EXCEPTIONS TO MENDEL'S LAWS

All genes are not determined by only two alleles- one dominant and one recessive. There are some exceptions to Mendel's Laws.

Today 3/23

- Turn in practice problems
- Get ready for a quiz to check your understanding of these punnett squares!

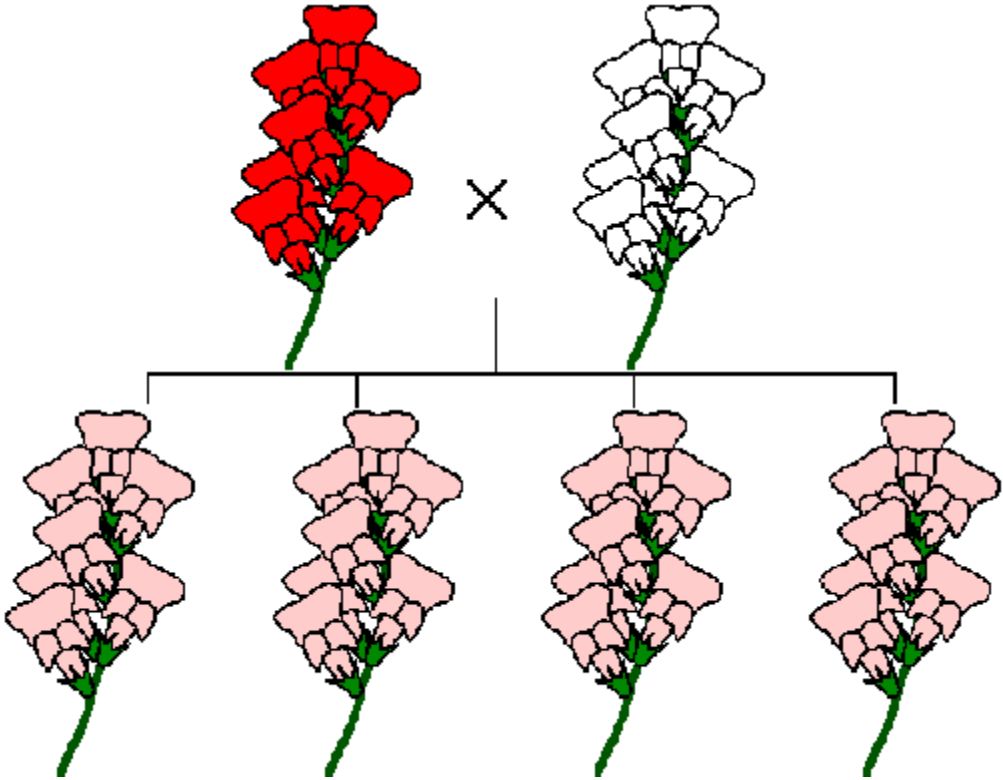

Benjamin
Cummings

Think of it like mixing paint…

=

1. INCOMPLETE DOMINANCE

- Neither allele is completely dominant
- Both alleles combine equally to give a new trait.
- Called hybrids

