Course Number  
BIO 113

Course Title  
Biological Science Concepts

Credits  
3

Hours: lecture/Lab/Other  
2 lecture/2 lab

Co- or Pre-requisite  
MAT 037 (or MAT 037A and 037B)

Catalog description:

A survey of fundamental ideals, concepts and principles in the biological sciences designed for the non-science and pre-allied health major. Prepares the student for intelligent participation in the biological world and provides a solid scientific basis on which knowledgeable attitudes and opinions can be developed. Lecture includes characteristics of life, evolution, biomolecules, cell biology, biological organization, cellular reproduction, inheritance, biotechnology, and mechanisms of disease. Laboratory exercises emphasize the scientific method and reinforce lecture topics.

Required texts/other materials:

Concepts of Biology – OpenStax College  
https://openstaxcollege.org

Laboratory Manual for BIO113, 8th edition  
Mercer County Community College, 2017

Revision date: 8/2017  
Course coordinator: Professor Ellen Genovesi  
Phone - (609) 570-3363  
Email - genoveea@mccc.edu
Course Competencies/Goals
At the end of this course students will be able to:
1. Investigate unifying features of living things and explore the diversity of life on earth.
2. Examine natural selection and evolutionary biology.
3. Explore structures and functions of cells, tissues, and organ systems in multicellular organisms.
4. Investigate chromosomes and gene inheritance.
5. Relate aspects of normal cell division to abnormal growth in cancer cells.
6. Analyze DNA structure and function and apply knowledge to technology.
7. Investigate the germ theory of disease and explore mechanisms utilized by infectious agents and effects on the human population.
8. Develop skills in observation, hypothesis construction, analysis of data, and application of the scientific method in an inquiry-based laboratory setting.

Course-specific General Education Knowledge Goals and Core Skills

General Education Knowledge Goals:
Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Goal 7. History. Students will understand historical events and movements in the World, Western, Non-Western or American societies and assess their subsequent significance.
Goal 9. Ethical Reasoning and Action Students will understand ethical issues and situations.

MCCC Core Skills:
Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal C. Ethical Decision-Making. Students will recognize, analyze, and assess ethical issues and situations.
Goal E. Computer Literacy. Students will use computers.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Units of study in detail -
Unit I: Biological Diversity, Scientific Method, Evolution (Weeks 1 – 4)
At the end of this unit, students will be able to:

1. Evaluate the criteria used to identify and classify all living things.
   (Course Competencies/Goals 1; Gen Ed Goal 1, 3 & 4; MCCC Core Skills A, E, &F.)
2. Compare the key characteristics of prokaryotic and eukaryotic organisms and organisms found in each of the four eukaryotic kingdoms.
3. Contrast the two prokaryotic domains bacteria and archaea.
   (Course Competencies/Goals 1 & 5; Gen Ed Goal 1, 3 & 4, MCCC Core Skills A, B, E, & F)

4. Engage in the process of science including the posing of a testable, falsifiable hypothesis.
   (Course Competencies/Goals 1 & 5; Gen Ed Goal 3 & 4, MCCC Core Skills A, B, & E)

5. Analyze the use of experimental variables, experimental and control groups, controlled variables, placebos, blind and double blind experiments.
   (Course Competencies/Goals 1, 2, & 5; Gen Ed Goal 1, 3 & 4, MCCC Core Skills A, B, E, & F)

6. Explore the contribution Darwin made to the understanding of evolution by natural selection and how his travels influenced his thinking. (Course Competencies/Goals 2 & 5; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

7. Synthesize aspects of natural selection including random variation, survival of the fittest, reproductive success, and descent with modification into an overarching scenario of evolution. Course Competencies/Goals 2, 3, & 5; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

8. Develop competency in conducting metric measurement and use of the light microscope. Course Competencies/Goals 8; Gen Ed Goal 3 & 4, MCC Core Skills B & E)

Unit II: Cell Biology, Inheritance of Traits (Weeks 4 – 8)

At the end of this unit, students will be able to:

1. Compare and contrast the two types of cells: prokaryotic and eukaryotic. Course Competencies/Goals 3; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

2. Investigate the architecture and function of the plasma (cell) membrane, the function of membrane proteins and select eukaryotic organelles. Course Competencies/Goals 43; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

