**Semester 2 Final Review Guide**

**June 2016**

**Genetics and Biotech**

**Introduction to Genetics**

* Define genetics
* Define trait
* Identify the Mendel's principle findings on the patterns of genetics (inheritance patterns)
  + What does it mean for a trait to be dominant or recessive?
  + What does the Law of Segregation state? How is this shown during meiosis?
  + What does the Law of Independent Assortment state? When does this occur during meiosis?
* Define genotype and phenotype
  + What is an allele?
  + How is genotype used to determine phenotype?
* Distinguish between a homozygous genotype and a heterozygous genotype
  + How is a homozygous dominant genotype different from a homozygous recessive genotype?

**Monohybrid & Dihybrid Crosses**

* Identify the purpose of a Punnett square
  + How is the Law of Segregation demonstrated while using a Punnett square?
  + How does this demonstrate the Law of Independent Assortment?
  + How is fertilization demonstrated while using a Punnett square?
  + Why is it important to realize that this is a PROBABILITY and not a certainty?
* Use a Punnett square to show the possible genotypes of the offspring in a monohybrid cross
* Calculate the genotypic and phenotypic ratio for a monohybrid cross
* Define monohybrid cross and dihybrid cross
* Determine the possible gametes from a parental genotype representing two traits
* Use a Punnett square to show the possible genotypes of the offspring in a dihybrid cross
* Calculate the genotypic and phenotypic ratio for a dihybrid cross

**Biotechnology**

* Identify the purpose of gel electrophoresis
  + What properties about the molecules allow them to move across the gel at faster or slower rates?
  + What is being applied to the molecules to make them move?
  + What is present in each band on the gel electrophoresis?
* Describe the steps for using gel electrophoresis
  + Where do you place the samples and with what piece of equipment?
  + What could be in the samples?
* Identify the molecular properties that mostly determine the rate at which those molecules travel through a gel during gel electrophoresis
  + What charge does DNA and RNA possess? Extra – what gives them this charge?
  + Which end will these nucleic acids move toward? What is this electrode called?
* Identify and explain the reason why polysaccharide agarose is used to make the gels
  + What if the two molecules are the same size, what else could make them move faster or slower?
* Identify the roles of the buffer
* Identify potential uses for gel electrophoresis

**Protein Synthesis**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vocab** | **Concepts** | **Skills** |
| **Proteins** | * **Structural,** * **signaling,** * **enzyme,** * **lysis,** * **amino acids** * **polypeptide** * **RNA** | * **Three functions of proteins,** * **how proteins are built (chain of amino acids)** * **RNA is a link: DNA into Proteins** * **Differences between RNA and DNA (there are 3!)** * **Where do amino acids come from?** | * **Identify the different types of proteins** |
| **Transcription** | * **Central Dogma** * **RNA Polymerase** * **mRNA** * **tRNA** * **rRNA/Ribosome** * **Uracil (U)** * **Transcription** | * **What are the steps, or stages of the Central Dogma, and in what order?** * **Differences between DNA and RNA** * **How does transcription happen? (steps of transcription)** * **Differencence between DnA replication and Transcription** | * **How to transcribe (or re-write) DNA into mRNA** |
| **Translation** | * **Codon** * **Start Codon/Met** * **Stop Codon** * **Anticodon** * **Translation** * **Amino Acids** * **Ribosome** * **3 types of RNA** * **Peptide bond** | * **There are 3 letters in the codon that codes for the amino acid** * **Start codon has an amino acid, tells the ribosome where the protein starts** * **Stop codon breaks the ribosome and ends protein** * **Ribosome uses codon and anticodon to connect tRNA to mRNA** * **Polypeptide chains fold into complex structures to become proteins** * **Protein function comes from it’s shape!!!!** | * **How to read a codon chart to find the amino acid** * **How and where to write the anticodon** |
| **Mutations** | * **Point Mutation** * **Frame shift Mutation** * **Silent** * **Missense** * **Nonsense** * **Gene Translocation** * **Cancer** * **Natural/Induced Mutation** * **Somatic/Gamete** | * **Different effects of mutations in gametes or somatic cells** * **What type of mutation effects phenotype** * **Difference between natural and induced** * **Different effects of point and frame shift mutations (on codon, amino acid and protein)** * **Most mutations are corrected!!!!** * **What is the effect of mutations on a species or population** | * **How to identify a mutation in a strand DNA or RNA (including the type of effect on amino acid and codon)** * **How to identify the effect of a mutation** |

**Evolution**

**Biological Evolution**

* Describe how a population can evolve instead of an individual organism
* Identify and describe Lamarck’s theory of evolution
  + What is an “acquired” characteristic? How does your knowledge of genes help to explain that acquired characteristics can’t be passed down?
  + Use an example organism to describe how Lamarck thought biological evolution occurred. (Giraffe used on powerpoint)
* Identify and describe Darwin and Wallace’s theory of evolution
  + How does variation play a role in the theory?
  + Why is reproduction so important?
* Define evolution
* Identify and describe factors that can change gene frequency in a population or species over time (3 mentioned)
* 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
* Identify causes of (genetic) variation
  + Is variation directional? What does that mean?
  + What must be true about a mutation for it to be passed on to offspring?
* Define differential survival
  + Is the “selection process” directional? What does that mean?
* Define genetic drift
  + Can you apply this concept to a real-life population? Try it. ☺
* Define speciation
  + What is the definition we use for a species in biology? (it’s not perfect…but it’s what we’ve got!)
* List/describe steps that could lead to a new species
  + Apply these steps to an example – consider using the finches on the Galapagos Islands
  + What do you think is a “selective pressure”?
* Hypothesize what could happen to a species that is unable to adapt
* Identify how many major extinction events have occurred in the history of life
  + What is the percentage of species that have ever lived on Earth that are estimated to be extinct?

**Examples and Evidence for Evolution**

* Identify and describe examples of biological evolution
  + Be able to use Peppered Moths, Antibacterial Resistance, and Artificial Selection as examples (and applying the 3 tenets of biological evolution)
  + What is the selective pressure in artificial selection?
* Identify different types of evidence that we can use to support biological evolution
* Explain how fossils can show evidence for change over time
* Describe what a vestigial structure is
  + What are examples of vestigial structures?
* Define homologous structure
  + How are forelimbs used to provide evidence for evolution? What could be used in other organisms?
* Identify how embryonic development is used as evidence for biological evolution
  + How is Darwin’s view different from Haeckel’s theory?
* Identify how DNA can be used to demonstrate relatedness among organisms

**Cladograms**

* Construct a cladogram
  + What does each point where two branches separate show?
  + How is this used to describe the evolutionary process?
* Know Cladogram vocabulary
  + Node
  + Clade
  + Cladistics

**Characteristics of Life and Classification**

* Characteristics of Life
  + Name the 8 characteristics
    - Describe and give examples of each
    - Categories of metabolism and what they mean
* Classification
  + Taxonomy
    - 7 levels in order (KPCOFGS)
    - Binomial system of nomenclature (eg. Homo sapien)
  + 6 kingdoms
    - General characteristics of each and examples for each kingdom
      * Eubacteria
      * Archaebacteria
      * Plante
      * Fungi
      * Protista
      * Animalia
    - Kingdom animalia
      * Know the phyla, and general characteristics
        + Porifera
        + Radiata
        + Platyhelminthes
        + Nematodes
        + Rotifers
        + Mollusca
        + Annelida
        + Arthropoda
        + Echinodermata
        + Chordata

Cellular organization

Prokaryote vs. eukaryote

Unicellular vs. multicellular

Definition of species