

KINGSBOROUGH COMMUNITY COLLEGE
CITY UNIVERSITY OF NEW YORK
DEPARTMENT OF BIOLOGICAL SCIENCES

BIOLOGY 33

INTRODUCTION TO MODERN CONCEPTS OF BIOLOGY

SYLLABUS

FALL 2017

COURSE DESCRIPTION:

BIO 33 INTRODUCTION TO MODERN CONCEPTS OF BIOLOGY (4 CREDITS, 5 HOURS)

For non-science and liberal arts majors and those who plan to transfer to senior colleges. Focus is on major biological topics and principles, with emphasis on how biology influences human issues and problems. Lectures, discussions and hands-on laboratory experiences provide insight into past, present and future aspects of the diversity of life on earth. Topics considered include: genetics, ecology, evolution, and cell biology. *This course does not satisfy the Biology major elective requirement.*

Required Core: Life and Physical Sciences

Prerequisites: None

Welcome to Bio 33, Introduction to Modern Concepts of Biology. This is a one-semester, 5-hour, 4-credit general biology course designed for students who are not biology majors. It fulfills the CUNY Pathways Required Core for Life and Physical Sciences.

This course introduces students to the major principles of biology, with emphasis on the interactions of humans with the natural world. Even though you are not majoring in biology, this course is designed to equip you with the knowledge and skills necessary to understand the biological issues that face society, and to form educated opinions about these issues.

Following is a list of advice for success in this course. Faculty and staff will provide all the necessary materials for you to succeed, but responsibility for learning rests with you.

- Carefully read and review often the specific class policies distributed by your instructor. Be sure you know and comply with the expectations for the class, as well as the dates of all assignments, quizzes, and exams.
- Attend every class and laboratory session. If you must miss a class, contact the instructor in advance or as soon as possible to find out what was done in class and whether there were any announcements or assignments.
- Read the assigned portion of the textbook and lab manual **before** the day the material will be discussed in class (see list of assigned readings and lab exercises in this document). Come prepared with questions.
- Take careful notes in class. If you must be absent, request notes from a classmate.
- Review the learning objectives listed in this document for each topic. This may be done before and after each class and laboratory, so that you can track what you are learning and identify concepts with which you may need more help.
- If you find that you are unsure of particular concepts, visit your instructor in office hours or make an appointment with them at another time.
- Complete all assignments on time, and do not miss any quizzes or exams.

We wish you the very best in your academic efforts, and encourage you to contact us if we may be of any assistance to you in the successful completion of this course.

Sincerely,

The Biology 33 Course Coordinators

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CUNY PATHWAYS REQUIRED CORE LEARNING OUTCOMES: LIFE AND PHYSICAL SCIENCES

- Identify and apply the fundamental concepts and methods of a life or physical science.
- Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.
- Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
- Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report.
- Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.

It is expected that you will fulfill the Pathways learning outcomes through the following course learning outcomes, which are specific to Biology 33.

COURSE LEARNING OUTCOMES

By the end of the course, it is expected that you will achieve the following learning outcomes.

1. Apply the scientific method appropriately to investigate biological problems, and collaborate with your peers to carry out scientific investigations and produce a laboratory report.
2. Discuss how the traits and interactions observed in living things can be explained by the principles of evolution, ecology, and genetics.
3. Demonstrate an understanding of cell structure and function, including fundamental metabolic processes.
4. Demonstrate a general understanding of human anatomy and physiology.
5. Discuss the ethical issues related to biological research, knowledge, and discoveries.

REQUIRED TEXTBOOKS

1. *Campbell: Essential Biology with Physiology* by E.J. Simon, J.L. Dickey, J.B. Reece, & K.A. Hogan, 5th edition. Pearson Benjamin-Cummings. ISBN 978-0-321-96767-1
2. *Biology 33: Introduction to Modern Concepts of Biology* (lab manual), 4th edition. Bluedoor LLC, 2017. ISBN 978-1-68135-585-6

You are also required to purchase a long-sleeved, knee-length lab coat and wear it to **every** BIO 33 lab. Shoes that completely cover your toes are also required in the lab. **You will not be permitted to remain in lab without a lab coat and proper footwear.** Certain labs, such as those involving dissection, also require safety goggles and surgical gloves. Please check your schedule and confirm with your instructor as to which labs require these additional items.

