GENERAL BIOLOGY I (Biology 006)

5.00 units (UC:CSU)
Section 18481 (lecture) & 18484 (lab)
Spring 2019
Professor: Patricia Zuk, PhD
email: zukp@wlac.edu

LECTURE: MSA Rm. 303
11:10am – 12:35pm

LABORATORY: MSA Rm. 303
1:00pm – 4:10pm

OFFICE HOURS: by appointment or from:

1. 10:00 AM to 11:00 AM Monday & Wednesday
2. 12:00 PM to 1:00 PM Tuesday & Thursday
3. Office is MSB Room 210

PREREQUISITES: Biology 3A/3B & Chemistry 101 with a grade of 'C' or better in both; Intermediate Algebra (Math 125) with a grade of 'C' or better

COURSE DESCRIPTION: General Biology I is the first of a two semester general biology series for Biology Majors, pre-Medical, pre-Dental, pre-Pharmacy. The principles of molecular biology, cell structure and function, genetics, reproduction and organization at the tissue level in plants and animals are covered. Biology 6 and 7 satisfy requirements of lower division biological science majors.

ATTENDANCE: Attendance is mandatory (see Administration Regulation E13). If enough absences occur throughout the semester, I can exclude you from the course. Be aware that your grade in this course depends on your performance – which is dependent upon your attendance. **I guarantee if you miss too many classes and labs – you will fail the course.**

Lectures begin at 9:35am and run until 11:00am. You have a lunch break until 12:00pm.
At this point, the laboratory section of the course begins. Each laboratory is preceded by a lecture portion and will cover the concepts of the laboratory for that day. These lectures are often an extension of the morning session. So being late for lab means you will miss part of this lecture. Labs run until 3:15pm.

Since biology labs cannot be duplicated outside the class it is very important for you not to miss any labs if possible. You also must plan on attending the entire lab period. When you are finished the labs – to my satisfaction – you may leave quietly without disturbing your fellow lab mates.

I consider extreme tardiness or early departure from lab/lecture without a valid cause to be very disrespectful conduct. However, I realize traffic and life gets in the way sometimes. So being late and having to leave early is fine – every now and then. **Do NOT insult me or your classmates by consistently showing up late to lecture/lab every time!!!**

DO NOT EVEN CONSIDER BEING LATE IF THERE IS AN EXAM SCHEDULED. I will NOT give you the exam if you are more than 10 minutes late and have provided me with a valid excuse for your tardiness that day!! If you have conflicts in your schedule – come and talk to me. I am very understanding about many things and do not bite my students (much!). Also, exchange numbers with your lab-mate so that if you are running late for an exam you can relay a message to me through them.

WITHDRAWING FROM THE CLASS: Any student withdrawing from the class must inform the admissions office and complete the required steps. Students failing to follow the correct procedure for withdrawing will receive an 'F' at the end of the semester. **I will not be held responsible for your grade if you fail to correctly withdraw from this course.** Therefore, confirm your registration status. Finally, there are deadlines for withdrawing without a "W", with a "W" and a deadline where withdrawing is no longer possible. Be aware of these dates.

COURSE CONSTRUCTION: This course is comprised of two weekly lectures/labs that total over 9 hours per week! This is a lot of lecture time and a lot of lab time. Breaks will NOT be given during these sessions. However, you will have 60 minutes in between the morning and afternoon sessions to recharge your batteries.

The morning session is approximately 90 minutes of lecture. These lectures cover the major topics in your biology textbook and will coincide with what we will be studying in the afternoon laboratory session. The afternoon session is 3 hrs and 15 minutes of lab time. The first 60 minutes will be a lecture that covers the specific concepts of that lab topic or continues on with what we were covering in the morning session. The remaining time will be devoted to the laboratory.

