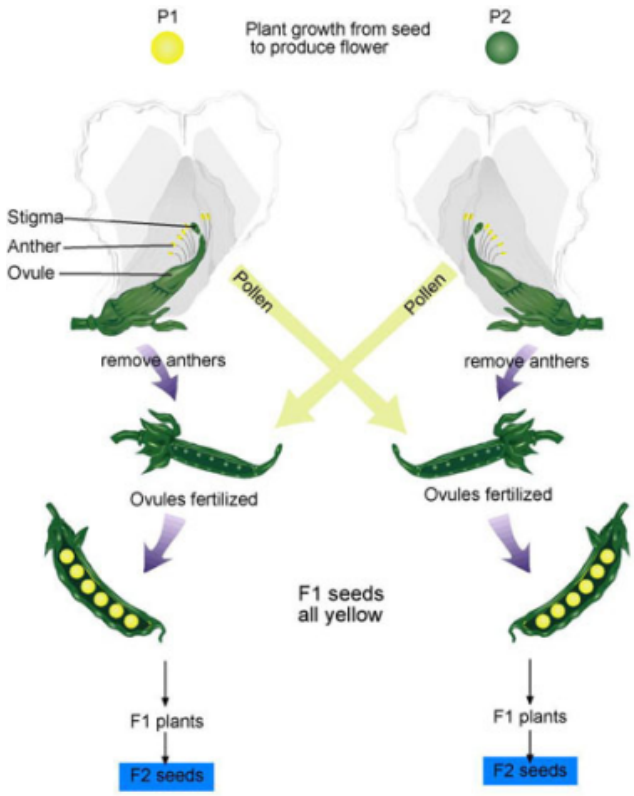
Genes and Heredity

Heredity is the passing of traits from parents to offspring. The genes that govern traits are found in every cell of the body. These genes determine a specific trait which will be expressed in the phenotype. A *hybrid* is an offspring that is different from its parent. It is a combination of genes from both parents.

Gregor Mendel is considered to be the father of *genetics*, the study of inherited characteristics. Mendel used garden peas to study genetics for several reasons. They have several characteristics which are easy to identify such as: height, seed shape, seed color, flower color, etc… Mendel used cross-fertilization between two plants to trace the passing of traits. He used the anther, which holds the pollen or male sex cell, from one plant, and the egg from another, to create a new plant. This allows a recombination of genes and leads to variation in the offspring.