COURSE POLICIES

Attendance

It is very important to attend every class. If you must be absent, it is better to talk to the instructor BEFORE the absence if possible. If you miss a classroom meeting or lab session, please contact the instructor as soon as possible to find out what you missed. Make sure to get notes from a classmate. If you miss a lab, contact the instructor as soon as possible to find out whether you can make it up by attending another section. Please note that often it is not possible to make up a lab, so try not to miss any!

KCC policy states that students who are absent more than 15% of the class hours (approximately 10 hours for Bio 33) may be assigned a WU grade (Unofficial Withdrawal). If you stop attending class and do not communicate with your instructor about the absence, you may receive a WU unless you have appropriate documentation for the absence, such as a doctor's note.

Grading

Your grade is divided into two parts, 50% for lecture and 50% for lab as outlined below. You will receive specific information from your instructor as to the number and timing of assignments, quizzes, and exams. Extra credit is at the discretion of your instructor and is not guaranteed. Make-ups for missed work are also at the discretion of your instructor, according to their individual class policy.

Lecture:

Exams, homework, etc.	30%
Final exam	20%
	<u>50%</u>

Lab:

Lab reports, quizzes, etc.	50%
Lecture + Lab	<u>100%</u>

Academic Integrity

We uphold the CUNY policy on academic integrity (see the Student Handbook online or <http://www.kingsborough.edu/studres/Documents/CUNYAcademicIntegrityPolicy.pdf>). There are serious consequences for cheating on exams or plagiarizing someone else's work (i.e., turning in work that is copied from another source without proper attribution). If you are not sure what constitutes academic dishonesty, please check with the instructor.

Plagiarism is the use of others' words and/or ideas without clearly acknowledging their source. As students, you are learning about other people's ideas in your course texts, your instructors' lectures, in-class discussions, and when doing your own research. When you incorporate those words and ideas into your own work, it is of the utmost importance that you give credit where it is due. Plagiarism, intentional or unintentional, is considered academic dishonesty and the consequences are at the discretion of your instructor.

Civility

Kingsborough Community College is committed to the highest standards of academic and ethical integrity, acknowledging that respect for self and others is the foundation of educational excellence.

Civility in the classroom and respect for the opinions of others is very important in an academic environment. It is likely you will not agree with everything that is said or discussed in the classroom. Courteous behavior and responses are expected. Therefore, in this class, any acts of harassment, and/or discrimination based on matters of race, gender, sexual orientation, religion, and/or ability are not acceptable.

Whether we are students, faculty, or staff, we have a right to be in a safe environment, free of disturbance and civil in all aspects of human relations.

Accessibility

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

Cell Phones and Other Electronics

The use of cell phones and other electronics is not permitted in class, unless specifically stated otherwise by your instructor. Texting or other use of your phone, tablet, or laptop computer is not permitted during class except as approved by your instructor. All devices must be silenced or powered off during class.

LECTURE AND LABORATORY SCHEDULE

Lecture topics and lab topics for each week are correlated, so that the concepts you learn are supported in both lecture and lab. Your individual instructor may modify this schedule slightly to conform better to the specific timing of your Bio 33 section.