You are welcome to tape my lectures. I also have my own personal website – www. patriciazuk.com where the lecture presentations can be found along with additional learning materials. This website is password protected with the username of **student** and the **case-sensitive password** of **#1Wlacstudent**. The lectures on this site are "student lectures" and do NOT contain every detail you will find in my lecture presentations or will hear throughout my lectures. This is so that you are required to pay attention and write some things down. Therefore, please print out these lectures and bring them to class so that you may supplement them throughout the lecture/lab period with your own notes taken during class.

Videos shown in lecture and lab are to be considered as important as lecture and you should pay close attention to the material presented in them.

Handouts may be given in class so be sure to pick them up the day they are offered. I am not guaranteeing that these handouts will be available after the day I offer them.

LABORATORIES: Each afternoon session is 3 hours and 15 minutes long. The first 60 minutes will be lecture material pertinent to that lab session or a continuation of the morning's lecture. Please bring your lab manual to each lab as your assigned material will be in that manual. If no lab is planned, then we will continue the morning lecture section.

You will work in teams of 2 or 3 for each lab but are also encouraged to interact with other groups throughout the lab. **Each student must purchase a lab manual (see below).** This manual will give you the protocols for each lab along with some background information relevant to each lab. It will also give you places to insert your experimental data and direction on how to analyze the data. This manual also contains areas for you to write your own notes and observations. It will be your resource for writing the lab exams given in this course so it is important to keep a neat and well-organized manual.

WEST LA COLLEGE STUDENT LEARNING OUTCOMES (SLOs): West LA College as an institution is committed to an environment of learning and respect for its students. Its mission is to serve the community by providing quality instructional services through its programs and facilities. The college has created a series of Student Learning Outcomes (SLOs) that are designed to maximize the successes and experiences of the students here at WLAC.

A. Critical Thinking: Analyze problems by differentiating facts from opinions, using evidence, and using sound reasoning to specify multiple solutions and their consequences.
B. Communication: Effectively communicate thought in a clear, well-organized manner to persuade, inform, and convey ideas in academic, work, family, and community settings.
C. Quantitative Reasoning: identify, analyze, and solve problems that are quantitative in nature.
F. Technological Competence: Utilize the appropriate technology effectively for informational, academic, personal, and professional needs.

BIOLOGY PROGRAM SLOs: In addition, the Biology program also has several unique SLOs.
A student who completes this program will be able to:
1. Explain how scientists investigate causes of natural biological phenomena.
2. Explain how living things are organized, reproduce, acquire matter & energy, and inherit & express genetic instructions.
3. Utilize biological information to make informed decisions about environmental issues.
4. Utilize biological information to make informed decisions about personal issues.
5. Perform basic biological lab procedures.

STUDENT LEARNING OUTCOMES FOR BIOLOGY 6: At the end of the semester, the students should understand and be able to explain the fundamental concepts of the following:

1. the major components of both prokaryotic and eukaryotic cells and the function of eukaryotic organelles
2. the major cellular processes of eukaryotic cells such as membrane transport, cell division/mitosis, DNA replication, RNA transcription, protein translation, cellular organization and secretion and energy production

LEARNING OBJECTIVES FOR BIOLOGY 6: In addition to overall learning outcomes, there are multiple subject and technical objectives that the students should achieve by the end of the semester. These objectives encompass many of the major themes presented in this course, in addition to covering more specific topics.

For the LACCD-approved Biology 6 Course Outline of Record, click on this link:
https://ecd.laccd.edu/CC_Sheet.aspx?ID=209225&VersionID=2&Entry_ID=707991

SUBJECT OBJECTIVES: At the end of the semester the students should demonstrate proficiency in understanding and explaining the following:

1. The concept of concentration and molarity, including how to determine molar mass and how to prepare specific solutions if given molarity
2. The structure of an atom and how it influences the creation of a chemical bond
3. The types of chemical bonds and chemical reactions
4. The structure and function of the four major macromolecules: carbohydrates, lipids, proteins and nucleic acids
5. The major components of a cell, both prokaryotic and eukaryotic
6. The structure and function of the plasma membrane, including how the membrane controls transport and the types of transport capable of occurring across a membrane
7. The structure and function of the nucleus, including how DNA is organized in both prokaryotes and eukaryotes, how DNA is replicated and how RNA is transcribed.

