

Microevolution & Macroevolution Worksheet

Name _____

Section A: The Making of the Fittest --- Evolving Bodies, Evolving Switches

<http://www.hhmi.org/biointeractive/making-fittest-evolving-switches-evolving-bodies>

- Identify if the following statements are true or false. Explain your answer.
 - "Having pelvic spines is always advantageous to a stickleback." _____

 - "All mutations are bad." _____

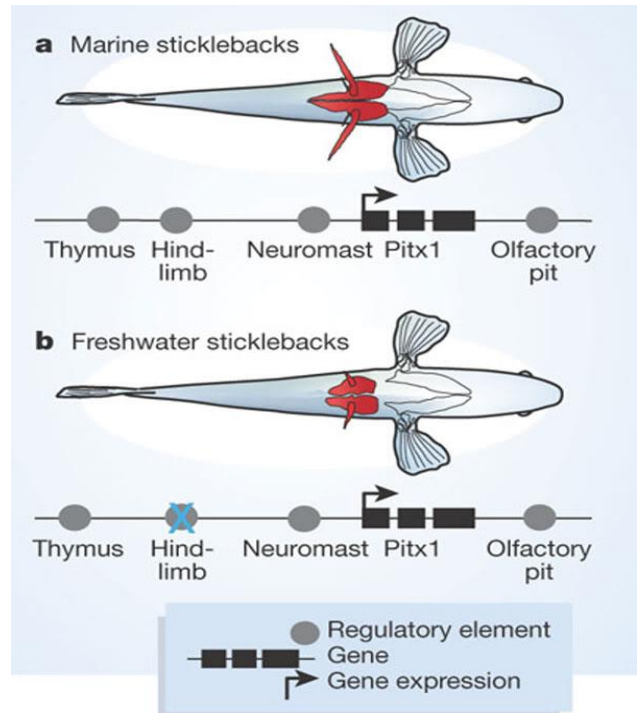
- What special features of the environment in Bear Paw Lake, Alaska, may have favored the survival and reproduction of stickleback fish with reduced pelvis? _____

- In the film, Dr. Bell notes that in multiple freshwater populations and at multiple times in history, the frequency of stickleback fish with pelvic fins decreased and frequency of stickleback fish with reduced pelvises increased. This demonstrates that _____.
 - only fish with smaller pelvises migrate to freshwater
 - similar environments select for similar genetic changes
 - the pelvis of the marine fish is destroyed by freshwater
- Circle whether each statement is true or false.
 - True or False Evolutionary change always takes millions of years.
 - True or False Dramatic changes in traits, such as the loss of limbs, can occur through mutations affecting a single gene.

5. In the diagram, the gray dots represent regulatory switches; each one allows a specific binding protein to interact with it and turn on the Pitx1 gene in a particular tissue. When expressed, the Pitx1 gene is transcribed and then translated to generate the Pitx1 protein. Read each question below and write a 'yes' or 'no'.

- A deletion in the Pitx1 gene causes a frameshift mutation. How likely is it that a functional Pitx1 protein would be produced in the jaw? _____ In the pelvis? _____ Explain your answers.

- The regulatory gene for hindlimbs was deleted. Would you see a functional Pitx1 protein in the jaw? _____ In the pelvis? _____ Explain your answers. _____



Section B: Natural Selection and Adaptation

<http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation>

- Explain how the environment plays a role in changing the frequency of a mutant allele in a population.

- Near the end of the film, Dr. Sean B. Carroll states that “while mutation is random, natural selection is not.” In your own words, explain how this is possible.
- For rock pocket mice, which of the following contributes to selective pressure favoring dark-colored fur? Write “yes” or “no” next to each of the four possible responses. **There may be more than one yes response.**

Predators _____	Genetic mutations _____
Rock color _____	Availability of food for the rock pocket mice _____

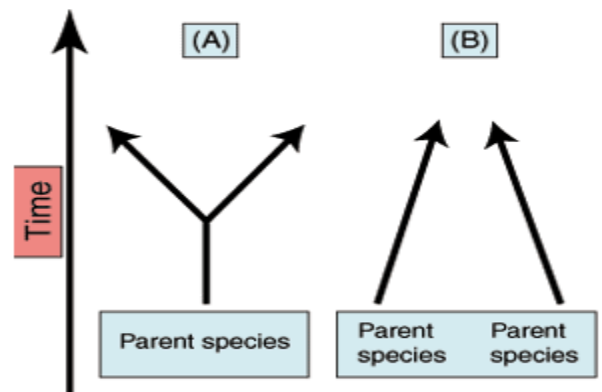
Section C: Genetic Drift

- Polydactyly – extra fingers or toes – is one symptom of Ellis-van Creveld syndrome. The syndrome is commonly found among the Old Order Amish of Pennsylvania, a population that experiences the “founder effect”. This disease is more concentrated among the Amish because they marry within their own community, which prevents new genetic variation from entering the population. Children are more likely to inherit two copies of the recessive genes leading to the genetic disease.
http://www.pbs.org/wgbh/evolution/library/06/3/l_063_03.html
 - Is this an example of genetic drift? Explain your answer. _____
 - Would the frequency of the disease be different in a larger population? Explain your answer. _____
- Below are examples of genetic drift. What similarities do you see in the examples? _____

- ✓ Many individuals are killed due to a disease that only attacks those with blue eyes, causing blue eyes to become rarer in the area.
- ✓ An airplane crash introduces the white heron, which loves spotted mackerel, into a population of spotted and unspotted mackerel. Over time, fewer mackerel are born with spots.
- ✓ A man steps on a group of beetles, randomly killing most of the green ones but leaving most of the brown ones alive, resulting in fewer green beetles being produced in the population.
- ✓ A wildflower population consisting of blue, purple, and pink flowers is subjected to a mudslide that kills most of the blue ones. As time progresses, blue flowers eventually die out, leaving only purple and pink wildflowers.

