Lesson 6.11	Dragon Genetics, pt. VI: Making a dragon	Name Date Period

Engage I

Dragons are an extremely endangered species and researchers are interested in documenting the genetics of the species and starting a captive breeding program in order to increase the dragon population. Each student will become a surrogate dragon parent. Dragons have five pairs of homologous chromosomes (2n = 10), including a single pair of sex chromosomes and four pairs of autosomes. Students will analyze the chromosomes of their dragon and determine its genotype and resulting phenotype. This information will be recorded on the following pages to aid in future dragon research and captive breeding programs.
Next, students will seek out another student with a dragon that is of a different gender then their own and allow their dragons to mate. Dragons, like all other sexually reproducing organisms, produce gametes by meiosis. During meiosis each dragon will produce haploid gametes containing only one allele from each gene. Meiosis will occur according to the same principles of segregation and independent assortment that are typically observed in meiosis. The alleles for each gene on each inherited chromosome will be documented. This information will then be used to determine the genotype of the baby dragon and predict its phenotype.

Explore I

Procedure – On your Own:

A. Each student must pick up five pairs of popsicle stick chromosomes – two of each color of autosome, and two sex chromosomes.

B. For each pair of colored autosomes, and then for the pair of sex chromosomes, each parent will randomly drop his or her chromosomes on the table. The side of the stick that is facing up represents the combinations of alleles in your pet dragons genotype. Arrange the chromosomes in front of you in homologous pairs (matching colors). Be sure to keep them right side up for the rest of this lab or you will become extremely confused.

C. Look at the homologous pair of sex chromosomes and determine if your dragon is a male or female. All dragons receive a purple "X" chromosome from the mother. To determine gender look at your black male sex chromosome. If your black chromosome has an "X," you are female and if it has a "Y" you are male. **1. Record this information at the bottom of the data sheet.**

D. **2. Record the pairs of alleles from each pair of homologous chromosomes in the data chart under parental genotype** (If your dragon is a dragonette use the "mom" box. If your dragon is drake use the "dad" box.

E. The decoding table indicates the phenotypic effect of each gene. The trait produced by each pair of parental alleles should be recorded in the data chart under parental phenotype. Remember not all traits follow normal Mendilian inheritance patterns of strictly dominant or recessive. Check for alternate inheritance patterns such as co-dominance, incomplete dominance, or polygenic inheritance at the bottom of the decoding table. There are also sex-linked traits to keep track of as well.

F. Before they can mate dragons must produce gametes through the process of meiosis. To simulate the production of gametes by meiosis we will flip a coin. Heads, the gamete contains the chromosome on the left in each homologous pair of chromosomes. Tails, the gamete contains the chromosome on the right in each homologous pair of chromosomes. You will need to flip a coin once for each pair of homologous chromosomes.

3. Record the alleles from each of the inherited chromosomes in the appropriate "alleles found in" column of the data table. (If your dragon is male it produces sperm, if it is female it produces eggs).

G. Once you flipped, push away the 5 popsicle sticks you are not using.

Procedure – With your Partner:

H. Now that you know the genetic make-up of your dragon you are ready to have it mate with another dragon. Find another dragon surrogate parent with a dragon whose genetic make-up has been completed and is known to be of a different gender.

4. Record the name of your dragon mates surrogate parent at the bottom of the data sheet. (If there is an un-even matching of parents, there may need to be spontaneous sequential hermaphroditism – sex change!!)

I. **5. Record the genetic make up of your partners dragon in the remaining parental genotype and phenotype columns**. (Write down your partner's info and vice-versa)

J. **6. Record the alleles from the gamete it produced in the remaining "alleles found in" column**.

K. Use the alleles listed for each of the parent dragon gametes to determine the genotype of your dragon offspring.

7. Record this in the data table in the "offspring genotype" column.

L. Compare the offspring genotype information to the decoding table to determine the phenotype of your baby dragon for each of the traits. **8. Record this information in the "offspring phenotype" column on the data table.**

M. Draw and color a picture of your baby dragon on a blank piece of paper. Use the pictures of the various traits at the end of the lesson to help with any unfamiliar traits. **9. <u>Label the genotype and the phenotype of each trait on the drawing. You and your partner should have similar looking dragons.</u>**

Explain I

8. a. State Mendel's Law of Segregation in **your own words**.

b. During this lab how did we simulate the law of segregation?

c. What accounts for segregation in the cells of living things?

