

**EVOLUTION 101**

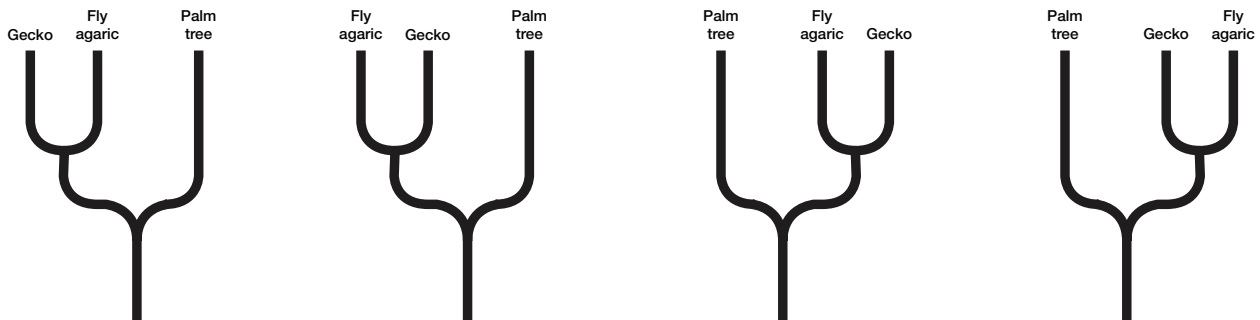
1. c
2. c
3. c
4. Sample answer: The bird is eating the yellow insect. This is probably because it was easier to see and catch than the green one, which is blended in with the leaf. This illustrates natural selection because a variation (green color) is giving some of the insects an advantage that will help them to survive longer and reproduce more frequently than the yellow-colored insects.
5. d

MISSION 1: Training Trees**Introductory video:**

1. c
2. a
3. The common ancestor of B and C
4. A and B: trait 1; B and C: traits 1 and 3
5. From left to right, trees 1, 3, and 4 are equivalent.

Red, green, & gecko:

6. c
7. They are heterotrophs.
8. Any two of these four trees:



9. Sample answer: Because mushrooms and plants look a lot more alike than do mushrooms and animals, and neither move around like animals do—you might think that the mushroom and plant are more closely related than the mushroom and animal.

Familiar faces:

10. An amniote is an animal whose embryos develop inside the set of protective membranes. The snake and dog are amniotes.
11. Sample answer: Hair

Tree of life—Vegetarian edition:

12. c
13. Sample answer: Because an onion is a vegetable, but bananas and lemons are both yellow fruits—you might think that the banana and lemon plants are more closely related than banana plants and onion plants.





MISSION 2: Fossils: Rocking the Earth

Introductory video:

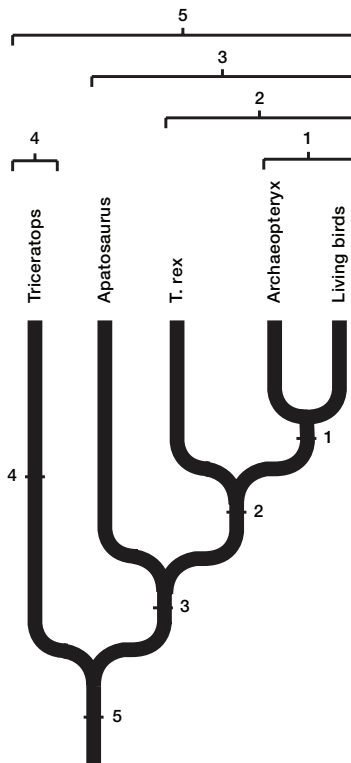
1. See labeled image



2. b

Eating dinosaurs for dinner:

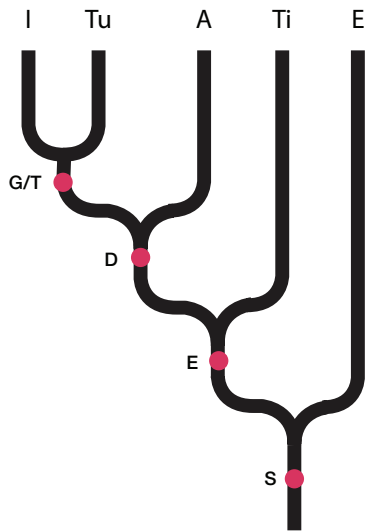
3. a
4. d
5. a. Correctly labeled tree



- a. Aves (clade 1), Theropoda (clade 2), Ornithischia (clade 3), and Dinosauria (clade 5)
- b. Birds are dinosaurs because in addition to being a part of clade Aves, they are a part of clade Dinosauria (clade 5).

**One small step:**

6. It helps them to see and catch prey above them in the water.
7. d
8. This tree, or an equivalent:



9. c

Origin of whales:

10. a
11. b
12. Sample answer: Because sharks and whales are not closely related and did not inherit these traits from a common ancestor. Whales evolved from tetrapods; sharks did not.



