



North Polk Community Schools Pacing & Course Description Guide



Grade Level: 11-12

Content: DMACC General Biology (112-113)

Year: 2022-2023

Course Description/Rationale

First year of Biology for majors. Topics covered include chemistry of life, cells, bioenergetics, genetics, evolution, microbes, fungi, plants, animals, and ecology. *Prerequisite:* H.S. Biology & H.S. Chemistry or equivalent

Name of Unit	Time Frame	DMACC Competencies / Essential Learning Targets	DMACC BIO 112/113 Standard(s)
Intro to Bio	2 weeks	1.1 Locate safety equipment in the laboratory 1.2 Model safe behavioral practices when in the laboratory 1.3 Use laboratory equipment correctly 2.1 Distinguish between hypotheses and theories 2.2 Gain exposure to primary scientific literature 2.3 Engage in scientific writing 15.1 Explain the concept of evolution as a central theme of biology 16.2 Contrast the biological species concept with other definitions of species 4.1 Identify the structural and functional similarities that exist between prokaryotic and eukaryotic cells. 10.11 Distinguish between sexual and asexual reproduction of organisms.	1) Demonstrate competent and safe laboratory skills 2) Examine different methods of scientific investigation, including The Scientific Method 15) Analyze the origins and evolution of life 16) Classify life 4) Compare and contrast key structural and functional properties of living cells 10) Summarize cellular reproduction
Basic Chemistry and Water	1 week	3.1 Define atoms, molecules, chemical bonds, and chemical reactions 3.2 Describe the unique physical and chemical characteristics of water that support life	3) Examine the Chemistry of Life
Macromolecules of Life	3 weeks	3.3 Identify structural characteristics of carbohydrates, lipids, proteins, and nucleic acids and explain their modes of synthesis and degradation 3.4 Investigate features of biological macromolecules in the laboratory	3) Examine the Chemistry of Life
Intro to Cells		4.1 Identify the structural and functional similarities and differences that exist between prokaryotic and eukaryotic cells 4.2 Correlate the structure of each eukaryotic cell component to its biological function	4) Compare and contrast key structural and functional properties of living cells

		4.3 Understand the pros and cons of using compound light microscopes, dissecting microscopes and electron microscopes for visualizing living cells	
Cell Membranes and Transport		5.1 Understand how compositional and organizational aspects of membrane structure underlie cellular functions 5.2 Compare and contrast passive and active modes of membrane transport in terms of energetic requirements and existing gradients of concentration or electrical potential	5) Correlate biological membrane structure with membrane function
Enzymes		6.1 Distinguish between endergonic and exergonic reactions and anabolism and catabolism 6.2 Describe the structure of ATP and how it powers the work of cells 6.3 Relate energy of activation to enzyme activity 6.4 Describe enzyme structure/function and its regulation by negative feedback mechanisms 6.5 Investigate enzymes in the lab	6) Examine metabolism
Cellular Respiration		7.1 Describe production of chemical energy in cells 7.2 Summarize chemical reactions of aerobic and anaerobic respiration of glucose 7.3 Distinguish between oxidation and reduction 7.4 Explain the importance of electron carriers in cellular respiration 7.5 Specify the cellular sites of the processes of cellular respiration 7.6 Distinguish types of phosphorylation 7.7 Track and explain ATP production through each stage of cellular respiration 7.8 Explain the necessity of oxygen for cellular respiration 7.9 Investigate respiration in the laboratory	7) Examine cellular respiration
Photosynthesis		9.1 Use current terminology to describe photosynthetic events and structures. 9.2 Distinguish between autotrophic and heterotrophic nutrition 9.3 Distinguish between photosynthetic autotrophs and chemosynthetic autotrophs. 9.4 Relate chloroplast structure to function 9.5 Summarize chemical reactions of photosynthesis 9.6 Describe features of light 9.7 Relate the absorption spectrum of chlorophyll to its action spectrum.	9) Summarize photosynthesis 1. Use current terminology to describe photosynthetic events and structures. 2. Distinguish between autotrophic and heterotrophic nutrition 3. Distinguish between photosynthetic autotrophs and chemosynthetic autotrophs. 4. Relate chloroplast structure to function