3. Examine Mendel’s Laws and generate Punnett Squares to solve single trait crosses. Course Competencies/Goals 4; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

4. Analyze models of genetic inheritance including: pleiotropy, incomplete dominance, polygenic inheritance, and x-linked recessive traits. Course Competencies/Goals 4; Gen Ed Goal 1, 3 & 4, MCC Core Skills A, B, E, & F)

5. Relate the number of chromosomes in sperm and egg to genetic chromosomal number disorders in humans, including monosomic and trisomic genetic disorders. (Course Competencies/Goals 3; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)

6. Examine homologous chromosomes in a human karyotype and detect translocation, deletion, inversions and discuss the potential effects of these genetic abnormalities. (Course Competencies/Goals 3; Gen Ed Goals 3 & 4; MCC Core Skills B & E.)

7. Apply understanding of the techniques of karyotyping, amniocentesis, chorionic villi sampling, and preimplantation testing to fetal genetic typing, discussing the ethical implications of genetic testing and sex selection and genetic profiling. (Course Competencies/Goals 3; Gen Ed Goals 1, 3, 4 & 9; MCCC Core Skills A, B, C & E.)

8. Employ aspects of the scientific method to perform colorimetric tests for biomolecules and discover the role of catalase enzyme in eukaryotic organisms. (Course Competencies/Goals 8; Gen Ed Goals 1 & 3; MCCC Core Skills A, B, C & E.)
9. Analyze the release of oxygen and utilization of carbon dioxide by plants during photosynthesis. **(Course Competencies/Goals 3 & 8; Gen Ed Goals 1, 3, 4; MCCC Core Skills A, B, E)**

**Unit 3: Cell Division, Cancer, DNA, Biotechnology (Weeks 9 – 12)**

At the end of this unit the student will be able:

1. Analyze changes exhibited by cancer cells comparing malignant and benign tumors, treatment options, and risk factors. **(Course Competencies/Goals 5; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

2. Explain why cancer is a "multi-hit" genetic disease, examining the changes exhibited by cancer cells and treatment options. **(Course competencies/Goals 5; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

3. Define DNA, genetic code, genes, double helix, nucleotide, and genome; calculate the complementary strand of DNA given a particular DNA sequence. **(Course Competencies/Goals 6; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

4. Evaluate materials required body tissue sources to obtain material for DNA fingerprinting, examining various uses of DNA fingerprinting such as paternity testing and criminal investigations using gel electrophoresis. **(Course Competencies/Goals 5; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

5. Apply an understanding of recombinant DNA technology to the use of transgenic organisms for medical and commercial uses. **(Course Competencies/Goals 5; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

6. Differentiate therapeutic cloning from reproductive cloning, investigating the origin and use of stem cells to treat disease and evaluating the concepts of undifferentiated cells and the difference between an embryo and a stem cell line. **(Course Competencies/Goals 1, 5, & 9; Gen Ed Goals 1, 3 4 & 9; MCCC Core Skills A, B, E, & F.)**

7. Isolate DNA from plant cells. **(Course Competencies/Goals 8; Gen Ed Goals 1 & 3; MCCC Core Skills A, B, & F.)**

8. Compare the four principle types of animal tissue, identify tissues types and structures in 2 organ specimens. **(Course Competencies/Goals 8; Gen Ed Goals 1 & 3; MCCC Core Skills A, B, & F.)**

**Unit 4 Disease and the Immune System (Weeks 13 – 15)**

At the end of this unit the student will be able:

1. Examine the Plague (black death) and its transmission from flea to rats to humans and the impact of the plague in The Middle Ages. **(Course Competencies/Goals 6 & 7; Gen Ed Goals 3, 4 & 7 MCCC Core Skills B & E.)**

2. Describe key characteristics of diseases caused by the following bacterial agents: viruses, viroids, prions, bacteria, protists, fungi and parasites. **Course Competencies/Goals 7; Gen Ed Goals 3, 4 & 7 MCCC Core Skills B & E.)**

3. Recognize organs of the lymphatic system including red bone marrow, the thymus gland, spleen, and lymph nodes, contrasting the role of the immune system in autoimmune disease. **(Course Competencies/Goals 7; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

4. Distinguish between specific and nonspecific body defense systems and between self-antigens, foreign antigens, and antibodies, differentiating the roles B lymphocytes and T lymphocytes in specific immunity and the effect of immunization. **(Course Competencies/Goals 7; Gen Ed Goals 3 & 4; MCCC Core Skills B & E.)**

5. Examine the biology of blood cells, examining bones involved in hematopoiesis, hematocrit results, causes of
anemia, and blood typing (Course Competencies/Goals 1, 3 & 4; Gen Ed Goals 1 & 3; MCCC Core Skills A, B, & F.)