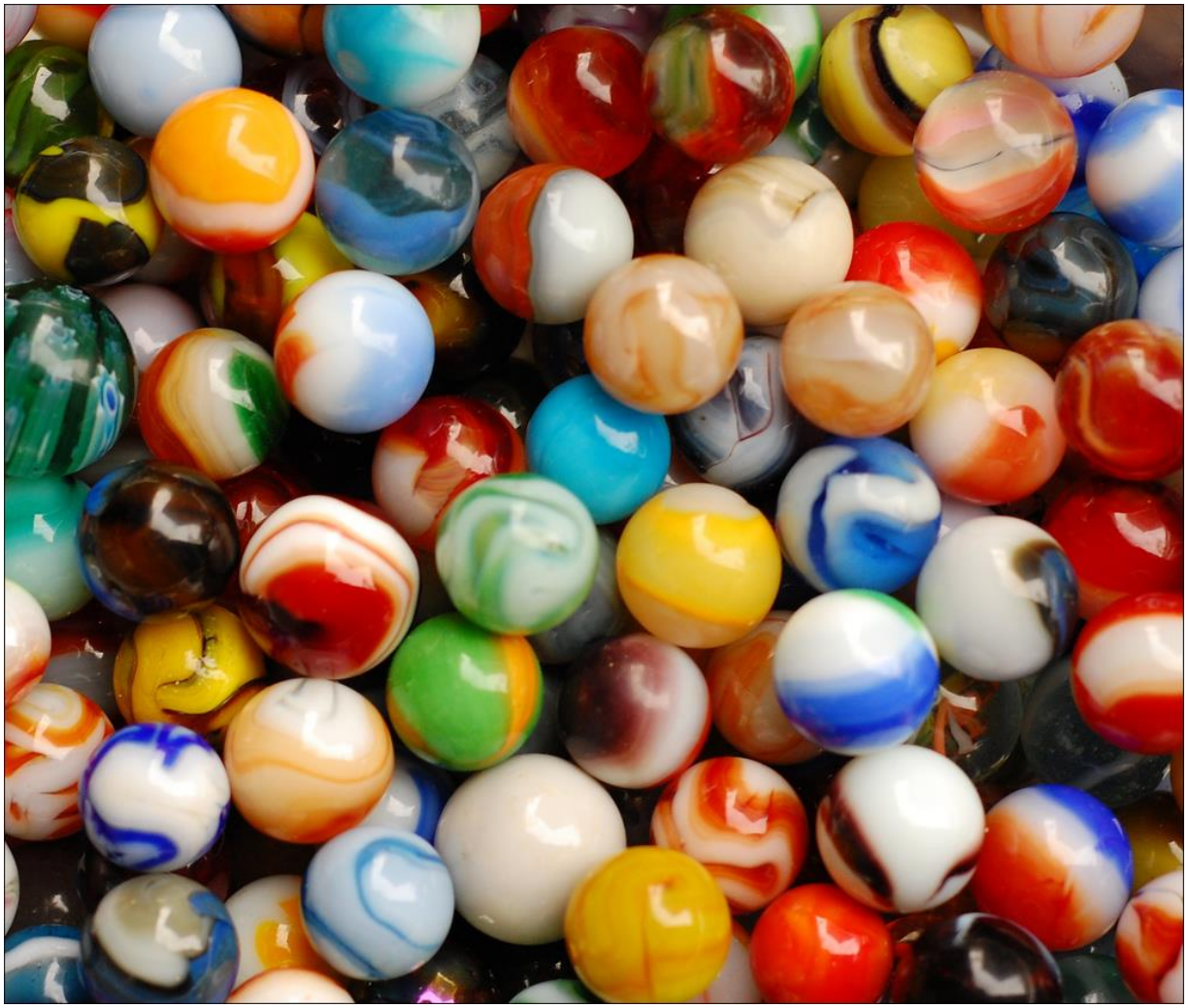


PRACTICE TIME

In the box in your notes:

Cross a Red flower (RR) with a white flower (R’R’)

The traits don’t mix any better than a bunch of marbles…



2. CODOMINANCE

- Both alleles are expressed
- Always use the dominant form of each allele

Red cow (RR)

White cow (WW)

