetic information is transmitted to new cells in the process of cell division and gamete formation.** You will be able to explain how cells in our tissues assure that all new cells replacing dead cells have identical genetic information; what are the mechanisms enabling formation of sperm and eggs with only half of the chromosomes that can then fuse and form a cell with diploid number of chromosome; how partitioning of chromosomes during meiosis establishes genetic variability of the offspring. Chromosomes are vehicles carrying genes to their destinations and understanding their behavior during cell division will give you the foundation to build on while studying the principles of heredity.

**2. Identify and interpret the basic principles of heredity and major extensions and modifications of these principles.** You will be able to explain why you look like one of your siblings, but not the others; why certain traits disappear in the offspring, but re-appear again in the next generation; why boys are more prone to hemophilia and colorblindness than girls; as well as other important questions about

heredity. Why should you care? If you want to understand how cells work, how our immune system works, etiology of many diseases and disorders, developmental biology, or the evolution, you have to understand basic principles of heredity.

**3. Apply principles of heredity to solve genetic problems and predict outcome of genetic crosses.**

If you understand principles of inheritance you can actually predict what would happen if for example two healthy people who both carry a mutation have a child, or what is the probability that children of a person with certain disease will be healthy. You can also design a breeding strategy to obtain desired traits in the animals and plants.

**4. Define and describe the molecular mechanisms by which genetic information is transferred.**

To fully understand what determines who we are and how we evolved, you will have to go deep into genes encoded in our DNA; our "blue prints" containing the code of life. You will be able to recognize their language and the mechanisms by which they determine every basic structure in our cells, tissue, and body.

**5. Define how gene expression is regulated.** Every cell in our body, except for gamete and lymphocytes, possess the same genes, e.g. "blue print". How is it then possible that cell in different tissue looks and work differently? How the same blue print generates such difference? How we all starts as one single cell and growth and differentiate into an individual with such variety of cells and tissues? The answer lies in a tightly regulated differential expression of our genes and you will be able to define such mechanisms.

**6. Define epigenetic and its role in inheritance.** What is epigenetic and how does it affect inheritance? Can your diet or chemicals in the environment affect your health by altering gene expression without causing mutations? How your diet can affect health of your grandchildren? How can epigenetic changes affect cancer development? You will learn that modification of chromatin and histones, such as methylation and acetylation, are some of the epigenetic mechanisms that may give you the answers to such questions.

**7. Recognize and interpret the outcomes of genetic mutation and identify the genetic nature of cancers.** What are mutations and how are they generated? Why you shouldn't be exposed to certain chemicals and radiation? Why is intensive tanning linked to skin cancer and smoking to lung cancer? What is cancer and how does it relate to our "blue print"? Are mutations always deteriorating or can they help us? How mutations drive evolution? What are "jumping genes" and how can they trigger mutations?

**8. Explain how gene pool of a population shapes it and changes with time.** What defines population? What does isolation do to populations? Why many diseases rare in large populations are common in small inbreeding populations? Why small population of protected endangered animals are still in danger of extinction? How can we rescue such populations? How natural selection works? These are just few questions highly relevant to our world in which many animal species are disappearing and those who survived in small isolated populations are threatened by low genetic variability.

## **What learning material will you need?**

The required learning material for the course will be **Benjamin A. Pierce. GENETICS: A Conceptual Approach**, 5<sup>th</sup> edition, W.H. Freeman and Company, New York (loose-leaf packaged with Launchpad access: ISBN 9781464192685). **You will need access to Launchpad**; an online site with many features that will help you mastering genetics, including Learning Curve, animations, videos, and science news. You will also have home assignments from Launchpad. Launchpad includes an eBook and you may get an access to Launchpad without printed textbook (ISBN: 9781464150906).

In addition to the required readings, we will discuss articles from peer-reviewed as well as popular journals. I will post all assigned as well recommended readings on Blackboard periodically throughout the semester. You are welcome to bring any article that you find interesting to the class discussions, or post them on blackboard discussion forum "What's new in Genetics?". Although the textbook is great source of information, articles will enrich your knowledge and keep you well-informed. Questions from assigned readings will be included in tests, and questions from recommended readings and discussion forum posts may appear as test extra credit questions.

We will also use iClickers in the class.

