



Biology B - Unit 2 - EVOLUTION
Unit Study Guide

*Welcome to your Unit 2 Evolution Answer Key! Answers to each question are in **red**, any additional explanations are provided in **blue***

1. Define/describe endosymbiosis.
According to endosymbiosis, mitochondria were once free-living organisms that became a permanent part of host cells. Also according to this theory, mitochondria in cells today are the descendants of aerobic prokaryotes that used oxygen to generate energy.
2. List some evidence for evolution that we discussed in this unit.
Anatomy
Molecular biology
Biogeography
Fossils
Homologous structures
(Explanation: Homologous structures are those features or organs that are shared by very different species (ex. forelimbs bones in bats and penguins).
3. Scientists think that the development of warning coloration in insects is the result of **natural selection**.
(Explanation: The development of specialized warning color patterns results from the pressure of natural selection. The insects that are less affected by predators will survive and leave the most offspring.)
4. How are DNA sequences used as evidence for evolution?
Similarities in DNA sequences of organisms is valuable evidence for evolutionary relationships. Biochemical analysis looks at DNA, and also at proteins.
5. Define/describe vestigial structures.
Vestigial structures are useless structural leftovers, such as wisdom teeth, appendixes, and tailbones in humans, as well as the useless leg bones that float inside the bodies of whales.

6. Phylogeny is the study of
A) human evolution.
B) evolutionary relationships.
C) DNA similarities between related organisms.
D) shared physical features between related organisms.
7. What is true of members of the same species?
They can produce offspring plants that also produce fertile seed. This is what matters.
8. What are some advantages and disadvantages of sexual reproduction?
Advantages: More variation assists with survival. It increases the chance that at least some offspring of a parent survive.
Disadvantages: Sexual reproduction requires two individuals, which may be difficult for endangered or uncommon species of organisms.
9. Parents can pass on chromosomes to their children that are different than their own when the new gene combinations are created by what process?
Crossing over of homologous chromosomes during meiosis. This allows genes from the person's parents to recombine before they are passed on.
10. Compare/contrast meiosis and mitosis.
Similarities:
- Both mitosis and meiosis are types of cell division.
- Both mitosis and meiosis produce daughter cells.
- Both mitosis and meiosis have the "PMAT" stages (which stand for Prophase, Metaphase, Anaphase, and Telophase).
Differences:
- Mitosis has only one round of cell division, while meiosis has two.
- Mitosis only occurs in somatic (body) cells, while meiosis occurs in sex cells.
- Mitosis produces daughter cells (diploid cells) that are identical to the parent cell, while meiosis produces haploid/monoploid cells that only have half of the normal number of chromosomes.
- IMPORTANT: Errors during MEIOSIS can produce new combinations of genetic traits. Errors during MITOSIS cannot.**
(Explanation: Mitosis is strictly used for growth and replacement of cells within the organism itself in animals, as traits are passed on via cell division by meiosis.)

11. Think back to Darwin's trip to the Galapagos Islands. While there, he studied finches. How were the finches different on each island? What was Darwin's explanation for why they were different?

Darwin observed that the birds were similar in many ways but often differed in the size and shape of their beaks. The beaks of each finch species were the result of natural selection. Darwin believed that the shape and size of the beak were best suited for the environment in which the bird lived.

12. Jurassic Park scientists are working hard to bring dinosaurs back from extinction. First, they must find organisms that share a similar embryonic development pattern to these extinct dinosaurs. What species might they use??

Alligators or other reptiles

(Explanation: A reptile like an alligator is most likely to be similar in development to an extinct dinosaur. Organisms such as mammals are unlikely to have an embryological development like that of a dinosaur.)

13. Define/describe homologous structures.

Homologous structures is the term used to describe body structures in different organisms that have different outward appearances but develop from the same embryonic tissues.