RR	R	R
W	RW	RW
W	RW	RW

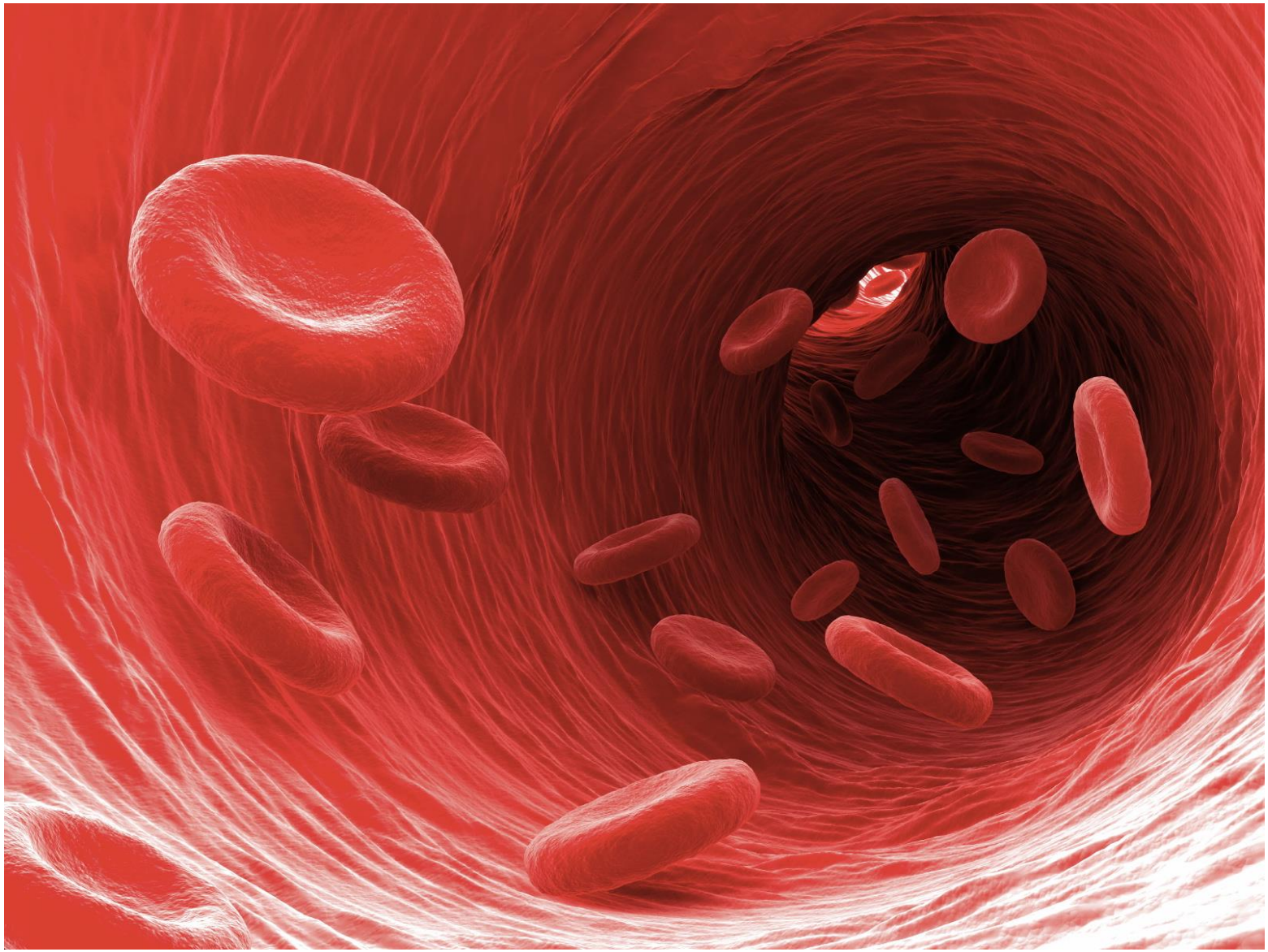
WW

Roan cow (RW)

PRACTICE TIME

In the box in your notes:

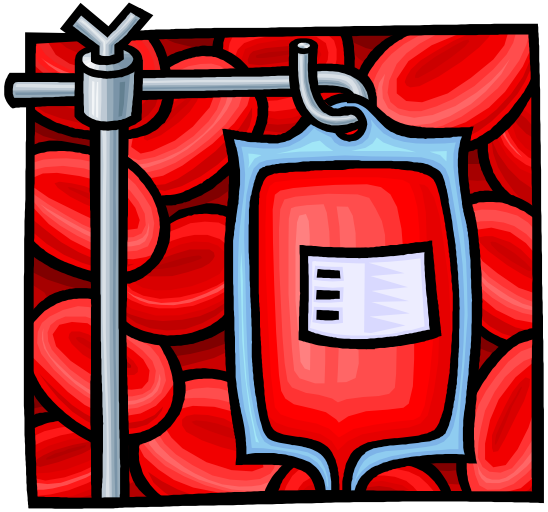
Cross a black chicken (BB) with a black and white chicken (BW)



3. MULTIPLE ALLELES:

more than two alleles control a phenotype

- Ex: blood type



	O	O
A	AO	AO
O	OO	OO

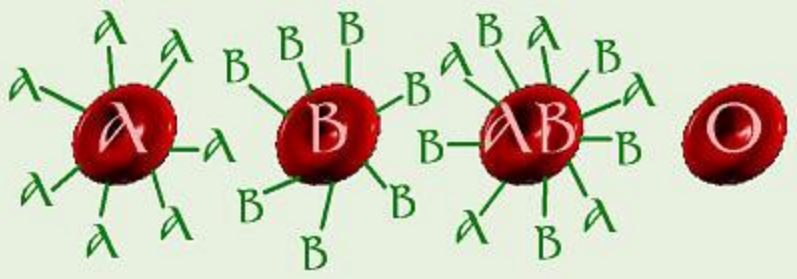
Genotypes:
AO- 2/4 or 50%
OO- 2/4 or 50%

Phenotypes:
Type A- 2/4 or 50%
Type O- 2/4 or 50%

Blood type inheritance

- Blood type = presence or absence of proteins on red blood cells
- Usually have to do more than one punnett square to determine possibilities for kids.

Phenotypes Blood types	Genotypes Alleles for blood type
A	AA or AO
B	BB or BO
AB	Only AB
O	Only OO



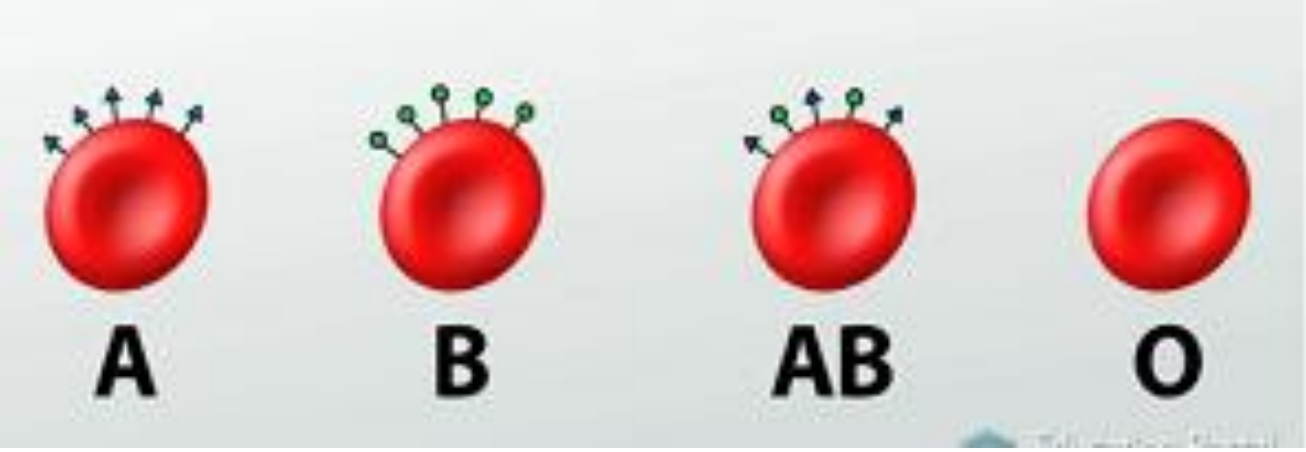
PRACTICE TIME

In the box in your notes:

