Davison Community Schools
ADVISORY CURRICULUM COUNCIL
Human Development Phase II
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Human Development

Course Essential Questions:
Where did *Homo sapiens* come from?
How do cells interact to form living things?
How is a human conceived and grown in utero?
How are the genetic factors inherited?
How do genetic factors control humans?

Phase II Curriculum

Unit 1: Primate Evolution

Essential Questions:

1. What are the common characteristics of all primates?
2. How are hominins different from hominoids?
3. How are modern humans different from their ancestors?

Essential Understandings:

1. All Primates have manual dexterity, keen eyesight, highly movable arms, large brains (reasoning)
2. Hominins have bigger brains, specifically complexity in higher level thought areas, face is thinner and flatter, teeth smaller, longer thumbs, flexible wrists - high dexterity, bipedal, fully upright stance, shortened arms, bowl shaped pelvis, s shaped spine, skull attaches inferiorly, femur angled inwardly
3. Modern Humans have bigger brains, lighter skeletons, flatter faces, and smaller teeth, control fire, use tools, developed language and culture

Curriculum Standards- DOK noted where applicable with Standards

B2.4d Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.
B5.1c Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis).
B5.1d Explain how a new species or variety originates through the evolutionary process of natural selection.
B5.1f Explain, using examples, how the fossil record, comparative anatomy, and other evidence supports the theory of evolution.
B5.2b Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequences.
B5.3e Explain how changes at the gene level are the foundation for changes in populations and eventually the formation of new species.

LEARNING TARGETS

Knowledge/Content I Know …	Skills/Processes I Can …
Vocabulary: **Anthropoids** A member of a primate group made up of the apes (gibbon, orangutan, gorilla, chimpanzee, and bonobo), monkeys, and humans. **Australopithecines** A hominin genus that lived in Africa between 4 million and 2.5 million years ago. **Binocular Vision** The ability to focus the two eyes in a coordinated manner in order to see one image. **Bipedal** A special form of locomotion on two feet found in humans and their ancestors. **Cro-Magnons** Type of Homo Sapien. Lived from 40,000-8,000 BC. They were discovered in Europe. They created art. Created advanced tools. More like modern man than Neanderthals. Nomadic. **Diurnal** Active during the day. **Haplorhines** A subdivision within the primate order based on shared genetic characteristics; includes tarsiers, New World monkeys, Old World monkeys, and apes (including humans). **Hominoids** A term that refers to great apes and humans **Homo** Genus that includes living and extinct humans, having bigger brains, lighter skeletons, flatter faces, and smaller teeth than their ancestors **Neanderthals** 300,000 - 200,000 had short, powerful bodies, the possibility of speech and the skeletons were found in arranged position **Opposable first digit** either a thumb or a great toe, is set apart from the other digits **Prehensile tail** long muscular tail used as a fifth limb for grasping wrapping around objects **I know….** ● The traits of Primates ● The difference between Apes and Monkeys ● The difference between hominins and hominoids ● The difference between Chimps and Humans ● The difference between Modern humans and their ancestors ● The names of fossils that support our theory of evolution of the human species	● classify primates into several groups based on their characteristics ● describe each trait of a primate ● differentiate between new world and old world monkeys as well as the different great apes ● list 5 ways humans and chimps are different ● trace the line of ancestry from the first primates all the way to *Homo sapiens* ● explain how human ancestry is more like a bush than a tree ● identify traits in modern humans and their ancestors ● list several examples of fossils that support the theory of evolution of humans ● explain how tool use and fire use has contributed to the development of *Homo sapiens*

Phase III Textbook/Materials
Phase IV Summative Assessment Evidence

Common Summative Unit Assessments: (*identifies Performance Task)	**Agreed Upon Interim Summative Assessments:** (*identifies Performance Task)

