Course Outcome Summary

Course Information

Description
This lecture/laboratory course provides students with an in-depth study of the plant kingdom. The content includes, but is not limited to, plant cell anatomy and physiology, plant genetics, plant classification, plant anatomy and physiology, plant responses, plant life cycles, and ecology. A survey of viruses, prokaryotes, protista, and fungi as they pertain to plants is presented.

Total Credits 3.00

Pre/Corequisites

Prerequisite
Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College.

Course Competencies

1. Investigate the characteristics of living things

   Assessment Strategies
   1.1. through class discussions, quizzes and examinations

   Criteria

   Your performance will be successful when:
   1.1. you list the characteristics of living things
   1.2. you distinguish between growth, development and reproduction
   1.3. you define homeostasis and give examples
   1.4. you distinguish the levels of organization of living things

2. Apply the scientific method to the biological sciences

   Assessment Strategies
   2.1. through class discussions, quizzes and examinations, and a written and oral report

   Criteria

   Your performance will be successful when:
   2.1. you list the steps used in the scientific process
   2.2. you develop an example utilizing the scientific method
   2.3. you utilize inductive and deductive logic in the scientific method
   2.4. you differentiate between the following terms: hypothesis, observation, theory, and law
3. Demonstrate a working knowledge of microscopes
   
   **Assessment Strategies**
   3.1. through class discussions, quizzes and examinations, and a laboratory exercise and report

   **Criteria**

   *Your performance will be successful when:*
   3.1. you name the parts of the compound microscope and the stereoscopic microscope
   3.2. you describe the function of each of the parts of the microscope
   3.3. you determine the total magnification of any given combination of ocular and objective lenses
   3.4. you measure the field of view at 40x, 100x, and 470x magnification
   3.5. you demonstrate the correct use of the compound microscope and the stereoscopic microscope

4. Apply basic biochemistry concepts as they relate to macromolecules
   
   **Assessment Strategies**
   4.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

   **Criteria**

   *Your performance will be successful when:*
   4.1. you define matter, energy and force
   4.2. you identify bond types: covalent, ionic, and hydrogen (proton bonds) and name their basic structural subunits
   4.3. you define the characteristics of water and name the basic structural subunits
   4.4. you discuss acid-base balance and name the basic structural subunits
   4.5. you discuss the nature of buffers and name the basic structural subunits
   4.6. you describe the nature of synthetic and hydrolytic reactions and name the basic structural subunits
   4.7. you name the four main types of organic molecules found in plants and their basic structural subunits
   4.8. you describe the principal functions of each macromolecule
   4.9. you distinguish between hydrolysis and dehydration synthesis and give an example of each
   4.10. you distinguish between structural polysaccharides and energy storage polysaccharides and give an example of each
   4.11. you define what an enzyme is and why enzymes are important to cells
   4.12. you name the parts of an enzyme and describe the function of each part
   4.13. you differentiate between ATP and ADP, and explain why ATP is important
   4.14. you distinguish between primary and secondary metabolites
   4.15. you name the main types of secondary metabolites and provide examples of each type

5. Investigate the plant cell and the cell cycle
   
   **Assessment Strategies**
   5.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

   **Criteria**

   *Your performance will be successful when:*
   5.1. you compare selected features of prokaryotic and eukaryotic cells -- size, cell wall, nuclear envelope, DNA, organelles, and cytoskeleton
   5.2. you name the various types of plastids and what role(s) each plays
   5.3. you describe the cytoskeleton and its functions
   5.4. you describe how primary cell walls differ from secondary cell walls
   5.5. you describe the cell cycle and its regulation
   5.6. you describe the key events that occur in the G1, S, G2, and M phases of the cell cycle
   5.7. you explain what mitosis is
   5.8. you identify each of the four phases of mitosis, using a microscope
   5.9. you describe what events occur in each of the four phases
   5.10. you describe cytokinesis
6. **Investigate the movement of substances into and out of cells**

