ANTHR 1-L: Bio Anthro Lab **Name:**_____

EVOLUTIONARY GENETICS LAB PROBLEMS

1. In Likis, a type of monkey (hypothetical), a single dominant allele determines whether or not a Liki is spotted (S) or not (nonspotted is recessive = s). A single dominant allele also determines whether or not a Liki has a tufted tail (T) or not (nontufted tail is recessive = t). Given this information, answer the following questions:

a. What **genotype(s)** could result in a spotted phenotype? _____

b. What **genotype(s)** could result in a nonspotted phenotype?_____

c. What **genotype(s)** could result in a tufted tail phenotype? _____

d. What **genotype(s)** could result in a non-tufted tail phenotype? _____

2. For the Liki matings given below, calculate the phenotypic and genotypic ratios of the offspring. Use a Punnett square to show your work.

a. A male spotted Liki who is *homozygous dominant* mates with a female who is *heterozygous*.

Genotypes and their ratio:

Phenotypes and their ratio:

What is the probability that they will have a spotted child? _____

b. A male tufted tail Liki who is *heterozygous* mates with a female who is *heterozygous* for a tufted tail.

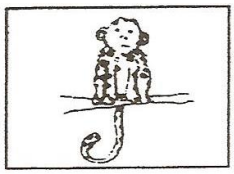
Genotypes and their ratio:

Phenotypes and their ratio:

What is the probability that they will have a child with a tufted tail? _____

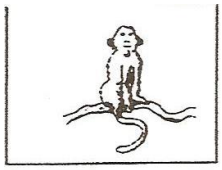
3. Below are drawings of two Liki families, A and B. In the spaces provided below a family member's picture, please indicate the phenotype and genotype of that individual based on your observations.

Family A



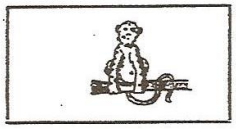
Father's phenotype:_____

Father's genotype: _____



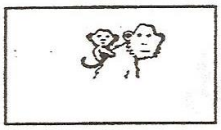
Mother's phenotype:_____

Mother's genotype: _____



Junior's phenotype:_____

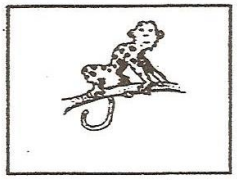
Junior's genotype: _____



Baby's phenotype:_____

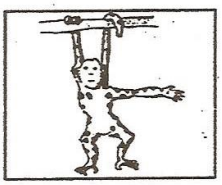
Baby's genotype: _____

Family B



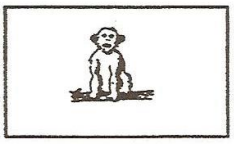
Mother's phenotype:_____

Mother's genotype: _____



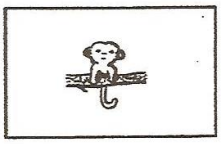
Father's phenotype:_____

Father's genotype: _____



Junior's phenotype:_____

Junior's genotype: _____



Baby's phenotype:_____

Baby's genotype: _____

Explain why Baby Liki in Family A is non-spotted._____

_____

Explain how both Junior Liki and Baby Liki in Family B could be non-spotted._____

_____

_____

4. The human ABO blood type gene has three alleles: A (a dominant allele), B (also a dominant allele), and O (a recessive). Below is a table outlining the genotypes that determine the phenotype (Blood Type). An individual who has

GENOTYPE	PHENOTYPE
AA or AO	Blood Type A
BB or BO	Blood Type B
AB	Blood Type AB
OO	Blood Type O

a. What are the three heterozygous (i.e. non-matching alleles) genotypes in the human blood type system?

b. What are the three homozygous (i.e. matching alleles) genotypes in the human blood type system?

c. Of the three alleles in the human blood type system, which is recessive? _____

d. Which blood type is recessive?_____

e. Explain why the heterozygous genotype of AB creates a phenotype of Type AB Blood.

5. Practice with Blood Type Problems.

a. A male is who homozygous for blood type A mates with a female who has type AB blood.

Genotype for male? _____ Genotype for female? _____

What are the possible **genotypes** of their offspring? (Show this by means of the Punnett square)

What are the possible **phenotypes?** (NOTE: The phenotype in this case is the Blood Type – write out the type of blood, not the combination of alleles, which is the genotype and already shown above in the Punnett square).