Phase V Learning Plan

Unit 2: Cells and Reproductive Structures

Essential Questions:	**Essential Understandings:**
1. How is a cell organized to maintain homeostasis? 2. How does a cell grow and divide? 3. How does a human create gametes that will in turn develop into a new human?	1. Cells contain many structures and organelles that do specific jobs for the cell. Each helps to maintain homeostasis by providing energy, building cell parts and products, breaking down and removing wastes, etc. 2. Mitosis and Meiosis are the two processes that divide a cell's nuclear material and allow cells to grow and divide and make new organisms. Mitosis is used for growth, development, and specialization. 3. Meiosis is used for creation of gametes. Spermatogenesis creates sperm cells in testis while Oogenesis creates egg cells in the ovaries. The male and female sexual organ systems are designed so these two different cells will come together in fertilization to grow into a new human.

Curriculum Standards- DOK noted where applicable with Standards

B2.1d Describe how, through cell division, cells can become specialized for specific function.
B2.r6b Explain that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Note that cell behavior can also be affected by molecules from other parts of the organism, such as hormones.
R B2.r6c Recognize and explain that communication and/or interaction are required between cells to coordinate their diverse activities.
R B2.r6d Explain how higher levels of organization result from specific complex interactions of smaller units and that their maintenance requires a constant input of energy
B4.3A Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations.
B4.3C Explain how it might be possible to identify genetic defects from just a karyotype of a few cells.
B4.3d Explain that the sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations from the offspring of two parents.
B4.3e Recognize that genetic variation can occur from such processes as crossing over, jumping genes, and deletion and duplication of genes.

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
Anaphase Third phase of mitosis, the chromatids of each chromosome separate at the centromere and move to opposite poles	● Identify organelles on cell diagrams ● describe the function of the different organelles

Apoptosis A type of programmed cell death, which is brought about by activation of enzymes that break down many chemical components in the cell.

Cell Cycle
An ordered sequence of events (including interphase and the mitotic phase) that extends from the time a eukaryotic cell is first formed from a dividing parent cell until its own division into two cells.

Centrioles
Cell organelle that aids in cell division in animal cells only

Centromere
A specialized condensed region of each chromosome that appears during mitosis where the chromatids are held together to form an X shape.

Chromatids
Identical chromosome copies held together by a centromere

Crossing over
Process in which homologous chromosomes exchange portions of their chromatids during meiosis.

Cytokinesis
Division of the cytoplasm during cell division.

Cytoplasm
A jellylike fluid inside the cell in which the organelles are suspended

Cytoskeleton A network of fibers that holds the cell together, helps the cell to keep its shape, and aids in movement (microtubules, microfilaments, intermediate filaments)

Differentiated Cells
Cells that have developed to do specific jobs such as bone, blood, nerve and muscle cells

Diploid
A cell having two sets of chromosomes or twice the haploid number (2n).

Endoplasmic Reticulum
A system of membranes that is found in a cell's cytoplasm and that assists in the production, processing, and transport of proteins and in the production of lipids

Eukaryotes
All multicellular and unicellular non-bacterial organisms. Are bound by a cell membrane and contain cytoplasm. Cytoplasm contains membrane bound organelles suspended in a semi-fluid medium called cytosol. The genetic material consists of linear strands of DNA organized into chromosomes located in the nucleus.

gametes
A haploid cell such as an egg or sperm. Gametes unite during sexual reproduction to produce a diploid zygote.

Gap 1 phase
The first part of interphase: the cell grows and

- compare and contrast plant, animal and bacterial cells
- differentiate between prokaryotic and eukaryotic cell
- identify 4 structures that all cells have in common
- Describe the stages of the cell cycle
- Describe how the cell cycle is regulated
- list the 4 stages of mitosis and describe what happens to the chromosomes in each stage
- list the 8 stages of meiosis and describe what happens to the chromosome in each stage
- Compare and contrast mitosis and meiosis
- predict what would happen if crossing over occured in meiosis
- describe chromosome number in haploid and diploid cells
- predict the haploid or diploid number given one or the other
- describe oogenesis
- describe spermatogenesis
- differentiate between the products of spermatogenesis and oogenesis
- identify reproductive structures on a diagram
- describe the function of reproductive structures or match the structure to its function

functions. Also known as G1

Gap 2 phase

During this stage of the cell cycle, the cell undergoes additional growth, prepares to divide, inventories cell parts, grows microtubules, known as G2