**Assessment Strategies**
6.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

**Criteria**

*Your performance will be successful when:*
6.1. you explain the concept of water potential
6.2. you distinguish between osmosis and diffusion
6.3. you describe the fluid mosaic model of the cell membrane
6.4. you describe the role played by its two major components
6.5. you explain the role of transport proteins in the movement of materials across the cell membrane
6.6. you describe the similarities and differences between facilitated diffusion and active transport
6.7. you describe vesicle-mediated transport
6.8. you describe the roles of signal transduction and plasmodesmata in cell-to-cell communication

7. **Investigate the flow of energy in living systems**

**Assessment Strategies**
7.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

**Criteria**

*Your performance will be successful when:*
7.1. you describe how the first and second laws of thermodynamics apply to living systems
7.2. you explain why oxidation-reduction (redox) reactions are important to living systems
7.3. you describe some of the factors that influence enzyme activity
7.4. you describe how feedback inhibition regulates cellular activity
7.5. you describe coupled reactions
7.6. you explain how ATP functions as an intermediate between exergonic and endergonic reactions

8. **Investigate cellular respiration**

**Assessment Strategies**
8.1. through class discussion, quizzes and examinations, a laboratory exercise and report, and by developing a concept map

**Criteria**

*Your performance will be successful when:*
8.1. you outline the main events of respiration -- glycolysis, the transition reaction, the citric acid cycle, oxidative phosphorylation (electron transport and chemiosmosis), and fermentation
8.2. you differentiate between aerobic and anaerobic respiration
8.3. you explain how glycolysis and fermentation are related
8.4. you explain the central role of the citric acid cycle in the metabolism of the cell

9. **Investigate photosynthesis**

**Assessment Strategies**
9.1. through class discussion, quizzes and examinations, a laboratory exercise and report, and by developing a concept map

**Criteria**

*Your performance will be successful when:*
9.1. you explain the role of light in photosynthesis
9.2. you name the principal pigments involved in photosynthesis
9.3. you explain why leaves are green
9.4. you separate the photosynthetic pigments using paper chromatography and thin layer chromatography
9.5. you name the reactants and products of the light dependent reactions
9.6. you name the reactants and products of the light independent reactions
9.7. you describe the main events associated with each of the two photosystems in the light reactions
9.8. you differentiate between antenna pigments and reaction center pigments
9.9. you describe the differences and similarities between C3, C4, and CAM pathways for carbon fixation
9.10. you describe the absorption spectrum
9.11. you describe the action spectrum
9.12. you prepare an action spectrum for the pigments in spinach leaves, using a spectrophotometer

10. Investigate sexual reproduction and heredity

Assessment Strategies

10.1. through class discussion, quizzes and examinations, a laboratory exercise and report, and by performing genetic crosses using living plants (e.g., Wisconsin Fast Plants)

Criteria

Your performance will be successful when:

10.1. you relate the haploid and diploid chromosome number, meiosis, and fertilization
10.2. you explain the importance of crossing over
10.3. you list the main events of meiosis I
10.4. you explain how meiosis I differs from meiosis II
10.5. you compare the advantages and disadvantages of sexual and asexual reproduction
10.6. you summarize the major findings of Gregor Mendel and explain the unique aspects of his experimental method
10.7. you explain why a trait is visible in the parent but not in the offspring
10.8. you explain how a test cross is performed and its importance
10.9. you explain the concept of linked genes
10.10. you explain how the concept of linked genes is at odds with independent assortment
10.11. you list and give examples of different types of mutations
10.12. you explain how mutations affect the evolution of a population of organisms

11. Investigate the chemistry of heredity and gene expression

Assessment Strategies

11.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

Criteria

Your performance will be successful when:

11.1. you explain how DNA replication occurs
11.2. you explain what the genetic code is
11.3. you describe the main steps in transcription of RNA from DNA
11.4. you explain where translation occurs
11.5. you list the major steps of translation
11.6. you explain how gene expression is regulated in eukaryotes
11.7. you extract DNA from living cells

12. Investigate recombinant DNA technology, plant biotechnology, and genomics

Assessment Strategies

12.1. through class discussion and quizzes and examinations

Criteria

Your performance will be successful when:

12.1. you explain how recombinant DNA technology is used to create novel genotypes
12.2. you discuss the importance of Arabidopsis thaliana as a model organism
12.3. you describe some of the techniques used in plant biotechnology to manipulate the genetic potential of plants
12.4. you explain what genomics is
12.5. you explain how one determines the function of a newly discovered gene

13. Examine the concepts of evolution

Assessment Strategies

13.1. through class discussion and quizzes and examinations
Criteria

Your performance will be successful when:
13.1. you explain the difference between static and dynamic views of species
13.2. you describe five lines of evidence supporting the evolutionary process
13.3. you describe the Darwinian view of change over time
13.4. you distinguish the Darwinian view from inheritance of acquired characteristics
13.5. you distinguish natural from artificial selection
13.6. you identify each of Darwin's postulates
13.7. you provide evidence in support of each postulate
13.8. you relate evolution to Mendelian genetics
13.9. you recognize that evolution acts on phenotypes, not genotypes
13.10. you recognizes that populations, not individuals, evolve
13.11. you state the Hardy-Weinberg law
13.12. you demonstrate mathematically that gene frequency doesn't change in a non-evolving population
13.13. you identify five agents that can change gene frequency in a gene pool
13.14. you explain how each agent can alter frequency
13.15. you describe allopatric and sympatric speciation
13.16. you explain genetic isolation
13.17. you define co-evolution
13.18. you give examples of co-evolution

14. Investigate systematics
Assessment Strategies
14.1. through class discussion, quizzes and examinations, and by preparing a cladogram

Criteria

Your performance will be successful when:
14.1. you explain what binomial system of nomenclature is
14.2. you explain why the term "hierarchical" is used to describe taxonomic groups
14.3. you name the principal categories between the levels of species and kingdom
14.4. you explain what a cladistic analysis is
14.5. you draw a cladogram for mosses, ferns, pines, and oaks
14.6. you provide evidence for the existence of the three major domains of living organisms
14.7. you compare the major characteristics of each of the four kingdoms of eukaryotes

15. Investigate viruses and prokaryotic organisms
Assessment Strategies
15.1. through class discussion, quizzes and examinations, and by preparing a cladogram

Criteria

Your performance will be successful when:
15.1. you describe the basic structure of a prokaryotic cell
15.2. you explain how prokaryotes reproduce
15.3. you describe ways for genetic recombination to occur in prokaryotes
15.4. you explain the importance of cyanobacteria
15.5. you compare the metabolism of cyanobacteria and the purple and green bacteria
15.6. you explain how mycoplasms differ from all other bacteria
15.7. you describe the physiology of the three groups of archaea
15.8. you describe the basic structure of a virus
15.9. you describe how viruses reproduce

16. Investigate the protists
Assessment Strategies
16.1. through class discussion, quizzes and examinations, and a laboratory exercise and report
Criteria

Your performance will be successful when:

16.1. you explain how dinoflagellates, euglenoids, and cryptomonads are similar
16.2. you explain how oomycetes differ from other heterokonts
16.3. you list important plant disease causes by oomycetes
16.4. you list the basic characteristics of brown algae
16.5. you list the basic characteristics of red algae
16.6. you describe the characteristics of green algae that have led botanists to conclude that green algae are the protist group from which bryophytes and vascular plants evolved

17. Investigate fungi

Assessment Strategies
17.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

Criteria

Your performance will be successful when:

17.1. you name the characteristics of fungi that differentiate them from all other organisms
17.2. you describe the type of organism it is thought that fungi evolved from
17.3. you list the distinguishing characteristics of the Chytridomycoata, Zygomycota, Ascomycota, and Basidiomycota
17.4. you explain the relationship of yeast to filamentous fungi
17.5. you explain how conidial fungi are related to other fungi
17.6. you describe some of the symbiotic relationships between fungi and other organisms
17.7. you describe the ecological importance of fungi

18. Investigate bryophytes

Assessment Strategies
18.1. through class discussion, quizzes and examinations, and by preparing a correctly labeled drawing of the life cycle of Polypodium sp.