In what ratio will these phenotypes appear?

b. A female who is heterozygous (has non-matching alleles) blood type B marries a male who is heterozygous (has non-matching alleles) for blood type A.

Genotype of female? _____ Genotype of male? _____

What are the possible **genotypes** of their offspring? (Show these by means of the Punnett square in the space below)

What are the possible **phenotypes** and in what ratio do they appear in the Punnet square?

Dibhybrid (Two Trait) Genetics Problems

1. You should be getting fairly comfortable with determining genotypic and phenotypic outcomes given two parental genotypes for a single (monogenic) trait. Now we'll get some practice using the Punnett square for TWO monogenic traits, or a dihybrid cross. As a practice problem we will cross two parental pea plants which are heterozygous dominant for two traits, Seed texture (R = smooth, r = wrinkled) and Seed Color (Y = yellow, y = green).

Step One
What are the genotypes for both individuals? Parent 1_____ Parent 2_____

Remember, since we are using two traits (seed texture and seed color), the genotype will contain a total of FOUR alleles (two for each trait).

Step Two – Determining the gametes. The gametes contain HALF the genetic information of the individual. Since we have TWO traits, that means we need one allele from each trait in the reproductive cells (the gametes).

What combination of alleles from the two traits will the **gametes** of these individuals contain?

_____ _____ _____ _____

Step Three
Put the gametes for both parents along the top and the side of the Punnett square. Now, combine the alleles to find the potential genotypes for each square. The new genotypes will have FOUR alleles, and remember to write the dominant allele before the recessive one when you recombine the alleles from the gametes.

Step Four
Determine the possible genotypes and their ratios and the possible phenotypes and their ratios.

2 Assume for this question that Pedro and Blanca are heterozygous for TWO characteristics and that those traits are blood type and hair color. Further assume that a single dominant allele determines whether a human has brown hair (H) or red hair (h), with red being recessive. Both Pedro and Blanca are phenotypically brunettes and both are descended from parents, one of whom had brown hair and one of whom had red hair. Likewise, both Pedro and Blanca are Type A blood and are the descendants of parents one of whom had Type A blood and one of whom had Type O blood.

a. What is Pedro's **genotype**?

b. What is Blanca's **genotype**?

c. What alleles will Pedro's **gametes** contain? (remember, you'll need one allele from EACH trait)

d. What alleles will Blanca's **gametes** contain?

6. Pedro and Blanca wish to have children and have asked you to tell them what genotypes could appear among their offspring. What **genotypes** could appear among the offspring of this dihybrid cross? (Show your work below by using a Punnett square).

a. In what ratios do the various **genotypes** appear? (you can record these on the side of the punnet square above)

b. What **phenotypes**, that is, hair color and Blood Type, (and in what ratios) could appear among the potential offspring of Pedro and Blanca?

3. Imagine a gene that controls whether or not a person has big feet or small feet. Big feet (F) are dominant, while small feet is recessive (f). The ability to roll one's tongue is also controlled by one gene. Rolling is dominant (R) and non-rolling is the recessive condition (r).

David is **heterozygous dominant** for big feet and CANNOT roll his tongue. Donna is also **heterozygous dominant** for big feet and **heterozygous dominant** for the tongue rolling trait.

What is David's genotype?_____

What is Donna's genotype?_____

Can Donna roll her tongue?_____

What type of gametes will David produce?_____

What type of gametes will Donna produce?_____

Use the above information in a Punnett Square to determine the possible genotypes and phenotypes for David and Donna's offspring.

How many **genotypes** are possible?_____

How many **phenotypes** are possible?_____

Although David and Donna both have big feet, could any of their children be born with <u>small</u> feet?_____

4. Judge Judy has asked you to testify in a case of disputed parentage. You've decided to examine two genes: ABO blood group and the secretor gene in which the secretion (S) of substances into body fluids other than blood is dominant to their non-secretion (s). The appropriate tests are run and the results indicate the following:

	Blood Type	Secretion Gene
Mother	B B	S S
Child	B B	S s
Husband	A B	s s
Accused Man	B B	S S

a. What would you advise the court and why?