Semester 2 Unit Guide: Learning Goals and Content Expectations

|  |  |
| --- | --- |
| Unit 8: DNA, Chromosomes and Genetics | **Learning Goal 1: Ask questions to help clarify how DNA and chromosomes code for the instructions for characteristics that are inherited.** |
| **Vocabulary:** Nucleotide, Deoxyribonucleic Acid, Phosphate, Deoxyribose, Nitrogenous Base, Hydrogen Bonds, Adenine, Guanine, Cytosine, Thymine, Purine, Pyrimidine, Double Helix, Helicase, DNA Polymerase, Complementary Base Pairing, Enzyme, Free-Floating Nucleotide, Sugar Phosphate Backbone |
| I need to be able to answer: | I need to be able to: |
| 1. What does DNA stand for?
2. What is the monomer of DNA?
3. What are the parts of a nucleotide? How do they fit/connect together?
4. What are the nitrogenous bases? How are they similar and how are they different?
5. What type base pairs with what? Both in general (purine/pyrimidine) and in specific (A, T, G and C).
6. What is a pyrimidine? A purine?
7. What about the structure of a nitrogenous base causes it to bond with one other specific base?
8. What shape is DNA? Hos is that formed from many DNA monomers?
9. How does DNA structure allow relate to its function? Why does the structure of DNA mean that it can be the genetic material of all living things?
10. What is RNA?
11. How is it different and similar to DNA?
12. What is the function of RNA? How does it’s form allow it to do that function?
13. How does DNA replicate?
14. What about DNA’s form allows it to replicate?
15. What is the enzyme that splits DNA in replication?
16. What is the enzyme that builds the new strand of DNA?
17. What is a free-floating DNA nucleotide?

**Add your own!** | * Draw and recognize a nucleotide
* Identify all the parts of a nucleotide, either in a model or a drawing
* Draw both a generalized purine and pyrimidine
* Model how a strand of DNA is created
* Use base paring rules to create a complementary strand of DNA
* Recognize a DNA double helix
* Identify RNA and DNA, both from pictures and models
* Describe DNA replication
* Model DNA replication
* Draw DNA replication

**Add your own!** |
| **Learning Goal 2: Use Punnett squares and other probability tools to explain variation in a population** |
| **Vocabulary:** Punnett square, monohybrid, dihybrid, genetics, trait, inheritance, dominant, recessive, genotype, phenotype, allele, homozygous, heterozygous, independent assortment, Incomplete dominance, co-dominance, multiple alleles, sex-linked genes |
| I need to be able to answer: | I need to be able to answer: |
| 1. What does it mean for a trait to be dominant or recessive?
2. How does meiosis relate to a Punnett square?
3. What does the Law of Segregation state? How is this shown during meiosis?
4. What does the Law of Independent Assortment state? When does this occur during meiosis?
5. What is an allele?
6. How is genotype used to determine phenotype?
7. What is the difference between genotype and phenotype?
8. What is the difference between homozygous and heterozygous?
9. What is the difference between recessive and dominate? What do each mean in terms of the phenotype of the organism?
10. What is the difference between complete, incomplete and co dominance?
11. How do non-mendalian traits show up in a cross?
12. How can multiple alleles interact to form a unique phenotype?
13. What is a sex linked gene, and how is it passed on?

**Add your own!** | * Use a Punnett square to identify genetic probabilities of traits in offspring of a cross
* Use genotype to determine the phenotype of an organism
* Use letters to represent genotype (e.g. P and P)
* Identify genotype and phenotype ratios of a cross
* Preform both monohybrid and dihybrid crosses
* Use Punnett squares to predict the outcome of non-Mendalian trait crosses (e.g. incomplete and co dominance)
* Identify the form of inheritance based on the genotype ratios of the cross
* Preform a Punnett square cross for a sex linked gene, and identify the genotype and phenotype ratios

**Add your own!** |
| **Learning Goal 3: Use evidence to explain the three sources of genetic variation within a population** |
| **Vocabulary**: Segregation, Independent Assortment, Metaphase Plate, crossing over,  |
| I need to be able to answer: | I need to be able to answer: |
| 1. What are the sourses of genetic variation within populations?
2. What is the law of segregation?
3. What is the law of independent assortment?
4. What is crossing over? When does it happen?
5. How do offspring not look like their parents?
6. What is sexual reproduction?
7. How do fertilization, sexual reproduction, meiosis and Punnett squares all lead to genetic variety in a population?
8. Why is genetic variation important to the evolutionary success of a species?
9. How does mutations lead to variation?