Golgi Apparatus

An organelle in eukaryotic cells consisting of stacks of flat membranous sacs that modify, store, and route products of the endoplasmic reticulum.

gonads

Glands related to sexual characteristics and the processes involved in reproduction

haploid

A cell containing only one set of chromosomes (n).

Homologous pairs

Similarly constructed chromosomes that have the same shape and contain genes for the same traits

Interphase

Cell grows, performs its normal functions, and prepares for division; consists of G1, S, and G2 phases

Lysosomes

An organelle containing digestive enzymes that can break down many things in cells.

Metaphase

Second stage of mitosis, centromeres of duplicated chromosomes are aligned at equatorial plate by the spindle apparatus

Mitochondria

An organelle in eukaryotic cells that serves as the site of cellular respiration; uses oxygen to break down organic molecules and synthesize ATP

Mitosis

Cell division in which the nucleus divides into nuclei containing the same number of chromosomes

Nucleus

Control center of the cell. Contains DNA.

Oocyte

A female sex cell that develops into an ovum after two meiotic divisions

oogenesis

Formation and development of ovum

oogonium

Can either undergo repeated rounds of mitosis, producing additional oogonia, or enter prophase I, becoming primary oocytes.

Organelles

A specialized structure within a cell, such as a mitochondria, vacuole, or chloroplast, that performs a specific function.

ovaries

Female sex glands that produce the female sex cells - oocyte and hormones

Peroxisomes

An organelle that contains the enzyme catalase. This enzyme deoxides harmful substances that enter the cell into non harmful substances. **phospholipid bilayer** A double layer of phospholipids that makes up plasma and organelle membranes. **Plasma Membrane** A selectively-permeable phospholipid bilayer forming the boundary of the cells **polar body** Nonfunctioning daughter cell formed during oogenesis; It has little cytoplasm, It will l disintegrate **Prokaryotes** A single-celled organism that has no nucleus and has no membrane-bound organelles; bacteria and archaea **Prophase** First stage of mitosis, chromatin becomes chromosomes, nucleolus disappears, centrioles and or spindle appears **Receptors** Protein molecules located within or on the outer membrane of cells of various tissues, such as neurons. A receptor receives stimulation that causes a reaction resulting in stimulation or inhibition of the cell. **reduction division** cell division that produces reproductive cells in sexually reproducing organisms; the nucleus divides into four nuclei each containing half the chromosome number **Ribosomes** A cell organelle constructed in the nucleolus and functioning as the site of protein synthesis in the cytoplasm; consists of rRNA and protein molecules, which make up two subunits. **Somatic cells** Any cells in the body other than reproductive cells **Sperm** Haploid male sex cells produced by meiosis. **spermatogenesis** Formation of sperm cells **spermatogonium** A diploid cell that can undergo mitosis to form more spermatogonia, and can also be triggered to undergo meiosis to form sperm. **Spindle Fibers/Apparatus** A football-shaped, cage-like structure consisting of thin fibers made of microtubules. In plant cells, the spindle forms without centrioles. The spindle fibers play a vital role in the separation of sister chromatids during mitosis **Stem Cells** Undifferentiated cells that are not yet performing any specialized function, but have the potential to differentiate into one or more types of mature functional	

cells. **Synthesis** phase a cell's DNA is copied during this phase. at the end of this phase, each chromosome consists of two chromatids attached at the centromere (S) **Telomeres** DNA structure at the end of chromosomes, prevent loss of genes every time it duplicates **Telophase** Last phase of mitosis, chromosomes lengthen and become thinner, nuclear membrane reappears, spindle disappears, cytoplasm gets divided up evenly **testes** Male sex glands or gonads that produce the male sex cells - sperm and hormones **Vesicle** A membrane bound sac that contains materials involved in transport of the cell. **I Know….** ● The general structure of cells ● The function of cell parts ● The cell cycle and how it is regulated ● The stages of Mitosis ● The stages of Meiosis ● How to compare and contrast Mitosis and Meiosis ● How meiosis is different between males and females ● Structures of the male and female reproductive systems ● The functions of the parts of the reproductive systems	