8. The composition of the cytoplasm, including the components and function of the cytosol and cytoplasm
9. How cells divide through mitosis, including the roles of the centrioles and spindle
10. The process of protein synthesis, including protein translation, the four levels of protein organization
11. The structure of function of the following organelles: the endoplasmic reticulum, Golgi apparatus, lysosomes and peroxisomes
12. The control of DNA replication and RNA transcription, including the cell cycle and its role in abnormal processes like cancer
13. The control of both prokaryotic and eukaryotic gene expression
14. The role of the mitochondria and ATP in the bioenergetics of a eukaryotic cell, including understanding the steps of glycolysis, Kreb's cycle and the electron transport chain
15. The process of photosynthesis in plants, including the structure of a chloroplast, the role of chlorophylls and other photosynthetic pigments, the photosystems and Calvin cycle
16. How organisms produce gametes through meiosis and how this process results in genetic diversity
17. The concepts of Mendelian genetics: phenotype, genotype, alleles, homozygous and heterozygous
18. How Mendelian genetics can explain how DNA and phenotypic traits are passed through generations
19. The more advanced concepts of genetics and chromosomal inheritance such as co-dominance, multi-allele traits, sex-linked traits and gene linkage
20. How alterations in chromosomal number can occur and result in genetic disorders
21. How cells interact and communicate with one another, including the production and function of hormones, growth factors and the cell signaling pathways
22. How cells interact to produce tissues and the major types of tissues observed in organisms
23. The concepts and stages of embryonic development, including the early stages of cleavage, blastula and gastrula formation, morphogenesis and organogenesis.

TECHNICAL OBJECTIVES: Add the end of the semester, the student should be able to perform the following within a laboratory setting:

1. Weighing a given substance using a balance beam
2. Determining the absorbance of a given solution using a spectrophotometer
3. Detection of a sugar, lipid, protein or nucleic acid using specific stains
4. The proper operation of a compound and dissecting microscope, including being able to properly visualize cells and tissues
5. The identification if some of the major components of a plant and animal cell, such as the cell wall, vacuole and nucleus
6. The set up and performance of an experiment to illustrate the processes of diffusion and osmosis, including being able to determine diffusion rate and how solute concentration can affect osmosis
7. The simulation of DNA replication, RNA transcription and protein translation if given specific DNA sequences
8. The identification of the stages of mitosis and meiosis using both prepared slides and models
9. The completion of genetic problems, including determining allele frequency, genotypes and phenotypes using Punnett squares and a pedigree chart

10. The identification of the major tissue types: epithelial, connective, muscular and nervous, including their subtypes
11. The isolation of DNA using cells taken from the inside of their own cheek
12. The production and analysis of a DNA fingerprint, including being able to make an agarose gel, run the DNA using that gel and analyze the resulting DNA migration pattern

COURSE MATERIALS: be sure to bring these to each class
1. Textbook: Campbell Biology – Campbell, Reece et al. 9th Edition. Benjamin Cummings Publishing.

2. Lab Manual: Available at the bookstore.

3. Lecture notebook: The type you use may be your own preference. This book will be used to supplement the lectures given in the morning and afternoon sessions. You should also print out the lecture slides prior to coming to class and put these in your notebook. As a result, a three-ring binder may be a good option. That way you can place your notes and the printed slides together in the same notebook along with any handouts that I give you.

4. Numerous colored pens and pencils for lectures and labs
5. Scantron 882E forms for exams
6. A simple, non-scientific calculator for exams

EXAMINATIONS: You will have two different types of exams: Lecture exams and Laboratory exams. Lecture exams will be worth a maximum 100 points. These exams will be multiple choice, fill in the blank, short answers and may include figures from my notes and from the text that you will have to complete. These exams will range anywhere from 50 to 100 questions. You will use your lecture notes to study for this exam. If your exam is less than 100 questions, I will convert your grade to 100 when I calculate final grades

Each laboratory exam will be worth a maximum of 25 points. These exams are based on your afternoon lab sessions. They will also include multiple choice and fill in the blank questions and may also include identification questions using images projected by the computer. You will use your laboratory notes and manual to study for this type of exam.

