

Week 2 – LO-4

Utensilus plasticus feeds on small prey items, especially marshmallows. The population consists of two different head shapes, forks (n = 16) and spoons (n = 4). There is a sudden change in the prey population because an invasive species, the lima bean (hard, oval), is now present in a higher number than the typical prey species, the marshmallow. Over the next few generations Choose the hypothesis that is most plausible.

- a) Reproductive success of *Utensilus plasticus* depends on their morphology and their environment.
- b) Reproductive success of *Utensilus plasticus* depends on their environment.
- c) Reproductive success of *Utensilus plasticus* depends on their morphology.
- d) Reproductive success of the lima beans depends on consuming marshmallows.
- e) Reproductive success of *Utensilus plasticus* is random and it is equally likely that forks or spoons will succeed.

Lecture 4 – presented this scenario, asked “what hypotheses and predictions would you propose” (A) correct, as morphology (head shape) and environment (prey) now both play a role in reproductive success.

Week 1 – LO-4

Read the *New Scientist* article below and select the statement that most accurately represents the information below.

Grey wolf hunt is back on

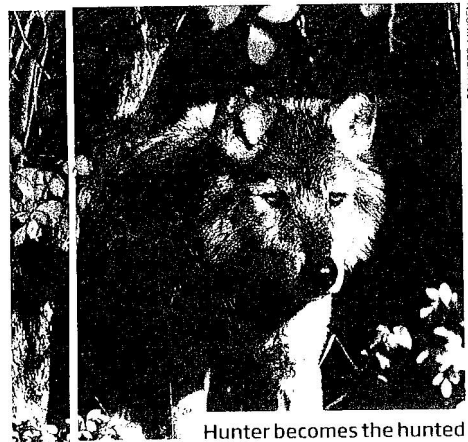
LIFE must be confusing for the grey wolves of Montana and Idaho. Last week those states' annual hunts were declared back on, despite a judge's ruling in 2010 that made them illegal.

The two states allowed hunting in 2009, after the US Fish and Wildlife Service decided the wolves there no longer needed the protection of the Endangered Species Act. Last year a district judge overturned that decision, halting the 2010 hunts and triggering a protracted legal battle.

In the latest instalment, the Ninth Circuit Court of Appeals once again ruled that the hunts can restart. Both states' hunts open this week.

Properly managed, the Idaho hunt should not be a serious threat, says Lisette Waits at the University of Idaho in Moscow, who monitors the local wolves. The Idaho population is “really healthy”, she says.

The Alliance for the Wild Rockies, however, insists that those wolves are threatened by shrinking habitat.



Hunter becomes the hunted

- a) Wolves were hunted to near extinction but the population has rebounded.
- b) Montana and Idaho have re-instated the wolf hunt in order to reduce the number of wolves preying on caribou.
- c) Researchers who monitor the wolf population in Idaho are able to predict population health of other populations.
- d) The wolf hunt is controversial because the group who monitors the population is satisfied that the wolves are not at risk whereas conservationists argue that wolves remain threatened.
- e) Wolves were extirpated in the past and were placed on the Endangered Species Act for protection.

Week 1 – LO-2, Week 2 – LO-1

The next 3 questions refer to the following observations about mussels in a particular region:

- i) Free swimming zebra mussel veligers (231-462 microns) enter metamorphosis and transform into settled juveniles (1-3 mm).
- ii) Efforts to identify species of native mussels can be confounded by the variation that exists in morphological traits within species.
- (iii) Female (not male) *Lampsilis reeveiana* have complex lures to attract a fish host.
- (iv) *Dreissena polymorpha* is native to eastern Eurasia.
- (v) Most freshwater mussels are either male or female in the adult stage.

Which of the above observations provides the best example of phenotypic variation.

- a) observation (i)
- b) observation (ii)**
- c) observation (iii)
- d) observation (iv)
- e) observation (v)

Which of the above observations is an example of ontogenic variation?

- a) observation (i)**
- b) observation (ii)
- c) observation (iii)
- d) observation (iv)
- e) observation (v)

(A) correct, “ontogeny” means development, ontogenic variations (online week 2) refers to changes that occur at different stages of life cycle.

Which of the above observations is an example of sexual dimorphism?

- a) observation (i)
- b) observation (ii)
- c) observation (iii)**
- d) observation (iv)
- e) observation (v)

(C) correct, sexual dimorphism refers to different phenotypes in males vs. females of same species.