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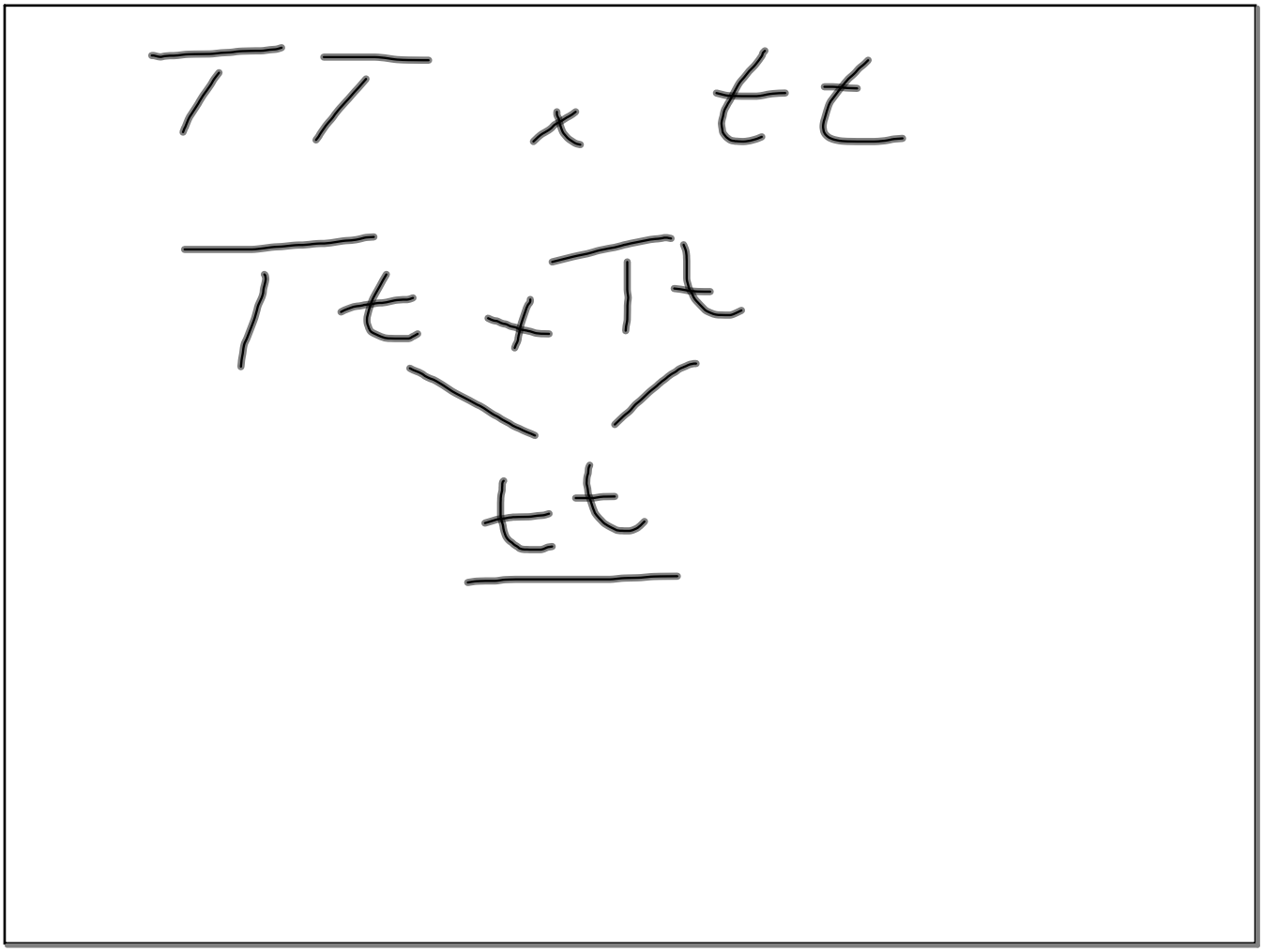
During his experiments, Mendel noticed that some traits were more likely to be expressed. For example, pea plants tend to be tall rather than short. Mendel called the gene that determines tallness a *dominant* gene. Dominant genes determine the traits we see in the organism. A *recessive* gene is only expressed in the absence of a dominant gene.

After careful observation Mendel concluded the following: 1. Traits are determined by genes which occur in pairs. Each organism has 2 genes for a trait. For example, a tall pea plant may have 2 genes for tallness, TT, or a gene for tallness and a gene for shortness, Tt. 2. One gene masks the effect of another. A tall gene masks a short gene and the tall trait is expressed. 3. The genes seperate or segregate during meiosis and the resulting gametes get one copy of the gene.

In his first set of experiments he discovered that one trait always dominated another. Tall plants crossed with short plants always produced tall plants. (TT x tt = Tt) When Mendel crossed the plants from the first cross he found that 75% of the offspring were tall and 25% were short.

(Tt x Tt = TT, Tt, tt)

Apr 11 - 10:54 AM



Nov 15-3:10 PM

Genetic Terms

Genotype--genetic makeup of an organism, the genes it contains. TT, Tt, tt.
Phenotype--observable traits in an organism. Tall, Short.
Homozygous--2 genes for the same trait. TT, tt.
Heterozygous-2 different genes for the same trait. Tt.
Alleles--2 or more alternate forms of a gene. T for tall and t for short.
Monohybrid cross-one trait cross between two organism. TT x tt.
Punnett square--chart used to show possible gene combinations.
Questions pg. 576 # 1-4.

Monohybrid Crosses

Apr 11 - 10:41 AM

Test Cross-a cross performed to test the genotype of a dominant phenotype. It is always performed between an unknown genotype and a homozygous recessive individual. In sheep, white is dominant over black. To perform a test cross, a black sheep is crossed with a white sheep. If all of the offspring are white, the white parent is homozygous. If half of the offspring are white, the white parent is heterozygous.