Phase III Textbook/Materials
Phase IV Summative Assessment Evidence

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Phase V Learning Plan

Unit 3: Fertilization, Embryology, and Pregnancy

Essential Questions:	Essential Understanding:
1. How does a human zygote change from fertilization to birth? 2. What are the stages of pregnancy and how does the female body change.	1. After fertilization occurs in the fallopian tubes, the zygote changes from a one celled organism into a trillion cell highly specialized organism in approximately 9 months due to cell signaling that originates from the combination of parental DNA at fertilization. 2. The term of human pregnancy is broken into three periods called trimesters. During each period, significant changes happen to the developing human.

Curriculum Standards- DOK noted where applicable with Standards

B2.5B Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions.
R B2.r6c Recognize and explain that communication and/or interaction are required between cells to coordinate their diverse activities.
R B2.r6d Explain how higher levels of organization result from specific complex interactions of smaller units and that their maintenance requires a constant input of energy
B4.3g Explain that cellular differentiation results from gene expression and/or environmental influence (e.g., metamorphosis, nutrition).

LEARNING TARGETS

Knowledge/Content I Know …	Skills/Processes I Can …
amniotic fluid Fluid inside the amniochorionic membrane that regulates the baby's temperature, cushions the baby against injury, and allows the baby to move around easily. **blastocyst** A fluid-filled sphere formed about 5 days after fertilization of an ovum that is made up of an outer ring of cells and inner cell mass. THis is the structure that implants in the endometrium of the uterus. **blastomeres** The zygote moves towards the uterus, and along the way it divides repeatedly to produce 2 cells, then 4 cells, then eight cells, and so on. These daughter cells are called blastomeres. **chorion**	● identify structures on an embryo during different stages of development ● distinguish the critical periods for most body systems and structures of a developing embryo ● list the stages of development of an embryo ● differentiate between zygote, embryo, and fetus ● differentiate between morula, blastula, and gastrula ● list the body structures that arise from the mesoderm, endoderm, and ectoderm ● explain the functions of the different hormones in menstrual cycle ● explain the functions of the different hormones

Outermost layer of the two membranes surrounding the embryo; it forms the fetal part of the placenta.

Chorionic villi

finger-like outgrowths containing embryonic blood vessels that exchange materials by diffusion with the mother's blood

Cleavage

(1) The process of cytokinesis in animal cells, characterized by pinching of the plasma membrane. (2) The succession of rapid cell divisions without significant growth during early embryonic development that converts the zygote to a ball of cells.

corpus luteum

Endocrine tissue (part of follicle) which produces hormones, estrogen, and progesterone which prepares the uterine lining for receiving an embryo

critical period

A time frame deemed highly important in developing in a healthy manner; can be physically, emotionally, behaviorally, or cognitively.

dizygotic

(Fraternal Twins)- Develop from separate eggs and separate sperm, making them genetically no more similar than ordinary siblings.

ectoderm

One of the three primary (embryonic) germ layers formed during gastrulation. Ectoderm ultimately forms external structures such as the skin, hair, nails, and inner linings of the mouth and anus, as well as the entire nervous system.