There will be a final exam held during the exam period. It will be a **cumulative exam worth 125 points (lab and lecture).** Each of these exams will be cumulative and will encompass all materials (lab or lecture) presented to you during the entire semester. They will have the same format as the regular semester exams.

You have a total of 5 lecture exams and 4 lab exams held during the normal course of the semester. In addition, you have a final lecture and lab exam held during finals. This means you have a total of 6 lecture exams and 5 lab exams. **However, I drop your lowest lecture and lab exams.** This means if, at the end of the semester, you are happy with your final grade (based on 5 lecture and 4 lab exams), you do not have to take the final. If you are not happy, you may take the final exams and if the grades are better, I will use them to replace your lowest lecture and lab exams you took during the regular semester. **At the end of the course, I will use your top 5 lecture exams and your top 4 labs exams to calculate your final grade (out of 600 points).**

In creating my course like this, it also allows you the chance to skip a regular semester test if you are not prepared for it or miss a regular semester test due to illness, family emergency, being out of town or

religious holiday. **This means I will not give make-up exams due to these reasons.** For example, if you must miss a regular semester test due to a religious holiday, you may make up for this missed exam during finals in the form of the final cumulative exam. **I will NOT allow you to re-take your missed exam at any other time.** I realize that everyone has a good reason for missing a test, but in the interest of being fair to everyone, I must create a single policy and stick to it no matter the individual or personal circumstances.

I will discuss each exam and what to expect prior to each exam – so don't freak out! I may also provide you with some study guides to ensure you are keeping yourself on track during your study times. But don't count on it! **This is a majors-level biology course** - so you are expected to know what could be on an exam.

Exam breakdown:
Lecture exams = 5 x 100 = 500 points
Laboratory exams = 4 x 25 = 100 points
Final cumulative lecture exam = 100 points
Final cumulative lab exam = 25 points

Top 5 lecture exams chosen = 500 points
Top 4 lecture exams chosen = 100 points
Total points = 600 points

I do not allow you to keep any tests so please keep track of your performance in the class by recording all your exam scores.

Cheating will NOT be tolerated. ANY STUDENT FOUND CHEATING WILL RECEIVE THE GRADE OF 'F' FOR THAT EXAM AND MAY BE EXPELLED FROM THE COURSE!!! Please see the college's policy on academic dishonesty for additional information. **While not written in this syllabus, the college's policy on academic dishonesty will be adhered to in this course.**

All personal items will be placed at the front of the room prior to each and every exam. The only thing allowed at your desk during an exam will be your pencils, pens, erasers etc…. and the exam itself. Cell phones will NOT be allowed at your desk during any exam!!! Before each exam, you will place your cell phone on top of your backpack so that I may see it. If I catch you with a cell phone at your desk, I will take your exam from you and give you a zero for that exam.

Scientific calculators will NOT be allowed during exams as well. I will try to provide you with a simple calculator that you may use during the exam. In addition, your cell phone may NOT be used as a calculator.

ASSOCIATE DEGREE FOR TRANSFER: Biology 6 is part of the state-approved Associate Degree for Transfer in Biology that is offered at West LA. Successful completion of this 60-unit degree guarantees admission to the CSU system as a junior. I encourage you to apply for this degree upon the completion of your transfer studies. Please see me for more details.

