**Review Worksheet Answers Changes to Allele Frequencies in Gene Pools**

1: List the three main ways that allele frequency can change within gene pools:

(3 marks)

*Gene flow, Genetic Drift, Natural Selection*

2: Define ‘gene flow’

(3 marks)

*Gene flow is the flow of genes (1) from one population to another (1) through migration (0.5) and inter-breeding (0.5).*

3: The allele for the Type B blood group is believed to have arisen in East Asia. Frequency of the B group allele is highest there. There are people in Europe who carry the Type B allele, but the frequency is lower. Explain how the Type B allele came to be present in the European population.

(5 marks)

*The allele for Type B blood moved into Europe via gene flow(1). During the 12th and 13th centuries, Mongol invaders moved across Asia and into Europe (1), interbreeding with populations as they went (1). In this way alleles were passed on to offspring across Asia and into Europe (1), where the allele has persisted in the population until the present day (1).*

4: What are barriers to gene flow?

(5 marks)

*Barriers to gene flow are things that prevent populations from interbreeding (1). They include geographic barriers (1) like mountains, rivers and lakes (1). They also include sociocultural barriers (1), like marrying and having children within a religious group (1).*

5: Why are geographical barriers to gene flow less of a consideration for humans today?

(2 marks)

*Due to advances in transport technology (1), people are more easily able to travel from one area of the world to another (1), even quite isolated areas.*

*Not for marks, but: Globalisation of economies and businesses mean that people often move far from their area of birth to work. Populations are no longer as isolated for this reason.*

6: What are the disadvantages of barriers to gene flow?

(3 marks)

*Greater incidence of genetic disease (1) as carriers are more likely to reproduce with each other in a small, isolated population (1).*

*Advantageous genes will not flow into the population (1).*

7: What is an advantage of barriers to gene flow?

(1 mark)

*Lethal recessive alleles will not flow into the population (1).*

8: What is genetic drift?

(2 marks)

*Genetic drift is a change in allele frequency in a population (1) due to random chance (1).*

9: Explain how the random nature of reproduction may result in increases and decreases in allele frequency due to chance.

(6 marks)

*Members of a population vary in the alleles they have for given traits (1). For example, a proportion of the population carries the allele for red hair (1). In some generations, by chance, more couples carrying the allele may marry each other (1), therefore increasing the allele frequency for red hair in the next generation (1). The opposite may also be true. The next generation, by chance, fewer couples carrying the allele may marry each other (1), so fewer offspring will carry the allele (1), decreasing the frequency (1).*

10: Explain how the ‘Dunker’ population in the USA provides evidence for genetic drift.

(10 marks)

*The Dunkers originated in Germany, and are a small religious group that migrated to the USA (1). They have lived for several hundred years in the USA (1), but there has been no gene flow with the local population (1) as the Dunkers only marry within the religion (1). Allele frequency of the Dunker population is different to both the current population in Germany (1) and the surrounding US population (1). This is evidence for genetic drift because if the change in Dunker allele frequency was due to natural selection (1), they would have similar allele frequency to the surrounding population (1) in the same environment (1). The difference in allele frequency compared to the rest of the German population (1) is evidence that the alleles in the Dunker population were different by chance to those of the whole population (1).*

11: What is the Founder Effect?

(4 marks)

*The Founder Effect is a change in allele frequency (1) that occurs when a subset of a larger population migrates to a new area (1). Variation within the broader population will mean that the smaller sample is very likely to have a different allele frequency (1) than the broad population. If this subset moves to a new location, and then reproduces, the new population will have a different gene frequency than the original. (1)*

12: Give an example of the Founder Effect.

(6 marks)

*One example of the Founder Effect is the Pitcairn Islanders (1). The island was settled by a small group of mutineers from the Bounty and Polynesian Islanders (1). The founding population had an allele frequency different from both the original English and Polynesian population (1). Over time there have been very few new settlers – no gene flow (1), so some recessive traits have become very prevalent(1). An example is cardiovascular disease. (1)*

13: Describe the Bottleneck Effect and give an example.

(15 marks)

*The bottleneck effect occurs when an event such as a natural disaster (1) randomly kills the majority of a population (1), leaving a surviving population that is a small sample of the original (1). Due to variation within a population (1), the small population of survivors are likely to have a different allele frequency (1) than the original population (1). Once the population reproduces, the new population will have a different gene frequency to the original population (1).*

*An example of the Bottleneck Effect is the islanders of Pingelap(1). In 1775, a typhoon killed the majority of islanders (1). There were only 20 remaining survivors (1), and of these, one was carrying an allele for achromatopsia (1), a form of colourblindness. Over time, reproduction within the small population meant that the allele for achromatopsia remained in the population (1), so that the incidence of achromatopsia on Pingelap remained at around 5% (1), with 30% carrying the allele (1). In comparison, the incidence of achromatopsia worldwide is far lower (1): 0.003%. The bottleneck effect is responsible for the greatly increased allele frequency for achromatopsia on Pingelap. (1)*

14: a) When an inhibitory neurotransmitter binds to the post-synaptic

receptors, what happens?

(6 marks)

*It causes either K+ gates to open (1), allowing K+ to move out of the post-synaptic neuron (1), or it causes Cl- gates to open (1) causing Cl- to move in to the post-synaptic neuron (1). In both cases, the membrane potential becomes increasingly negative (hyperpolarisation) (1), meaning that it is harder to reach the threshold for a new AP to be generated. (1)*

b) What does this mean for the speed of transmission?

(1 mark)

*It will be slowed (0.5) or stopped (0.5)*