♀  ×  ♂

For Labrador retrievers, black fur is dominant to yellow. Explain how a homozygous black dog can have a different genotype than a heterozygous black dog. Could the heterozygous black dog have the same genotype as a yellow dog?

Apr 20-8:50 AM

For dalmation dogs, the spotted condition is dominant to non-spotted.

a. Using a punnett square, show the cross between two heterozygous parents.

b. A spotted dalmation dog mates with an unknown father. From the appearance of the pups, the owner concludes that the male was a dalmation. The owner notes that the female had six pups, three spotted and three non-spotted. What are the genotypes and phenotypes of the unknown father?

Apr 20-9:01 AM

For Mexican hairless dogs, the hairless condition is dominant to hairy. A litter of eight pups is found; six are hairless and two are hairy. What is the genotype of the parents?

Apr 20-9:05 AM

Multiple Alleles-Many traits are controlled by more than two alleles.

TABLE 12-2
ABO Blood Types

Genotype	Blood type
I^AI^A	A
I^Ai	A
I^BI^B	B
I^Bi	B
I^AI^B	AB
ii	O

For example, in Drosophila (fruit fly) there are four different eye colors. They can have wild type, apricot, honey, or white. Although there are four different alleles, only two may be present at one time. Capital letters and superscripts are used to identify phenotypes.

Wild —— $E^1E^1, E^1E^2, E^1E^3, E^1E^4$

Apricot —~~E^2E^2~~ E^2E^3, E^2E^4

Honey —— E^3E^3, ~~E^3E^4~~

White —— E^4E^4

State the phenotypes from the following crosses:

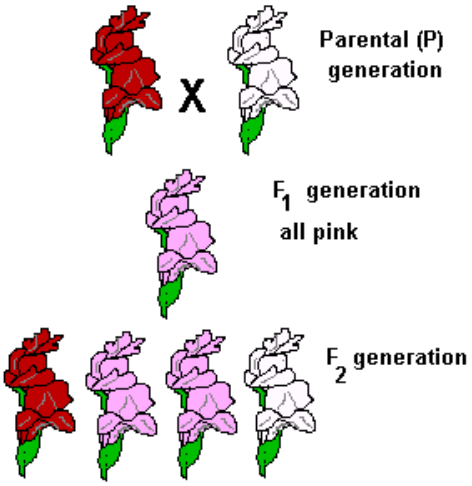
1. Heterozygous honey color male is crossed with a white female.

2. Heterozygous apricot male, who had a homozygous honey mother, is crossed with a wild female who had a white mother.

Incomplete Dominance-when two genes are equally dominant, they produce a new phenotype. Crossing red and white snapdragons produces pink snapdragons. This type of inheritance is called *intermediate inheritance*, a type of incomplete dominance.