Criteria

Your performance will be successful when:

18.1. you explain the concept of alternation of generations
18.2. you describe the general characteristics of a bryophyte
18.3. you compare the three phyla of bryophytes
18.4. you describe the life cycle of a bryophyte
18.5. you identify the parts of sporophyte
18.6. you identify the parts of the gametophyte
18.7. you compare the structure and form of the liverworts, hornworts, and mosses

19. Investigate seedless vascular plants

Assessment Strategies
19.1. through class discussion, quizzes and examinations, a laboratory exercise and report, and by preparing correctly labeled drawings of the life cycles of a zygomycete, an ascomycete, and a basidiomycete

Criteria

Your performance will be successful when:

19.1. you list "pivotal step" in the evolution of vascular plants that account for their success on land
19.2. you explain the difference between microphylls and megaphylls
19.3. you explain the evolutionary origin of each -- microphylls and megaphylls
19.4. you compare homospory with heterospory
19.5. you describe the life cycle of a fern (Polypodium)
19.6. you compare the structure and form of the whisk ferns, club mosses, quillworts, horsetails, scouring rush, and ferns
20. **Investigate the evolution and life cycle of gymnosperms**

**Assessment Strategies**

20.1. through class discussion, quizzes and examinations, and by preparing a correctly labeled drawing of the conifer life cycle

**Criteria**

*Your performance will be successful when:*

20.1. you discuss the importance of the seed in the evolution of plants
20.2. you discuss what group of plants is it hypothesized that seed plants evolved from
20.3. you draw and label the life cycle of conifers
20.4. you name the four phyla of gymnosperms with living representatives

21. **Investigate reproduction in angiosperms**

**Assessment Strategies**

21.1. through class discussion, quizzes and examinations, a laboratory exercise and report, and by preparing a correctly labeled drawing of the angiosperm life cycle

**Criteria**

*Your performance will be successful when:*

21.1. you identify the principal parts of a flower
21.2. you describe some of the variations that exist in flower structure
21.3. you compare the processes by which angiosperms form microgametophytes and megagametophytes
21.4. you describe the structure of the mature microgametophyte in angiosperms
21.5. you describe the structure of the mature megagametophyte in angiosperms
21.6. you describe double fertilization
21.7. you name the products of double fertilization

22. **Investigate the evolution of angiosperms**

**Assessment Strategies**

22.1. through class discussion, quizzes and examinations

**Criteria**

*Your performance will be successful when:*

22.1. you state the current hypothesis on the origin of angiosperms
22.2. you list the four principal evolutionary trends among flowers
22.3. you compare different methods of pollination
22.4. you describe some of the adaptations of fruits to their dispersal agents
22.5. you describe how secondary metabolites have influenced angiosperm evolution

23. **Investigate early development of the plant body**

**Assessment Strategies**

23.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

**Criteria**

*Your performance will be successful when:*

23.1. you explain why polarity is important to plant embryogenesis
23.2. you name the primary mersistems of plants
23.3. you list the tissues each of these mersistems forms
23.4. you compare the embryogenesis of monocots and dicots
23.5. you explain how mutations have helped scientists to understand embryo development
23.6. you identify the main parts of the monocot embryo and the dicot embryo
23.7. you plant seeds of monocots and dicots to compare their development

24. **Investigate cells and tissues of the plant body**

**Assessment Strategies**

24.1. through class discussion, quizzes and examinations, and a laboratory exercise and report
Criteria

Your performance will be successful when:
24.1. you describe the composition of a meristem
24.2. you describe the overlapping processes of plant development
24.3. you identify the three tissue systems of the plant body
24.4. you identify the tissues that comprise each of these tissue systems
24.5. you identify parenchyma, collenchyma, and sclerenchyma cells
24.6. you compare parenchyma, collenchyma, and sclerenchyma cells
24.7. you identify the principal conducting cell in xylem
24.8. you identify the principal conduction cell in phloem
24.9. you list the characteristics of each cell type
24.10. you list the roles played by the epidermis

25. Investigate root structure and development
Assessment Strategies
25.1. through class discussion, quizzes and examinations, and a laboratory exercise and report
Criteria