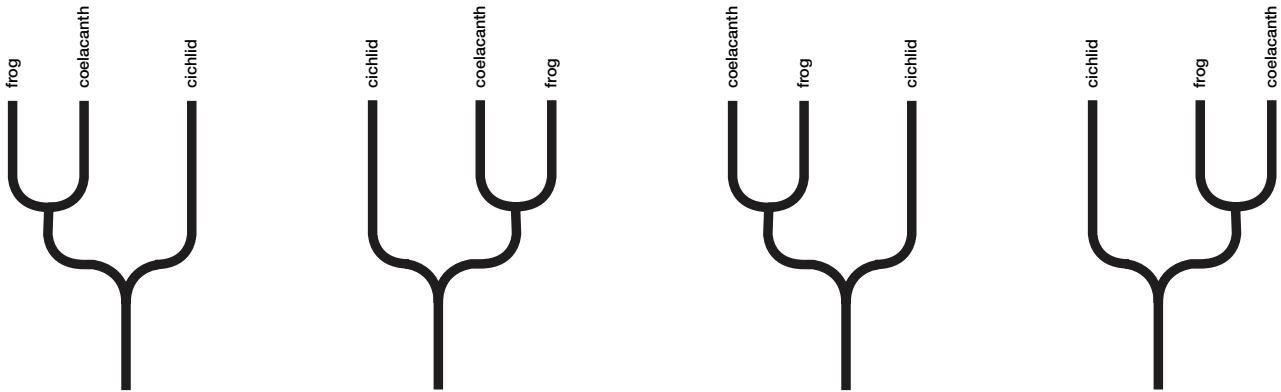
MISSION 3: DNA Spells Evolution

Introductory video:

1. c
2. c
3. c
4. Sample answer: The more closely related two organisms are, the more similar you'd expect their DNA to be. This is because less time has passed since they split from a common ancestor, so fewer mutations will have accumulated.
5. Sample answer: You'd have to compare the physical traits of the fossil and living organisms.

Frog legs and fish eggs:

1. Any two of these four trees:



2. False. Sample explanation: One nucleotide change is not enough to generate all of the changes. In fact, in most cases, a single nucleotide change has absolutely no effect on an organism.

One fish, two fish, red fish, lungfish:

3. No. The alternative hypothesis based on DNA is that the lungfish is the closest living relative to amphibians.
4. Answers will vary. Be sure students provide an explanation for their choice.
5. d

Where the tiny wild things are:

6. d
7. *T. thermophilus* and *D. radiodurans* (must have both to be correct)
8. No, you cannot. Sample explanation: You can only tell the relative timing of changes along a single lineage. So, you could say that the C at position 15 evolved after the C at position 7 along the archaean lineage, but you don't know from this data whether it evolved before or after the T at position 17 in the bacteria lineage.
9. When fossil organisms are part of the group you are studying (You can almost never get DNA from fossils.)



**MISSION 4: Biogeography: Where Life Lives****Introductory video:**

1. Sample answer: They are carried by wind or water from nearby landmasses.
2. b
3. b
4. Sample answer: Populations of the species' ancestors were split up and ended up on two different landmasses as the continents broke apart and moved around.

Saving Hawaiian treasure:

5. d
6. Between 6 and 7 million years ago, blown to the islands by a large storm
7. a
8. A species living only on the island of Hawaii most likely evolved after the one living on multiple islands.
Sample explanation: The island of Hawaii formed much later than the islands of Maui and Oahu. The species that lives on multiple islands likely evolved on an older island and recently migrated to the island of Hawaii, whereas the one that lives only on the island of Hawaii likely evolved on that island.

Cone rangers:

9. Completed table:

	compound cones	cone scales w/o wings	large bladeliike leaves	pollen w/o air sacs	smaller scaly leaves	small fleshy cones	location
<i>A. fibrosa</i>	✓		✓	✓			present-day Antarctica
Bois bouchon	✓					✓	New Caledonia (islands near Australia)
Coral reef pine	✓			✓	✓		New Caledonia (islands near Australia)
Monkey puzzle tree	✓	✓	✓	✓			Chile and Argentina
Norfolk Island pine	✓			✓	✓		Norfolk Island (island near Australia)
Parana pine	✓	✓	✓	✓			Brazil
Pino hayuelo	✓					✓	South America

10. Bois bouchon and Pino hayuelo
11. It suggests that the climate of present-day Antarctica was once much warmer.
12. Because the land mass it was on drifted south toward the pole and the climate got too cold for *A. fibrosa* to survive



**Kangas, gliders, and snakes, oh my!:**

13. Completed table:

	vertebrate	gives birth to live young	pouch	prolonged development in womb	"warm-blooded"	location
Elephant	✓	✓		✓	✓	Asia, Africa
Flying squirrel	✓	✓		✓	✓	Europe, N. America, Asia
Kangaroo	✓	✓	✓		✓	Australia
Platypus	✓				✓	Australia
Rat snake	✓					N. America
Sugar glider	✓	✓	✓		✓	Australia and Tasmania

14. The yellow rat snake; it is closely related to the others (all mammals) but not itself a mammal

15. Placental mammals: elephant, flying squirrel; marsupial mammals: kangaroo, sugar glider; monotreme mammals: platypus

16. a





MISSION 5: Tree of Life and Death

Introductory video:

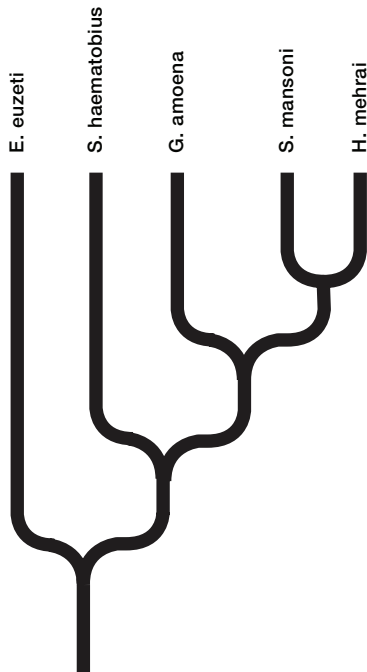
1. d
2. Sample answer: That the evolution of one species affects the evolution of the other
3. b

Hosting blood flukes for dinner:

4. Completed table:

Parasite	Host
<i>E. euzeti</i>	red snapper
<i>G. amoena</i>	freshwater crocodile
<i>H. mehrai</i>	green sea turtle
<i>S. mansoni</i>	human
<i>S. haematobius</i>	freshwater turtle

5. This tree, or an equivalent:



6. The red snapper and its fluke are the outgroup in both; however, the green sea turtle's fluke is more closely related to the human's fluke and the freshwater crocodile's fluke than it is to the freshwater turtle's fluke.
7. Suggested answer: The two trees do not follow the same exact pattern (suggesting cophyly), which they would if there had been no host switching.



**Fatal fangs:**

8. Completed table:

	nucleotide at position 3	nucleotide at position 8	gap between fangs	single undertail scales	treat with antivenom
Black whip snake	A	T			A
Fierce snake	A	T	✓		B
King brown snake	A	T	✓	✓	C
Taipan snake	A	T	✓		B
Tiger snake	C	T	✓	✓	D
Unknown snake	C	T	✓	✓	D

9. d

10. b

Dawn of a modern pandemic:

11. Gorilla SIV
12. a
13. Through the hunting, killing, and eating of illegal ape bushmeat
14. At least three times—once from gorillas (HIV-1 P), and twice from different populations of chimpanzees (HIV-1 M, HIV-1 N)
15. Sample answer: Mutations frequently occur when genetic material is replicated, which happens when a virus reproduces. The faster a virus or cell reproduces, the more mutations occur. Mutations are the raw material for evolution. The more mutations, the more opportunities there are for natural selection or another evolutionary mechanism to affect the population.





MISSION 6: You Evolved, Too

Introductory video:

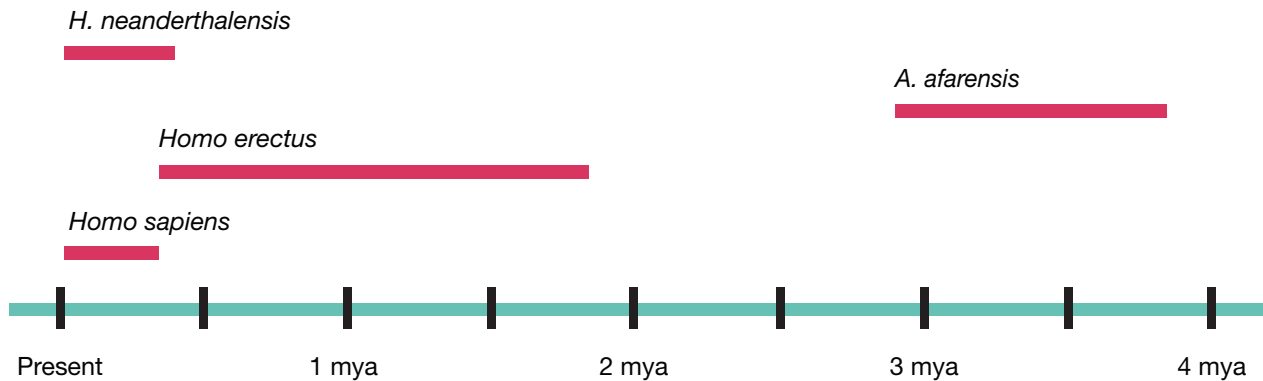
1. c
2. b

Planet of the apes:

3. d
4. d
5. False. Sample explanation: Gorillas are most closely related to chimpanzees and humans (equally) and more distantly related to orangutans. This is because they share a more recent common ancestor with humans and chimps than they do with orangutans.

Back to skull:

6. c
7. b
8. Completed timeline:



9. At least three
10. Sample answer: Humans did not evolve from chimps—rather, living chimps and living humans both evolved from a common ancestor. After the split from this common ancestor, many hominin species arose, lived, and went extinct.

Inside out of Africa:

11. d
12. a
13. Populations of *Homo sapiens* migrated back to Africa and carried with them Neanderthal DNA, which was then mixed into the populations through interbreeding.

Conclusion: Evolution Continues

Answers will vary.