**Add your own!** | * Identify sources of genetic variation within a population
* Understand how variation leads to evolution

**Add your own!** |

|  |  |
| --- | --- |
| **Unit 9: Cell Division and Reproduction** | **Learning Goal 4: Use models of the process of mitosis, meiosis and differentiation to describe how these processes allow the organism to grow, develop and reproduce.** |
| **Vocabulary:** Binary Fission, The Cell Cycle, G1, S, G2, Chromosome, Chromatin, Chromatid, Interphase, Prophase, Metaphase, Anaphase, Telophase, Cytokinesis, Spindle Fibers, Centromere, Centrioles, Metaphase Plate, Cell Plate, Cleavage Furrow, Carcinogen, Mutagens, Tumor, Cancer, Oncogenes, Benign, Malignant, Metastasis, Meiosis, Homologous Pair, diploid, haploid, 1N or 2N, Somatic Cell, Gamete, Prophase 1 and 2, Metaphase 1 and 2, Anaphase 1 and 2, telophase 1 and 2, Cytokinesis 1 and 2, Fertilization, Nondisjunction, Karyotype, Aneuploidy, Trisomy, monosomy, spermatogenesis, oogenesis, totipotent, pluripotent, multipotent, differentiation, zygote, embryo, stem cells,  |
| I need to be able to answer: | I need to be able to: |
| 1. What is Binary Fission? What types of cells do this?
2. What is the difference between Mitosis and Binary Fission?
3. What are the stages of the cell cycle, and what happens at each stage?
4. What form of division do eukaryotic cells do? What form of division do prokaryotic cells do?
5. What is the difference between chromosomes, chromatin, chromatids and genes?
6. What are the phases of mitosis?
7. What happens at each stage of mitosis?
8. What form of DNA is present at each stage of mitosis? (e.g., chromatin, chromosomes)
9. What percentage of time does a cell spend in each stage of the cell cycle? How about in each stage of mitosis?
10. Hoe does cancer relate to the cell cycle?
11. What part of the cell cycle is effected by cancer?
12. How does cancer change the percentage of time spent in each phase of the cell cycle?
13. What is a carcinogen and how does it cause cancer?
14. What are the different sources of carcinogens? What are the three main causes of cancer?
15. What are the stages of cancer?
16. What is the current treatments for cancer, and what do they do? How do they work?
17. What id the difference between a cell that is 1N and a cell that is 2N? What is the difference between haploid and diploid?
18. When is a human cell haploid and when is it diploid?
19. What is a homologous pair?
20. What is the difference between a replicated chromosome and an unreplicated chromosome? How many chromatids does each have? How many copies of the same genes?
21. What are the phases of meiosis? What happens at each phase? What form of DNA is present at each phase?
22. During which meiosis phases is a cell diploid? When is it haploid?
23. What are the similarities between Mitosis and Meiosis?
24. What is the difference between spermatogenesis and oogenesis?
25. What are the stages of fertilization, and what happens at each?
26. What is the difference between non-disjunction 1 and 2?
27. What are the different types of stem cells, when are they present in the human body and what are their uses in medicine?
28. What does “gene expression” mean?
29. What is the difference between monosomy and trisomy?
30. What are examples of both monosomy and trisomy in humans?