Apr 12 - 10:08 AM

Intermediate Inheritance with Snap Dragons



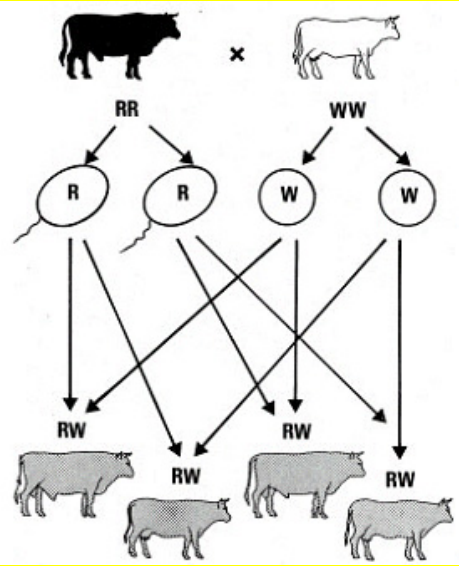
RR x WW

RW

RR

RL

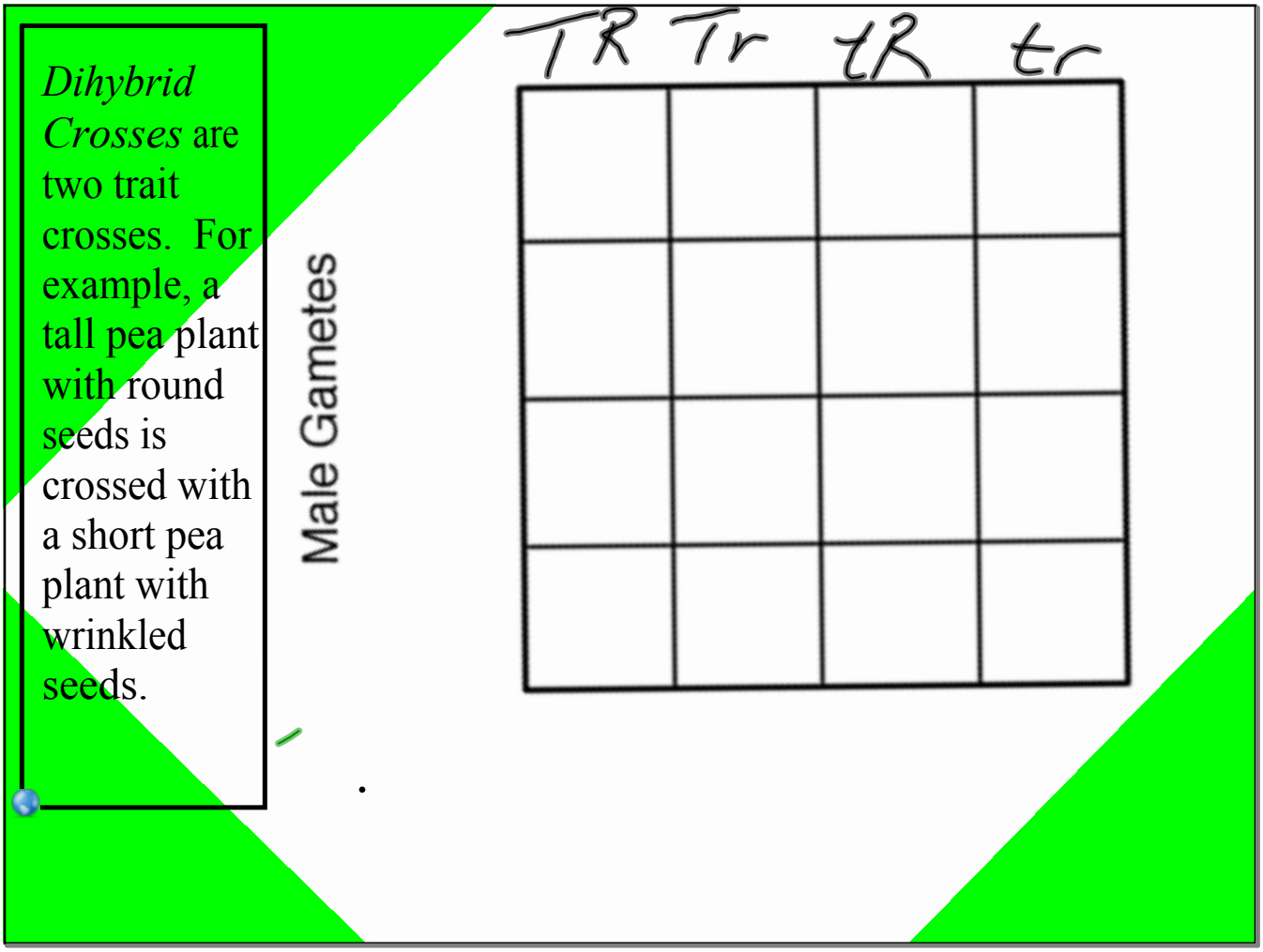
LL



Codominance-two genes are expressed at the same time. A red bull crossed with a white cow produces a roan calf. The calf has both red and white hair expressed at the same time which creates a pinkish coat. This is another type of incomplete dominance.

Apr 12 - 10:16 AM

Dihybrid Crosses are two trait crosses. For example, a tall pea plant with round seeds is crossed with a short pea plant with wrinkled seeds.



