

FRQ Friday #21

2022 #4

Existing isolated brook trout populations in Newfoundland, Canada, were once part of a larger population that was fragmented at the end of the most recent glaciation period about 10,000 to 12,000 years ago. Researchers investigated 14 naturally separated stream populations of brook trout. They found that the populations are all genetically distinct and show differences in morphology.

(a) Describe the prezygotic barrier that results in these genetically distinct populations.

- Geographic isolation prevents gene flow between the populations.

a) ^{habitat} geographic isolation, they live in separate areas so they do not meet and mate, so no gene flow occurs and they become genetically distinct over time.



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(b) Brook trout with longer fins are able to swim faster than brook trout with shorter fins. In one of the Newfoundland streams, the main prey of the brook trout evolved to move faster. For brook trout living in this stream, **explain** the difference in fitness between longer-finned individuals and shorter-finned individuals.

- Individuals with longer fins are more likely to capture prey and reproduce.

b) longer-finned trout can move faster and more easily catch their fast-moving prey than shorter-finned trout, so they have more fitness because they are better adapted to survive & reproduce in this environment because they have a more accessible food supply.



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(c) If two morphologically and behaviorally distinct populations of brook trout remain isolated for many generations, **predict** the likely impact on both populations.

Accept one of the following:

- The two populations will become separate species.
- The two populations will continue diverging (behaviorally/morphologically/genetically).

c) they will become separate species (speciation will occur) because there is no gene flow between the populations, so their differences will become more pronounced until they can no longer interbreed and are classified as separate species.



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(d) Researchers claim that there are more genetic differences between any two current brook trout populations than there are between any single current population and the ancestral brook trout population from which all the trout are descended. Provide reasoning to **justify** their claim.

Accept one of the following:

- Each single population has accumulated mutations/experienced genetic drift (distinguishing it from the ancestral population). The mutations each population accumulated are likely to differ (as a result of different selective pressures).
- Allele production (as a result of random mutation) and genetic drift/selection by local environmental conditions has resulted in a collection of alleles unique to each population.



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d) they are all descended from the same common ancestor, so most of the alleles in their pools, excepting recent mutations, come from that ancestor. They split from each other as the frequency of alleles changed based on their environments and the niches they needed to fill, so they are more different from each other than their ancestors, from whom they received almost all of their traits, and natural selection acted to remove different alleles from the gene pools of different populations, causing them to differ greatly from each other and only slightly from their ancestors.

