

HOMEWORK #3 ANSWER KEY

1. Variance of the F_2 is expected to be greater than F_1 variance because

*F_2 is a **segregating generation** - it will contain animals with different genotypes and hence there will be greater variability.*

F_1 (and parental animals within each strain) will all have similar genotypes and variation present will be due to environment only

$$V(P_1 \text{ and } P_2) = V(E) \quad , \quad V(F_1) = V(E) \quad \text{but} \quad V(F_2) = V(G) + V(E)$$

2. a. A selection study can be said to have been successful

if separation between a high and a low line is achieved. (Note: heritability could be a REASON for the success, but is not a measure of the success)

b. Three examples of mice behaviors shown to respond to selection or differ between inbred lines

1. *any from class or the book eg open field behavior*

2. *response to alcohol*

3. *maze learning avoidance learning*

c. Response from a selection study: Nature of action of genes

rapid response that separates the lines but then levels off = evidence for non-additive effects

slow steady response continuing for many generations = evidence for additive gene effects

and number of genes involved

quick leveling off in response indicates fewer genes

response continuing for many generations indicates larger number of genes involved

3. "Genetic variance for behavior is nearly ubiquitous"

Variation in every behavior that has been investigated has been shown to be caused by genetic variation at least to some extent. Can anyone name a behavior (that has been investigated in an experiment able to detect a genetic influence) that has NOT shown at least a small genetic influence?

4. Trait easier to eliminate *head-shaking*

Reason: *all those with the dominant allele can be recognized and selected out*

5 i. *True Reason: we have seen these inbred strains in class and the data is consistent with them being inbred strains*

ii. *True Reason: negative correlation – as activity goes up, defecation rate goes down*

iii *True Reason: F₁ mean score is predictably midway between the means scores of the 2 parental strains*

iv *True Reason for a successful selection there needs to be a genetic influence on the trait (true here) and there needs to be genetic variation present in the animals used to start the selection (also true here in the F₃ generation)*

5. a. i. *True Reason: can select for activity level*

ii. *True Reason: defecation level also changed (even though it was NOT selected for)*

iii. *True Reason: change in defecation would NOT have occurred otherwise*

b. Genes for open field activity and defecation are *pretty much the SAME genes*

if the genes influencing one trait are changed by selection and another trait is also influenced, those same genes must either be also influencing that other trait or be tightly linked . Since here the traits are phenotypically correlated and that the correlation is always negative, it is more likely that there is also a genetic correlation and the SAME genes influence both activity level and defecation rate in the open field

This is an important finding – it may mean that the genes that have been changed are influencing the traits through a higher-order brain function (eg. level of anxiety)