

Name: _____

Nova - What Darwin Never Knew

DNA, Genetics, and Evolution - A documentary on the Living Science of Evolution

<https://www.youtube.com/watch?v=N0m-cJYnuG4>

PART 1 - An Introduction to Darwin

1. a. What is the full name of the famous book written by Charles Darwin?

b. When was it published?
2. What is the relationship between Darwin's ideas and our modern understanding of genetics? Have we found Darwin to be fundamentally correct or incorrect in his understanding of how new species develop?
3. Describe Darwin's childhood and early college pursuits.
4. What was the HMS Beagle, and what was its mission?
5. a. Where did Darwin make his first important discovery?

b. What did he find there?

6. Describe the Galapagos Islands.

7. How did Darwin record his observations?

8. Describe Darwin's key observations on the Galapagos Islands, as well as upon return to Britain. What specifically did he notice about the following?

a. Tortoises:

b. Birds:

9. After returning to England and pondering his collected specimen further, Darwin realized that for some reason, species _____.

10. What specifically did Darwin notice and conclude about the following?

a. Fossils of extinct organisms (like sloths and armadillos) as compared to currently living organisms:

b. Embryos of developing organisms:

11. What did Darwin end up calling the process of change over time that he hypothesized had and was happening?
12. Once he concluded that animals change, Darwin wondered *why* animals would change over time. Describe what he learned AND concluded from studying dog breeding:
13. From observing nature, Darwin saw that nature was a battlefield and that every organism was in _____ with each other.
14. The pattern in nature that Darwin saw was that the creatures that survived were those best adapted to the specific _____ in which they lived.
15. In contemplating why the Galapagos finches had variations in beaks, Darwin later concluded that the finches had different beaks because the finches used their beaks as _____.
16. What did Darwin learn from observing his own family?
17. Darwin realized that variation was the start of change in nature. He concluded that over many generations, tiny variations allow the fit to get fitter and the unfit to vanish. This he called evolution by _____.

18. After Darwin published his book, gone was the theory that all animals were created _____.
19. How were Darwin's views different from the Victorian thinking of the time? How did they differ with the religious thinking of the time?

Part 2 - Genetics: What Darwin Didn't Know

20. a. What is the Snickers Bar of the desert?
- b. What is its best method for survival?
21. Describe the evolutionary change that has been observed in the mice in the Arizona desert.
22. DNA is a code. It contains all the information living organisms need to grow, develop, and reproduce. Lined along the DNA molecule are special sequences of this code that form our _____.
23. Many genes get translated into _____.
24. DNA has one other vital quality. It doesn't stay the _____.

- 25. Why do we look a little like both of our biological parents, but also different from each of them?**
- 26. There is one critical ingredient in the recipe for evolution. Without _____, everything would stay the same, generation after generation. We can now find the genes that are responsible for evolutionary change.**
- 27. There are different ways in which the DNA code may change, why mutations may happen. What is one way new mutations are introduced into DNA?**
- 28. When changes occur in the cells that end up making our children (sperm and eggs in sexually reproducing organisms), big changes can occur in offspring. How did the mutation in one of the in the pocket mouse genes help the mice survive in their environment.**
- 29. Give 1 other example of a mutation that led to an evolutionary advantage for a specific species.**
- 30. What was the purpose of the Human Genome Project?**
- 31. What was one erroneous assumption made at the beginning of the Human Genome Project?**

32. As it turns out, Humans have _____ genes. The same numbers as a chicken and less than an ear of corn. Many of our key genes are also similar to organisms' genes.
33. How do you get all these differences if you have the same number of genes? The first clues are from the study of _____. They are the platform of diversity and all use the same basic genes.
34. Explain how the study of embryology has led to a greater understanding of animal diversity.
35. How much of the human genome is non-coding or "junk" DNA that doesn't code for proteins? **Note that it turns out not all that "junk" DNA is indeed useless, parts of it turning out to be rather important as we will come to learn in this course.*
36. Describe what was done in the experiment that led to flies with glow-in-the-dark spots on their wings.
37. What is a switch? ** These are among the DNA sequences that turned out not to be "junk" after all*
38. How has the discovery of switches contributed to our understanding of evolution? Give an example.

39. What is the difference between ocean and lake sticklebacks?

40. What were scientists able to discover by returning to the study of Darwin's finches?

41. Fossils show that creatures with legs appeared _____ million years ago. Before this, their ancestors were only fish.

42. Dinosaurs share a common ancestor with _____.

43. _____ share a common ancestor of all four-legged forms.

44. The Archaeopteryx fossil had features of both birds and _____.

45. Tiktaalik is a perfect transitional form: the body of a fish with scales, but also the _____ structure is seen in every four-legged forms.

46. The body plan genes called _____ genes are found in all complex animals from 600 million year worms to humans.

47. The genes needed for arms and legs were in pre-historic fish. All they needed was a few _____ to change the order of what genes are turned on and off.

48. There is a _____ percentage difference in the DNA of humans and chimps.
49. The two signature organs of humankind are the _____ and the _____.
50. A mutation in the human _____ muscle allows the skull to keep expanding into adulthood, creating a bigger space for the _____.
51. There are _____ different mutations responsible for microcephaly.
52. A study of human and chimp DNA sequences show that the differences weren't in the actual genes, but in the _____ that direct the genes. More than half of these switches are near a gene that involves the _____. That gene was different in 2 letters between the chimp and the chicken, but different in _____ letters when compared to humans.
53. DNA works in many different ways: through genes that make the stuff of our bodies, through _____ that turn those genes on and off, and through sequences of the DNA that throw those switches. This shows how small differences in _____ can generate enormous change.

Part 3 - Your Reflection After Viewing the Documentary

1. How does this video help illustrate the principle of unity and diversity among living things? Give 2 specific examples.
2. How does this video help illustrate the idea that structure reflects (*matches*) function? Give 2 examples.
3. Explain your understanding now of the relationship between genetics and evolution.