Probability is the study of the possible outcomes for an event. The two possibilities arising from a coin toss are heads or tails. The probability of tossing a head is ½. Remember the following two rules of probability. 1. The rule of independent events. Previous events do not affect future events. 2. The product rule. The probability of independent events occurring simultaneously is equal to the product of these events occurring seperately. Genotypic and phenotypic ratios are determined by probability.

Free ear lobes and widow's peak.

Apr 12 - 10:33 AM

In humans free ear lobes is controlled by a dominant allele E and attached ear lobes is e
The widow's peak hairline is regulated by W, while the straight hairline is regulated by w.

Consider the mating of 2 heterozygous individuals.

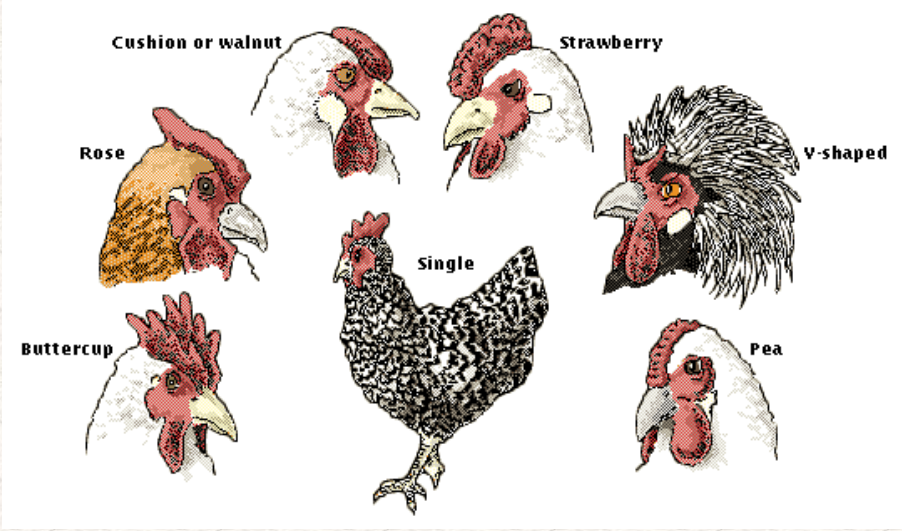
Treat dihybrids as 2 monohybrids
Look at phenotypes to see F1 generations traits

Nov 30-9:44 AM

Selective breeding is used to produce a desired phenotype. A high grade bull and a high grade cow will produce a high grade calf. Inbreeding is an example of selective breeding in which the phenotypes of the offspring can be predicted. If organisms are very closely related, what would happen if a disease affected one of the population?

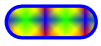
Apr 12 - 10:41 AM

Gene Interaction-some traits are controlled by more than one gene. They are called polygenic traits. These genes interact to produce a phenotype. Genes that interfere with the expression of other genes are called *epistatic*. Complementary interaction occurs when two different genotypes interact to produce a phenotype that neither can produce by itself.



