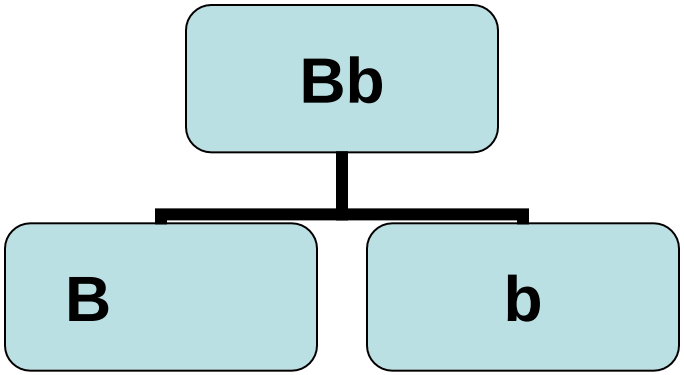
Exploring Mendelian Genetics

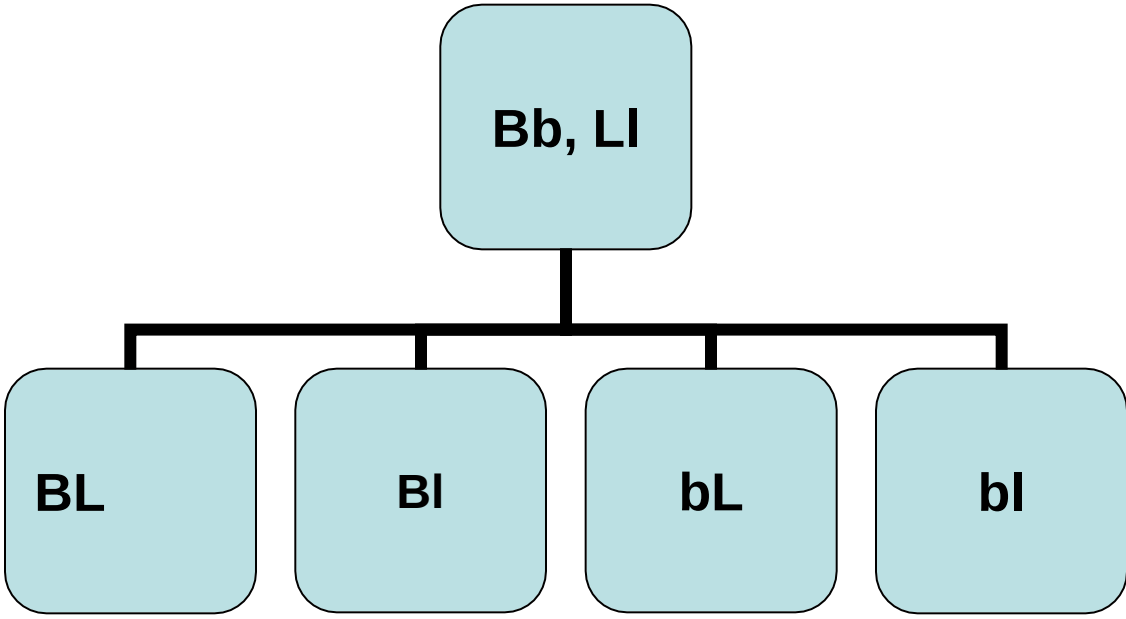
11.3

Allele Assortment

- Segregation – when gametes are formed, alleles separate themselves.



- Independent Assortment – genes on separate chromosomes segregate independently and don't influence each other's inheritance.