Cross a parent with type AB blood with a parent with type A blood (2 punnetts)

Blood Type	Genotype		Can Receive Blood From:
A	$i^A i$ $i^A i^A$	AA AO	A or O
B	$i^B i$ $i^B i^B$	BB BO	B or O
AB	$i^A i^B$	AB	A, B, AB, O
O	$i\ i$	OO	O

	Caucasians	African-American	Hispanic	Asian
O +	37%	47%	53%	39%
O -	8%	4%	4%	1%
A +	33%	24%	29%	27%
A -	7%	2%	2%	0.5%
B +	9%	18%	9%	25%
B -	2%	1%	1%	0.4%
AB +	3%	4%	2%	7%
AB -	1%	0.3%	0.2%	0.1%



Another example… Labrador Retrievers!

- Labrador Retriever coat color
  - Determined by 1 gene with 4 alleles.
  - Even if more than 2 alleles exist in a population, any given individual can only have 2 of them
    - (1 from mother, 1 from father)

Lab Coat is controlled by MULTIPLE ALLELES (B, b, E, and e)

- Black is dominant to chocolate
  - B: black
  - b: chocolate
- Yellow is recessive **epistatic** (when present, it blocks the expression of the black and chocolate alleles)
  - Yellow: E or e
  - * must be ee to produce a yellow lab