Which of the following statements is TRUE about evolution?

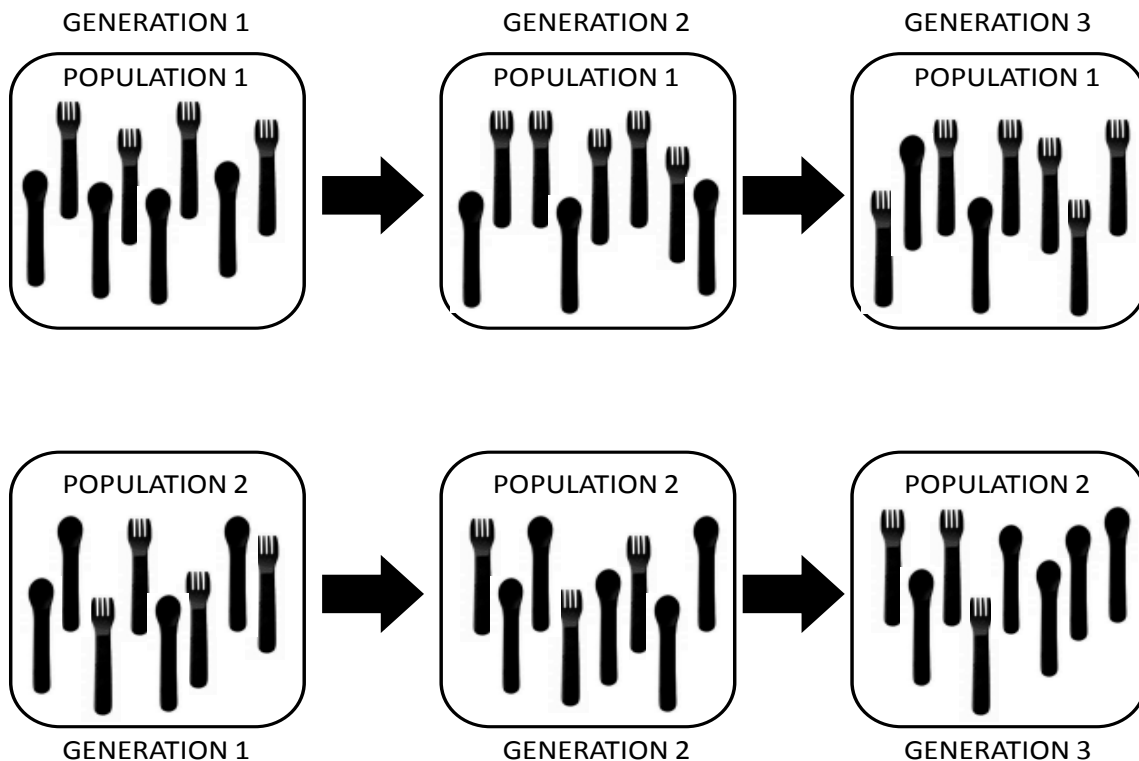
- a) Evolution creates new alleles through genetic error, but how common a new allele becomes may depend on whether it happens to have a beneficial or deleterious effect.
- b) Over many generations, the accumulation of beneficial mutations can lead to the evolution of specialized features (eg. complex lures in Unionids).
- c) Evolution involves a change in allele frequencies in a population that can ONLY occur through the process of natural selection.
- d) A good example of evolution is antibiotic resistance in bacteria, where exposure to antibiotics causes individual bacteria to become more resistant.
- e) Populations evolve primarily through random changes in allele frequencies caused by chance events.

Mutations create new alleles through genetic error (not evolution), therefore, (A) is incorrect. (B) is correct.

Evolution can occur as a result of gene flow (immigration, emigration), genetic drift (chance events), not only natural selection, so (C) is incorrect.

Week 3 – LO-2

There are two populations of *Utensilus plasticus* residing in the same area. These are all members of the same species, though two different phenotypes (fork and spoon) are present. You decide to observe the two populations for several generations, and you notice the following:



Which is the most likely interpretation of these observations?

- a) Neither population is undergoing natural selection because the same total number of individuals is found in each population in every generation.
- b) Populations 1 and 2 are evolving into two separate species due to extensive gene flow.
- c) Random mutations occurred that created new alleles in both populations.
- d) Population 1 was founded by individuals from Population 2 and due to the “founder effect” the two populations differ in their proportions of fork and spoon phenotypes.
- e) the ancestors of population 1 and 2 ate the same prey but distinct subgroups arose that favoured different diets and over time their allele frequencies diverged.