**Add your own!** | * Recognize Binary Fission
* Recognize the Eukaryotic cell cycle, and identify each phase
* Diagram the cell cycle
* Identify chromosomes, genes, chromatin and chromatids in pictures and models
* Identify and describe all the phase of Mitosis
* Draw each phase of mitosis, and identify what happens
* Identify which stage of mitosis a cell is in, both in real life and from pictures and diagrams
* Draw a diagram based on a real picture of each stage of mitosis
* Diagram how cancer effects the cell cycle
* Draw a diploid or haploid cell, given what N equals
* Identify a diploid or haploid cell from a picture or diagram
* Identify each phase of Meiosis, and describe what happens
* Draw each phase of meiosis, and label what is happening and whether the cell is diploid or haploid
* Identify the differences between mitosis and meiosis in pictures or diagrams
* Recognize the difference between sperm formation and egg formation
* Diagram what happens in the process of fertilization
* Diagram the process of Non-Disjunction 1
* Diagram the process of Non-disjunction 2
* Calculate the N number in situations of Nondisjunction
* Make a karyotype
* Identify karyotype disorders

**Add your own!** |

|  |  |
| --- | --- |
| **Unit 10: Protein Synthesis** | **Learning Goal 5: Use evidence to explain how DNA structure leads to protein structure, and protein structure drives all functions and traits in an organism.** |
| **Vocabulary:** DNA, RNA, amino acid, protein, denature, codon, anticodon, codon chart, transcription, translation, tRNA, rRNA, mRNA, ribosome, point mutation, frame shift, missense mutation, nonsense mutation, silent mutation, deletion mutation, insertion mutation |
| I need to be able to answer: | I need to be able to: |
| 1. What are the monomers of a protein?
2. What type of bond holds a protein together?
3. How does the forma of a protein = its function?
4. What is the central dogma?
5. How does the cell get form DNA to RNA to protein?
6. How does RNA code for an amino acid?
7. What is the start codon?
8. How is RNA made? What enzyme does it?
9. What is transcription, and how and where does it happen?
10. What is translation, and how and where does it happen?
11. What are the similarities and differences between DNA replication and transcription?
12. What are the different forms of RNA, how are they different, and what are their jobs?
13. What does the ribosome do?
14. What is a codon and an anticodon, and where are they both found?
15. How do mRNA codons lead to an amino acid?
16. How many amino acids are there?
17. How does the structure of a protein relate to the phenotype of an organism?
18. How do mutations in DNA lead to differences in phenotype?
19. What is the difference between a missense, nonsense, and silent mutation?
20. What is the difference between a point and frame shift mutation?
21. Which type of point mutation would most likely cause the biggest problem for protein synthesis?
22. What is the difference between a mutation in a somatic cell or a gamete?
23. Which type of traits could effect the phenotype of an organism? How?

**Add your own!** | * Use a codon chart to determine the amino acid order of a strand of DNA
* Use complementary base pairing to create a strand of RNA from a strand of DNA
* Identify transcription and translation in a diagram
* Diagram the process of transcription
* Diagram the process of translation
* Use DNA to determine RNA to determine the amino acid sequence to determine the traits of an organism
* Identify the effect of a missense, nonsense or silent mutation on the final protein
* Identify the effect of a deletion or insertion mutation on the final protein
* Describe the steps of transcription
* Describe the steps of translation

**Add your own!** |

|  |  |
| --- | --- |
| **Unit 11: Evolution** | **Learning Goal 6: Use current scientific evidence to support biological evolution** |
| **Vocabulary:** biological evolution, scientific theory, mutation, common ancestor, fossil, homologues structure, vestigial structure, embryonic development, geologic changes,  |
| I need to be able to answer: | I need to be able to: |
| 1. What is biological evolution?
2. What is a scientific theory?
3. What is a “common ancestor?”
4. How do fossils support biological evolution?
5. How do homologous structures support biological evolution?
6. How do vestigial structures support biological evolution?
7. How does embryonic development support biological evolution?
8. How do geologic changes and data support biological evolution?
9. How does DNA structure support biological evolution?