BLACK

CHOCOLATE

YELLOW

BBEE
BbEE
BBEe
BbEe

bbEE
bbEe

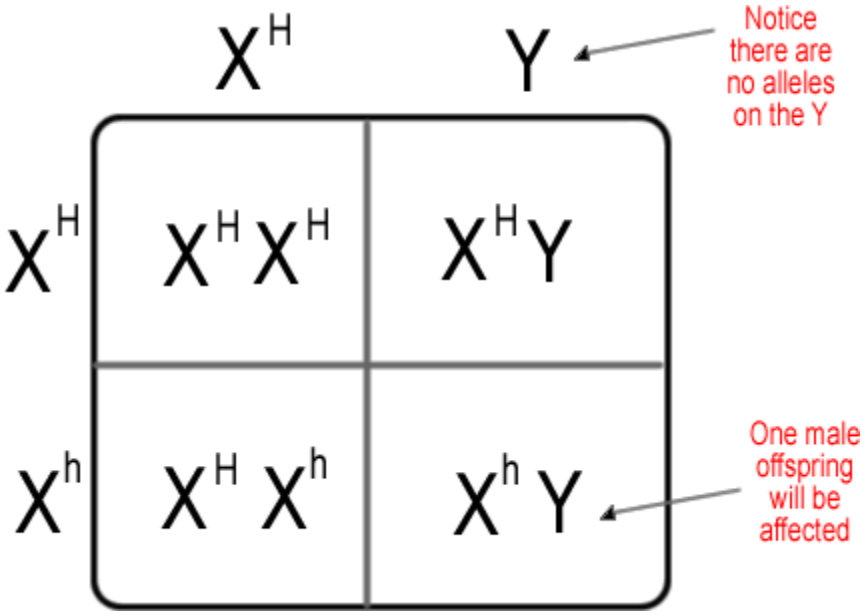
BBee
Bbee
bbee

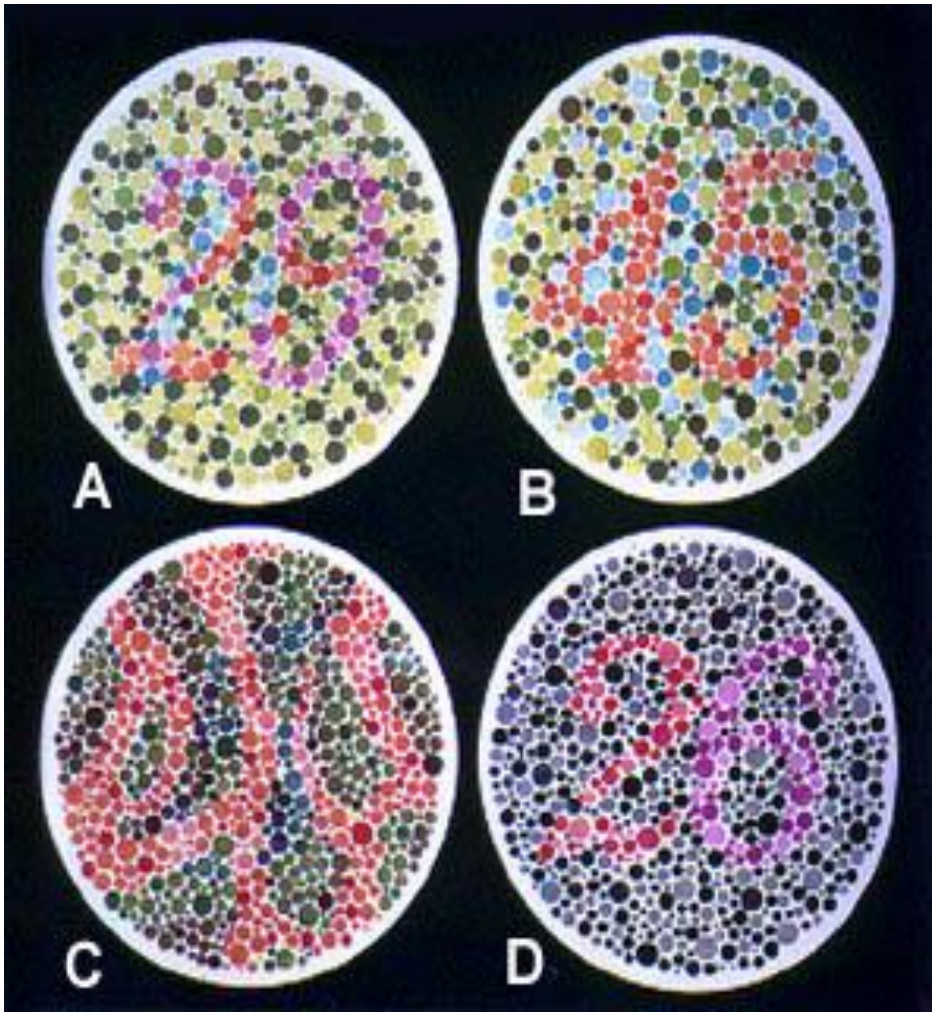
Possible Genotypes

4. SEX-LINKED TRAITS:

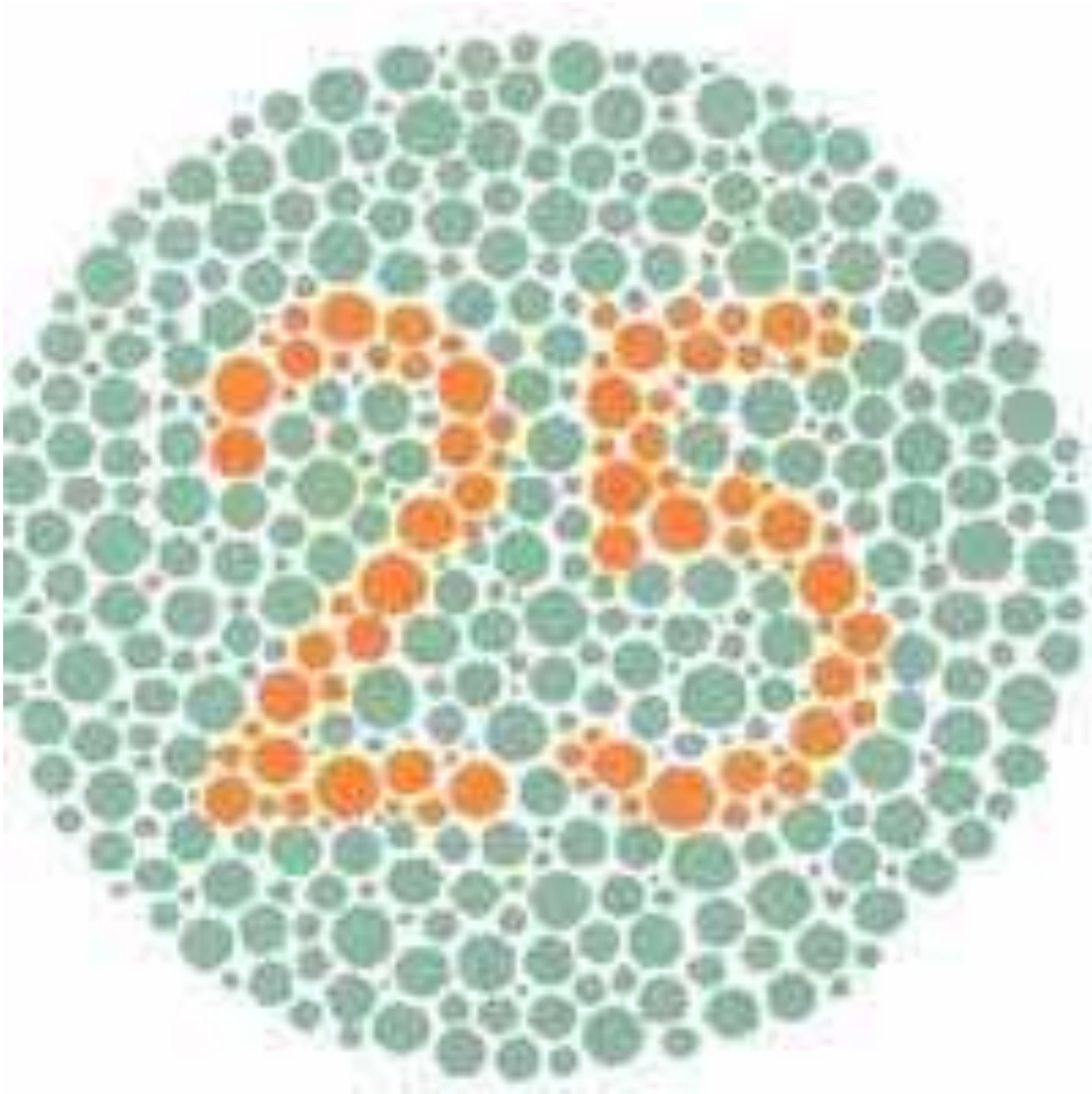
controlled by genes located on sex chromosomes