Embryo

2 weeks through 8 weeks, attaches to the mother's uterine wall, organs being to form and function, heart begins to beat; liver begins to make red blood cells, head arms and legs are clearly noticeable

endoderm

Embryonic germ layer; forms the lining of the digestive tube and its associated structures.

endometrial tissue

inner layer of uterus that either sheds if pregnancy does not occur or provides nutrients for the developing embryo after implantation

Estrogen

During the follicular phase this hormone inhibits the release of LH from the anterior pituitary

Fetus

In humans, the term for the developing organism between the embryonic stage (end of 8 weeks) and birth

First Trimester

Period of pregnancy when all vital organs and tissues are in place; most dangerous period in life because all major systems are developing; called fetus by week 8

in pregnancy

- explain the functions of the different hormones in the male reproductive system
- describe the structure of the corpus luteum and which parts give rise to the embryo and the placental complex
- explain the changes the woman’s body undergoes during each trimester of pregnancy

(weeks 1-12) **Follicle Stimulating Hormone** (FSH) Released from the anterior pituitary gland to target the ovaries & testes. In females it stimulates the development of follicles in the ovaries and in males it promotes the development of sperm cells (and stimulates the interstitial cells of the testes to produce testosterone). **Gastrula** Phase in embryonic development during which the single-layered blastula is reorganized into a three layered structure containing the ectoderm, mesoderm, and endoderm. **Human chorionic gonadotropin** (hCG) hormone produced by the placenta to sustain pregnancy **inner cell mass** The mass of cells in the blastocyst that ultimately give rise to the embryo and other embryonic structures (the amion, the umbilical vessels, etc.). Source of ESC **Luteinizing Hormone** (LH) stimulates the formation of corpus luteum, estrogen and progesterone in females and testosterone in males, a hormone produced by gonadotroph cells in the anterior pituitary gland. In females, an acute rise of LH ("LH surge") triggers ovulation and development of the corpus luteum (remaining follicle producing progesterone once egg is released) **menstrual cycle** Cycle during which an egg develops and is released from an ovary and the uterus is prepared to receive a fertilized egg. **mesoderm** Embryonic tissue that forms tissues such as muscle, bone, and blood vessels (Meso = middle) **monozygotic** Identical twins formed when one zygote splits into two separate masses of cells, each of which develops into a separate embryo. **morula** A solid ball of cells that makes up an embryo; in humans, this stage occurs within four days of fertilization **neural tube** A tube of cells running along the dorsal axis of the body, just dorsal to the notochord. It will give rise to the central nervous system. **notochord** A flexible, cartilage-like longitudinal rod located between the digestive tract and nerve cord in chordate animals, present only in embryos in many species **Ovarian Follicle** little sacs or cavities in the ovary that contain a	

developing oocyte **placenta** A mass of tissue that is attached to the wall of the uterus and connected to the developing fetus by the umbilical cord; it supplies nutrients and eliminates waste products **primary germ layers** Three layers of embryonic tissue from which all primary tissues and body organs are derived; includes ectoderm, mesoderm and endoderm **Progesterone** A steroid hormone produced by the corpus luteum in the ovary during the second half of the menstrual cycle Progesterone maintains and enhances the uterine lining for the possible implantation of a fertilized ovum. It is the primary hormone secreted during pregnancy. **Second Trimester** Corpus luteum deteriorates, and hCG declines. Placenta secretes its own progesterone and estrogen which maintain pregnancy. Rapid growth of fetus - most bones, some hair. Fetus becomes very active. (weeks 13-27) **Teratogens** Agents, such as chemicals and viruses, that can reach the embryo or fetus during prenatal development and cause harm **Third Trimester** Body systems completely develop, Fetus increases dramatically in size and weight, Fetus is about 20 inches long, and Birth occurs. (28 weeks to birth) **umbilical cord** Contains two arteries and one vein connecting the baby to the placenta **Zygote** A one-celled organism formed by the union of a sperm and an egg. **I KNOW……** ● how menstrual cycle is regulated with different hormones ● when and how fertilization can occur ● the different stages of pregnancy and the major events during each ● how a zygote develops into an embryo, fetus, and newborn baby ● how a woman's body changes during pregnancy	

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Phase V Learning Plan

Unit 4: Inheritance

Essential Questions:	**Essential Understandings:**
1. How are our genes inherited and expressed? 2. What happens if the genes/chromosomes are changed?	1. One copy of each gene is inherited from each parent. Thousands of genes are contained on each of the 23 DNA molecules received from each parent. One gene may code for a specific trait or a combination of genes may determine a trait. 2. Changes in genes can create new traits which may be beneficial or harmful to the organism. Changes in chromosome number can also have beneficial or detrimental effects.

