**Evolution Exam Review Guide: Exam is on FRIDAY April 4th**

**Evolution** is the *slow* change of species over time (**BILLIONS** of years).

**Factors that cause evolution, or change, in species:**

* Mutation
* Sexual reproduction (genetic recombination)
* Variation (diversity)
* Competition
* Natural Selection
* The Environment

**Mutation:**

* Mutations occur **RANDOMLY**.
* Factors that *increase the chance* of mutation are exposure to radiation (**UV light**), chemicals, and toxins.
* Some mutations are harmful or deadly. Some mutations go unnoticed. But **some mutations create new characteristics that are beneficial** (advantageous). A helpful mutation gives an organism *an advantage in a particular environment*.
* In order for a mutation to be passed on to offspring, **the mutation must occur in the SEX CELLS** (gametes, sperm/egg).
* Mutations in body cells *will ONLY be passed on to other body cells* that form by mitosis.
  + Example- An individual with liver cancer will create more liver cancer cells (tumor), but an individual with cancer will not give birth to a child with cancer. BODY CELL MUTATIONS CANNOT BE PASSED TO OFFSPRING.

**Sexual Reproduction:**

* **Genetic recombination** is the mixing and sorting of genes **during meiosis and fertilization**- two events that occur *only during sexual reproduction*.
* Genetic recombination makes unique offspring with new traits and characteristics.
* Genetic recombination *increases the variation* in a species
* **Asexual reproduction** (mitosis/cloning)- ***Identical*** offspring are formed. There is no variation in asexual reproduction. Asexual reproduction does NOT cause evolution, because asexual reproduction creates CLONES, and evolution means CHANGE.

**Variation:**

* Variations are differences among species.
  + Humans are a species, but not all humans are identical
* **Variation increases the chance that a SPECIES will survive** and continue on.
  + The Black Plague killed a third of the world’s population, but because there was variation in the human population, some humans were able to survive. The human population continued.

**Competition:**

* Organism and species in nature compete for **FINITE resources** (finite means limited)
  + *There is limited food, space, water, shelter, and mating partners in nature.*
* **Only the best organisms will be able to compete and survive.**
* Organisms that are **best fit** for their environment will win the competition for resources.
* The “winners” **survive longer and get to reproduce more.** They will get to *pass on their adaptations through their genes to the next generation*.

**Natural Selection:**

* The environmental conditions decide which organisms survive and reproduce.
* Naturally, the organisms that are best adapted will live longer and reproduce more.
* Overtime, the population of the best fit organism will increase. Overtime, the population of less fit organisms will decrease. The natural selection for the best fit organisms causes populations to change overtime.
  + In the snowy environment, the mutated white bear was naturally best fit to compete. Overtime, more white bears survived and reproduced, and overtime more and more white bears were seen. The brown bear population decreased over time because it was no longer able to compete. This is natural selection

**Environment:**

* Environmental conditions decide which species can live there.
  + Species adapted for a hot, dry environment will be able to live and compete in a desert. Species adapted for a cold, dry environment will be able to live and compete in the North Pole., etc.

**Extinction:**

* Species that are no longer living in the present day are extinct
* Extinction is common. Most species that were once living are now extinct.
* Extinction happens when a species’ adaptations are no longer fit for the environment. The species is unable to compete for finite resources.

**Modern Evidence for Evolution:**

* Scientists can analyze the DNA of present-day species using Gel Electrophoresis.
* Gel Electrophoresis is a procedure when scientists use an enzyme to cut DNA into fragments. The fragments are separated by size. The smallest pieces travel furthest.
* Species with the most similar gel electrophoresis patterns are most closely related.

**Fossil Record:**

* Because earth is *3.5 billions* years old, and because most species of the past have gone extinct, the fossil record is the most important source of evidence for evolution.

**To sum it up……10 FACTS YOU MUST KNOW BY THE TEST:**

**If you do not have complete understanding of these 10 important statements, then you will struggle on the exam.**

1. Mutations happen RANDOMLY and can only be passed on to offspring if they occur in sex cells.
2. Genetic recombination during sexual reproduction causes variations in a population
3. Variation increases the chance that species will survive (aka less likely to go extinct)
4. In nature, resources are finite (limited)
5. Organisms that are best adapted for an environment will survive and reproduce
6. In order to survive, an organism must have adaptations that are fit for the environment that it lives in. If the environment changes, the organism must also change to survive.
7. Organisms that cannot adapt to their environment will go extinct
8. Extinctions are common
9. Because earth is 3.5 billion years old, most evidence for evolution comes from the fossil record.

10. Gel electrophoresis- a procedure where scientists cut DNA into fragments with an enzyme, and then separate the fragments according to size.

**Vocabulary words that you should know and understand:**

Fragment- piece, or chunk

**Finite**- limited

Infinite- unlimited

Variation- differences

**Descend**- to come from

Adaptation- a trait that helps an organism survive

Adapt- to change

**Heritable**- able to be passed on

Inherit- to receive from a previous generation

Advantageous- helpful

Beneficial- helpful

Occur- to happen

Separate- to move apart

Branch- to split

**Diverge**- to split

Present- today, modern times

Exist- to live

**Practice Test Questions:**

These are *exactly* where the test questions are made from. HAVE SOMEONE QUIZ YOU. (Like Ms. Taylor, a friend, or a parent/guardian).

1. What factors increase the chance of mutation?
2. Mutations occur randomly. True or false?
3. All mutations are harmful. True or false?
4. How can a mutation be **advantageous**?
5. In order for a mutation to be **heritable**, where must it **occur**?
6. If a body cell is mutated, where will it be passed on to? And, HOW will it be passed on (What type of cell division)?
7. During which two processes of sexual reproduction does genetic recombination occur?
8. How does genetic recombination increase **variation**?
9. What is asexual reproduction?
10. Why doesn’t asexual reproduction (aka cloning, aka mitosis) cause evolution?
11. What is **variation**?
12. How is **variation** in a species **beneficial**?
13. What do organisms compete for?
14. What does **finite** mean?
15. Which organisms will get the resources?
16. Organisms with the best adaptations (traits) will survive longer and will reproduce more. What will they pass on to their offspring?
17. Describe what natural selection is in your own words.
18. How does the environment play a role in natural selection?
19. List 3 **adaptations** that would help a mouse to survive in a forest environment.
20. Do extinct species **exist** in the **present** day?
21. Are extinctions common?
22. What causes a species to go extinct?
23. What is gel electrophoresis?
24. How old is the earth?
25. DNA analysis is used in modern science, but what is the most important source of evidence for evolution **and why?**