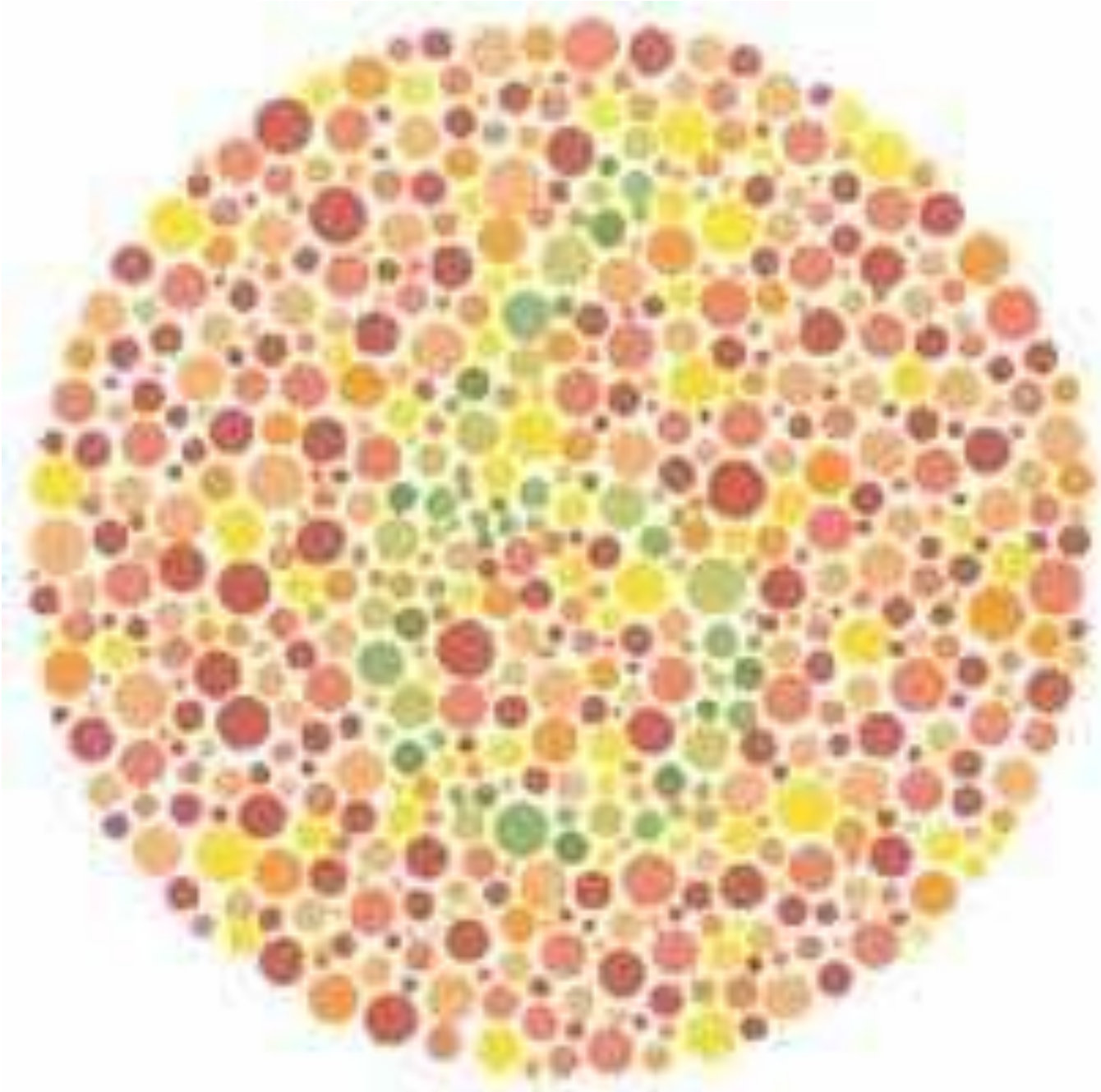
- Usually carried on X chromosome
- Since females are XX, they are usually carriers of the trait
- Since males are XY, they have one big & one small, stumpy chromosome.
  - The small chromosome (y) does not carry an allele so whatever allele is on the X (donated by mom) is what the boy will have.
  - He is either completely dominant or completely recessive
  - Boys cannot be a carriers of a sex linked trait.

