BIOLOGY 121 Optional worksheet

TOPIC: EVOLUTIONARY MECHANISMS

1. What are the four main evolutionary mechanisms?
   - A. *Mutation*
   - B. *Natural selection (including sexual selection and many forms of non-random mating)*
   - C. *Genetic Drift*
   - D. *Gene Flow*

2. What genetic and evolutionary mechanisms create the phenotypic variation that selection acts upon?

(5 minutes) ***Mutation*** *creates new variants of genes (alleles), which are responsible for new variants of phenotypic traits.* ***Gene flow*** *can introduce new alleles to a population, but only if mutation creates them in another population first. Crossing-over, independent assortment and random fusion of gametes can create new combinations of alleles (and thus phenotypes) in gametes and zygotes.*

3. Imagine that major advances in space travel have allowed humans to explore outside of our solar system. A group of humans (*Homo sapiens*) is stranded on an isolated, habitable planet far from Earth. Suppose they eventually evolved into a different species (*Homo novus*) and then came back in contact with the humans remaining on Earth.

a) State and explain how possible prezygotic reproductive isolating mechanisms could separate *Homo novus* from *Homo sapiens*. List as many mechanisms as you can and describe how they would work, and which are more likely, in this scenario.

(5 minutes) *Prezygotic:* ***Habitat*** *(different planets), OR* ***Gametic*** *(egg and sperm are incompatible), OR* ***Mechanical*** *(genitalia are incompatible)*
Other answers are possible.
NOT likely to be Temporal or Behavioural

b) State and explain how possible postzygotic reproductive isolating mechanisms could separate *Homo novus* from *Homo sapiens*.

(5 minutes) *Postzygotic – Low* ***Hybrid viability*** *(hybrids do not develop due to genetic problems)*
or ***Hybrid sterility*** *(hybrid offspring mature but are sterile)*
These are much more likely than prezygotic isolating mechanisms.

c) Would the speciation described be allopatric or sympatric? What is the difference?

Allopatric*, the populations are physically separated. In sympatric speciation, there is no physical separation, just reproductive isolation.*

d) Explain fully the steps how this might have lead to speciation.

(10 minutes)

*The two populations would be **geographically isolated**, without **gene flow**. There would be **genetic divergence** over time (and possibly phenotypic or morphological divergence).*

*Due to one of the following factors: (any **one** of the following)*

A) The founder effect

B) Different mutations would arise by chance in the two populations, the mutation rate could be higher on the new planet

C) Genetic drift may fix alleles and reduce genetic variability in the isolated population if it remains small

D) Differential natural selection will almost certainly occur on the two planets.

e) How could genetic drift affect allele frequencies in the new species of *Homo novus*, because of a change in population size?

(5 minutes)

*If the new population of humans on the new planet are a random subset of genetic types from Earth, their allele frequencies could be different because of **the founder effect**. If the new population on the new planet undergoes a sudden reduction in population size, their allele frequencies could be randomly different due to a **population bottleneck**.*

f) How could genetic drift affect allele frequencies in a population of *Homo novus*, without population size change?

(5 minutes)

*Even if both populations started with the same allele frequencies, because they are physically isolated with **no gene flow**, genetic drift could cause changes in the allele frequencies in one population that would not be shared with the other. By **random chance more or fewer of certain alleles would be passed on to the next generation**, allowing the allele frequencies to **randomly drift up or down**.*