**Add your own!** | * Identify causes of (genetic) variation
* Identify and describe examples of biological evolution
* Use examples to create an argument in support of biological evolution

**Add your own!** |
| **Learning Goal 7: Use statistics to support an explanation of the process of natural selection** |
| **Vocabulary:** natural selection, genetic variation, differential survival, gene pool, genetic frequency |
| I need to be able to answer: | I need to be able to: |
| 1. What is an “acquired” characteristic? How does your knowledge of genes help to explain that acquired characteristics can’t be passed down?
2. Use an example organism to describe how Lamarck thought biological evolution occurred. (Giraffe used on powerpoint)
3. How does variation play a role in the theory?
4. Why is reproduction so important?
5. What is differential survival? How does it apply to evolution?
6. Is the “selection process” directional? What does that mean?
7. How does genetic frequency change over time in a population?

**Add your own!** | * Identify and describe Lamarck’s theory of evolution
* Identify and describe Darwin and Wallace’s theory of evolution

**Add your own!** |
| **Learning Goal 8: Use evidence to explain how natural selection leads to changes in populations over time.** |
| **Vocabulary:** genetic drift, speciation, species, |
| I need to be able to answer: | I need to be able to: |
| 1. Why can only populations evolve, instead of individuals?
2. What is genetic drift, and when does it happen?
3. What is speciation, and how does it happen?
4. How do the Galapagos finches provide an example of speciation?
5. What do you think is a “selective pressure”?
6. What could happen to a species that is unable to adapt?
7. How do cladograms show common ancestry?
8. How do you read a cladogram?
9. What is a node on a cladogram, and what does it signify?

**Add your own!** | * Describe how a population can evolve instead of an individual organism
* Identify and describe factors that can change gene frequency in a population or species over time
* Apply the concept of genetic drift to a population
* List/describe steps that could lead to a new species
* Identify an example of speciation
* Use a cladogram to trace common ancestry between species

**Add your own!** |
| **Learning Goal 9**: Critically evaluate evidence supporting claims that changes in the environment lead to changes in populations |
| **Vocabulary**: extinction, mass extinction, gene frequency, gene pool, stabilizing selection, directional selection, divergent selection,  |
| I need to be able to answer: | I need to be able to: |
| 1. What is a mass extinction?
2. What causes a mass extinction, and when have them happened?
3. How do populations evolve?
4. How does the environment relate to evolution?
5. What is gene frequency?
6. How does changes in gene frequency lead to evolution?
7. How do changes in the environment lead to differential survival?
8. What is stabilizing selection? What environmental changes can cause it?
9. What is directional selection? What environmental changes can cause it?
10. What is divergent selection? What environmental changes can cause it?
11. What would the graph of each type of selection look like?

**Add your own!** | * Identify factors that could lead to changes in the traits of organisms in a particular environment
* Diagram the steps of speciation
* Identify the steps of speciation in an example population
* Predict the type of specification caused by changes in the environment in a specific environment
* Use graphs to show the changes in a population over time

**Add your own!** |
| **Learning Goal 10: Use evidence to explain how 4 factors (overproduction, inherited variability, competition for resources, and the ability of those best suited to survive and reproduce) result in biological evolution** |
| I need to be able to answer: | I need to be able to: |
| 1. What are the three tenants of biological evolution?
2. How are Peppered Moths, Antibacterial Resistance, and Artificial Selection examples of biological evolution? Use the three tenants to describe each!
3. Is variation directional? What does that mean?
4. What must be true about a mutation for it to be passed on to offspring?
5. How do the tenants of evolution lead to changes in gene frequency in a population, and to evolution?

**Add your own!** | * Identify and explain the three tenets of the theory of evolution
* Apply these three tenets of the theory of evolution to an example scenario/organism

**Add your own!** |

|  |  |
| --- | --- |
| **Unit 12: Behavior** | **Learning Goal 11: Evaluate evidence for the role of group behavior on individual and species’ chances to survive and reproduce.** |
| **Vocabulary:**  |
| I need to be able to answer: | I need to be able to: |
| **Add your own!** | **Add your own!** |