Schedule of Topics

Section	Text Chapters (Campbell 9th edition)	Date	Lecture Topic Lab Topic
Introduction	Ch. 1	02/04	An introduction to science ***Take home Lab 1: The Metric System***
	Ch. 2 & 3	02/06	The chemical context of life ***Take home Lab 2: Molarity*** ***In Class Lab 3: Pipetting Lab***
	Ch. 4 & 5	02/11	Organic molecules ***Lab 4: Spectrophotometer lab***
	Ch. 4 & 5	02/13	Organic molecules cont… ***Lab 5: Chemical analysis lab***
		02/18	**PRESIDENT'S DAY – NO CLASS**
	Ch. 6 (in part)	02/20	An introduction to the cell ***Lab 6: Microscope lab - Introduction to the cell***
	Ch. 6	02/25	**LAB EXAM 1 (In Class) – 11:10AM to 12:35PM** **LECTURE EXAM 1 – 1:00 PM to 3:00 PM (2 hours)**
The Cell – Cellular Processes and Cellular Control	Ch. 7	02/27	Cellular processes – the Plasma Membrane & Membrane Transport ***Lab 7: Diffusion Lab***
	Ch. 16	03/04	Cellular processes – the Nucleus & DNA replication ***Lab 8: Osmosis Lab***
	Ch. 12	03/06	Cellular processes – Mitosis & Control of the Cell Cycle ***Lab 10: Mitosis Lab***
	Ch. 12	03/11	Cellular processes – from the Nucleus to the Cytoplasm: Transcription & Translation ***Lab 9: Genes in a bottle lab***
	Ch. 17	03/13	Cellular control – Control of gene expression in bacteria: the Operon model of gene expression ***Lab 11 : DNA Transcription & Translation Lab***
	Ch. 18	03/18	Cellular control – Control of gene expression in eukaryotes: Promoters & Enhancers ***Lab 12: Protein Quantitation Lab***
	Ch. 18	03/20	Cellular control – Control of gene expression in eukaryotes cont… ***Lab 13: Agarose Gel Electrophoresis Lab***
	Ch. 18	03/25	Cellular control – Control of gene expression in eukaryotes cont… ***No lab planned - AM & PM lecture***
		03/27	**LECTURE EXAM 2 – 12:00 PM to 3:00 PM** **TAKE HOME LAB EXAM DUE**
The Cell - Bioenergetics		**04/01**	**SPRING BREAK – NO CLASS**
		04/03	**SPRING BREAK – NO CLASS**
	Ch. 8	04/08	Cellular processes –The Cytoplasm The Cytoskeleton Non-membranous vs. membranous organelles ***No lab planned - AM & PM lecture***

	Ch. 8	04/10	Bioenergetics –Energy flow in the cell ***No lab planned – AM & PM lecture***
	Ch. 9	04/15	Bioenergetics – Cellular Respiration ***Lab 14: Fermentation Lab***
	Ch. 10	04/17	Bioenergetics – Photosynthesis ***No lab planned – AM & PM lecture***
		04/22	**LECTURE EXAM 3 – 12:00 PM to 3:00 PM** **NO LAB EXAM**
Genetics	Ch. 13	04/24	Genetics – Sexual life cycles Meiosis & genetic variation ***Lab 15: Meiosis Lab***
	Ch. 14	04/29	Mendelian Genetics ***Take home Lab 16: Genetics Lab #1***
	Ch. 15	05/01	The chromosomal basis of inheritance ***Take home Lab 17: Genetics Lab #2***
	Ch. 15	05/06	The chromosomal basis of inheritance cont…. ***Take home Lab 17: Genetics Lab #2***
		05/08	**LECTURE EXAM 4 – 12:00 PM to 3:00 PM** **TAKE HOME LAB EXAM DUE**
Embryology & Development	Ch. 47	05/13	Animal Development ***Lab 18: Vertebrate development lab***
		05/15	Animal Development cont…. ***No lab planned – AM & PM lecture***
		05/20	Animal Development ***No lab planned – AM & PM lecture***
		05/22	**LAB EXAM 5 (In Class) – 11:10AM to 12:35PM** **LECTURE EXAM 5 – 1:00 PM to 3:00 PM (2 hours)**
		05/29	**CUMULATIVE FINAL EXAM** **FINAL LAB EXAM - 11:10AM to 12:35PM** **FINAL LECTURE EXAM – 1:00 PM to 3:00 PM (2 hours)**

