Medical Biology at Argo Community High School

Updated 8/2022

Semester One

Unit	Topic	Enduring Understanding	Learning Objective	Essential Knowledge
Unit 1 Experimental Design and Clinical Trials	1.1 Experimental Design	Modern science is based on a precise method of experimentation. This method allows scientists to understand the natural world.	Identify the variables in a scientific experiment.	A valid experiment should have one independent variable. An independent variable is the one that is being tested. The dependent variable will change in response to the independent variable. It is measured at the end of the experiment. Controlled variables are kept the same in both the control and experimental groups to maintain a fair experiment.
			Develop an appropriate control group in an experiment	A control group is used as a comparison to determine if the independent variable had any effect.
	1.2 Clinical trials	Medical researchers rely on clinical trials to establish the effect of an intervention. Treatment effects are efficiently isolated by controlling for bias and by minimizing variation.	Explain how clinical trials are conducted and evaluate the methodology of a clinical trial.	Experimenter bias occurs when researchers' expectations influence study outcome. These biases are strongest when researchers expect a particular result, are measuring subjective variables, and have an incentive to produce data that confirm predictions. To minimize experimenter bias, it is good practice to conduct "double-blind" experiments: experimenters are unaware of the identity or treatment group of their subjects while conducting research. Subjects in the experiment are not told if they are in the control or experimental group. Clinical trials adhere to a strict protocol to ensure the validity and reliability of the data. ***Exclusion Statement**: Students will not be conducting or designing clinical trials* **Unit 1 recommended activities/labs:** Case Study—Evaluating Scientific Evidence HASPI Lab: Making a Medical Diagnosis
Unit 2 Bioethics	Bioethics	Bioethics is the study of ethical, social, and legal issues that arise in biomedicine and biomedical research.	Identify an ethical question	Ethical questions are characterized by the following: -They often involve the words "ought" or "should," implying a difficult decision must be made. -There are several alternate solutions, none of which is without some challenging or problematic aspect. -They contain conflicting moral choices and dilemmas, and the underlying values of the people involved may clash. -They have no right or wrong answer that satisfies all parties, but better or worse answers based on well-reasoned justifications.

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Unit 2: Bioethics (continued)	Bioethics (continued)	Bioethics is the study of ethical, social, and legal issues that arise in biomedicine and biomedical research.	Use the principals of bioethics to propose and evaluate potential solutions to an ethical question	There are three principals of bioethics: -Fairness -Respect for the patient's autonomy -Minimize risk and maximize benefits to the patient **Unit 2 recommended activities/labs:** Principles of Bioethics Bioethics--Dennis's Decision ***Exclusion statement:*** *Students will only be assessed on their ability to form or identify an ethical question and on their participation in the ethical discussions.*
Unit 3 Biochemistry	3.1 Biomolecules	The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules	Describe the composition of macromolecules required by living organisms	Hydrolysis and dehydration synthesis are used to form and cleave covalent bonds between monomers Carbohydrates are made from monosaccharides and contain carbon, hydrogen, and oxygen. The main function of carbohydrates is to provide energy to the organism Proteins are used to build skin, muscle, organs, tissue, and enzymes. Proteins are a polymer of amino acids and contain carbon, hydrogen, oxygen, and nitrogen. Lipids are composed of long-chain fatty acids Nucleic acids are responsible for transmitting genetic information and contain carbon, hydrogen, oxygen, nitrogen, and phosphorus. ***Exclusion statement:*** *The molecular structure of specific nucleotides, proteins, lipids, carbohydrates, and amino acids will not be assessed.* *Students do not need to know the types of bonds in each biomolecule.* *Specific structure of proteins and nucleic acids will be discussed at greater length in the DNA/ Genetics unit*
Unit 3 Biochemistry (continued)	3.2 Enzymes (continued)	The highly complex organization of living systems requires	Describe the properties of enzymes.	The structure of enzymes includes the active site that specifically interacts with substrate molecules.