Section D: Patterns of Evolution

- Identify if the following organisms represent divergent evolution or convergent evolution.
 - butterflies and bats – different ancestry, similar structures (wings) _____
 - dolphins and porpoise – closely related, different traits (teeth shape) _____
 - snakes and lizards - _____
 - sharks and whales - _____
 - eels and earthworms - _____
 - zebra and horses - _____
 - letter 'A' in the diagram - _____
 - letter 'B' in the diagram - _____

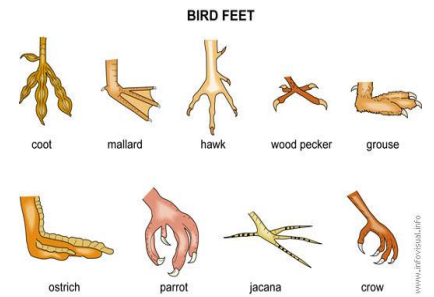


2. What evolutionary evidence supports divergent evolution? _____

3. A brown bird of some African prairies and grasslands, the African yellow-throated longclaw (*Macronix croceus*), a motacillid, has a yellow breast with a black chevron "V". This motacillid looks and acts so much like an American meadowlark (*Sturnella magna*), an icterid, that a competent bird watcher might mistake them for the same species, yet they belong to different avian families. Why would these organisms that are not related start to look similar?



4. The pattern of evolution that explains how birds have evolved so many different kinds of feet that are adapted to many different environments is _____ evolution.



Section E: Coevolution of Genes and Culture

<http://www.hhmi.org/biointeractive/making-fittest-got-lactase-co-evolution-genes-and-culture>

1. Which discovery supports the hypothesis that the evolution of lactase persistence may have been driven by a dependence on drinking milk for survival?
 - a. The lactase gene is present both in humans and in domesticated animals.
 - b. Ancient pots that were used to hold milk are nearly the same age as the lactase-persistence mutation.
 - c. Most human cultures today drink milk and most people worldwide are lactase persistent.
 - d. Scientists have identified different mutations that cause lactase persistence.
2. List two possible explanations for why drinking milk could have provided strong favorable selection for lactase persistence. _____

Section F: Macroevolution

Macroevolution is evolution over geologic time above the species level. One of the main topics in macroevolution is how new species arise; this process is known as speciation. How does speciation usually happen? First a species become isolated.

- ❖ Assume that some members of a species become geographically separated from the rest of the species. If they remain separated long enough, they many evolve genetic differences. If the differences prevent them from interbreeding with the original species. They have evolved into a new species. This speciation is caused by geographic isolation.
- ❖ Assume Hawthorn flied lay eggs in Hawthorn trees. The eggs hatch into larvae that feed on fruits. Apple trees were introduced to the U.S. and often grown near Hawthorn trees. Some Hawthorn flied started laying eggs in nearby apple trees. When the eggs hatched, the larvae fed on apples. Overtime, they become reproductively isolated because they breed at different times; the breeding season matches the season when the apple or hawthorn fruits mature. Because they rarely interbreed, the two populations of flies are evolving genetic differences and becoming different species. This speciation is caused by temporal isolation.
- ❖ The blue footed booby bird has an elaborate mating "dance" that males must do to woo the female. The female can either then accept or reject the advances of the male. Other species of birds do not have the same mating dance and will be fully ignored by the female meaning they have no chance at reproducing with the female blue footed booby. This speciation is caused by behavioral isolation.

1. How is macroevolution different from microevolution? _____

2. What factors has to be present for speciation to occur? _____

3. You are provided with examples and explanations of three isolation mechanisms. Use this information to identify the type of isolation mechanism is illustrated in these examples.
 - a. In North America, five frog species of the genus *Rana* differ in the time of their peak breeding activity. What mechanism is illustrated? _____
 - b. The lion and tiger habitat overlapped in India until 150 years ago, but the lion lived in open grassland and the tiger in forest. Consequently, the two species did not hybridize in nature. What mechanism is illustrated? _____
 - c. If a male firefly tries to impress a female and the female firefly does not recognize the patterns of light created by a male firefly. What type mechanism is illustrated? _____

Section G: Gradualism or Punctuated Equilibrium?

Every now and then, paleontologists uncover what appears to be a complete series of fossils. They find batches of fossils which seem to represent a population of one species, living at one period of time, and showing a typical range of variation, but still clearly members of one species. As they search layers of sediment above and below, they find more fossil groups of what appear to be the same species.

As paleontologists study the entire series of fossils, they tend to find two kinds of patterns. Sometimes there appear to be slight shifts in the average features of the fossils over time, eventually becoming so different from the earliest form that they have to say a new species has formed. But with another series of fossils (may be a totally different kind of organism), they find very little difference for long periods of time, then, all of a sudden, they begin to find fossils similar to the earlier ones, but showing some striking differences, clearly a new species. Sometimes, in both cases, the original species continues to exist along with the new species, and sometimes the original species can no longer be found.

1. Which rate would show transitional fossils showing slight variations in fossils? _____

Section H: Rates of Evolution

1. Identify if the following demonstrates gradualism or punctuated equilibrium.
 - a. Evolution of humans _____
 - b. Darwin believed that evolution happened slowly over a long period of time.

 - c. Bacteria becoming resistant _____
 - d. Transitional fossils are present _____
 - e. Pattern seen in horses in which long periods without change are interrupted by short periods of rapid change. _____

Quizzes:

<http://www.sciencegeek.net/Biology/review/U6Evolution.htm>

<http://www.sciencegeek.net/Biology/review/U6Populations.htm>

<http://www.sciencegeek.net/Biology/review/U6Review.htm>