Curriculum Standards- DOK noted where applicable with Standards

B4.1B Explain that the information passed from parents to offspring is transmitted by means of genes that are coded in DNA molecules. These genes contain the information for the production of proteins.
B4.1c Differentiate between dominant, recessive, codominant, polygenic, and sex-linked traits.
B4.1d Explain the genetic basis for Mendel's laws of segregation and independent assortment.
B4.1e Determine the genotype and phenotype of monohybrid crosses using a Punnett Square
B4.3B Explain why only mutations occurring in gametes (sex cells) can be passed on to offspring.
B4.3d Explain that the sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations from the offspring of two parents.

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
Autosomal Dominant Gene for the trait is dominant: phenotype appears every generation, affected individual has at least one affected parent. **Autosomal Recessive** A gene on one of the non-sex chromosomes that is only expressed if two copies are present, phenotype usually skips generations, normal parents must carry the gene to have affected child **Bioethics** A discipline dealing with the ethical implications of biological research methods and results, especially in medicine. **codominant** Inheritance pattern in which a heterozygote expresses the distinct trait of both alleles. **consanguinity** Being descended from the same ancestor and producing offspring **dihybrid cross** Cross between two organisms where two distinct traits are being studied. **dominant** Describes a trait that covers over, or	• write heterozygous, homozygous dominant and homozygous recessive genotypes • conduct a monohybrid cross to determine probability of offspring • conduct a dihybrid cross to determine probability of offspring • conduct a test cross to determine probability of offspring and genotype of unknown parent • utilize punnett squares for each inheritance pattern to determine probability of offspring or parental genotypes • use blood types to determine parental identities • interpret pedigrees • create pedigrees that include 3 generations, 10 individuals, and trace a simple dominant or recessive trait

dominates, another form of that trait. **epistasis** A type of gene interaction in which one gene alters the phenotypic effects of another gene that is independently inherited., One gene masks the expression of a different gene for a different trait **expressivity** Severity or extent of expression of a genotype **genetic heterogeneity** the production of the same or similar phenotypes by different genetic mechanisms; the character of a phenotype produced by mutation at more than one gene or by more than one genetic mechanism. **genotype** An organism's genetic makeup, or allele combinations. **hemizygous** Describes an individual who has only one member of a chromosome pair or chromosome segment rather than the usual two; refers in particular to X-linked genes in males who under usual circumstances have only one X chromosome **heterogametic** Pair of sex chromosomes are different (Ex. XY in human ♂) **heterozygous** An organism that has two different alleles for a trait **homogametic** Pair of sex chromosomes are the same (Ex. XX in human ♀) **homozygous** An organism that has two identical alleles for a trait **incomplete dominance** A pattern of inheritance in which two alleles, inherited from the parents, are neither dominant nor recessive. The resulting offspring have a phenotype that is a blending of the parental traits. **law of independent assortment** The alleles of different genes separate independently of one another during gamete formation **law of segregation** Mendel's law that states that the pairs of homologous chromosomes separate in meiosis so that only one chromosome from each pair is present in each gamete **monohybrid cross** Cross between two organisms where only one trait is being studied. **mutant** an animal that has undergone mutation **mutation** A rare change in the DNA of a gene, ultimately creating genetic diversity. **pedigrees** a chart that shows a trait in a family and how it is inherited **Penetrance** Frequency with which a heritable trait is exhibited by individuals carrying the gene or genes that determine that trait. **phenotype** An organism's physical appearance or visible traits. **pleiotropic** a single gene determines more than one phenotype for and organism.	• describe how genes interact with the environment • explain how several genes can cause a single trait • explain how one gene can cause several traits • describe the sex genotypes • research a genetic disorder and explain what pattern of inheritance it follows • Explain how mutations caused the different possible alleles