6. Determine the optimal conditions for bacterial and fungal growth. (Course Competencies/Goals 3 & 8; Gen Ed Goals 1, 3 & 4; MCCC Core Skills A, B & E.)

7. Utilize the process of fermentation to make yogurt describing organisms used in fermented foods and well as food-borne pathogens. (Course Competencies/Goals 3 & 8; Gen Ed Goals 1, 3 & 4; MCCC Core Skills A, B & E.)

**Evaluation of Student Learning**

Questions on exams are taken from lecture, reading assignments, handouts, or other material presented. It is the student's responsibility to be present at and on time for all exams. There are no regular makeup exams. A student who misses an exam must contact the instructor within 12 hours. A student who misses an exam AND has contacted the instructor within the designated time period may be allowed to take an essay make-up exam. Discussion boards, essays, or additional assignments may be added as per the instructors discretion.

A 20 point quiz will be given at the beginning of each laboratory session, you must be punctual. Students who do not complete a laboratory session (arrive late or leave early) will be counted as absent and given a “0” grade. Missed laboratories cannot be made up. Any potential problems should be discussed in advance with the laboratory instructor. The 2 lowest laboratory grades are dropped.

All tests, homework assignments, laboratory grades, and class attendance contribute to the final grade. The laboratory grade is approximately 35% of the final grade for the course.

*It is the student's responsibility to decide to withdraw from the course and to do so by the deadline*

**Grading:**

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100%</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<tr>
<td>B</td>
<td>87-89%</td>
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<tr>
<td>B-</td>
<td>83-86</td>
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<tr>
<td>C</td>
<td>77-79%</td>
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<tr>
<td>C-</td>
<td>70-76</td>
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<tr>
<td>D</td>
<td>60-69%</td>
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<tr>
<td>F</td>
<td>&lt;60%</td>
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**Accommodations**

Mercer County Community College is in compliance with both the ADA and section 504 of the Rehabilitation Act. If you have, or believe you have, a differing ability that is protected under the law please see Arlene Stinson in LB 216 {570-3525 {stinsona@mccc.edu} for information regarding support services.

**Academic Integrity**

Cheating of any kind is not tolerated. Cheating includes copying papers or website information, presenting another person's work as one's own in any way, looking at notes during a unit test or unit lab test, or obtaining information about an exam, quiz, or any other information that other students do not have and the instructor does not intend them to have, or communication with another student during a unit test or unit lab test. Discussion responses should be written in your own words. All violations of academic integrity will be reported to the Academic Integrity Committee. For additional information: Refer to the MCCC Student Handbook.
Classroom conduct
The college welcomes students into an environment that creates a sense of community pride and respect.

Attendance
It is a student's responsibility to attend all of his/her classes. If a class meeting is missed, the student is responsible for content covered, announcements made in his/her absence, and for acquiring materials distributed in class. A student who misses more than three laboratory sessions will receive an F grade for the course no matter how high the lecture grade.

Tardiness
It is expected that students will be on time for all classes. Students late for an exam may be denied the opportunity to take the exam. A student who enters the laboratory late may not be able to participate in the lab.

Behavior
Students are expected to follow ordinary rules of courtesy during class sessions. The instructor has the right to eject a disruptive student from the class at any time. Turn off cell phones at the beginning of each class.