			<p>5. Summarize chemical reactions of photosynthesis</p> <p>6. Describe features of light</p> <p>7. Relate the absorption spectrum of chlorophyll to its action spectrum.</p>
Cell Division - Mitosis		<p>10.1. Use current terminology to describe cellular reproduction.</p> <p>10.2. Describe binary fission in prokaryotes</p> <p>10.3. Describe chromosomes and their structural forms</p> <p>10.4. Summarize cell chromosome number changes in the sexual life cycles.</p> <p>10.5. Describe events of the periods of the cell cycle.</p> <p>10.6. Identify characteristics and events of the phases of mitosis</p> <p>10.7. Describe structures and events required or chromosomal movement in mitosis.</p> <p>10.8. Compare cytokinesis of plant and animal cells</p> <p>10.9. Describe control of the cell cycle and the consequences of lack of this control.</p> <p>10.10. Explain the relationship of chromosomes to heredity</p> <p>10.11. Distinguish between sexual and asexual reproduction of organisms.</p> <p>10.17. Identify stages of mitosis and meiosis in the laboratory</p>	10) Summarize cellular reproduction
Cell Division - Meiosis		<p>10.1. Use current terminology to describe cellular reproduction.</p> <p>10.10. Explain the relationship of chromosomes to heredity</p> <p>10.11. Distinguish between sexual and asexual reproduction of organisms.</p> <p>10.12. Identify characteristics and events of the phases of meiosis.</p> <p>10.13. Differentiate between mitosis and meiosis</p> <p>10.14. Distinguish between mitotic interphase and meiotic interkinesis.</p> <p>10.15. Explain how independent assortment, crossing over, and random fertilization contribute to genetic variability in sexually reproducing organisms.</p> <p>10.16. Explain how genetic variation in populations of organisms is crucial to Darwin's theory of evolution</p> <p>10.17. Identify stages of mitosis and meiosis in the laboratory</p>	
Mendelian Genetics		<p>11.1. Use current terminology of Mendelian genetics</p> <p>11.2. Summarize Mendel's laws of segregation and independent assortment.</p> <p>11.3. Use Punnett squares and the laws of probability to</p>	11) Summarize Mendelian Genetics

		<p>predict the genotype and phenotype ratios of F1 and F2 generations of mono-, di-, and tri-hybrid crosses.</p> <p>11.6. Use pedigrees to determine patterns of inheritance</p> <p>11.9. Relate chromosomal inheritance to independent assortment and sex determination</p> <p>11.10. Describe processes and results of crossing-over</p> <p>11.14. Perform mendelian crosses in the laboratory</p>	
Beyond Mendelian Genetics		<p>11.4. Differentiate between complete dominance, recessiveness, incomplete dominance, and codominance.</p> <p>11.5. Explain how sex-linkage may affect genotype and phenotype ratios.</p> <p>11.6. Use pedigrees to determine patterns of inheritance</p> <p>11.7. Explain the presence of lethal genes in the population</p> <p>11.8. Explain methods used in genetic screening.</p> <p>11.9. Relate chromosomal inheritance to independent assortment and sex determination</p> <p>11.11. Describe how changes in chromosome number can occur and the results of these changes</p> <p>11.12. Explain the theory of genomic imprinting</p> <p>11.13. Explain examples of extra nuclear inheritance</p>	11) Summarize Mendelian Genetics
Molecular Genetics		<p>11.1 Describe the processes used to determine that DNA is the genetic material.</p> <p>11.2. Identify chemical characteristics of DNA replication</p> <p>11.3. Identify characteristics of DNA replication</p> <p>11.4. Explain the one gene-one polypeptide hypothesis</p> <p>11.5. Differentiate between RNA and DNA</p> <p>11.6. Differentiate between types of RNA</p> <p>11.7. Distinguish between transcription and translation by processes and the location of these processes in cells.</p> <p>11.8. Use the universal genetic code to work problems involving transcription and translation</p> <p>11.9. Describe characteristics of the genetic code</p> <p>11.10. Explain the processes and cellular structures that are involved in translation.</p> <p>11.11. Explain processes involved translation in the cytoplasm and on the rough endoplasmic reticulum</p> <p>11.12. Explain how protein targeting in cells. relates to the site of translation.</p> <p>11.13. Describe differences between prokaryotic and eukaryotic mRNA.</p> <p>11.14. Explain eukaryotic mRNA nuclear processing</p> <p>11.15. Describe functions of introns and gene splicing</p> <p>11.16. Differentiate between types of base-sequence mutations and their effects.</p> <p>11.17. Investigate molecular genetics in the laboratory</p>	<p>11) Summarize molecular genetics</p> <p>13) Investigate genome organization and expression in prokaryotes and eukaryotes</p>