RR-Rose
PP-Pea
RP-Walnut
rrpp-single

RRPP X rrpp =RrPp

	RP	Rp	rP	rp
RP				
Rp				
rP				
rp				

Apr 28-8:45 AM

12 a) CCBB x Ccbb

CB Cb

	Cb	cb
CB	CCBb	CcBb

Apr 30-9:12 AM

b) ccBB x CcBb

cB

cB
cB
Cb

cB cB cb cb

	cB	cB	cb	cb
cB	CcBB	ccBB	CcBb	ccBb

Apr 30-9:14 AM

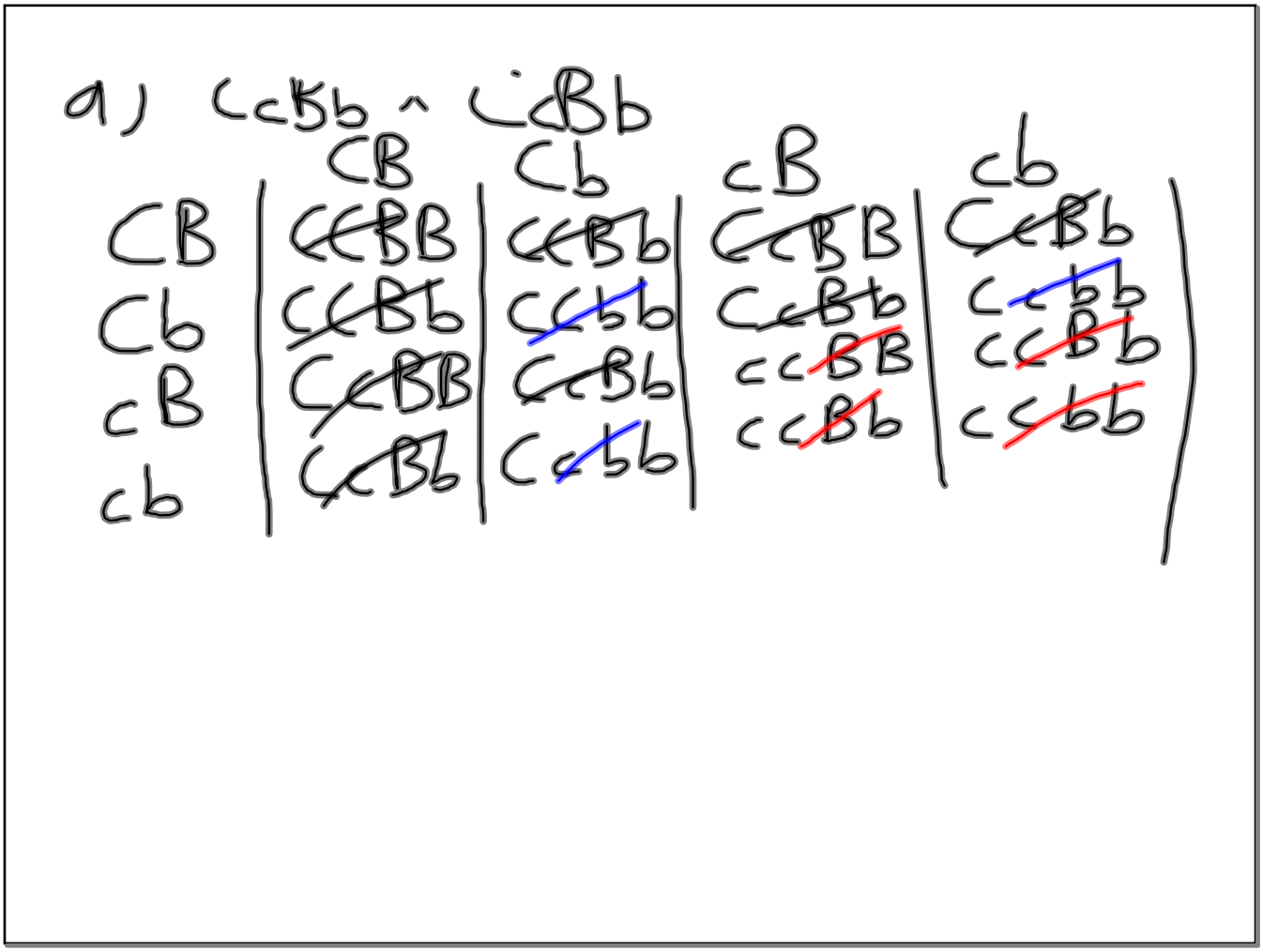
c) CcBb x ccbb

CB
cB
Cb
cb
cB

cb

	Cb	cB	cb
cb	CcBb	Ccbb	ccBb	ccbb

Apr 30-9:17 AM


a) CcBb x CcBb
CB
Cb
cB
cb
CB
Cb
cB
cb

black-B
white-b
solid-S
spotted-s

BbSs X bbSS

BbSs x BBss

BbSs X BbSs= bbss

BBSs
BBss
BbSs
Bbss

BbSs X bbss=bbss

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Apr 28-1:45 PM

Pleiotropic genes affect many different characteristics. Sickle-cell anemia is caused by a mutated gene resulting in a lack of oxygen delivery to the body. Discuss pg. 591.