14. How is asexual reproduction different from sexual reproduction? Compare and contrast the offspring of both.

Sexual reproduction just means combining genetic material from two parents, resulting in offspring that are genetically different. Asexual reproduction produces offspring genetically identical to the one parent.

15. In order for natural selection to occur, Charles Darwin stated we must begin with a population of organisms that has genetic **variation**.

(Explanation: In order for natural selection to occur, Charles Darwin stated we must begin with a population that has genetic variation. The genetic variation allows some members of the population to have traits, like a certain color, that helps them to survive. If an organism survives, it reproduces, and then passes those traits on to the offspring.)

16. Describe the adaptation of mimicry and how it is used. Give one example of a species using mimicry.

In evolutionary biology, mimicry is an evolved resemblance between an organism and another object, often an organism of another species. Organisms with this adaptation use it to avoid predators or to camouflage. Some nonpoisonous snakes, like the king snake look a lot like a poisonous variety. In this case, the king snake looks like the deadly coral snake. The king snake is not attacked by predators and survives.

17. Natural selection would favor which of the these bears in Antarctica?

- A) grizzly bear
- B) black bear
- C) polar bear

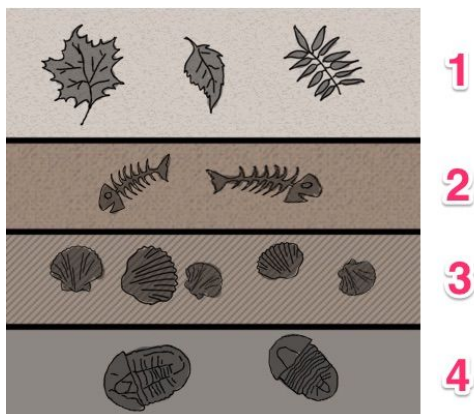
Why?

A white colored bear, such as the polar bear, would be favored by natural selection in Antarctica because it would blend into the snow covering the land. By blending in, the polar bear would be able to hunt more successfully than other color bears.

18. A fossil of a fern and other large-leafed plants were found in an area of Alaska. What might this suggest about this area in Alaska?

The fossilized fern suggests the area once had a warmer climate.

19. Geologists searching for clues to the ancestors of modern-day vertebrate land animals should look in layer _____ of the fossil beds below.



Geologists should look in layer 2 for evidence of ancestors of modern-day vertebrate land animals. Layer 2 contains fossil evidence of bony fish, and although they lived in water, they had internal skeletons.

20. Horses are much larger today than their two-foot tall ancestor, mesohippus. Geologists believe the change in size was the result of changing environments, from tropical forests to a grassland habitat. Larger size would be an advantage for survival in this new habitat because...

- A) taller horses could reach the leaves that grow high on trees.
- B) larger horses could find food easier than the shorter horses.
- C) the larger horses were better camouflaged than the smaller horses.
- D) larger horses had longer legs and could run faster to escape predators.

(Explanation: Larger size would be an advantage for survival in this new habitat because larger horses had longer legs and could run faster to escape predators. The open grasslands made it easier for predators to see the grazing horses, so in order to survive, the horses had to run fast to escape them.)

21. In any field of crops, the height of the plants vary. Birds first eat the seeds from the tallest plants. If this eating pattern continues season after season, what would we expect to happen to these crops over time? Why?

We would expect the sunflowers to get shorter over time. The birds eat the seeds from the tall plants. The seeds from the short plants fall to the ground, sprout, and eventually grow new short plants.

22. Peppered moths vary in color from light gray to almost black. The color of any moth depends on how many black spots are found on its wings. The name "peppered" refers to these black spots. During the day, the moths rest on trees. In England where the moths live, many light gray trees were covered with soot that came from the smoke stacks of factories. The trees got darker and darker from the soot. Over time the peppered moth population in polluted areas

- A) will become extinct.
- B) will become darker in color.
- C) will probably stay the same.
- D) will become lighter in color.