Week	Lecture topic	Reading assignment (from textbook)	Lab topic/exercise (from lab manual)
1	Scientific method Major themes in biology	Chapter 1	The Scientific Method Exercise 1
2	Cell structure and function	Chapter 4	Microscope skills Exercise 2
3	Cell division Cell cycle	Chapter 8	Cells & mitosis Exercise 3
4	Bioenergetics Cellular Respiration Photosynthesis	Chapter 5 Chapter 6 Chapter 7	Photosynthesis Exercise 4
5	Inheritance	Chapter 9	Mendelian inheritance & DNA lab; Meiosis & sea urchin fertilization Exercise 5
6	DNA structure and function	Chapter 10	Biodiversity & Classification Exercise 6
7	Introduction to evolution Natural selection	Chapter 13	Predators & Prey Exercise 7
8	Origin of species Diversity and classification Origin of life	Chapter 14 Chapter 15	Ecosystem Interactions Exercise 8
9	Introduction to ecology and the biosphere Population ecology	Chapter 18 Chapter 19	Marine ecosystems (at the MAC Aquarium) Exercise 9
10	Communities & ecosystems Human impact on ecosystems	Chapter 20	Digestive system Exercise 10 Fetal pig dissection
11	Overview of organ systems & homeostasis Human nutrition and digestive system	Chapter 21 Chapter 22	Respiratory & circulatory systems Exercise 11 Fetal pig dissection
12	Respiratory, circulatory, urinary & reproductive systems	Chapter 23 Chapter 21 Chapter 26	Urinary & reproductive systems Exercise 12 Fetal pig dissection

The following pages contain a list of suggested learning objectives for each of the topics listed in the table on the previous page. The 12 sections relate to the 12 weeks of the course. At the beginning of each section, the overall learning outcome is listed (see also p. 3 of this syllabus), with suggested detailed learning objectives below. Your instructor will inform you which learning objectives he or she expects you to master. These pages serve as an excellent review sheet for quizzes and exams, including the final exam (which is comprehensive). Refer often to these learning objectives as you study each week.

In addition to the overall outcome indicated for each week, the following two outcomes will be integrated throughout the course as determined by your instructor.

- Outcome: Apply the scientific method appropriately to investigate biological problems, and collaborate with your peers to carry out scientific investigations and produce a laboratory report.
- Outcome: Discuss the ethical issues related to biological research, knowledge, and discoveries. An appendix on bioethics is included at the end of this syllabus.

LEARNING OBJECTIVES

1. The scientific method & major themes in biology:

Outcome: Demonstrate an understanding of the scientific method and the major themes in biology.

- List at least seven properties and processes associated with life.
- List and define all levels of the hierarchy of life (biosphere, ecosystem, communities, populations, organisms, organ systems and organs, tissues, cells, organelles, molecules and atoms)
- Describe in one paragraph the steps of the scientific method.
- Define the following terms in relation to the experimental approach: independent and dependent variables, representative sample size, control group, experimental group, data analysis.

2. Cell structure & function

Outcome: Demonstrate an understanding of cell structure and function.

- List the three ideas that make up cell theory.
- List and define differences between prokaryote and eukaryote cells, and give examples of organisms that contain each type of cell.
- Describe the structure and function of the cell membrane.
- List cellular organelles (ribosomes, mitochondria, chloroplasts, rough ER, smooth ER, Golgi complex, lysosomes, centrioles, vacuoles, cytoskeleton, etc.) and other cellular

components (such as nuclear membrane, cytoplasm, cell wall, and cell membrane).

Describe in one sentence each the structure and function of each cellular structure.

- List the major differences between plant and animal cells.

3. Cell division & the cell cycle

Outcome: Demonstrate an understanding of cell structure and function.

- State three functions or purposes of mitotic cell division, and then state the one function or purpose of meiotic cell division.
- Define the following: chromosome, homologous chromosomes, centromere, mitosis, meiosis, cytokinesis, crossing over (during meiosis), diploid, haploid, gamete, zygote, spindle apparatus.
- Draw a diagram depicting the cell cycle and indicate which parts of the cell cycle constitute interphase. Describe in three or four sentences what happens in each phase of the cell cycle.
- Describe in a paragraph the events that occur in each phase of mitosis (prophase, metaphase, anaphase, telophase). Be sure to especially indicate what the chromosomes are doing in each phase.
- Describe in a paragraph the events that occur in each phase of meiosis (for both meiosis I and meiosis II).
- Explain in one to two sentences why meiosis is necessary for cells that will become gametes.
- Explain in three or four sentences the differences between mitosis and meiosis.

4. Bioenergetics, Cellular Respiration & Photosynthesis

Outcome: Demonstrate an understanding of fundamental metabolic processes.