## How will you succeed in this course?

**Prepare and Participate:** Be active in the class discussions and group activities. Active class participation is very important and even though you might feel nervous to raise your hand and speak, please do so; ask questions, answer questions, trigger discussions, share what you have been reading. Any course material relevant question is appropriate, so do not hesitate to ask. Remember that having an inquisitive mind is vital for science and learning. You will discover that being active in the class and within your group will help you to learn. However, in order to be active in the class **you have to come prepared**. If you want to succeed in the class and be an active member of your group, you have to do your work, complete your home assignments and readings before coming to the class. Identify challenging concepts and material and prepare relevant questions for the class. Remember that: "***The will to succeed is important, but what's more important is the will to prepare (Bobby Knight)***". This apply not only to sport, but to your studies as well.

**Communicate:** Don't try to solve all class challenges by yourself. Talk.....Talk to your peers, talk to me, and talk to LAs. Come to my office and share your concerns, request further clarifications of the material, share your thoughts. Let me know if any of the material or class activity is challenging for you and you struggle with it. We will try to find solution together. Don't wait until the end of semester to do so; come early and come as many time as you need. If you can't come during my office hours, please take an appointment with me or with one of the LAs. It is important that you start doing this early in the semester in order to overcome obstacles and succeed.

## What will we do in this course?

The **Team-Based Learning (TBL)** will be the major component of this flipped class. We will follow the findings of neuroscience, biology, and psychology, which show that "***It is the one who does the work who does the learning (Doyle, 2008)***". Following such strategy, I will not spend time lecturing and telling you what you can read, watch, and practice at home. Instead, all material you need to study from will be posted on blackboard. In classroom you will work in groups and together to reinforce your knowledge and develop critical and problem solving potential. However, considering that genetics may encompass some challenging concepts, we will devote 15 -20 minutes of the class time to discussion and explanation of genetics concepts that you identify as challenging at the beginning of the class.

What is the advantage of flipped class? It has been shown that students exposed to active learning environment improved significantly their problem solving and critical thinking skills. This will give you

an advantage when taking admission exams for graduate schools (GRE) or health professions exams, such as MCAT, and DAT.

## How will your progress be assessed?

**Class activity** (200 points=20%). Class activities will include individual (iClickers) and group activities. They will consist of

1) ***In-class Readiness Assurance Test:*** The RAT will be an important component of the class and your active participation and progress will be evaluated. Each student will be presented with work sheet assignment and given time to complete it individually. Afterwards, the same work sheets will be discussed and completed in a group. Although you will only get points based on the group results, your individual work results will allow you to evaluate your knowledge. Each question is worth 1 point. At the end of semester, your cumulative points will be added to class activity points

2) ***In-class Group Activities:*** Group activities will comprise of problem solving, presentations, and formal debate for which you will earn up to 10 points. You will accumulate points through semester and at the end of semester, your cumulative points will be added to class activity points.

You will also evaluate contribution of each individual member of your group by filling evaluation Workgroup Peer Review form at least 2 times per semester. Each evaluation will be worth 5 points.

3) ***In-class individual activity*** will consist of iClicker questions. The purpose of iClickers is to follow your progress in the class and provide an immediate feedback. We will also use iClickers for open and anonymous polling to survey class opinions and feedback.

Points earned in all activities and points from evaluation will be added together and the highest class score will equal 200 points.

There will be no make-up for any of the class activities.

**Learning Curve Assignments** (90 points=9%): Learning Curve is a formative assessment activity that will guide you through a series of questions catered to your individual level of understanding. Learning Curve is an integral part of Launchpad. You will have target points to reach in order to get 5 points for each assignment. You will have options, either to answer the question if you know the answer, or request the hint, or open the appropriate book chapter to find the answer. You will have 18 assignments, each worth 5 points. You can accumulate 90 points from all of them. To obtain the points, you have to complete learning curve before deadline. If you miss deadline, you can still access it and learn by practicing, however, you will not receive points for it. Access to Learning Curve is not limited, so you can get back to it anytime you want to rehearse or refresh your skills. It is a great tool to help you mastering genetic concepts and practice your understanding of the material. There will be no make-up.

**Launch Pad Animation Study Resources (LPASR)** (110 points=11%): LPASR are study formative assessment activities that will help you master the genetics concepts. They will navigate you step-by-step through the most difficult concepts in genetics, help you study, and develop deeper knowledge and understandings of the genetics concepts. You will test your understanding at the end of each animation. LPASR will also include problem solving video from chapter 5. You will have 22 assignments, each worth 5 points. You can accumulate 110 points from all of them. To obtain the points, you have to complete assignments before deadline. If you miss deadline, you can still access it and learn by practicing, however, you will not receive points for it.

**In-class tests** (450 points =45%): You will have 3 tests worth 150 points each; 450 points from all of them will weight 45% of your final grade. They are summative quizzes designed to test your understanding of the material covered up to the point of the exam. Each test will consists of multiple-

choice, matching, true-false questions, and essay questions, which besides testing your understanding of the material will challenge you with problems to assess your ability to integrate genetics concepts and solve genetics problems.