Overview of Covered Topics

Lecture #1: An introduction to Science
-themes in the study of life
-levels of biological organization
-Core theme: Evolution accounts for the unity and diversity of life
    -diversity of life
    -3 domains of life
    -natural selection
    -descent with modification – the tree of life
-Scientific method: asking questions and testing hypotheses
    -types of data
    -inductive reasoning
    -deductive reasoning & hypothesis testing
    -flexibility of the scientific method
    -proper experimentation – controls and repeatability
-Theories in science

Lecture #2: The chemical context of life
-the chemical connection to biology
-elements and compounds
-the elements of life
-atoms and its components
-isotopes and radioactivity
-molecules and chemical bonds
-chemical reactions
-Water: polar covalent bonds and hydrogen bonding
    -properties of water: cohesion, temperature modification, specific heat, density
    -water as a solvent: hydrophilic vs. hydrophobic
    -solute concentration in water – Molarity
-Acids & bases: pH scale
    -buffers
    -acidification

Lecture #3: Organic molecules
-Carbon: the backbone of life
    -properties of carbon
    -hydrocarbns & their isomers
-functional groups in biology
-organic molecules
-macromolecules & polymers:
    -diversity of polymers
    1. carbohydrates – types of polysaccharides
    2. lipids – fatty acid structure and the types of lipids
    3. proteins – amino acids and polypeptides
        -protein structure and levels of organization
        -protein function
        -chaperonins and protein folding
    4. nucleic acids – types and structure
        -DNA and RNA structure
        -ATP - a modified nucleotide

Lecture #4: Introduction to the cell
-the cell theory
-types of microscopes
-four components of a eukaryotic cell:
    1) the plasma membrane – intercellular junctions & adhesions, membrane proteins
    2) the cytoplasm & cytoskeleton – cilia and flagella
    3) the nucleus – forms of DNA (ch. 12)
    4) cytoplasmic organelles – membranous and non-membranous

Lecture #5: Cellular processes – the Plasma Membrane
-the plasma membrane and transport mechanisms
    -passive mechanisms – diffusion, osmosis and facilitated diffusion
    -active mechanisms – primary and secondary transport, exocytosis, endocytosis

Lecture #6: Cellular processes – the Nucleus & DNA replication
-organization of DNA in the nucleus – chromatin & histones
-problems with DNA replication
-the machinery of replication – polymerases
-DNA repair mechanisms

Lecture #7: Cellular processes – from nucleus to cytoplasm – transcription & translation
-the transcription unit
-transcription: DNA to RNA
    -types of RNA
    -mechanisms of transcription – the RNA polymerase
    -modifications of mRNA – the cap and the polyA tail
    -promoters
-translation: mRNA to protein
    -the ribosome
    -tRNA function and structure
    -the genetic code and codon table

Lecture #8: Cellular processes – the Cytoplasm
-cilia and flagella – dynein motors
-actin microfilaments and cellular movement
-actin and myosin interactions – muscle contraction
-non-membranous organelles – the centriole
-the mitotic spindle
-mitosis and cytokinesis
-evolution of mitosis – prokaryotic binary fission

Lecture #9: Cellular processes - the Cytoplasm cont….
-membranous organelles
-protein synthesis: ribosomes, the RER and the Golgi
    -protein modifications – folding, glycosylation, proteases
    -protein trafficking – sorting signals
-lipid synthesis: the SER
    -lipid biosynthesis
-waste management: peroxisomes and lysosomes
    -functions and diseases

Lecture #10: Cellular control – Control of DNA

-regulation of DNA replication – chromatin/chromosome structure and histone modification (ch. 18)
    -histone acetylation
-regulation of DNA replication – the cell cycle (ch. 12)
    -phases of the cell cycle
    -checkpoints
    -cyclins and cdks
    -loss of control – cancer
    -the G0 phase