- Define metabolism, energy, cellular respiration, and photosynthesis.
- Define the term “enzymes” and explain in one to two sentences their function.
- Explain in three to four sentences the purpose and function of ATP, including how it stores and releases energy. Draw a simple cycle to show how ATP is recycled from ADP.
- Write the chemical equation for cellular respiration, and the equation explain in three to four sentences.
- Explain in one sentence the different ways that autotrophs and heterotrophs acquire energy.
- In two or three sentences, describe the electromagnetic (EM) spectrum and indicate which type of electromagnetic radiation is used by autotrophs.

- Explain in two or three sentences how plants capture light energy (using pigments such as chlorophyll contained in chloroplasts) and indicate which wavelengths (i.e., colors) of light are absorbed best by chlorophyll.
- Write the chemical equation for photosynthesis, and explain this equation in three to four sentences.

5. Inheritance

Outcome: Discuss how the traits observed in living things can be explained by the principles of genetics.

- Define the following terms: true-breeding, gametes, gene, allele, F_1 , F_2 , heterozygous, homozygous, dominant, recessive, genotype, phenotype, and mutation.
- State and explain in one paragraph Mendel's two laws of inheritance: the law of segregation and the law of independent assortment.
- Use a Punnett square to illustrate a monohybrid cross and to predict the genotypic and phenotypic ratios expected from such a cross.
- Use the two rules of probability (the sum rule and the product rule) to correctly predict the probability of genetic events (see examples in textbook and power point).
- Explain in two to three sentences what is meant by incomplete dominance and co-dominance.
- Define the following terms as they relate to chromosomes: autosome, sex chromosome, linkage, crossing over, duplication, deletion, translocation, nondisjunction.

6. DNA structure & function

Outcome: Demonstrate an understanding of cell structure and function.

Outcome: Demonstrate an understanding of fundamental metabolic processes.

- Describe in three to four sentences the basic structure of DNA (the 3 parts of the nucleotide, the base-pairing rule, and the double helix).
- Define replication, transcription, and translation as they relate to DNA, and in one paragraph describe how each of these processes occurs in cells as a series of steps.
- Explain in three to four sentences how DNA codes for proteins (the amino acid code).

7. Introduction to evolution & natural selection

Outcome: Discuss how the traits observed in living things can be explained by the principles of evolution.

- Explain in two to three paragraphs how each of the following provides evidence of evolution, and give an example of each type of evidence: fossil record, comparative

anatomy, comparative embryology, molecular biology, artificial selection, and analogous structures (convergent evolution).

- Describe in a detailed paragraph Darwin's theory of natural selection as a series of steps that lead to adaptation.
- Define natural selection and evolution.

8. The origin of species, diversity, & classification and origins of life

Outcome: Discuss how the traits observed in living things can be explained by the principles of evolution.

- Define species.
- Describe in three to four sentences the general mechanisms for speciation.
- Describe in three to four sentences the system used to classify the biodiversity of life, and state the characteristics of the major taxa (domains and kingdoms).
- List the hypothetical step-by-step process by which life originated on earth, in chronological order.
- Describe in one paragraph the possible composition of the atmosphere on the early earth and explain the significance of this composition to the origin of life.
- Describe in one paragraph at least 3 possible theories for the origins of life on earth.

9. Introduction to ecology and the biosphere & population ecology

Outcome: Discuss how the interactions observed in living things can be explained by the principles of ecology.

- Define ecology.
- Define the term "ecosystem" and list at least five biotic and five abiotic factors that may be found in an ecosystem.
- List and briefly define the major terrestrial and aquatic biomes.
- Draw graphs representing exponential population growth and logistic population growth, and explain in one to two sentences what each growth curve shows.
- Define carrying capacity and indicate where it is found on the logistic population growth curve.
- List and define the factors that affect population growth rate (birth rate, death rate, immigration and emigration).
- List and define factors that limit population growth.

10. Communities, ecosystems and human impacts on ecosystems

Outcome: Discuss how the interactions observed in living things can be explained by the principles of ecology.