(Explanation: Over time the peppered moth population in polluted areas will become darker in color. The darker moths blend in with the darker tree bark. Since the darker moths were camouflaged, the birds did not see them and did not eat them. They survived and reproduced to produce more dark moths.)

23. Scientists have recently devised a new six-kingdom classification of organisms.

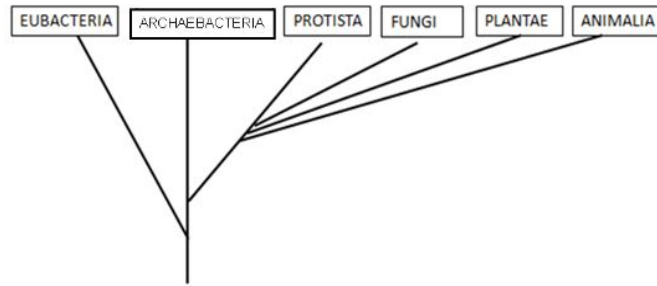
According to the cladogram for the six-kingdom system

A) the Eubacteria gave rise to all life on Earth.

B) the Archaeobacteria gave rise to the eukaryotes.

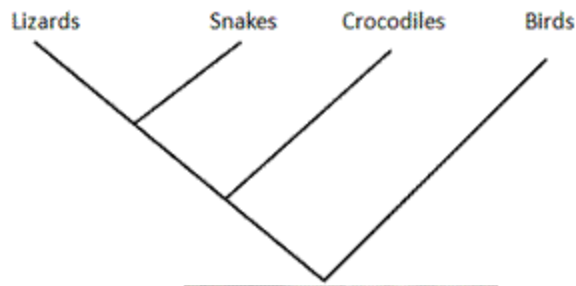
C) the Archaeobacteria are classified as eukaryotic.

D) only the bacterial kingdoms have a common ancestor.



(Explanation: According to the cladogram for the six-kingdom system the Archaeobacteria gave rise to the eukaryotes. Theoretically, all six kingdoms have a common ancestor. The first divergence gave rise to the Eubacteria and Archaeobacteria. The next major branching gave rise to the ancestors of the four eukaryotic kingdoms.)

24. Review the cladogram below. Which are more closely related to lizards genetically?



Lizards and snakes are more genetically alike than lizards and crocodiles or birds.

(Explanation: All living things share a universal genetic code. What we are is determined by how that genetic code is arranged. The four organisms once shared a common ancestor and similar, although not identical, genetics. Over time, the genetic code of each changed. The branches of the cladogram indicate relatedness so we can say that lizards and snakes are more genetically similar than lizards and crocodiles or birds.)

25. All life on Earth started as unicellular, prokaryotic organisms. Which of these structures was vital for organisms to develop in order to evolve into more complex, multicellular organisms?

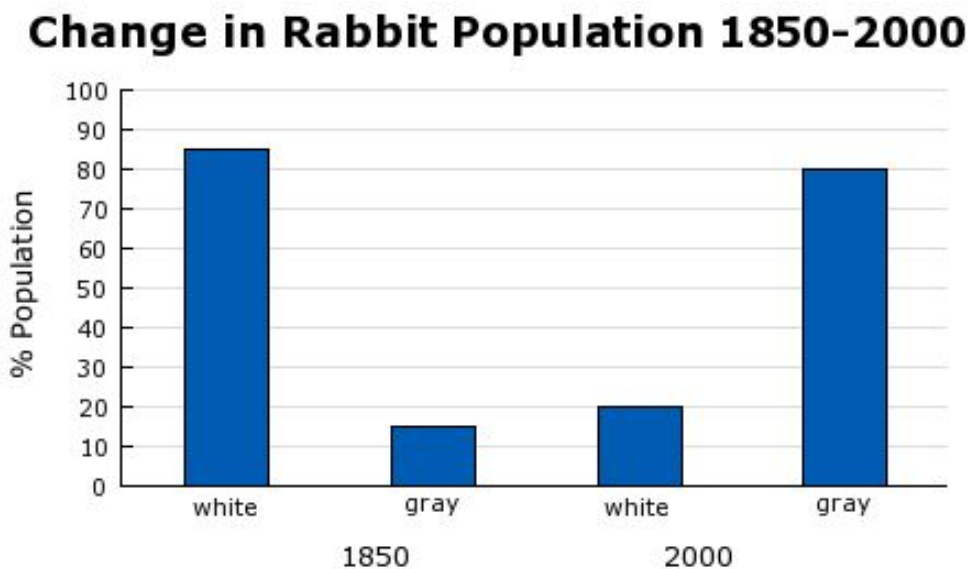
- A) nucleus
- B) ribosomes
- C) cytoplasm
- D) cell membrane