Your performance will be successful when:
25.1. you compare the two principal types of root systems
25.2. you describe the functions of the root cap
25.3. you identify the tissues present in the root at the end of primary growth
25.4. you describe the effect secondary growth has on the primary body of the root
25.5. you identify the origin of lateral roots
25.6. you name modifications to the "typical" root in various plants

26. Investigate the primary structure and development of the shoot
Assessment Strategies
26.1. through class discussion, quizzes and examinations, and a laboratory exercise and report
Criteria

Your performance will be successful when:
26.1. you identify the structures of the shoot apical meristem
26.2. you describe the relationship between apical meristem and the shoot
26.3. you describe the three primary types of organization found in the primary structure of the stems of seed plants
26.4. you define leaf traces
26.5. you name the four basic types of leaf arrangement
26.6. you describe the structural differences between the leaves of monocots and dicots
26.7. you describe the structure of a "typical" leaf
26.8. you describe modifications to the "typical" stem found in various plants
26.9. you describe modifications to the "typical" leaf found in various plants

27. Investigate secondary growth in stems
Assessment Strategies
27.1. through class discussion, quizzes and examinations, and a laboratory exercise and report
Criteria

Your performance will be successful when:
27.1. you contrast annuals, biennials, and perennials
27.2. you describe the functions of the cells that compose the vascular cambium
27.3. you describe how secondary growth affects the primary body of the stem
27.4. you name the tissues that are reproduced by the cork cambium
27.5. you describe the function of the periderm
27.6. you explain what bark is
27.7. you explain how the composition of bark changes during the life of a woody plant
27.8. you define wood
27.9. you contrast conifer wood and angiosperm wood
27.10. you discuss the various uses of plants

28. Investigate plant hormones

Assessment Strategies
28.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

Criteria

*Your performance will be successful when:*
28.1. you compare the five major groups of plant hormones as to their chemical nature, site of biosynthesis, transport, and effects
28.2. you observe how plant hormones are used in tissue culture
28.3. you investigate how plant hormones exert their effects at the molecular level

29. Investigate external factors that influence plant growth

Assessment Strategies
29.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

Criteria

*Your performance will be successful when:*
29.1. you define tropism and provide examples of tropisms
29.2. you define and give examples of nastic movements
29.3. you explain how plants respond to light and gravity
29.4. you explain why it is important for plants to be able to "tell time"
29.5. you investigate the characteristics of biological clocks in plants
29.6. you explain how day length affects flowering
29.7. you characterize phytochrome
29.8. you explain how phytochrome is involved in flowering, seed germination, and stem growth
29.9. you characterize dormancy
29.10. you list environmental cues that may be necessary to break dormancy in seeds and buds

30. Investigate plant nutrition and soils

Assessment Strategies
30.1. through class discussion, quizzes and examinations, and a laboratory exercise and report

Criteria

*Your performance will be successful when:*
30.1. you name the elements that are essential to plant growth
30.2. you list the function and deficiency symptoms of some of the essential elements
30.3. you name the sources of inorganic nutrients utilized by plants
30.4. you identify the components of nutrient cycles
30.5. you explain how humans have disrupted nutrient cycles

31. Investigate the movement of water and solutes in plants

Assessment Strategies
31.1. through class discussion, quizzes and examinations

Criteria

*Your performance will be successful when:*
31.1. you explain the process of transpiration
31.2. you explain the structure and function of guard cells
31.3. you explain how the cohesion-tension theory accounts for the movement of water to the top of tall trees
31.4. you explain how the osmotically generated pressure-flow mechanism accounts for the movement of sugars from source to sink
32. Investigate ecology

Assessment Strategies
32.1. through class discussion, quizzes and examinations, and an oral and written report

Criteria

Your performance will be successful when:
32.1. you differentiate between a population, a community, and an ecosystem
32.2. you describe how energy flows through a food chain
32.3. you identify various symbiotic relationships
32.4. you list factors that influence the distribution of biomes
32.5. you describe the characteristic plants of the major biomes
32.6. you describe succession
32.7. you describe biogeochemical cycles