(E) is correct (Lecture 5) sympatric speciation, species is split without geographic isolation (e.g. different prey).

(B) is incorrect as gene flow would result in final (generation 3) populations being the same.

(D) is incorrect, as the founder effect refers to a smaller population splitting off from a larger population (lecture 3).

Week 2 – LO-2

As a 4th yr research student you analyze DNA sequences from a population of purple wartyback mussels in the St. Clair River and discover a relatively high level of genetic variation in the population. Which of the following hypotheses would you ACCEPT as an explanation for this observation?

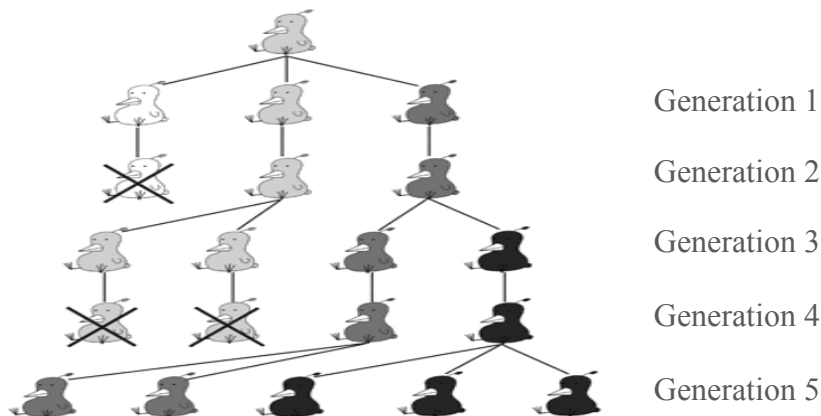
- a) The high dispersal rate of veliger larvae increases genetic variation in this species.
- b) Host fish carrying glochidia migrate seasonally from distant rivers.
- c) The river depth was reduced by drought years ago wiping out a significant portion of mussels.
- d) Conglutinates attached by a mucus thread contain thousands of glochidia.
- e) Purple wartyback are host dependent and dioecious and therefore have a higher rate of mutations.

(A) Is incorrect because Unionids do not have veliger larvae.

(B) is correct as different glochidia are brought into a river each with a different genotype so adult purple wartybacks have a high level of genetic variation.

(E) is incorrect because mutation rates are NOT related to host dependency or whether a species is dioecious.

The next two questions refer to the following observations about variation in birds over five generations. Note that an “X” represents a death within the population.



Which of the following is the most likely interpretation of these observations?

- Light colored birds are experiencing a genetic bottleneck that may result in a population with little variation.
- Founder effects established successful populations of dark colored birds.
- Darker colored birds are more successful at surviving and reproducing through natural selection than lighter colored birds.
- Birds with dark colored feathers are more advanced than those with light colored feathers.
- Dark colored birds have evolved through randomly occurring natural selection.

(A) Is incorrect as the light colored variant is eliminated from the population, and therefore no variation.

(B) Is incorrect as there are larger populations of darker birds established.

(C) Correct

(D) Is incorrect because it is inappropriate to say these birds are more advanced.

(E) Is incorrect because natural selection is non-random.

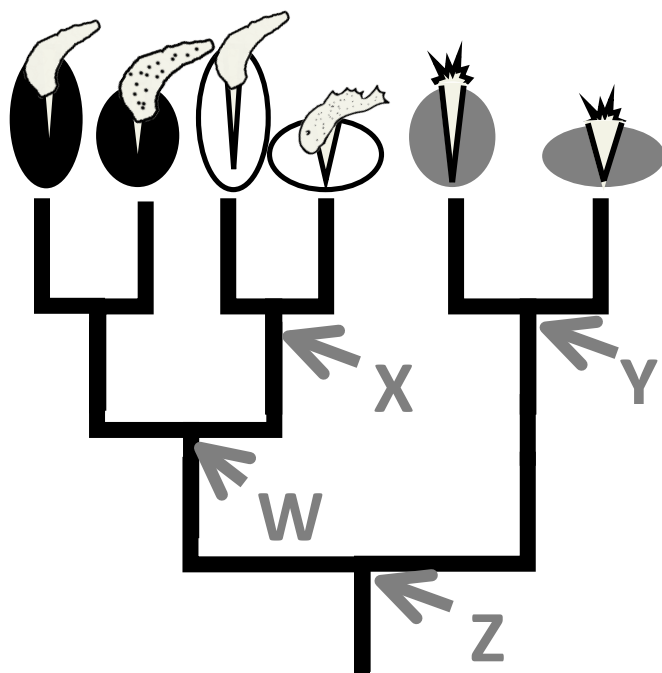
Which of the following explanations of the above diagram of bird diversity would you REJECT?

