

Selectively Breeding Sheep

Name _____

Part 1: Natural Selection and Selective Breeding

What is natural selection?

What is selective breeding?

What are the advantages of selective breeding?

Give an example of selective breeding and describe what trait might be selected for by the breeder.

Part 2: Using Punnett Squares in Sheep Breeding

Imagine you are a sheep farmer and there is a strange disorder that is affecting the lambs that are born in your flock. The parent sheep are healthy, but the lambs have bent limbs and twisted spines. Many of them are dying, which will drastically reduce your income to the farm and the longevity of your flock. How can you make wise mating decisions to prevent the births of these sick lambs?

Spider Lamb Syndrome (SLS) in sheep is a recessive genetic disorder. It causes skeletal deformities including bent limbs and twisted spines. It is difficult for sheep breeders to eliminate the risk of SLS in a flock because parents of SLS lambs do not exhibit any symptoms. This is a recessive disorder, so both parents must carry a recessive allele in order for the lamb to be affected.

Breeders have the difficult task of using a combination of selective breeding techniques and DNA tests to ensure healthy lambs. DNA tests can be expensive, so instead of purchasing DNA tests for an entire flock, breeders can test certain sheep and use Punnett Squares to predict the probability of other sheep in the flock of carrying recessive alleles.

Selectively Breeding Sheep (continued)

- You mate two sheep that are carriers for SLS, which means both the ram and the ewe have one dominant allele and one recessive allele. Fill out the Punnett Square.

	N	n
N		
n		

Possible Combinations

NN= Healthy Sheep

Nn=Healthy Sheep, but a “carrier” of the SLS gene

nn= Lamb with SLS

What is the probability that the offspring will have SLS?

What is the probability that the offspring will be carriers?

Do you think that breeders should mate two SLS carriers? Why or why not?

- You mate a sheep that does not carry a recessive spider allele with a carrier sheep. Fill out the Punnett Square.

	N	N
N		
n		

Selectively Breeding Sheep (continued)

What is the probability that the offspring will have SLS?

What is the probability that the offspring will be carriers?

Do you think that breeders should mate a RR sheep with a carrier? Why or why not?

3. You buy a healthy ram from a neighboring farm, and you do not know his genotype. You mate him with a SLS carrier and the lamb is born with SLS.

Fill in the Punnett Square with the genotype of the ram and his offspring.

Ram

— —

N		
n		

Selectively Breeding Sheep (continued)

4. A relatively simple genetic test is available for SLS. According to the information below, how much would it cost to test an animal for SLS? If you have a large flock and a limited budget, which sheep (rams or ewes) do you think you should select for testing and why?

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Sheep Tests

Tests	Info	Form	Price	Sample
Parentage/Genetic Marker Report			\$40 per animal	20-30 Hairs With Roots
Freemartin			\$50 per animal	Blood
Scrapie Susceptibility			\$15 per animal	Blood
Spider Lamb			\$20 per animal	20-30 Hairs With Roots
Scrapie and Spider Lamb package			\$30 per animal	Blood
Karyotyping			\$100 per animal	Blood

* If animal is deceased, please call for pricing & instructions.

The figure shows a gel electrophoresis image with six lanes labeled 1 through 6 at the top. Lane 1 and 2 each show two horizontal black bands. Lane 3 and 4 each show three horizontal black bands. Lane 5 and 6 each show one horizontal black band. Below the gel, blue arrows point from the labels NN, Nn, and nn to the corresponding bands in lanes 1-2, 3-4, and 5-6 respectively.

Electrophoresis gel: Lanes 1&2 are homozygous Normal. Lanes 3&4 are heterozygous or carriers. Lanes 5&6 are affected spider lambs.

A gel electrophoresis showing DNA bands for homozygous Normal (NN), heterozygous carriers (Nn), and homozygous SLS (nn) sheep.

Costs associated with genetic tests available from University of California-Davis Veterinary Genetics Laboratory.

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Part 1: Natural Selection and Selective Breeding

What is natural selection?

Natural selection is also known as natural breeding. Animals/plants have free choice in who to breed/reproduce with.

What is selective breeding?

Selective breeding is also known as artificial selection or unnatural selection. It is the process by which humans breed plants and animals for particular traits.

What are the advantages of selective breeding?

Breeders get to select which traits they want in their livestock.

Give an example of selective breeding and describe what trait might be selected for by the breeder.

Answers will vary. A rabbit breeder chooses to breed the rabbits that have the best markings.

Part 2: Using Punnett Squares in Sheep Breeding

Imagine you are a sheep farmer and there is a strange disease that is affecting the lambs that are born in your flock. The parent sheep are healthy, but the lambs have bent limbs and twisted spines. Many of them are dying, which will drastically reduce your income to the farm and the longevity of your flock. How can you make wise mating decisions to prevent the births of these sick lambs?