Apr 12 - 10:48 AM

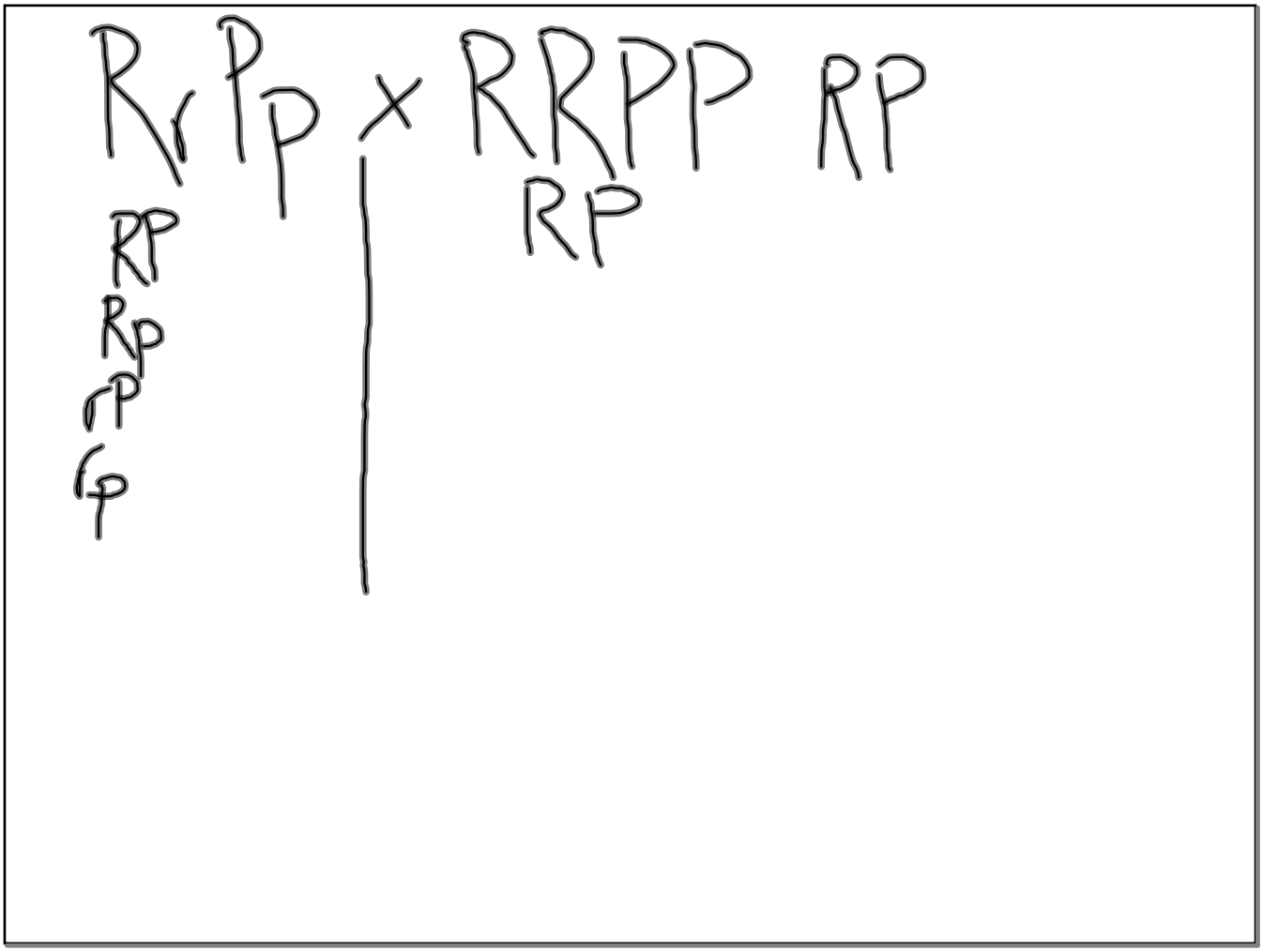
The Effects of the Environment on Phenotype.
Nature versus Nurture; which plays the dominant role in the expression of a gene? All genes interact with the environment and the phenotype may be affected accordingly. The phenotype of an individual is determined by a combination of genes and the effects of the environment. For example, himalayan rabbits are black when raised at low temperatures but white when raised at high temperatures. Discuss.

