

1. In humans, brown eye color is dominant, blue is recessive. A heterozygous brown-eyed man marries a blue-eyed woman. What are the possible genotypes and phenotypes of their offspring?

	B	b
b	Bb	bb
b	Bb	bb

1 Bb : 1 bb
1 Brown : 1 blue

2. Normal pigmentation is dominant and albino is recessive. If a normal man marries an albino woman and they have a normal boy and an albino girl, what are the genotypes of the parents?

mother →

	A	a
a	Aa	aa
a	Aa	aa

← father
← child

3. Cystic fibrosis is an autosomal recessive disorder. If two phenotypically normal parents have a child with cystic fibrosis, what are the genotypes of the two parents, and the child?

	F	f
F	FF	Ff
f	Ff	ff

← Parents must be heterozygous (Ff) in order to have a child with the recessive trait

4. What is the probability that their next child will also have the disease?

1/4 every time

5. Due to incomplete dominance, snapdragons are often blended to make interesting colors. If you crossed a red snapdragon with a white snapdragon, what would be the possible genotypic and phenotypic ratios of the offspring?

white →

	R	R
r	Rr	Rr
r	Rr	Rr

← red
All offspring are Rr and pink

6. Co-dominance occurs when both alleles in a heterozygote are expressed. Roan is the term for the condition where white hair is mixed in with a base hair color. This is common in horses. If two grey roan horses were crossed, what would be the genotypic and phenotypic ratios of their offspring?

RR = black
RR' = Roan
R'R' = white

	R	R'
R	RR	RR'
R'	RR'	R'R'

1 RR : 2 RR' : 1 R'R'
1 black : 2 roan : 1 white

7. Red-green color blindness in humans is a sex-linked recessive trait on the X-chromosome. If a color-blind male marries a female with normal vision (that is not a carrier), what percent of their male children will likely be colorblind?

	X ^N	X ^N
X ⁿ	X ^N X ^N	X ^N X ^N
Y	X ^N Y	X ^N Y

N = normal n = colorblind
0% colorblind

8. A female who is heterozygous for type A blood marries a man that is type O. What are the possible genotypes and phenotypes of their children?

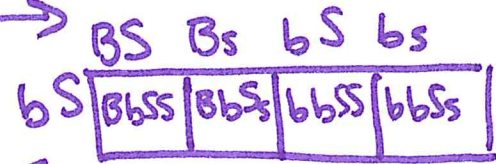
	I ^A	i
i	I ^A i	ii
i	I ^A i	ii

A = I^AI^A o = ii
genotypes: 1 I^Ai : 1 ii
phenotypes: 1 A : 1 O

9. If a corn plant has a genotype of Tt, what are the possible genetic combinations that could be present in a single grain of pollen from this plant? *Ty and ty*

10. Fur color in cats is controlled by an autosomal gene that can occur in the dominant form, (B), or the recessive form, (b). The length of the cat's fur is controlled by another autosomal gene that occurs in the dominant form, (S), or the recessive form, (s). The table below shows the traits for these allele codes.

Gene	Trait
B	Black fur
b	White fur
S	Short-haired fur
s	Long-haired fur



The following genotypes were found in a male cat and a female cat.

BbSs (male)

bbSS (female)

What will the genotype and phenotype of the offspring be?

genotype: 1 BbSS : 1 BbSs : 1 bbSS : 1 bbSs

phenotype: 1 black short : 1 white short

11. Two heterozygous black short-haired cats mate. What is the probable phenotypic ratio of their offspring? (use data table above for information)

9 black short : 3 black long : 3 white short : 1 white long

12. If a human baby boy inherits a recessive allele from his mother, in which circumstance would he most likely show the trait coded for by the recessive allele?

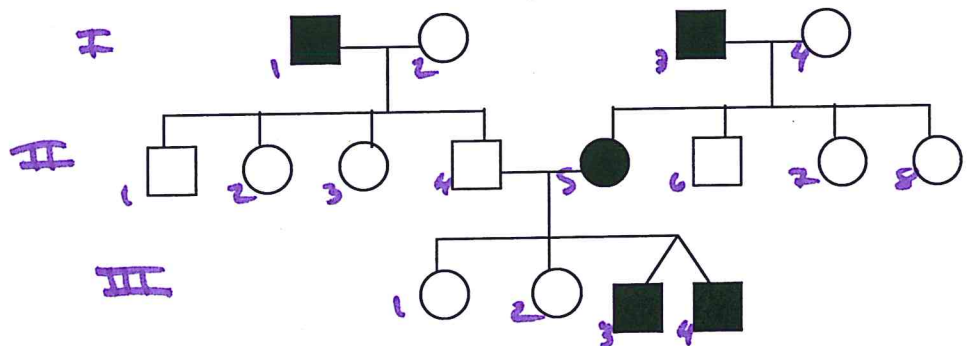
- A. The baby inherits the dominant allele from his father
- B. The allele is on an autosomal chromosome and the baby is a twin.
- C. The allele is on the X chromosome.
- D. The allele is on the Y chromosome.

← boy gets X-linked traits directly from the mother

13. Below is a pedigree tracking the phenylthiocarbamide (PTC) tasting gene. Is this gene dominant or recessive? *Dominant (in each generation)*

14. Write the genotype of each individual on the line. *(any letter is fine) I'll use "g"*

- Genotype
- I 1 *Gg*
- 2 *gg*
- 3 *Gg*
- 4 *gg*
- II 1 *gg*
- 2 *gg*
- 3 *gg*
- 4 *gg*
- 5 *Gg*
- 6 *gg*
- 7 *gg*
- 8 *gg*



- III 1 *gg*
- 2 *gg*
- 3 *Gg*
- 4 *Gg*

15. A tall pea plant sprouts up in a garden away from the rest of the pea plants. You want to know if the pea plant is heterozygous (hybrid) or homozygous dominant (purebred). Describe how you could find out.

Use a test cross! Cross the unknown with a homozygous recessive individual (short plant in this case)

16. The prevalence of carriers for Tay-Sachs disease among Ashkenazi Jews is $\frac{2}{5}$. If two Ashkenazi Jews marry and have a child, what is the chance that this child would have the recessive Tay-Sachs disease?

$$\frac{2}{5} \cdot \frac{2}{5} \cdot \frac{1}{4} = \frac{4}{100} \text{ or } \frac{1}{25}$$

	T	t	
T	TT	Tt	← Tay Sachs'
t	Tt	tt	

17. **Challenge: Draw a pedigree for the information below. Label each person's genotype and name.**
Condition of Interest: Huntington's Disease (also known as HD or Huntington's chorea)

Huntington's disease is a neurodegenerative genetic disorder that affects muscle coordination and leads to cognitive decline and dementia.

Inheritance Pattern: the allele for the normal "Huntingtin" protein is **autosomal recessive**; Huntington's disease is caused by an **autosomal dominant allele** which codes for an abnormal form of the "Huntingtin" protein. Symptoms are more severe in homozygous individuals.

Use **H** or **h** to represent the alleles.

A normal man (Joseph) marries a woman (Rebecca) who is heterozygous for HD and they have four children. Two of their sons (Adam and Charles) are born healthy without HD. Charles marries a woman without HD and they have a normal daughter. Joseph and Rebecca's daughter Tasha and their last son (James) both have HD. James marries a non-HD woman whose sister and parents also do not suffer from HD. James and his wife have three children - a normal boy, a normal girl, and a son with HD.