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Selectively Breeding Sheep (continued)

1. You mate two sheep that are carriers for SLS, which means both the ram and the ewe have one dominant allele and one recessive allele. Fill out the Punnett Square.

	N	n
N	NN	Nn
n	Nn	nn

Possible Combinations

NN= Healthy Sheep

Nn=Healthy Sheep, but a “carrier” of the SLS gene

nn= Lamb with SLS

What is the probability that the offspring will have SLS?

There is a 25% chance the offspring will have SLS.

What is the probability that the offspring will be carriers?

There is a 50% chance the offspring will carry the SLS allele.

Do you think that breeders should mate two SLS carriers? Why or why not?

Answers will vary.

2. You mate a sheep that does not carry a recessive spider allele with a carrier sheep. Fill out the Punnett Square.

	N	N
N	NN	NN
n	Nn	Nn

Selectively Breeding Sheep (continued)

What is the probability that the offspring will have SLS?

There is a 0% chance the offspring will have SLS.

What is the probability that the offspring will be carriers?

There is a 50% chance the offspring will be carriers.

Do you think that breeders should mate a RR sheep with a carrier? Why or why not?

Answers will vary.

3. You buy a healthy ram from a neighboring farm, and you do not know his genotype. You mate him with a SLS carrier and the lamb is born with SLS.

Fill in the Punnett Square with the genotype of the ram and his offspring.

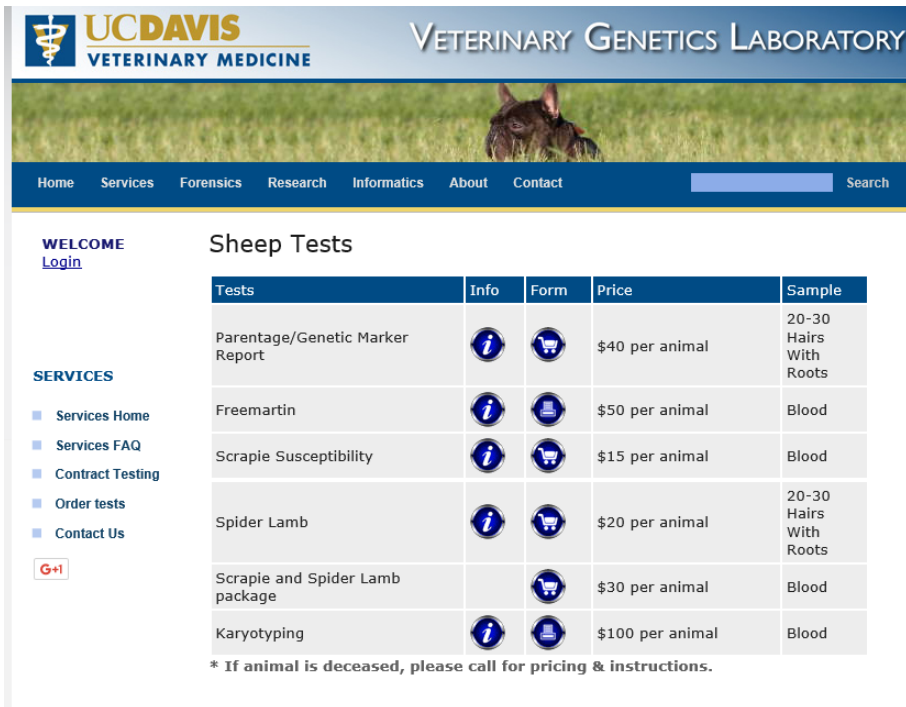
Ram

	N	_n_
N	NN	Nn
n	Nn	nn

Selectively Breeding Sheep (continued)

4. A relatively simple genetic test is available for SLS. According to the information below, how much would it cost to test an animal for SLS? If you have a large flock and a limited budget, which sheep (rams or ewes) do you think you should select for testing and why?

The cost of a test is \$20. Testing rams should be tested because they will be mated with multiple ewes and pass their genes off to more offspring than a single ewe. This is a more cost effective strategy.



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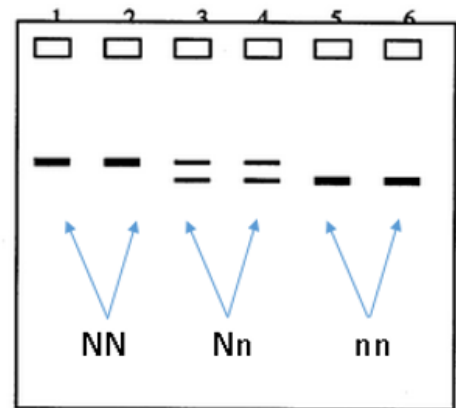
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