(Explanation: All multicellular organisms contain a nucleus in their cells. The first organisms on Earth were prokaryotic (lacking a nucleus). Prokaryotic cells are limited in their complexity due to not having a central region for DNA storage. Once the nucleus evolved, organisms evolved into much more complex structures, and eventually, began to team up and form multicellular organisms.)

26. What is the difference between a scientific theory and a scientific law? Is evolution considered a theory or a law and why?

In general, a scientific law is the description of an observed phenomenon. It doesn't explain why the phenomenon exists or what causes it. The explanation of a phenomenon is called a scientific theory. It is a misconception that theories turn into laws with enough research. Evolution is considered a scientific theory because the ideas are supported by data and facts. As controversial as it may seem to many, the theory of evolution is accepted by most of the scientific community since it is supported by facts. As new information is found, it may be changed or altered slightly.

27. The graph below show changes in rabbit population between 1850 and 2000.



Part 1: In northern Canada, a population of rabbits was predominantly white in color. The allele for white color is recessive, while the allele for gray color is dominant. Over the last several decades, the average annual temperature of this area has increased, and the long-term deposits of ice and snow have become scarce. How can we explain this change in terms of allelic frequency?

Gray rabbits were more likely to survive in the changed habitat. The gray alleles were passed to offspring. The gray allele is dominant, but the frequency of the allele in the original population was low. As the habitat changed, more white rabbits were seen and caught by predators. The surviving gray rabbits passed on the dominant gray allele to offspring.

Part 2: This change in population is an example of which type of selection?
(nonrandom, directional, disruptive, stabilizing)

Directional Selection

(Explanation: When the frequency of a previously scarce allele increase and a trait different from the original becomes obvious, it is referred to as directional selection. The allele for gray fur was once scarce in this population, but over time, due to environmental factors, that allele became more frequent.)

28. Farmers have long been using DDT to control pests that would prey on their crops. Over time, these pests have become resistant to this pesticide. What happened that allowed the bug population to increase?

The pests that survived the DDT years ago, reproduced new generations of chemical resistant offspring.

29. One way new species may be formed is by geographic isolation. This occurs when members of a population are physically separated, for example, by a river, or a desert. After the separation the two populations, responding to different conditions, will adapt differently, and so their evolutionary paths will _____.

- A) converge.
- B) dissect.
- C) diverge.
- D) reverse.

30. Analyze the data in the table below and answer the following questions. Imagine that the different color beans represent animals that might be prey: mice, for example. A student in each group was the predator: a hawk. Beans (mice) were randomly scattered on multicolored floor tiles, each color within four tiles. The hawk collected mice (beans) for 10 seconds. Mice not eaten reproduced. Three generations of data are shown in the table.