		<p>13.1 Compare genomic organization in eukaryotes and prokaryotes</p> <p>13.2 Describe genetic and epigenetic mechanisms that regulate gene expression</p> <p>13.3 Understand the role of selective gene expression in regulating development</p> <p>13.4 Explain how operons function in metabolic control</p>	
Biotechnology		<p>14.1 Describe functions and uses of restriction enzymes</p> <p>14.2 Describe various research tools used in biotechnology</p> <p>14.3 Cite specific advances that have been achieved through biotechnology</p> <p>14.4 Consider safety and ethical aspects of recombinant DNA research</p> <p>14.5 Investigate biotechnology in the laboratory</p> <p>12.1 Summarize virus structure and function</p> <ol style="list-style-type: none"> Describe processes of viral genome replication Discuss virus reproduction and transmission 	<p>14) Examine the processes, applications, and ethics of biotechnology</p> <p>12) Examine viruses</p>
Evolution		<p>15.1 Explain the concept of evolution as a central theme of biology</p> <p>15.2 Trace the historical development of the theory of natural selection, including the contributions of Charles Darwin and other scientists</p> <p>15.3 Describe the evidence for the evolution of life</p> <p>15.4 Use the geologic timescale to sequence major events (extinctions, adaptive radiations) in the evolution of life</p> <p>15.5 Recognize the role of the population as the unit of evolution</p> <p>15.6 Distinguish between artificial and natural selection</p> <p>15.7 Contrast macroevolution and microevolution</p> <p>15.8 Describe other modes of evolution, such as genetic drift and gene flow</p> <p>15.9 Investigate evolution in the laboratory</p> <p>16.1 Use the phylogenetic approach to classification</p> <p>16.2 Contrast the biological species concept with other definitions of species</p> <p>16.3 Identify prezygotic and postzygotic reproductive isolation mechanisms that underlie allopatric and sympatric speciation</p> <p>16.4 Distinguish homologous and analogous structures, and provide examples of each</p> <p>16.5 Utilize cladistics to discuss monophyletic, paraphyletic, and polyphyletic groupings</p>	<p>15) Analyze the origins and evolution of life</p> <p>16) Classify life</p>

		16.6 Summarize how molecular clocks are utilized	
Prokaryotes		2.1 Understand the 3-domain classification scheme and the criteria used to construct prokaryote phylogenies 2.2 Compare and contrast structural and functional characteristics that distinguish Bacteria and Archaea 2.3 Describe processes of prokaryotic genetic recombination 2.4 Classify major types of heterotrophic and autotrophic metabolism 2.5 Recognize the diverse ecological roles of prokaryotes and understand how roles can be exploited for biotechnology applications 2.6 Observe prokaryotes in the laboratory	2) Evaluate prokaryotes
Fungi		4.1 Discuss phylogeny and classification of fungi 4.2 Discuss the economic and ecological significant of fungi 4.3 Describe modes of reproduction and dispersal used by fungi 4.4 Describe symbiotic relationships between fungi and other species 4.5 Investigate fungus structure and function in the laboratory	4) Compare and contrast fungi
Animals 1		7.1 Explain the evolutionary origin of animals 7.2 Compare and contrast the body plans of animals 7.3 Describe the development of germ layers 7.4 Discuss the relationship between bilateral symmetry and cephalization 7.5 Describe the current hypothesis of animal phylogeny 8.1 Compare and contrast features of major invertebrate taxa 8.2 Understand invertebrate phylogeny and classification 8.3 Explain the colonization of land by invertebrates 8.4 Explain the economic, medical, and ecological significance of invertebrates 8.5 Examine invertebrates in the laboratory	7) Evaluate animal evolution 8) Compare and contrast invertebrate diversity
Animals 2		9.1 Explain the evolutionary origin of vertebrates and their colonization of land 9.2 Compare and contrast features of major vertebrate taxa 9.3 Discuss the origin and evolution of tetrapods 9.4 Explain the terrestrial advantages of amniotes 9.5 Discuss origin of birds and unique adaptations for flight. 9.6 Describe mammalian traits 9.7 Identify primates and primate characteristics	9) Compare and contrast vertebrate diversity 10) Critique animal anatomy, physiology and behavior