9. a. State Mendel's Law of Independent Assortment in **your own words**.

b. Compare the way we assorted alleles in this lab to the way Mendel believed alleles assort into gametes.

c. Did all pairs of alleles assort independently into gametes in this lab?

d. Why or why not?

10. The gene for no fangs is dominant, yet most of the dragons have fangs. How did this happen?

11. Explain the difference between incomplete dominance and co-dominance in **your own words**. Use examples from your dragon.

12. What genes are more likely to be expressed in male dragons than female dragons? Explain! (*This assumes that the dominant and recessive alleles for each of these traits are equally likely in the dragon population*)

13. a. Do you and your partner's baby dragon have any traits that are not seen in the phenotype of either parent? If so list them.

b. Explain how it is possible for offspring to have phenotypes not seen in either parent.

DRAGON GENOME: *DECODING* OF THE GENES

Chromosome	Dominant genes	Recessive genes
Green Autosome	A. chin spike	a. no chin spike
	B^R. Rounded tail spikes; B^P. Pointed tail spike	b. no tail spikes
	C. Back spikes	c. No back spikes [incomplete dominance & polygenic]
	D. visible ear hole	d. no visible ear hole
	E. Eye pointed at each end; Ee. eye round at front only	e. Oval eyes
Red Autosome	F. long neck	f. short neck
	G. no back hump; G^s small back hump	g. large back hump
	H. 4 clawed feet	h. 3 clawed feet
	I. long tail	i. short tail
	J. Back spikes	j. No back spikes [incomplete dominance and polygenic]
Blue Autosome	K. red eyes	k. yellow eyes
	L. spots on neck [Pleiotropic]	l. no spots on neck [Pleiotropic]
	M. wings	m. no wings
	N. no fang	n. fang
	O. spots on back [Pleiotropic]	o. no spots on back [Pleiotropic]
Yellow Autosome	P. blue spots on thigh [Pleiotropic]	p. gold spots on thigh [Pleiotropic]
	Q. Bright Green [Incomplete dominance]	q. Purple [Incomplete dominance]
	R small comb on head	r. large comb on head
	S. [See below]	s. [See below]
	T. no elbow spike	t. elbow spike
All Sex Chromosomes	U. long arms	u. short arms
	V. chest plate	v. no chest plate
	W. Back Spikes	w. No Back Spikes [incomplete dominance & polygenic]
X Chromosome Only	X. Female	
	Z. nose spike	z. no nose spike
	+ non-fire breather	- fire breather
Y chromosome only	Y. Male	

Codominant Traits

B^R. Dominant (rounded tail spikes)	B^P. Dominant (pointed tail Spikes)	b. Recessive (no tail spikes)
E Eye pointed at each end	Ee. Eye round at front only	e. Round eye
GG no back hump	G^s small back hump	gg. large back hump

Incomplete Dominant Traits

QQ. Bright green body color	qq. Purple body color	Qq. Dark Olive green body color
JJ. Two back spikes	jj. No back Spikes	Jj. One back Spike
WW. Two back spikes	ww. No back spikes	Ww. One back spike

Polygenic Inherited Trait

Back spikes are an example of polygenic inheritance. Dragons can have 0 – 6 spikes along the crest of their spine depending on the number of dominant alleles found at loci C, J, and W (# of dominant alleles = number of back spikes)

Sex-linked Traits

Nose spikes and fire-breathing

Green Autosomes

Parental Genotypes		Parental Phenotypes		Allele Found in:		Offspring Genotype	Offspring Phenotype
Mom	Dad	Mom	Dad	Egg	Sperm		

Red Autosomes

Parental Genotypes		Parental Phenotypes		Allele Found in:		Offspring Genotype	Offspring Phenotype
Mom	Dad	Mom	Dad	Egg	Sperm		

Blue Autosomes

Parental Genotypes		Parental Phenotypes		Allele Found in:		Offspring Genotype	Offspring Phenotype
Mom	Dad	Mom	Dad	Egg	Sperm		

Yellow Autosomes

Parental Genotypes		Parental Phenotypes		Allele Found in:		Offspring Genotype	Offspring Phenotype
Mom	Dad	Mom	Dad	Egg	Sperm		