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		constant input of energy and the exchange of macromolecules		For an enzyme-mediated chemical reaction to occur, the shape of the substrate must be compatible with the active site of the enzyme (Lock and key hypothesis)
			Explain how changes to the structure of an enzyme may affect its function.	Change to the molecular structure of a enzyme may result in a change of the function or efficiency of the system— a. Denaturation of an enzyme occurs when the protein structure is disrupted, eliminating the ability to catalyze reactions. b. Environmental temperatures and pH outside the optimal range for a given enzyme will cause changes to its structure, altering the efficiency with which it catalyzes reactions. c. All enzymes have an optimal pH and temperature d. Enzymes can be reused and are not altered in an enzyme catalyzed reaction. **Unit 3 recommended activities/ labs:** Lab: Function of Catalase Case study: Evolution of Lactase Persistence Lab: Effectiveness of Lactaid Project: Enzyme disorders Explore Learning STEM case—Enzymes
Unit 4 DNA and Protein Synthesis	4.1 Discovery of DNA and DNA Structure	Heritable information provides for continuity of life.	Describe the structures involved in passing hereditary information from one generation to the next.	DNA, and in some cases RNA, is the primary source of heritable information. Genetic information is transmitted from one generation to the next through DNA or RNA

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			Describe the characteristics of DNA that allow it to be used as the hereditary material	DNA, and sometimes RNA, exhibits specific nucleotide base pairing that is conserved through evolution: adenine pairs with thymine or uracil (A-T or A-U) and cytosine pairs with guanine (C-G)
			Describe the mechanisms by which genetic information is copied for transmission between generations.	DNA replication ensures continuity of hereditary information— a. DNA is synthesized in the 5' to 3' direction. b. Replication is a semiconservative process—that is, one strand of DNA serves as the template for a new strand of complementary DNA. c. Helicase unwinds the DNA strands. d. Primase drops an RNA primer to indicate where replication should begin e. DNA polymerase adds nucleotides to the template strand f. DNA polymerase synthesizes new strands of DNA continuously on the leading strand and discontinuously on the lagging strand. g. Ligase joins the fragments on the lagging strand. (Okazaki fragments) X **Exclusion statement—***The names of the steps and particular enzymes involved—beyond DNA polymerase, ligase, RNA polymerase, and helicase—are not assessed*
Unit 4 DNA and Protein Synthesis (continued)	4.2 Protein synthesis	Heritable information provides for continuity of life.	Describe the structural similarities and differences between DNA and RNA.	DNA and RNA molecules have structural similarities and differences related to their function— a. Both DNA and RNA have three components—sugar, a phosphate group, and a nitrogenous base—that form nucleotide units that are connected by covalent bonds to form a linear molecule with 5' and 3' ends, with the nitrogenous

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				bases perpendicular to the sugar-phosphate backbone. b. The basic structural differences between DNA and RNA include the following: i. DNA contains deoxyribose and RNA contains ribose. ii. RNA contains uracil and DNA contains thymine. iii. DNA is usually double stranded; RNA is usually single stranded. iv. The two DNA strands in double-stranded DNA are antiparallel in directionality.
			Describe the mechanisms by which genetic information flows from DNA to RNA to protein.	The sequence of the RNA bases, together with the structure of the RNA molecule, determines RNA function— a. mRNA molecules carry information from DNA to the ribosome. b. Distinct tRNA molecules bind specific amino acids and have anti-codon sequences that base pair with the mRNA. tRNA is recruited to the ribosome during translation to generate the primary peptide sequence based on the mRNA sequence. Genetic information flows from a sequence of nucleotides in DNA to a sequence of bases in an mRNA molecule. This process is known as transcription.
			Describe the mechanisms by which genetic information flows from DNA to RNA to protein.	Translation of the mRNA to generate a polypeptide occurs on ribosomes that are present in the cytoplasm of both prokaryotic and eukaryotic cells The salient features of translation include— a. Translation is initiated when the rRNA in the ribosome interacts with the mRNA at the start codon. b. The sequence of nucleotides on the mRNA is read in triplets called “codons.”
Unit 4 DNA and Protein Synthesis (Continued)	4.2 Protein synthesis (continued)	Heritable information provides for continuity of life.	Describe the mechanisms by which genetic information flows from DNA to RNA to protein.	c. Each codon encodes a specific amino acid, which can be deduced by using a genetic code chart. Many amino acids are encoded by more than one codon. d. Nearly all living organisms use the same genetic code, which is evidence for the common ancestry of all living organisms. e. tRNA brings the correct amino acid to the correct place specified by the codon on the mRNA. f. The amino acid is transferred to the growing polypeptide chain. g. The process continues along the mRNA until a stop codon is reached.