Punnett Square A chart that shows all the possible combinations of alleles that can result from a genetic cross **recessive** An allele that is only expressed in the phenotype if there is not a dominant allele in the genotype is said to be recessive. **sex influenced traits** a characteristic controlled by autosomal genes that appears in both sexes but either the frequency of its occurrence or the relationship between genotype and phenotype is different in males and females. **sex limited traits** a characteristic controlled by autosomal genes that is phenotypically exhibited in only one of the two sexes. **wild type** An individual with the phenotype most commonly observed in natural populations; also refers to the phenotype itself. **X inactivation** During development, females inactivate half of their X gene/alleles in order to prevent producing double the amount of the protein. **X-linked** Pattern in which the trait is rare, recessive gene found on the X chromosome, the trait skips generations, affected fathers do not pass the trait to their sons, and males are often more affected than females **Y-linked** The pattern of inheritance that results from genes located only on the Y chromosome. **I KNOW…..** ● Each offspring gets one copy of a gene from each parent ● How to use punnett squares to show the different inheritance patterns ● how to create and interpret pedigrees and karyotypes ● all the different inheritance patterns ● How to express different genotypes for the different inheritance patterns	

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Phase V Learning Plan

Phase II Curriculum

Unit 5: Molecular Genetics

Essential Questions:	**Essential Understanding:**
1. How does DNA determine the sum of an organism? 2. How does DNA change allow for differences in organisms?	1. DNA contains all of the directions for assembling all proteins that either make up the structure of an organism or control all the chemical reactions an organism needs to maintain homeostasis. Through the processes of Replication, Transcription and Translation the genes DNA contains are changed into those proteins/enzymes. 2. DNA can be mutated to create different proteins which in turn may function differently - either beneficially or adversely.

Curriculum Standards- DOK noted where applicable with Standards

B4.1B Explain that the information passed from parents to offspring is transmitted by means of genes that are coded in DNA molecules. These genes contain the information for the production of proteins.
B4.2A Show that when mutations occur in sex cells, they can be passed on to offspring (inherited mutations), but if they occur in other cells, they can be passed on to descendant cells only (noninherited mutations).
B4.2B Recognize that every species has its own characteristic DNA sequence.
B4.2C Describe the structure and function of DNA.
B4.2D Predict the consequences that changes in the DNA composition of particular genes may have on an organism (e.g., sickle cell anemia, other).
B4.2E Propose possible effects (on the genes) of exposing an organism to radiation and toxic chemicals.
B4.2f Demonstrate how the genetic information in DNA molecules provides instructions for assembling protein molecules and that this is virtually the same mechanism for all life forms.
B4.2g Describe the processes of replication, transcription, and translation and how they relate to each other in molecular biology.
B4.4a Describe how inserting, deleting, or substituting DNA segments can alter a gene. Recognize that an altered gene may be passed on to every cell that develops from it and that the resulting features may help, harm, or have little or no effect on the offspring's success in its environment.
B4.4c Explain how mutations in the DNA sequence of a gene may be silent or result in phenotypic change in an organism and in its offspring.