BIO113 SCHEDULE OF LECTURE TOPIC AND LAB WORK

<table>
<thead>
<tr>
<th>UNIT 1</th>
<th>Topic</th>
<th>Reading Assignments</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>A View of Life</td>
<td>Chapter 1.1 Themes and Concepts in Biology</td>
<td>The Metric System of Measurement</td>
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<td>Bb Quiz: Char. of Life (1)</td>
<td>Chapter 12.1 Organizing Life on Earth</td>
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<td>Domains of Life (2)</td>
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<tr>
<td>Week 2</td>
<td>The Scientific Method</td>
<td>Chapter 1.2 The Process of Science</td>
<td>Microscopy</td>
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<td>Bb Quiz: Scientific Method (3)</td>
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<tr>
<td>Week 3</td>
<td>Evolution &amp; Natural Selection</td>
<td>Chapter 11.1 Discovering How Populations Change (omit Population Genetics)</td>
<td>The Scientific Method/ Extinction</td>
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<td>Bb Quiz: The Making of a Theory. (4)</td>
<td>Chapter 11.3 Evidence of Evolution</td>
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<td>The Making of the Fittest (5)</td>
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<td>Human Evolution (6)</td>
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<td>UNIT 2</td>
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<tr>
<td>Week 4</td>
<td>Unit 1 Exam – 100 points ALL UNIT 1 QUIZZES DUE</td>
<td>Chapter 3.1 How Cells Are Studied</td>
<td>Diffusion and Osmosis</td>
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<td></td>
<td>Inside the Cell</td>
<td>Chapter 3.2 Comparing Prokaryotic and Eukaryotic Cells</td>
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<td>Bb Quiz: The Cell and Plasma Membrane (7)</td>
<td>Chapter 3.3 Eukaryotic Cells (omit Animal Cells versus Plant Cells and Intercellular Juncitons)</td>
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<td>Week 5</td>
<td>Patterns of Inheritance</td>
<td>Chapter 8.1 Mendel's Experiments</td>
<td>Biomolecules</td>
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<td>Bb Quiz: Eukaryotic Organelles (8)</td>
<td>Chapter 8.2 Laws of Inheritance</td>
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</tbody>
</table>
| Week 6 | Patterns of Inheritance  
Bb Quiz:  
Mendelian Genetics (9)  
Beyond Mendel’s Law (10) | Chapter 8.3 Extensions of the Law of Inheritance (omit Linked Genes Violate the Law of Independent Assortment & Epistasis) | Enzyme Action |
|---|---|---|---|
| Week 7 | Genetic Counseling  
Bb Quiz:  
Sexual Reproduction (11)  
Chrom. Disorders (12) | Chapter 7.1 Sexual Reproduction  
Chapter 7.2 Meiosis (Introduction only) & Comparing Meiosis and Mitosis section  
Chapter 7.3 Errors in Meiosis | Human Genetics |
| **UNIT 3** | | | |
| Week 8 | Unit 2 Exam – 100 points  
ALL UNIT 2 QUIZZES DUE  
Cell Reproduction | Chapter 6.1 The Genome  
Chapter 6.2 The Cell Cycle | Photosynthesis |
| Week 9 | Cell Regulation and Cancer  
Bb Quiz:  
Cellular Reproduction & Cancer (13) | Chapter 6.3 Cancer and the Cell Cycle | Molecular Biology |
| Week 10 | DNA Biology  
Connect Quiz:  
DNA Biology (14) | Chapter 9.1 The Structure of DNA  
Chapter 9.2 DNA Replication (intro only, omit DNA Replication in Eukaryotes)  
Chapter 9.3 Transcription  
Chapter 9.4 Translation | Isolation of DNA from Plants |
| Week 11 | Biotechnology  
Bb Quiz:  
DNA Technology (15) | Chapter 10.1 Cloning and Genetic Engineering  
Chapter 10.2 Biotechnology in Medicine and Agriculture | Animal Tissues |
| **UNIT 4** | | | |
| Week 12 | Unit 3 Exam  
ALL UNIT 3 QUIZZES DUE  
Disease Transmission  
Bb Quiz:  
Diseases (16) | Chapter 13.1 Prokaryotic Diversity (section on Bacterial Diseases in Humans) | Blood |
| Week 13 | Pathogens  
Bb Quiz: | | Microbiology |
| Week 14 | The Lymphatic System & Immunity  
Bb Quiz: Lymphatic System (18) Vaccinations (19) | Chapter 17.1 (section on Vaccines for Prevention)  
Chapter 17.2 Innate Immunity | Food Microbiology and Disease Transmission |
|---------|--------------------------------------------------|-----------------------------------------------|---------------------------------------------|
| Week XV | **Unit 4 Exam**  
(May be scheduled for Finals Week)  
**ALL UNIT 4 QUIZZES DUE** | | |