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				h. The process terminates by release of the newly synthesized polypeptide/protein. X **Exclusion statement—***Students do not need to memorize the codons*
	4.3 Mutations	Differences in the expression of genes account for some of the phenotypic differences between organisms	Describe the various types of mutations and predict the outcome on the resulting protein	Alterations in a DNA sequence can lead to changes in the type or amount of the protein produced and the consequent phenotype. DNA mutations can be positive, negative, or neutral based on the effect or the lack of effect they have on the resulting nucleic acid or protein and the phenotypes that are conferred by the protein. Errors in DNA replication or DNA repair mechanisms, and external factors, including radiation and reactive chemicals, can cause random mutations in the DNA— a. Whether a mutation is detrimental, beneficial, or neutral depends on the environmental context. b. Mutations are the primary source of genetic variation ***Exclusion statement:*** *Students should recognize when a mutation has occurred but does not need to memorize the type of mutation (silent, frame-shift etc.)* **Unit 4 recommended labs/activities:** • Lab- DNA Extraction • Construct a 3-D model of DNA • Explore Learning: Protein Synthesis
Unit 5 Genetics	5.1 Meiosis	Heritable information provides for continuity of life.	Explain how meiosis results in the transmission of chromosomes from one generation to the next.	Meiosis is a process that ensures the formation of haploid gamete cells in sexually reproducing diploid organisms— a. Meiosis results in daughter cells with half the number of chromosomes of the parent cell. b. Meiosis involves two rounds of a sequential series of steps (meiosis I and meiosis II). c. A karyotype can be used to diagnose chromosomal abnormalities.
	5.2 Mendelian genetics		Explain the inheritance of genes and traits as described by Mendel's laws.	Mendel's laws of segregation and independent assortment can be applied to genes that are on different chromosomes. Fertilization involves the fusion of two haploid gametes, restoring the diploid number of chromosomes and increasing genetic

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				variation in populations by creating new combinations of alleles in the zygote— a. Rules of probability can be applied to analyze passage of single-gene traits from parent to offspring. b. The pattern of inheritance (monohybrid, dihybrid, and sex-linked,) can often be predicted from data, including pedigree, that give the parent genotype/phenotype and the offspring genotypes/phenotypes.
	5.3 Non-Mendelian genetics		Explain deviations from Mendel's model of inheritance	Patterns of inheritance of many traits do not follow ratios predicted by Mendel's laws and can be identified by quantitative analysis, where observed phenotypic ratios statistically differ from the predicted ratios. Some traits are determined by genes on sex chromosomes and are known as sex-linked traits. The pattern of inheritance of sex-linked traits can often be predicted from data, including pedigree, indicating the parent genotype/phenotype and the offspring genotypes/phenotypes. **Exclusion statements:** Assessment d*oes not cover gene linkage. Students will only be assessed on one or two-trait crosses.* **Unit 5 recommended activities and labs:** • Explore Learning Mouse Genetics • Lab: Human traits • Lab: Blood typing (simulated blood) • Case study: Smith Family genetic counseling

Semester Two

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Unit 6: The Cell	6.1 Cell organelles	Living systems are organized in a hierarchy of structural levels that interact.	Describe the membrane-bound structures of the eukaryotic cell.	Membranes and membrane-bound organelles in eukaryotic cells compartmentalize intracellular metabolic processes and specific enzymatic reactions. Eukaryotic cells contain specialized organelles and a membrane-bound nucleus. Prokaryotic cells lack the membrane bound organelles. Plant cells contain organelles that animals lack; specifically, a cell wall and chloroplasts. Organelles and subcellular structures, and the interactions among them, support cellular function— a. Endoplasmic reticulum provides mechanical support, carries out protein synthesis on membrane-bound ribosomes, and plays a role in intracellular transport. b. Mitochondrial double membrane provides compartments for different metabolic reactions. c. Lysosomes contain hydrolytic enzymes, which are important in intracellular digestion, the recycling of a cell's organic materials, and programmed cell death (apoptosis). d. Vacuoles have many roles, including storage and release of macromolecules and cellular waste products. In plants, it aids in retention of water for turgor pressure.
	6.2 Cell cycle	Heritable information provides for continuity of life.	Describe the events that occur during the cell cycle	In eukaryotes, cells divide and transmit genetic information via two highly regulated processes. The cell cycle is a highly regulated series of events for the growth and reproduction of cells— a. The cell cycle consists of sequential stages of interphase (G1, S, G2), mitosis, and cytokinesis. b. A cell can enter a stage (G0) where it no longer divides, but it can reenter the cell cycle in response to appropriate cues. c. Nondividing cells may exit the cell cycle or be held at a particular stage in the cell cycle
			Explain how mitosis results in the transmission of chromosomes from one generation to the next.	Mitosis is a process that ensures the transfer of a complete genome from a parent cell to two genetically identical daughter cells— a. Mitosis plays a role in growth, tissue repair, and asexual reproduction. b. Mitosis alternates with interphase in the cell cycle. c. Mitosis occurs in a sequential series of steps (prophase, metaphase, anaphase, telophase).