- Describe interspecific interactions such as competition, mutualism, predation, herbivory, parasitism, and pathogens, and indicate whether the interaction has a positive or negative effect on each species involved (+/-, +/+, -/-).
- Define the term ecological niche.
- Construct a simple trophic pyramid to show how energy moves through an ecosystem. Be sure to label each trophic level (producers, primary consumers/herbivores, secondary consumers/carnivores, etc.) and to define the terms on each level. In addition, define the role of decomposers in the ecosystem.
- Define “food web” and draw a simple food web based on a familiar terrestrial ecosystem (e.g., the food web that includes owls and their prey).
- Define the term “biogeochemical cycle” and list the four most significant cycles on earth.
- Using the water cycle (Ch 18) or the carbon cycle (Ch 20) as an example, explain in a paragraph how matter cycles through the biotic and abiotic components of an ecosystem.
- Identify human activities that cause extinction of other organisms, as well as the role humans play in introduction of non-native species.
- Explain the effect of greenhouse gases on global warming, and identify human activities that impact global warming.
- Explain in one paragraph three reasons for the preservation of biodiversity.

11. Overview of organ systems & homeostasis; Human nutrition and the digestive system

Outcome: Demonstrate a general understanding of human anatomy and physiology.

- List from least to most complex, the hierarchy of organization in humans (atoms, molecules, organelles, cells, etc.).
- List the eleven human organ systems and the major function of each (integumentary, skeletal, muscular, nervous, endocrine, digestive, respiratory, cardiovascular, lymphatic/immune, urinary, & reproductive).
- Define homeostasis and explain in one paragraph how it is regulated by negative and positive feedback.
- Identify the major organs found in the human digestive system and state the function(s) of each.
- Distinguish between the accessory organs of the digestive system, and the organs of the digestive (gastrointestinal or GI) tract.

12. Respiratory, circulatory, urinary and reproductive systems

Outcome: Demonstrate a general understanding of human anatomy and physiology.

- List the major organs of the cardiovascular system and state the function of each.

- On a diagram of the heart, lungs, and systemic circulation, trace the flow of blood through the cardiovascular system.
- List the major function(s) of the circulatory system.
- List the major organs of the respiratory system and state the function of each.
- State the major function(s) of the respiratory system.
- Explain in one paragraph the function of the diaphragm in respiration.
- List the major organs of the urinary system and state the function of each.
- State the function(s) of the urinary system.
- Identify the major organs found in the human male and female reproductive systems, and state the main function of each organ.

BIOETHICS OVERVIEW

Bioethical topics and reading assignments may be provided by your instructor at appropriate times during the course.

"Ethics" is the study of voluntary human actions and whether they are right or wrong. "Bioethics" is that study as it relates to the life and medical sciences. As biology students, it is important for you to recognize and analyze bioethical issues, and to use your intelligence to determine what is right and wrong. As citizens, long after you have completed your formal education, you will face and deal with bioethical issues for the rest of your life.

Recent developments in biology research and biotechnology enable man to interfere with or control life. Although society has the capacity to achieve certain results, the question often is whether we should do so.

1. We may be able to clone humans to achieve various objectives, e.g., to establish an embryo bank from which prospective parents could choose a child with genetic characteristics they desire, or to produce a society of superwomen and supermen. Should we do so?
2. We have a limited amount of resources for health care. Should we deny health care to persons over the age of 55 years if there is a younger person requiring the same treatment?
3. Should everyone be compelled to undergo compulsory drug testing?
4. Should smoking be banned entirely because of the reported effect of "second hand smoke"?
5. Should health care professionals be required to make public the names of all persons with diseases that are or are suspected to be contagious?
6. Should trained biologists, particularly genetic engineers, who have demonstrated practical applications of recombinant DNA technology, such as the production of human growth hormone and insulin in microbes, and who have produced an FDA approved genetically altered tomato now being marketed, be limited in their activities because of the concern that the formation of new plant and microbial organisms might some day lead to the creation of new kinds of human beings?
7. Does the insertion of genes from higher organisms to lower organisms by recombinant DNA technology itself represent interference in evolution?
8. Do we have the right to interfere with natural selection when we do not know where it will lead?
9. Recent advances in human genetics provide new methods for diagnosing and treating diseases, and promoting human health. Walter Eckhart, Ph.D. of The Salk Institute, raises the following bioethical issues:

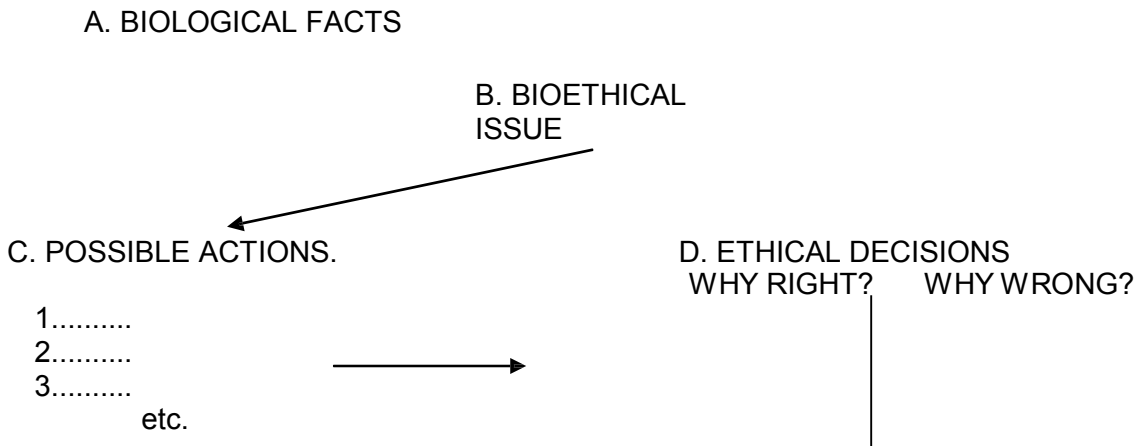
".....the new knowledge poses questions about who should have access to information about an individual's genetic makeup, how the information should be used, and what genetic manipulations should be permitted in an attempt to prevent or cure genetic diseases."

Dealing with bioethical issues requires a step-by-step approach.

1. Recognize the existence of bioethical issues, because not all biological facts involve bioethical issues.
2. Where a bioethical issue exists, define or describe the biological facts and principles related to the issue.
3. Think about the issue and decide which course of action appears to be right. In doing so, keep in mind that society and other individuals may make an opposite choice, that the outcome of your choice is uncertain, and that in the long run your choice may prove to be unwise or perhaps even disastrous.

You should be able to:

1. Identify major issues for the individual and the society that are considered bioethical.
2. Cite biological facts that do not involve bioethical issues.
3. Use the following model when considering bioethical issues:



Example 1 uses the model above to demonstrate how to make your own bioethical decisions. Select a bioethical issue, state the biological facts involved and possible opposing courses of action that might be taken to resolve the issue, and discuss why each course of action might be right or wrong. Complete Section D by making your own ethical decisions and explaining your reasons for them.

Example 1

A. BIOLOGICAL FACT. Nicotine damages the organs of the respiratory system. In addition, recent research suggests that cigarette smoke harms the health of persons near the smoker.

B. BIOETHICAL ISSUE. Should smokers be prevented from smoking near others in order to protect the health of non-smokers nearby?

C. POSSIBLE ACTIONS.

ACTION 1. Prohibit smoking in the presence of non-smokers.

ACTION 2. Require smokers to warn non-smokers that the smoker intends to smoke, so that the smoker can move away.

ACTION 3. Allow smokers to smoke where they wish.

ACTION 4. Ban smoking under all conditions. ACTION 5.

????????????????????

D. ETHICAL DECISIONS

RIGHT

WRONG

Action 1

Action 2

Action 3

Action 4

Action 5

3. Identify a single issue that you believe our society will be confronting in the twenty-first century and how the society could resolve it.

4. Discuss the relationship between science and morality.