All Done!
Test Soon.

9) rrPP x RRPP

rP | RP

Apr 30-9:25 AM



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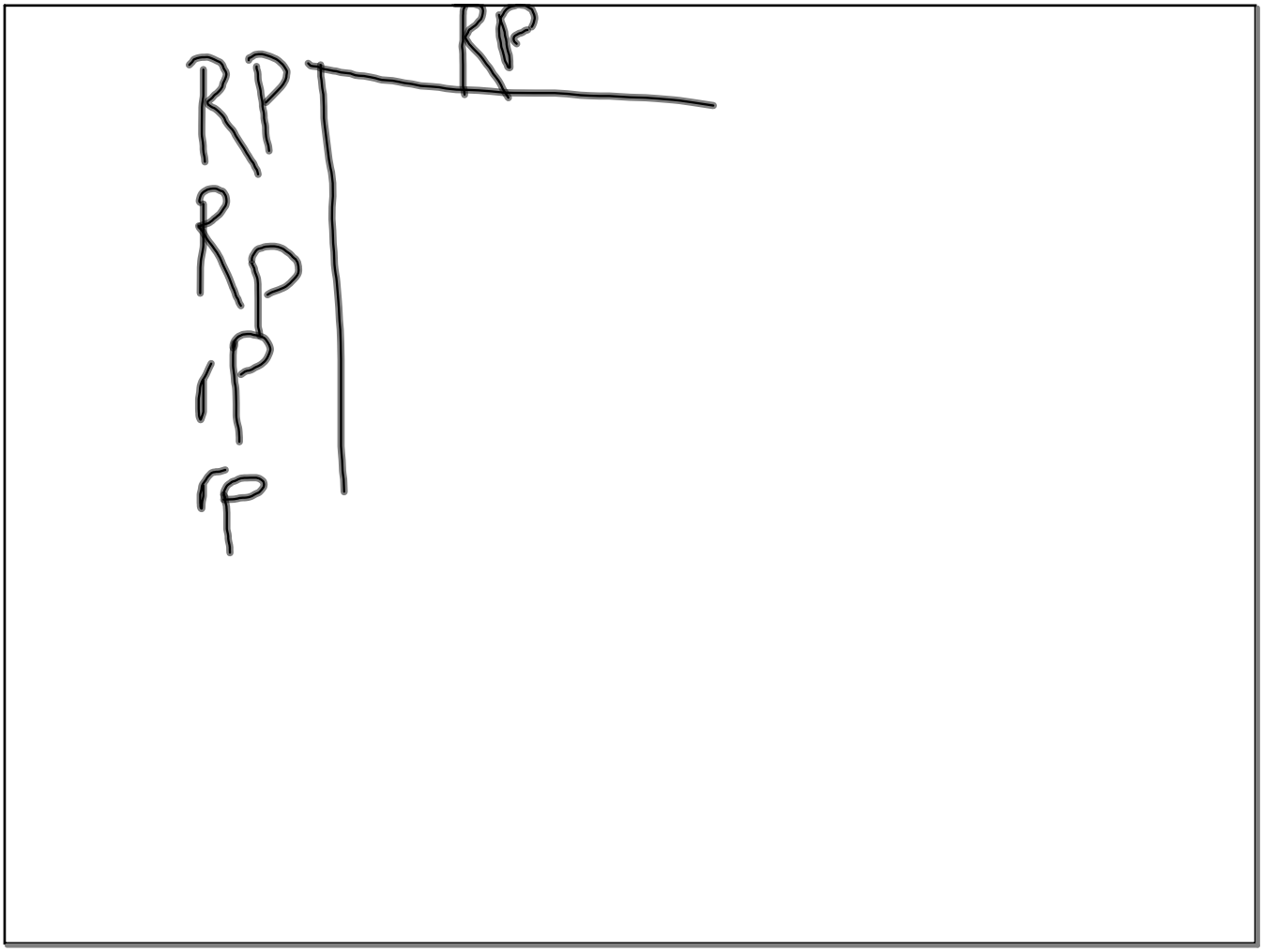

Apr 30-9:29 AM