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Unit 6: The Cell (continued)	6.3 Cancer	Heritable information provides for continuity of life.	Describe the role of checkpoints in regulating the cell cycle.	A number of internal controls or checkpoints regulate progression through the cycle. **Exclusion statement:** Students will not be assessed on the specific cyclins or cyclin-dependent kinases in the cell cycle
			Describe the effects of disruptions to the cell cycle on the cell or organism.	Disruptions to the cell cycle may result in cancer and/or programmed cell death (apoptosis).
	6.4 Structure of the Cell Membrane	Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.	Describe the roles of each of the components of the cell membrane in maintaining the internal environment of the cell.	Phospholipids have both hydrophilic and hydrophobic regions. The hydrophilic phosphate regions of the phospholipids are oriented toward the aqueous external or internal environments, while the hydrophobic fatty acid regions face each other within the interior of the membrane.
			Describe the Fluid Mosaic Model of cell membranes.	Cell membranes consist of a structural framework of phospholipid molecules that is embedded with proteins, steroids (such as cholesterol in eukaryotes), glycoproteins, and glycolipids that can flow around the surface of the cell within the membrane.
	6.5 Cell Transport		Describe the mechanisms that organisms use to maintain solute and water balance.	Passive transport is the net movement of molecules from high concentration to low concentration without the direct input of metabolic energy. Passive transport plays a primary role in the import of materials and the export of wastes. Active transport requires the direct input of energy to move molecules from regions of low concentration to regions of high concentration.
Unit 6: The Cell	6.5 Cell transport (continued)		Explain how concentration gradients affect the movement of molecules	External environments can be hypotonic, hypertonic or isotonic to internal environments of cells.

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			across membranes.	Water moves by osmosis from areas of high water potential/low osmolarity/low solute concentration to areas of low water potential/high osmolarity/high solute concentration. **Exclusion statement:** *Students will not be required to calculate water potential* **Unit 6 recommended activities/ labs:** • Lab: Using a microscope • Lab: Comparing prokaryotic and eukaryotic cells • Lab: Osmosis in onion cells • Lab: Identifying stages of mitosis • Case Study: Little Girl Lost (Defective cell organelles) • Case Study: A Cure for Cancer? • Reading: The Immortal Life of Henrietta Lacks
Unit 7: Evolution	7.1 Natural Selection	Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence	Describe the causes of natural selection.	Natural selection is a major mechanism of evolution. According to Darwin's theory of natural selection, competition for limited resources results in differential survival. Individuals with more favorable phenotypes are more likely to survive and produce more offspring, thus passing traits to subsequent generations.

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			Explain how natural selection affects populations	Evolutionary fitness is measured by reproductive success. Biotic and abiotic environments can be more or less stable/fluctuating, and this affects the rate and direction of evolution; different genetic variations can be selected in each generation
			Describe the importance of phenotypic variation in a population.	Natural selection acts on phenotypic variations in populations. Environments change and apply selective pressures to populations. Some phenotypic variations significantly increase or decrease fitness of the organism in particular environments.
	7.2 Population Genetics		Explain how random occurrences affect the genetic makeup of a population.	Evolution is also driven by random occurrences— a. Mutation is a random process that contributes to evolution. b. Genetic drift is a nonselective process occurring in small populations— i. Bottlenecks. ii. Founder effect. c. Migration/gene flow can drive evolution Reduction of genetic variation within a given population can increase the differences between populations of the same species. Mutation results in genetic variation, which provides phenotypes on which natural selection acts.
			Explain how the genetic diversity of a species or population affects its ability to withstand environmental pressures.	The level of variation in a population affects population dynamics— a. Population ability to respond to changes in the environment is influenced by genetic diversity. Species and populations with little genetic diversity are at risk of decline or extinction. b. Genetically diverse populations are more resilient to environmental perturbation because they are more likely to contain individuals who can withstand the environmental pressure. c. Alleles that are adaptive in one environmental condition may be deleterious in another because of different selective pressures.
Unit 7 Evolution (continued)	7.3 Evidence for Evolution	Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence	Describe the types of data that provide evidence for evolution.	Evolution is supported by scientific evidence from many disciplines (geographical, geological, physical, biochemical, and mathematical data). Molecular, morphological, and genetic evidence from extant and extinct organisms adds to our understanding of evolution— a. Fossils can be dated by a variety of methods. These include: i. The age of the rocks where a fossil