Bean Color	Parental Generation			First Generation			Second Generation		
	Begin	Eaten	Survived	Begin	Eaten	Survived	Begin	Eaten	Survived
White	50	30	20	80	68	12	48	42	6
Red	50	35	15	60	45	15	60	50	10
Black	50	28	22	88	72	16	64	48	16
Tan	50	10	40	160	50	110	440	142	298
Red Striped	50	5	45	180	60	120	480	135	345

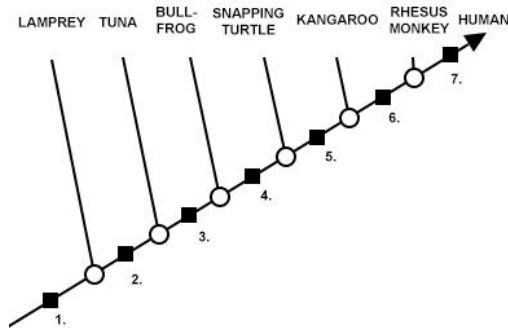
Question 1: Which color bean(s) had the best survival rates? Why do you think they performed better than the others?

Red Striped and Tan. The coloration allowed them to better camouflage in their environment.

Question 2: Give 2 possible reasons for the color variation in the “mice.”

1. Meiosis
2. Mutations

31. What kingdom and domain do all of the organisms below belong in?



Kingdom: **Animalia**

Domain: **Eukarya**

32. Flesh-eating parasitizing maggots are the offspring of the fly, *Ormia ochracea*, which invaded Hawaii from North America. The adult flies follow the chirps of a calling cricket and then deposit wriggling maggots onto the cricket's back. The maggots burrow into the cricket, and emerge, a week later, killing the cricket in the process. Between 1991 and 2001, there were documented major declines in the island's cricket population. In one study, 30% of calling males were infested with the parasite, and in 2001, the island was virtually silent. But in 2003, the cricket population had rebounded. Crickets were back but they were silent crickets! Speculate as to how this might have happened?

Some silent crickets existed that were genetically different. They survived and reproduced. Over time, that population grew.

(Explanation: This is the basis behind natural selection. Variation exists. Some variations are conducive to survival. The members of the population with the beneficial differences survive and reproduce.)

33. The table below is showing you the amino acid sequence of the same protein in different organisms. Knowing that genes code for proteins, identify the organism that is most closely related to the human and the organism that is the least related.

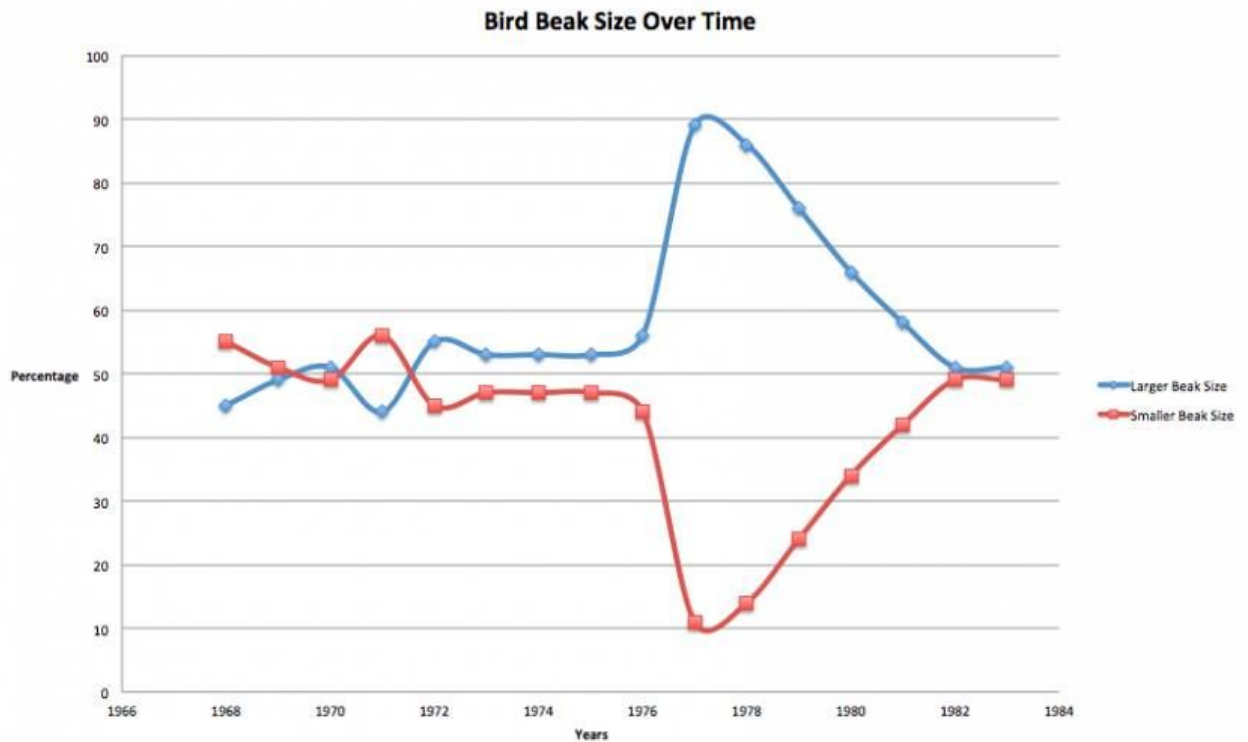
**Amino Acid Sequences and Evolutionary Relationships
(Molecular Homology)**

