

Biology 101 Learning Goals

Fall, 2011

General:

As part of an FYE Class/ Learning Community, this class will help its students:

1. Begin the process of becoming a critical thinker by learning to evaluate sources, analyze data, and come to conclusions based on that data.
2. Become a member of the scholarly community, implying:
 - a. An ability to locate and evaluate information
 - b. An ability to analyze that information in terms of the problem at hand using critical thinking skills
 - c. An ability to communicate one's own original conclusions clearly in writing and in speech
 - d. The integrity to conduct one's scholarly affairs with utmost respect for the opinions of others and for the proper attribution of scholarly thought

As a part of the General Education requirement in Natural Science, this class will help its students:

1. Learn about the scientific method and how it is applied to learn about the natural world.
2. Learn how scientific theories are developed.
3. Examine how the science of biology is critical to society
4. Be able to "think like a scientist" when examining problems.

As a foundation course in biology, this course will help its students:

1. Continue a natural fascination with the natural world.
2. Learn how the scholarly world of biology works, with the microcosm of that world as represented by the Department of Biology and Environmental Science at Marietta College as an example.
3. Become members of the community of scholars in the department; meeting its faculty and fellow students.
4. Learn basic principles of biology that will serve as the foundations for more advanced courses (enumerated in detail below).

Success in achieving these goals will be measured by surveys of student attitudes at the end of the course, by success (or lack thereof) on tests and assignments, and, most importantly, by success throughout life.

Specific Learning Goals:

- I. Ecology
 - a. Understand the concepts of communities and ecosystems
 - b. Understand the theoretical underpinnings of traditional views of communities.
 - c. Understand the concept of an ecological niche
 - d. Understand the concept of competitive exclusion in the context of the niche
 - e. Understand how organisms avoid competitive exclusion by means such as resource partitioning and character displacement
 - f. Understand how and why predator and prey populations affect each other and cycle as a result
 - g. Understand the concept of coevolution as it applies to predators and prey
 - h. Understand the methods by which prey avoid predation
 - i. Understand other species interactions (symbiosis [parasitism, commensalism, mutualism], herbivory, detritivory, etc. in addition to competition and predation.
 - j. Understand the process of change in a community known as succession
 - k. Understand a few other important ecological principles including keystone species and the intermediate disturbance principle.
 - l. Understand the principle of biogeochemical cycles
 - m. Know 4 biogeochemical cycles in detail (water, carbon, nitrogen, phosphorous)
 - n. Understand the flow of energy through ecosystems
 - o. Understand trophic levels in terms of energy flow
 - p. Understand how energy loss between trophic levels leads to a pyramid of energy – and the implications of this.
 - q. Understand what biodiversity is; how it arises, and what threatens it.

II. Evolution

- a. Understand the Darwinian formulation of evolution as descent with modification as controlled by natural selection
- b. Understand enough population genetics to see the genetic basis of evolutionary change
- c. Understand the concept of a null hypothesis in science, and the Hardy-Weinberg equilibrium as a specific example of a null hypothesis which has been disproven (thus supporting evolution)
- d. Understand the role of population size and random events in evolution
- e. Understand how evolutionary success is measured, i.e. the concept of fitness
- f. Understand how evolution can maintain genetic diversity
- g. Understand a series of natural and artificial experiments in support of evolution
- h. Understand how the fossil record supports the current model of evolution
- i. Understand how anatomical evidence from a variety of species supports the model of evolution
- j. Understand the concept of a species in a sophisticated biological sense
- k. Understand the pre- and postmating mechanisms that can cause populations to diverge over time into separate species.
- l. Understand the processes of allopatric and sympatric speciation
- m. Understand modern additions to Darwin's theory of evolution such as punctuated equilibrium.

III. Cellular Reproduction

- a. Understand the primacy of the cell in our conceptualization of biology.
- b. Know the two major types of cells and which organisms have which type of cell
- c. Understand the process of binary fission in prokaryotic cells
- d. Understand the nature of chromosomes in eukaryotic cells
- e. Understand that cell division in eukaryotic cells is dependent on separation of the chromosomes into two comparable groups
- f. Understand the eukaryotic cell cycle
- g. Understand the stages of mitosis
- h. Understand how the cell cycle is controlled in eukaryotic cells, and how failure of that control can lead to cancer.
- i. Understand the nature of stem cells
- j. Understand the process of meiosis and how it differs from mitosis
- k. Be able to compare and contrast mitosis and meiosis
- l. Understand the role of meiosis in reproduction and the passing of genetic information from one generation to the next

IV. Heredity

- a. Understand genetics by examining its history
- b. Understand more of science by thinking about the implications of Darwin's and Mendel's ideas, and what might have happened had Darwin been aware of Mendel's work in genetics
- c. Understand the basic crosses done by Mendel
- d. Understand how to trace simple genetic markers through a family by use of a pedigree
- e. Understand the characteristics of dominant and recessive traits, both at the level of the genotype and the phenotype
- f. Be able to use simple genetic mathematical models to predict the ratio of traits in a simple cross
- g. Be aware of several patterns that do not follow the patterns discovered by Mendel
- h. Understand several modern extensions of Mendel – polygenic inheritance, environmental influences, etc.

- V. Human Reproductive Systems
 - a. Understand the various forms of reproduction used by living organisms (sexual, asexual, parthenogenesis, budding, etc.)
 - b. Understand how sex (gender) is determined in various groups of organisms (it's not always XY or XX!).
 - c. Understand the process of fertilization
 - d. Understand the basics of mammalian reproduction
 - e. Understand the hormonal control of reproduction in mammals
 - f. Understand the human female estrous cycle
 - g. Understand how each of various forms of human birth control works and the advantages/disadvantages of each
 - h. Contrary to popular belief, there is not a hands-on lab for this section