LEARNING TARGETS

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
Amino Acid Building blocks of protein **Anticodon** group of three bases on a tRNA molecule that are complementary to an mRNA codon **Codon** a specific sequence of three adjacent bases on	● Describe the scientists and their discoveries which lead up to the understanding of the structure of DNA ● describe the structure and composition of DNA

a strand of DNA or RNA that provides genetic code information for a particular amino acid **DNA** A complex molecule containing the genetic information that makes up the chromosomes. **DNA Polymerase** Enzyme involved in DNA replication that joins individual nucleotides to produce a DNA molecule. **Double Helix** Double spiral; describes the three-dimensional shape of DNA **Exon** the actual gene part of mRNA that will contain the code for the protein **Exonuclease** This enzyme Removes the nucleotide primer during DNA replication **Helicase** An enzyme that untwists the double helix of DNA at the replication forks. **Intron** A segment of a gene situated between exons that is removed before translation of messenger RNA and does not function in coding for protein synthesis. **Ligase** An enzyme that connects two fragments of DNA to make a single strand; used on the lagging strand **mRNA** A type of RNA, synthesized from DNA, that attaches to ribosomes in the cytoplasm and specifies the primary structure of a protein. **Mutation** A change in the order of the bases in an organism's DNA **Nucleotide** A building block of DNA, consisting of a five-carbon sugar covalently bonded to a nitrogenous base and a phosphate group. **Primase** An enzyme that joins RNA nucleotides to make the primer using the parental DNA strand as a template. **Promoter** DNA sequence where RNA polymerase attaches and initiates transcription **Protein** An organic compound that is made of one or more chains of amino acids and that is a principal component of all cells **Purine** Nitrogenous bases; Adenine and Guanine; Have two rings **Pyrimidine** Nitrogenous bases; Cytosine, thymine, and uracil; Have one ring **Replication** The process whereby DNA makes a copy of itself before cell division **Replication Fork** A Y-shaped region on a replicating DNA molecule where new strands are growing. **RNA** a single-stranded nucleic acid consisting of a phosphate group and one of four nitrogenous bases that encodes information needed to synthesize proteins. **RNA Polymerase** An enzyme that links nucleotides into a growing RNA chain during transcription, based on complementary binding to nucleotides on a DNA template strand.	● distinguish between a pyrimidine and purine and give examples ● describe the three different types of RNA including their functions and structures ● describe the structure of proteins ● replicate DNA using complementary base pairing ● describe the enzymes involved in DNA replication ● transcribe DNA into mRNA using complementary base pairing and identifying a promoter sequence ● describe the enzymes involved in transcription of RNA ● translate mRNA into a protein ● describe the process that transcribes mRNA to protein ● Describe 5 types of mutations ● Identify how different mutations will affect the protein that will be made ● differentiate between a mutation in a somatic cell versus a germ cell

rRNA Combines with proteins to form the ribosomes that assemble the proteins **Semiconservative** Method of DNA replication in which parental strands separate, act as templates, and produce molecules of DNA with one parental DNA strand and one new DNA strand **SSB** Enzyme that stabilizes and protects single stranded DNA **Template Strand** The DNA strand that provides the pattern, or template, for ordering the sequence of nucleotides in an RNA transcript. **Transcription** The process whereby the DNA sequence in a gene is copied into mRNA **Translation** The process whereby genetic information coded in messenger RNA directs the formation of a specific protein at a ribosome in the cytoplasm **tRNA** Amino-acid-carrying RNA structure with an anticodon that binds to a mRNA codon; Carries one specific amino acid and places the amino acid in the correct location of the growing polypeptide. **Wobble Hypothesis** the hypothesis that some tRNA molecules can pair with more than one mRNA codon, tolerating some variations in the third base, as long as the first and second bases are correctly matched **I KNOW…..** ● the scientists and their experiments that lead to our understanding of DNA, RNA and protein synthesis ● the structure of DNA, RNA and proteins ● how to use complementary base pairing for replication and transcription and the enzymes involved ● how to use a codon chart to interpret mRNA and the process to do so ● the differences between several types of mutations and how they are caused ● the difference between a germ cell mutation and somatic cell mutation	

Phase III Textbook/Materials
Phase IV Summative Assessment Evidence

Common Summative Unit Assessments: (*identifies Performance Task)	**Agreed Upon Interim Summative Assessments:** (*identifies Performance Task)

Phase V Learning Plan