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				is found ii. The rate of decay of isotopes including carbon-14 iii. Geographical data b. Morphological homologies, including vestigial structures, represent features shared by common ancestry. A comparison of DNA nucleotide sequences and/or protein amino acid sequences provides evidence for evolution and common ancestry.
	7.4 Common Ancestry		Describe the fundamental molecular and cellular features shared across all domains of life, which provide evidence of common ancestry.	Many fundamental molecular and cellular features and processes are conserved across organisms. Structural and functional evidence supports the relatedness of organisms in all domains.
	7.5 Speciation	Life continues to evolve within a changing environment.	Describe the conditions under which new species may arise.	Speciation may occur when two populations become reproductively isolated from each other. The biological species concept provides a commonly used definition of species for sexually reproducing organisms. It states that species can be defined as a group capable of interbreeding and exchanging genetic information to produce viable, fertile offspring
Unit 7 Evolution (continued)	7.5 Evolution and infectious disease	Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence	Explain how evolution is an ongoing process in all living organisms.	Populations of organisms continue to evolve. All species have evolved and continue to evolve— a. Genomic changes over time. b. Continuous change in the fossil record. c. Evolution of resistance to antibiotics, pesticides, herbicides, or chemotherapy drugs. d. Pathogens evolve and cause emergent diseases **Exclusion statement**: *Students will not be assessed on the Hardy Weinberg equilibrium*

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				Unit 7 recommended activities/ labs: • Lab: HASPI Evidence for Evolution stations • Explore Learning STEM Case: Evolution of drug resistant bacteria • Case Study: Evolution of human skin color • HHMI: Using Scientific Process to Study Human Evolution (1 day) • HHMI: Recent Adaptations in Humans • Ethical Discussion: Is IVF Changing the Course of Human Evolution? • Ethical Discussion: CRISPR and the Future of Human Evolution