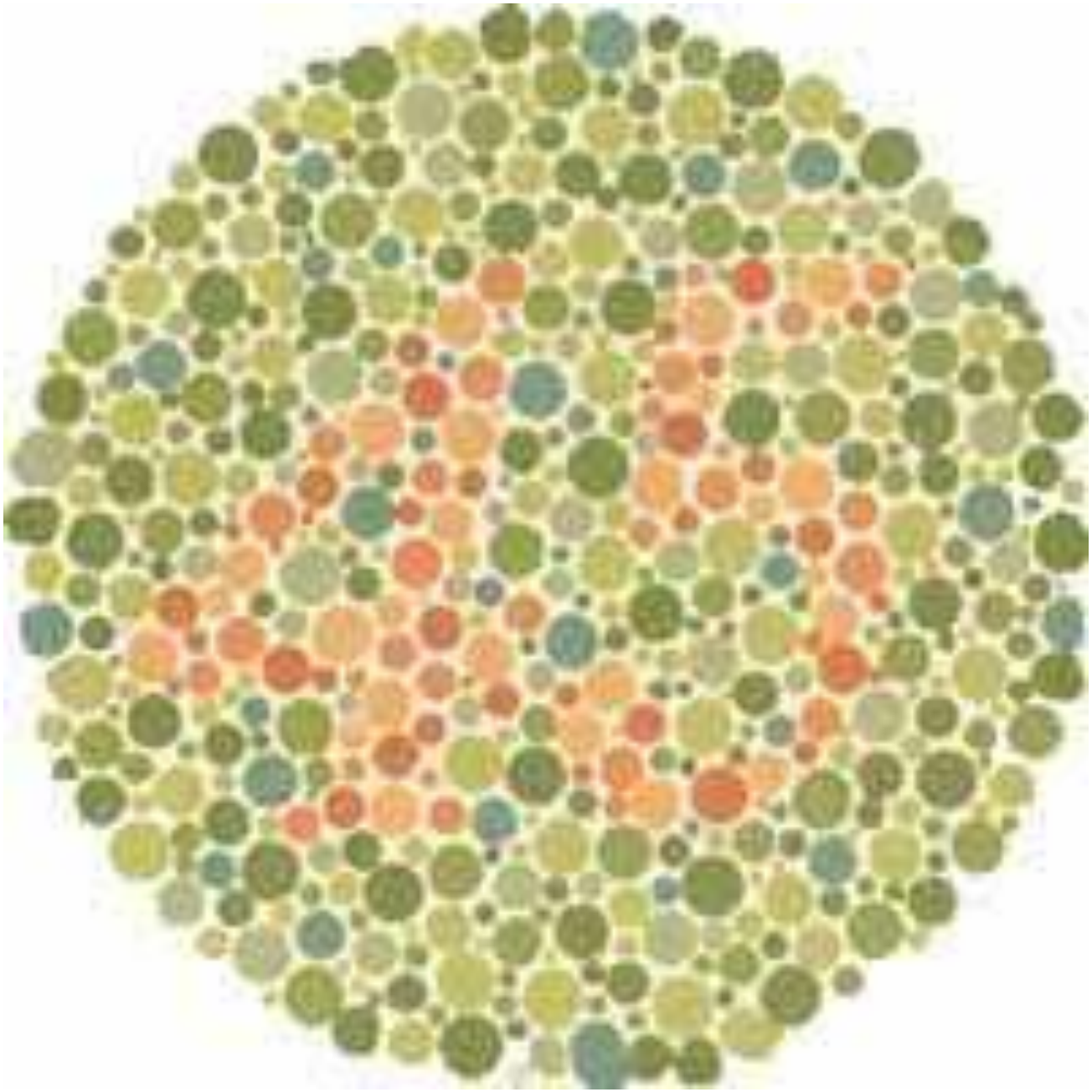




- Males can pass it to all of their daughters, none to sons
- Females have 50/50 chance of passing it to all of their children
- Ex:
  - Hemophilia- can't clot blood
  - Colorblindness- can't see certain colors.