- Within four generations birds with light feathers have been removed from this population.
- A mutation has occurred in generation three, which has resulted in birds with darker feathers.
- There has been intense natural selection favoring individuals with darker feathers.
- Birds have adapted to an environmental response through a mutation that resulted in an allele for dark feathers.
- The allele frequency for darker feathers increases with generations.

Remember "REJECT". First 3 answers are acceptable (A, B, C) and plausible explanations.

(D) is correct, that is, should be rejected because organism do not adapt to an environmental response through mutations (this does not make any sense).

The next three questions refer to the following evolutionary tree of six species of mussels.



Which of the following is the most likely interpretation of this evolutionary tree?

- a) Grey mussels are most primitive.
- b) White mussels with fish like lures are most advanced.
- c) More time was needed for black and grey mussels to evolve.
- d) All six mussel species have been evolving for exactly the same amount of time.
- e) Grey mussels are more closely related to white mussels than black mussels.

(D) Is correct. You can't describe any of the present day mussels as primitive, so (A) is incorrect.

Which of the following is the most likely relationship among these mussel taxa?

- a) Grey and white mussels are sister taxa.
- b) Black and grey mussels are sister clades.
- c) Smaller round grey or white mussels are sister taxa.
- d) Black and white mussels are sister clades.
- e) Black and grey mussels are sister taxa.

(D) Is correct because black and grey taxa are in a monophyletic clade that share a common ancestor "W". Sister taxa are found within a clade (the two white taxa OR the two black OR the two grey taxa).

Which of the following is true with respect to ancestral traits?

- a) Ancestor (X) could not have been black.
- b) Regardless of shell shape in ancestor (Z), this trait changed at least 3 times.

- c) It is likely that (Y) lost a complex ancestral lure.
 - d) Ancestor (W) probably had a very small lure.
 - e) Ancestor (Z) was very likely grey with a large lure.
- (b) is correct because the trait has changed at nodes “w”, “x” and “Y”. We have not told you anything about which nodes are associated with specific traits so you cannot support any of the other statements.

The Northern riffleshell *Epioblasma torulosa rangiana* has been listed by COSEWIC as endangered. They could go extinct for a number of reasons. Which one of the following explanations is NOT plausible?

- a) The zebra mussel may outcompete *E. t. rangiana* for food and/or habitat.
- b) Warmer summer water temperatures over the next 100 years may reduce fertilization success.
- c) *E. t. rangiana* may be particularly susceptible to new forms of shellfish viruses.
- d) The fish host(s) of *E. t. rangiana* become extinct.
- e) Failure to keep up with the evolution of sister species *Epioblasma triquetra*.

(A) Is plausible.

(B) Is plausible, as climate change can impact organisms in many different ways.

(C) Is plausible, as new diseases arise all the time.

(D) Is plausible.

(E) Is NOT plausible (correct answer) because these two species have no interaction (we are not told of any interaction here in the question, nor in class, or online), then as one evolves it should have no impact on the other.

Which of the following is an example of phenotypic plasticity?

- a) Female mussels each produce thousands of eggs per year.
- b) Species is split because some individuals move to a separate place.
- c) The shell morphology of *Lampsilis cardium* is oval, whereas in *Lampsilis siliquoidea* it is elliptical.
- d) Veliger larvae from the same parents (same genotype) distribute widely from their release site.
- e) In the lab, genetically similar glochidia attached to different species of fish hosts develop at different rates.

Phenotypic plasticity (online week 2, in class Lecture 3, 5, 6 Virginia creeper experiment: shaded leaves larger than full sun leaves) is when geotypically similar individuals within a species develop differently due to the environment and have slightly different phenotypes (structures or function).

(C) Incorrect, 2 different species have phenotypic variations.

(C) Incorrect, as this answer does not describe phenotypic differences.

(E) Correct, glochidia develop at different rates (function differently) possibly because of different nutrition during this early stage of development (remember the pig with her litter, runt may get less food, develop and grow slower).