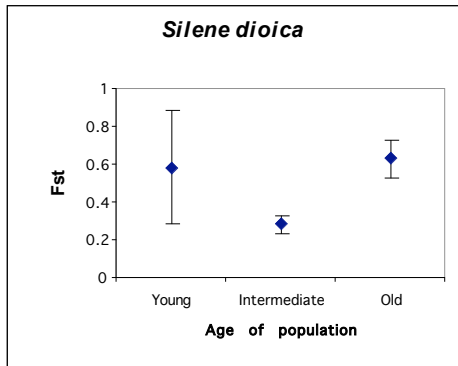


Quiz 2

1. The figure below comes from a study of genetic variation at selectively neutral loci in *Silene dioica* (red bladder campion), a perennial wildflower that grows on islands of different known ages. Describe what you can conclude from the data below, and propose explanations for the results using principles of population genetics. (20 points)



2. Explain the possible reasons why the following may occur (10 points):

inbreeding depression

outbreeding depression

3. In a survey of local squirrel populations, I've discovered the following frequencies of genotypes at two loci (A and B) that are known to be on different chromosomes:

	AABB	AaBb	aabb
Genotype freq.	.25	.50	.25

(a) Calculate the linkage disequilibrium (D) for this population. (use fractions if you don't have a calculator). (10 points)

(b) Describe two possible mechanisms that could have created this disequilibrium, and suggest a way to test which one is responsible. (10 points)

4. A colleague of mine studies genetic variation within and between species of *Drosophila* by sequencing an entire mitochondrial gene for many individuals within each of several closely related species. Within most species, sequence differences consist of small numbers of synonymous substitutions. In one species, however, there is *no* variation at all among individuals.. Describe your hypothesis for the cause of this difference. How would you test your hypothesis, using only the sequence information already gathered? (15 pts.)

5. *Tribolium castaneum* (flour beetles) are used as laboratory animals, but also exist in "natural" populations as pests of stored grain. The following figure shows the results of an experiment in which 2 inbred lines (or genotypes) of *Tribolium* were raised on two different types of grain flour. (Note: inbred lines have no genetic variation, so offspring of parents from the same line are identical to adults, i.e., they are equivalent to cloned offspring)



(a) What would be the significance of this result in considering evolution in 'natural' populations of these beetles.

(b) If I reared a population of Genotype 1 on a mixture of wheat and rye flour, what would be the heritability of the growth rate in that population?

6. The two lines of flour beetles in the last question differ in two adult phenotypic traits, with variation determined by different alleles at 2 loci:

Locus

Color	$C_R C_R$	$C_R C_B$	$C_B C_B$	(Genotype)
	Red	?	Black	(Phenotype)

Exoskeleton	$E_S E_S$	$E_S E_D$	$E_D E_D$	(Genotype)
	Shiny	?	Dull	(Phenotype)

Genotype 1 is Black and Shiny, and Genotype 2 is Dull and Red.

(a) Imagine I begin a new population of flour beetles with 50 larvae from Genotype 1 and 50 larvae from Genotype 2. What is the linkage disequilibrium (D) between the Color (C) and Exoskeleton (E) loci in this population's gametes?

(c) I allow these larvae to grow to adults and mate, collect all the eggs and then rear them to adult stage. My census of adult phenotypes produces the following results:

Dull and Red 200 Brown and Shiny 100 Black and Shiny

NAME _____

P.O. Box _____

6. Galen, in her study of alpine sky pilots, found relatively high heritability (0.5) for corolla flare (a measure of flower size), a trait which she also demonstrated is under strong directional selection in tundra populations. Describe two mechanisms that could maintain high heritability for corolla flare in the face of such strong selection. (20 points)