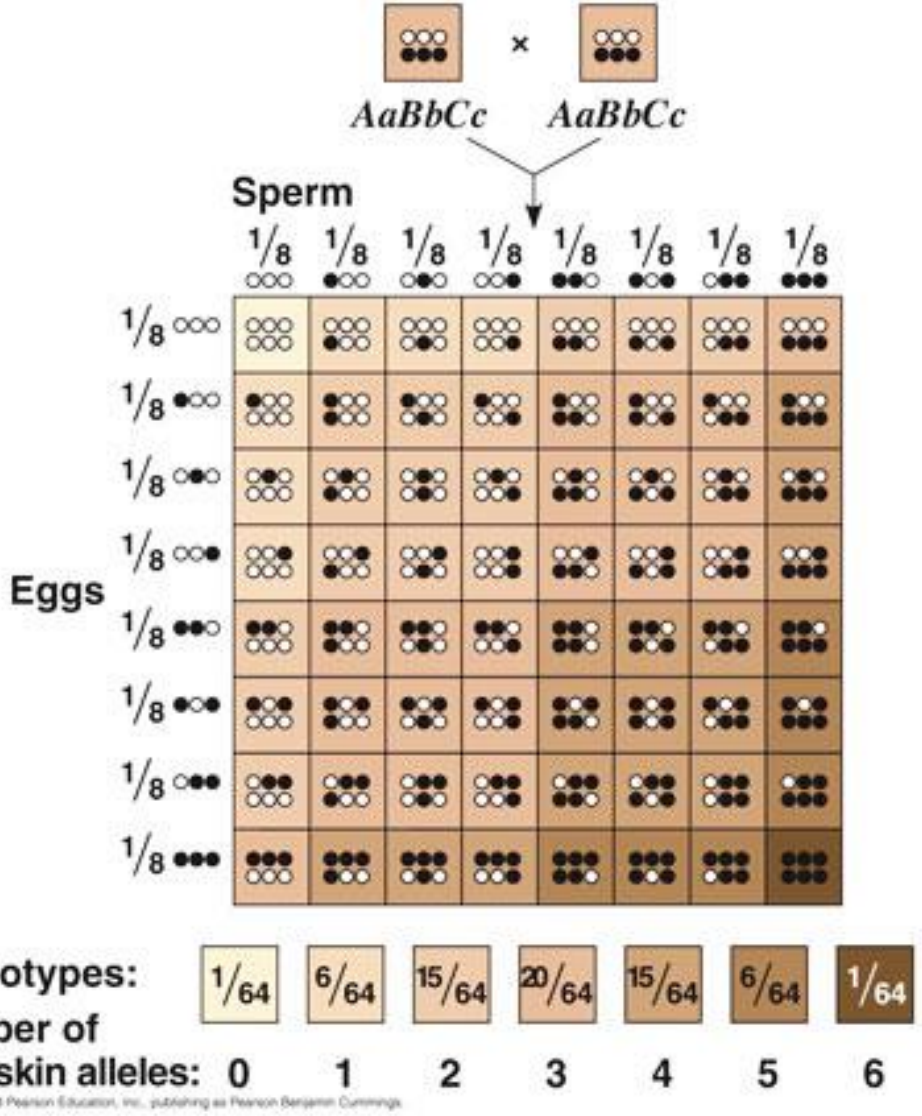




Heterochromia- uneven distribution of pigment resulting from disease or injury

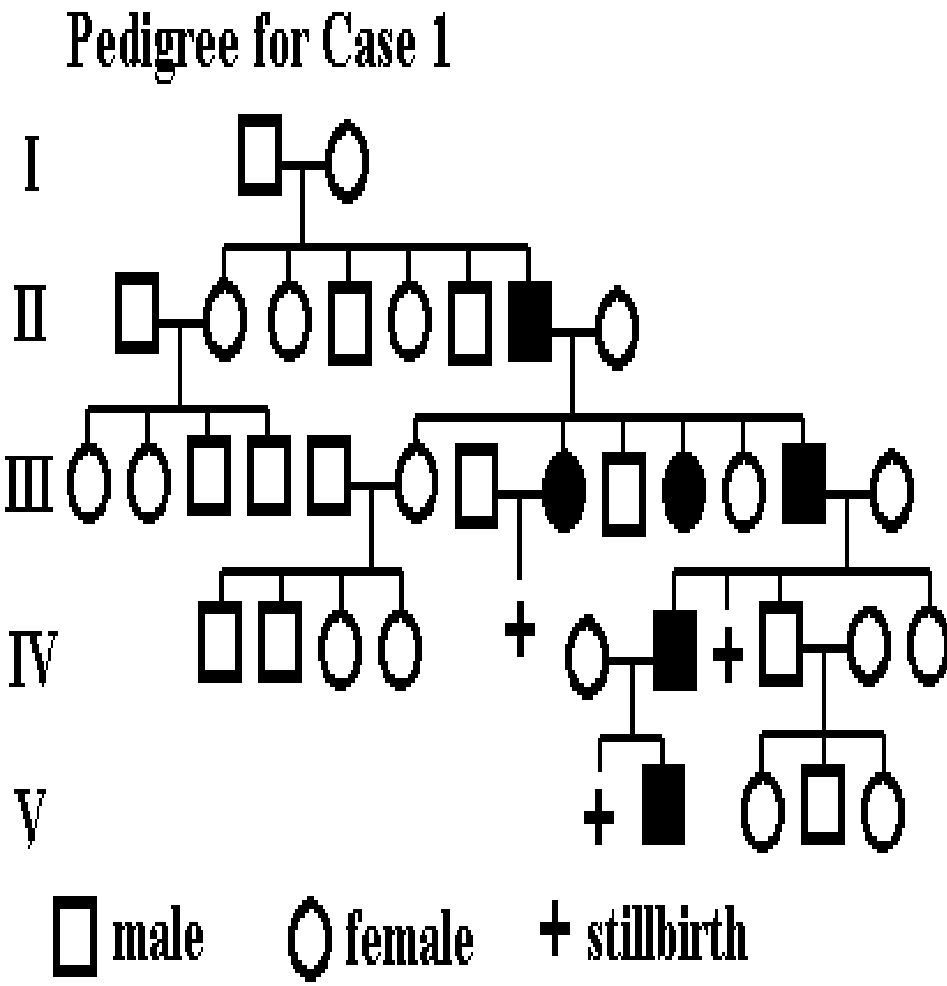
5. **Polygenic inheritance**-2 or more genes affect the phenotype.

- Ex: height, weight, skin color, eye color



What is a pedigree?

- Pedigrees: graphic representation of family tree
- May be used if testcross cannot be made
- Pedigree key:
  - ■ = male
  - ● = female
  - ■—● = marriage
  - Children = connected to marriage by vertical life
  - ● ■ = recessive male/female (bb)
  - ◫ = heterozygous ½ shaded, ½ unshaded



Make a little one using this fam…