Horse	Chicken	Tuna	Frog	Human	Shark	Turtle	Monkey	Rabbit
Q	Q	Q	Q	Q	Q	Q	Q	Q
A	A	A	A	A	A	A	A	A
P	E	E	A	P	Q	E	P	Y
F	F	Y	F	Y	F	F	Y	P
T	S	S	S	S	S	S	S	S
T	T	T	T	T	T	T	T	T
D	D	D	D	A	D	E	A	D
K	K	K	K	K	K	K	K	K
N	N	S	N	N	S	N	N	N
K	K	K	K	K	K	K	K	K
G	G	G	G	G	G	G	G	G
I	I	I	I	I	I	I	I	I
T	T	U	T	I	T	T	I	T
K	G	N	G	G	Q	G	G	G
E	E	N	E	E	Q	E	E	E
E	D	D	D	D	E	E	D	D
T	T	T	T	T	T	T	T	T
L	L	L	L	L	L	L	L	L
M	M	M	M	M	R	M	M	M
E	E	E	E	E	I	E	E	E
K	D	S	S	K	K	D	K	K
A	A	A	A	A	T	A	A	A
T	T	T	G	T	A	T	A	T
N	S	S	S	N	A	S	N	N

Monkey (Most closely related), Shark (Least)

(Explanation: The more similar the DNA, the greater the degree of relatedness, or the more recent in time the two organisms diverged from a common ancestor. If there is a great difference in DNA sequencing, this suggests that the organisms shared a common ancestor a long time ago.)

34. Data was collected concerning Galapagos bird beak size over time. There are 13 types of Galapagos finches, and they are also known as Darwin's Finches. These finches share the same habits and characteristics except for one; they all have different beaks. The differences in their beaks might be the most important aspect of their survival because beak size determines the type of seed able to be eaten. Only the birds with the largest of beaks are able to eat the toughest, biggest, and spine covered seeds. Based on the data given, choose the BEST conclusion.



- A) This data shows that over time the type of food available remained constant.
B) This data shows that the environment did not change over the course of time.
C) This data shows a fluctuation in bird species over time most likely due to food availability.
D) This data shows a fluctuation in bird species over time most likely due to the inheritance of acquired characteristics.

(Explanation: This data shows a fluctuation in bird species over time most likely due to food availability. Percentages are based on environmental pressures. In the years with more birds with a larger beak size, the majority of the food available were big, tough, spine covered seeds. Those birds with a larger beak size survived better during those years. In natural selection, those animals most suited or best adapted to the environment survive and reproduce.)