The exam dates:       Exam 1- Tuesday, September 29  
                              Exam 2, Tuesday, October 27  
                              Exam 3, Tuesday, December 1

If you miss an exam due to the circumstances beyond your control we can set up make-up date with you. However, all make-ups will have an essay format.

**The final exam** (150 points=15%): The final exam is cumulative and accounts for 15% of your grade. Similarly to in-class tests, the final exam will consist of a mix of the multiple-choice, matching, true-false questions, and essay questions, which besides testing your understanding of the material will challenge you with problems to assess your ability to integrate genetics concepts and solve genetics problems. The final exam is scheduled for **Tuesday, December 8, 2014, 9:45 AM- 11:45AM.**

**The Extra Credit:** You will have two options for earning extra credit. Your first option is completing Extra Credit Assignments on LaunchPad. You can get up to 60 points (6 %) extra credits towards the final grade. Extra Credit will consist of assigned problem-solving videos, which will help you master basic problem-solving strategies; worked problems and branched tutorials, which will help you identify where you might have difficulties in problem solving and will guide you through them step-by-step. Your extra credit points will be calculated as follows:

LaunchPad Assignment: 95 % - 100 % = Extra credit 60 points

LaunchPad Assignment: 90% - 95 % = Extra credit 50 points

LaunchPad Assignment: 80 % - 89 % = Extra credit 40 points

LaunchPad Assignment: 70 % - 79 % = Extra credit 30 points

LaunchPad Assignment: 60 % - 69 % = Extra credit 20 points

LaunchPad Assignment: 50 % - 59 % = Extra credit 10 points

The second option to earn extra credit is short 5-8 minutes presentation of peer-review article relevant to the course material. The article has to be approved and presented following the class topic schedule. You can earn up to 40 (4%) points for presentation. Selection for presentation will be on the first come basis, so don't wait until the last weeks to present.

You can choose to do both extra credits and earn up to 100 points.

## How will your final grade be calculated?

During whole semester, you can earn max 1000 cumulative points (Total points in Bb grade book), which will equal 100%. According to the points and corresponding % you can calculate your final grade:

A	93 % - 100%
A-	90 % - 92.9 %
B+	88 % - 89.9 %
B	83 % - 87.9 %
B-	80 % - 82.9 %
C+	78 % - 79.9 %
C	70 % - 77.9 %
D	60 % - 69.9 %
F	<60%

## Professional and academic integrity.

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all faculty members as well as students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their students or fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct (e.g. cheating, plagiarism, academic dishonesty), they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the *FIU Student Handbook* under the “Academic Misconduct” section.”

## Weekly tasks and Objectives

All tasks, learning objectives, readings, and home assignments are specified in more details in corresponding Blackboard week module.

## Tentative assignment schedule:

(Please be advised that the course syllabus schedule of events is subjected to change)

Week	Subject	Assign chapters to read
1 <sup>st</sup> week August 24 - August 30	Introduction to Genetics Cellular Reproduction	1 2
2 <sup>nd</sup> week August 31- September 6	Cellular Reproduction Basic Principal of Heredity	2 3
3 <sup>rd</sup> week September 7 -13	Basic Principal of Heredity Sex determination and Sex-linked characteristics	3 4
4 <sup>th</sup> week September 14 -20	Extension of basic hereditary principles Pedigree analysis	5 6
5 <sup>th</sup> week September 21 -27	Linkage and Recombination	7
6 <sup>th</sup> week: September 28 – October 4	<b>Exam 1, September 29</b> Chemical structure of the genes Chromosome structure and organelle DNA	10 11
7 <sup>th</sup> week: October 5- 11	Mechanisms of DNA Replication	12

8 <sup>th</sup> week: October 12 - 18	Transcription RNA molecules and RNA processing	13 14
9 <sup>th</sup> week: October 19 - 25	The Genetic Code and Translation	15
10 <sup>th</sup> week: October 26 – November 1	<b>Exam 2, October 27</b> Gene Expression in Prokaryotes	16
11 <sup>th</sup> week: November 2 - 8	Gene Expression in Eukaryotes Epigenetics	17 21
12 <sup>th</sup> week: November 9 – 15	Gene Mutations and Repair	18
13 <sup>th</sup> week: November 16 - 22	Population genetics	25
14 <sup>th</sup> week: November 23- 29 (November 26-27 FIU is closed)	Population genetics	25
15 <sup>th</sup> week: November 30- December 6	<b>Exam 3, December 1</b> Review of genetics	