Lecture #11: Cellular control – Control of gene expression

-control in bacteria – the operon model
    -repressible and inducible – negative regulation
    -cAMP and positive regulation
-control in eukaryotes – stages of control
    -differential gene expression
    -regulation of transcription – transcription factors & enhancers
    -coordinately controlled expression
-post-transcriptional control – mRNA degredation
    -splicing and the splicesome
    -initiation of translation – the UTR and the polyA tail
    -protein processing – phosphorylation, cleavage
    -protein degredation – ubiquitin & the proteosome
-role of non-coding RNAs – miRNA & siRNA

Lecture #12: Bioenergetics – Metabolism

-forms of energy
-laws of thermodynamics
-free energy change – stability and equilibrium
-free energy and metabolism
-review of ATP and ATP hydrolysis
-activation energy – exergonic reactions
-activation energy & enzymes – substrate specificity
    -catalysts and cofactors
-regulation of enzyme activity – allosteric regulation and regulatory molecules; feedback inhibition

Lecture #13: Bioenergetics – Cellular Respiration

-production of ATP – aerobic respiration vs. fermentation
-redox reactions
-NAD+ as an electron acceptor
-cellular respiration – review of the mitochondria
    -glycolysis
    -citric acid cycle
    -chemiosmosis & the electron transport chain
    -ATP "accounting"
-anaerobic respiration vs. fermentation
    -types of fermentation
    -anaerobes
-connections of glycolysis and the citric acid cycle to other metabolic pathways
    -use of fats and proteins as energy

-connections to biosynthesis (anabolism)
-control of cellular respiration reactions

Lecture #14: Bioenergetics – Photosynthesis
-chloroplasts – a new organelle
-the reactions of photosynthesis
-light reactions – the nature of sunlight
-chlorophylls and carotenoids
-photosystems
-linear and cyclic electron flow
-chemiosmosis – chloroplasts vs. mitochondria
-dark reactions – the Calvin cycle
-reduction of CO2 to sugar
-carbon fixation, reduction & regeneration
-C3, C4 and CAM plants - adaptations

Lecture #15: Genetics – Sexual Life Cycles
-inheritance of genes
-sexual vs. asexual reproduction
-chromosome types – diploid vs. haploid, karyotypes
-variety in sexual life cycles – alternation of generations
-meiosis – stages
-comparing mitosis with meiosis
-genetic variation by meiosis
–crossing over in recombinant chromosomes
-independent assortment
-random fertilization
-evolutionary significance of meiosis

Lecture #16 – Mendelian Genetics
-Mendel's experiments – pea plants, P and F generations
-Law of Segregation
-Mendelian model of inheritance
– genotypes, phenotypes, alleles
-Punnet squares and test crosses
-Law of Independent Assortment – monohybrid vs. dihybrid
-laws of probability – monohybrid crosses
-multiplication rule – i.e. the Product rule
-addition rule – i.e. the Sum rule
-probability and dihybrid crosses
-complex inheritance patterns – single genes
-degrees of dominance
-multiple alleles – blood groups
-pleiotropy and multiple phenotypes
-complex inheritance patterns –multiple genes
-multiple loci and epistasis
-polygenic inheritance
-nature and nuture: the impact of the environment
-pedigree analysis – analyzing the behavior of human traits

Lecture #17 – The Chromosomal Basis of Inheritance

-correlation behavior between a gene allele and its chromosome – Morgan and the fruit fly
-sex-linked genes
    -inheritance of X-linked genes
    -X inactivation in females
-linked genes and inheritance
    -genetic recombination – crossing over
    -linkage maps
-alterations in chromosome number
    -non-disjunction – aneuploidy and polyploidy
-alterations in chromosome structure
    -inversions, deletions and translocations
-genomic imprinting
-inheritance of organelle genes – extranuclear genes

Lecture #18: Animal Development

-fertilization mechanisms
-cleavage patterns
-gastrulation – sea urchin, frog, chick
-embryonic germ layers
-neural crest cells and the neural tube
-mechanisms of morphogenesis
    -the role of the cytoskeleton
    -apoptosis
-fate determination
    -determination vs. specification
    -fate mapping
-induction in embryogenesis
    -Spemann's organizer
    -chick limb bud development