		<p>9.8 Discuss human evolution</p> <p>9.9 Explain the economic, medical, and ecological significance of vertebrates</p> <p>9.10 Examine vertebrates in the laboratory</p> <p>10. Critique animal anatomy, physiology and behavior</p> <ol style="list-style-type: none"> 1. Compare and contrast animal tissue structure and function 2. Correlate muscular and skeletal systems with animal movement mechanisms 3. Describe the nervous, sensory and endocrine systems 4. Examine circulatory, respiratory and immune systems 5. Explore digestion and excretion 6. Discuss reproduction and development 7. Explore the evolutionary and ecological basis for animal behavior 8. Discuss how animals interact with the environment 9. Examine animal anatomy and physiology in the laboratory 	
Plants		<p>5. Compare and contrast plant diversity</p> <ol style="list-style-type: none"> 1. Discuss phylogeny and classification of plants 2. Describe structural and functional innovations that promote land plant survival 3. Compare structural and functional features of nonvascular and vascular plants 4. Discuss reproductive innovations of seed plants that favored land expansion 5. Compare and contrast the alternation of generation life cycles of plants 6. Compare and contrast the reproductive strategies of angiosperms and gymnosperms 7. Discuss pollination, seed and fruit development 8. Examine plant diversity in the laboratory <p>6. Examine plant anatomy and physiology</p> <ol style="list-style-type: none"> 1. List the major plant organs and explain how they contribute to meeting functional needs of plants 2. Understand the role of plant meristems in primary and secondary growth 3. Describe active and passive mechanisms for local and long-distance transport in xylem and phloem 4. Understand how water potential and its components govern water transport 5. Explain how complex hormone interactions govern plant physiological responses 	<p>5) Compare and contrast plant diversity</p> <p>6) Examine plant anatomy and physiology</p>

		6. Discuss mechanisms that plants use to respond to biotic and abiotic factors 7. Study plant anatomy and physiology in the lab	
		11. Survey concepts of ecology <ol style="list-style-type: none"> 1. Discuss the influence of climate and disturbance on the distribution of aquatic and terrestrial biomes 2. Examine abiotic and biotic factors that influence the abundance and diversity of living organisms 3. Examine ecology in the laboratory 12. Examine ecology at the population, community, and ecosystem levels <ol style="list-style-type: none"> 1. Describe the demographic factors that regulate the growth of populations 2. Identify the models used to describe population growth 3. Explain how the concept of carrying capacity applies to human and other populations 4. Classify the types of interspecific interactions within communities 5. Examine the components of diversity 6. Describe the influence of trophic structure, disturbance, and geography on patterns of diversity 7. Explain the flow of energy and matter through ecosystems 8. Identify the biogeochemical cycles that move nutrients between the living and nonliving parts of ecosystems 13. Discuss the importance of conservation biology <ol style="list-style-type: none"> 1. Explain how human activities can influence diversity at genetic, species, and ecosystem levels 2. Discuss the role of humans in global climate change 3. Describe scientific approaches to the conservation of populations and landscapes 4. Identify the goals of sustainable development 	11) Survey concepts of ecology 12) Examine ecology at the population, community, and ecosystem levels 13) Discuss the importance of conservation biology