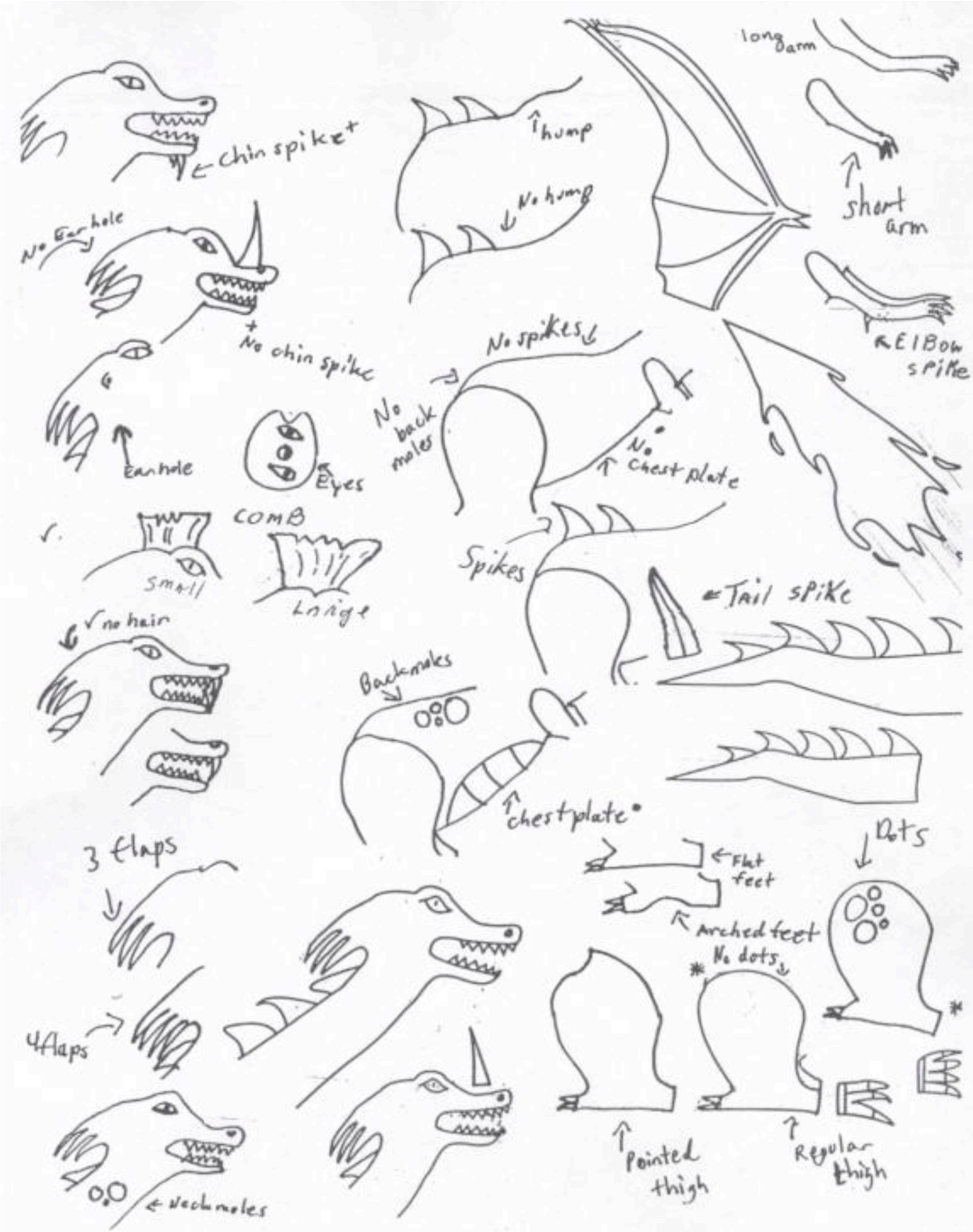
Purple and Black Chromosomes

Parental Genotypes		Parental Phenotypes		Allele Found in:		Offspring Genotype	Offspring Phenotype
Mom	Dad	Mom	Dad	Egg	Sperm		

Name of your Dragon/owner/gender of Dragon: ____________/ ____________ / __________________

Name of Partner's Dragon /owner/gender of dragon: _____________ / ________________ / ___________________

Baby Dragon Name /Gender: _________________ / ___________________



chin spike+
hump
No hump
long arm
short arm
Elbow spike
No Ear hole
No chin spike
No spikes
No back moles
No. Chest plate
Ear hole
Eyes
COMB
Small
Large
Spikes
Tail spike
no hair
Back moles
chestplate
3 flaps
4flaps
Flat feet
Arched feet
Dots
No dots
Pointed thigh
Regular thigh
Neck moles