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Unit 8 Infectious disease	8.1 Agents of disease	Microbes have co-evolved with humans and can cause infectious diseases	Describe the various agents of infectious disease	A pathogen is an organism that causes disease. There are five main types of pathogenic organisms: viruses, bacteria, fungi, protozoa, and worms. Pathogens can be transmitted in various ways depending on the type; through skin contact, bodily fluids, airborne particles, contact with feces, and touching a surface touched by an infected person.
	8.2 Immune system		Identify the cellular and molecular basis of immune responsiveness.	The immune system protects a person's body from outside invaders. These include germs such as bacteria, viruses, and fungi, and toxins (chemicals made by microbes). The immune system is made up of different organs, cells, and proteins that work together. There are 2 main parts of the immune system: • The innate immune system; including skin, mucous membranes, and the corneas • The adaptive immune system. A person develops this when the body is exposed to microbes or chemicals released by microbes. (Creates antibodies) The cells of both parts of the immune system are made in different organs of the body, including: -Adenoids; Two glands located at the back of the nasal passage. -Bone marrow; The soft, spongy tissue found in bone cavities. -Lymph nodes; Small organs shaped like beans, which are located all over the body and connect via the lymphatic vessels. -Lymphatic vessel; A network of channels all over the body that carries lymphocytes to the lymphoid organs and bloodstream. -Spleen; A fist-sized organ located in the belly (abdominal) cavity. -Thymus; Two lobes that join in front of the windpipe (trachea) behind the breastbone. -Tonsils; Two oval masses in the back of the throat. Antigens are foreign substances that a person's body can recognize. Lymphocytes are infection-fighting white blood cells are the reason a person gets sick from things like chicken pox only once. Lymphocytes called T cells and B cells work together to build acquired immunity. Once B cells recognize the antigen of a new invader, they make antibodies to either kill it or flag it as "Trouble here!" These Y-shaped molecules fit into antigens like puzzle pieces, making an immune complex. An antibody can also be called immunoglobulin or Ig
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Unit 8 Infectious disease (continued)	8.2 Immune system (continued)	Microbes have co-evolved with humans and can cause infectious diseases	Describe the difference between active and passive immunity	Active immunity occurs when our own immune system is responsible for protecting us from a pathogen. Passive immunity occurs when we are protected from a pathogen by immunity gained from someone else. (e.g. monoclonal antibodies)
	8.3 Germ theory		Describe the criteria for establishing the cause of a disease	Robert Koch is known for developing four basic criteria (known as Koch's Postulates) for demonstrating, in a scientifically sound manner, that a disease is caused by a particular organism. These postulates grew out of his seminal work with anthrax using purified cultures of the pathogen that had been isolated from diseased animals. Koch's postulates: 1. The microorganism must be found in abundance in all organisms suffering from the disease but should not be found in healthy organisms. 2. The microorganism must be isolated from a diseased organism and grown in pure culture. 3. The cultured microorganism should cause disease when introduced into a healthy organism. 4. The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.
	8.4 Epidemiology		Explain methods for the prevention of infection	In the 1870s, Joseph Lister was instrumental in developing practical applications of the germ theory of disease with respect to sanitation in medical settings and aseptic surgical techniques—partly through the use of carbolic acid as an antiseptic. Ignaz Semmelweis proposed the practice of washing hands with chlorinated lime solutions in 1847 while working in Vienna General Hospital's First Obstetrical Clinic, where doctors' wards had three times the mortality of midwives' wards.
			Describe the methods used by epidemiologists to study diseases	Epidemiology is the study and analysis of the distribution (who, when, and where), patterns and determinants of health and disease conditions in defined populations. Major areas of epidemiological study include disease causation, transmission, outbreak investigation, disease surveillance, and comparisons of treatment effects such as in clinical trials. Epidemiologists rely on other scientific disciplines like biology to better understand disease processes, statistics to make efficient use of the data and draw appropriate conclusions, social sciences to better understand proximate and distal causes, and engineering for exposure assessment.
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Unit 8 Infectious disease (continued)	8.5 Vaccines	Microbes have co-evolved with humans and can cause infectious diseases	Explain how vaccines were developed	Vaccine development started more than two centuries ago when English doctor Edward Jenner treated a young boy by injecting him with pus from cowpox blisters found on a milkmaid's hands. Cowpox contains the vaccinia virus, which causes smallpox. The injection immunized the boy against smallpox. In 1881, Louis Pasteur helped develop a vaccine for anthrax, which was used successfully in sheep, goats and cows. Then, in 1885, while studying rabies, Pasteur tested his first human vaccine. Pasteur produced the vaccine by attenuating the virus in rabbits and subsequently harvesting it from their spinal cords.
			Describe how vaccines produce an immune response	Today there are five main types of vaccines that infants and young children commonly receive in the U.S.: 1. Live, attenuated vaccines fight viruses and bacteria. These vaccines contain a version of the living virus or bacteria that has been weakened so that it does not cause serious disease in people with healthy immune systems. Examples of live, attenuated vaccines include measles, mumps, and rubella vaccine (MMR) and varicella (chickenpox) vaccine. 2. Inactivated vaccines also fight viruses and bacteria. These vaccines are made by inactivating, or killing, the germ during the process of making the vaccine. 3. Toxoid vaccines prevent diseases caused by bacteria that produce toxins (poisons) in the body. In the process of making these vaccines, the toxins are weakened so they cannot cause illness. 4. Subunit vaccines include only parts of the virus or bacteria, or subunits, instead of the entire germ. Because these vaccines contain only the essential antigens and not all the other molecules that make up the germ, side effects are less common. The pertussis (whooping cough) component of the DTaP vaccine is an example of a subunit vaccine. 5. Conjugate vaccines fight a different type of bacteria. These bacteria have antigens with an outer coating of sugar-like substances called polysaccharides. This type of coating disguises the antigen, making it hard for a young child's immature immune system to recognize it and respond to it. Conjugate vaccines are effective for these types of bacteria because they connect (or conjugate) the polysaccharides to antigens that the immune system responds to very well. This linkage helps the immature immune system react to the coating and develop an immune response.
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Unit 8 Infectious				**Recommended activities and labs:** • Lab-HASPI antibiotic resistance

disease (continued)				• Lab-HASPI Bacteria in food/ food borne illnesses • Lab-HASPI Epidemiology • Research infectious diseases controlled by vaccination