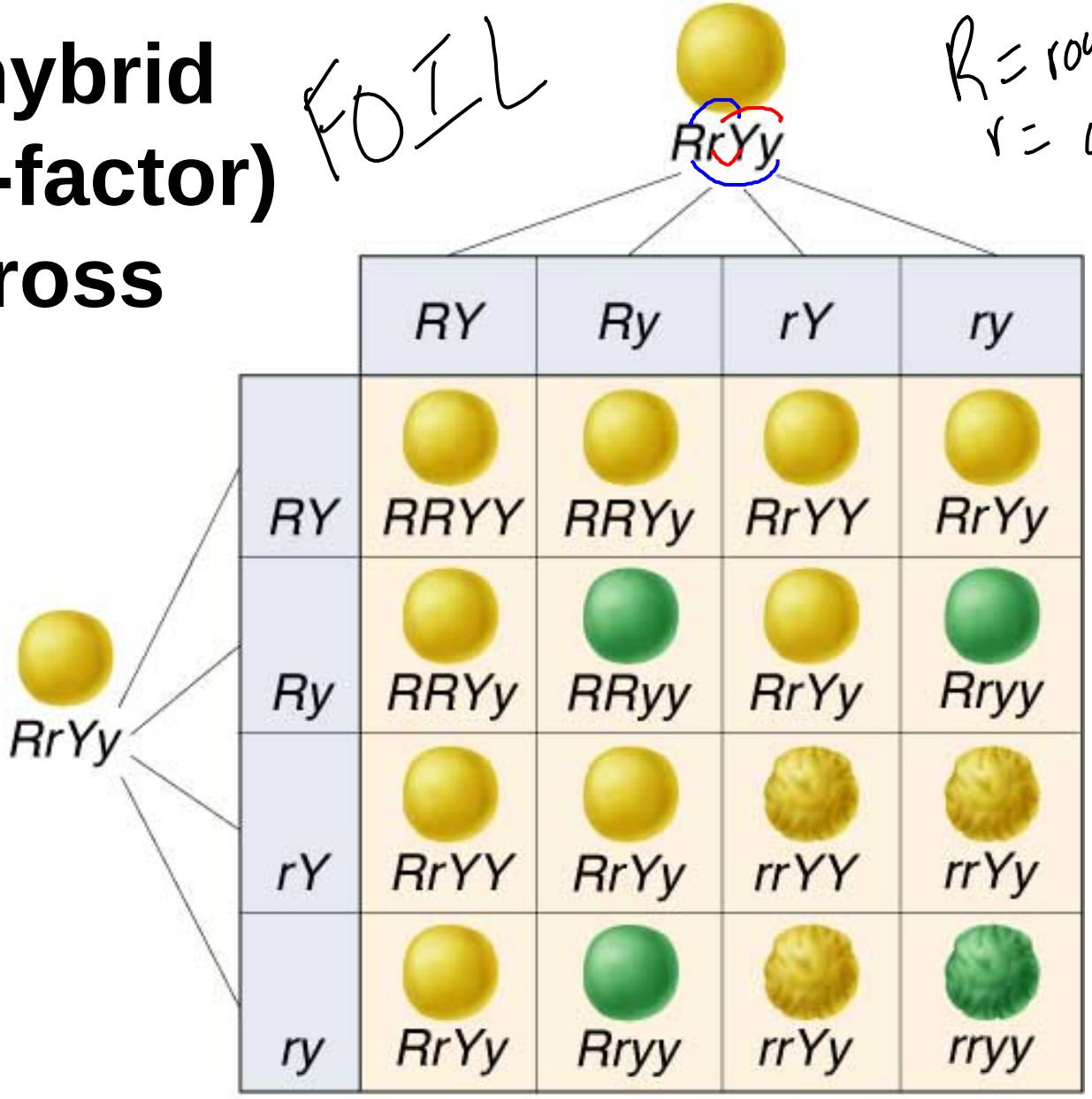
Dihybrid (two-factor) Cross

FOIL

R = round
r = wrinkled
Y = yellow
y = green

Phenotype:

9:3:3:1



R = round, r = wrinkled

Y = yellow, y = green

R = round
r = wrinkled

FOIL

rrYy

Y = yellow
y = green

Rryy

	rY	ry	rY	ry
Ry	RrYy 	Rryy 	RrYy 	Rryy 
Ry				
ry				
ry				

In lizards green skin (G) is dominant over blue skin (g). Bulging eyes (e) is recessive to normal eyes (E)

Cross a homozygous recessive lizard with a lizard that is homozygous recessive for skin color and homozygous dominant for eyes. What are the phenotypes? What are the genotypes?

ggee x ggEE

G: green g: blue
E: normal e: bulging

In hamsters, short hair (S) is dominant to long hair (s), and pink noses (P) are dominant to black noses (p).

Cross a heterozygous hamster with a homozygous recessive hamster. What are the phenotypic ratios?

SsPp x sspp

S = Short hair

s = long

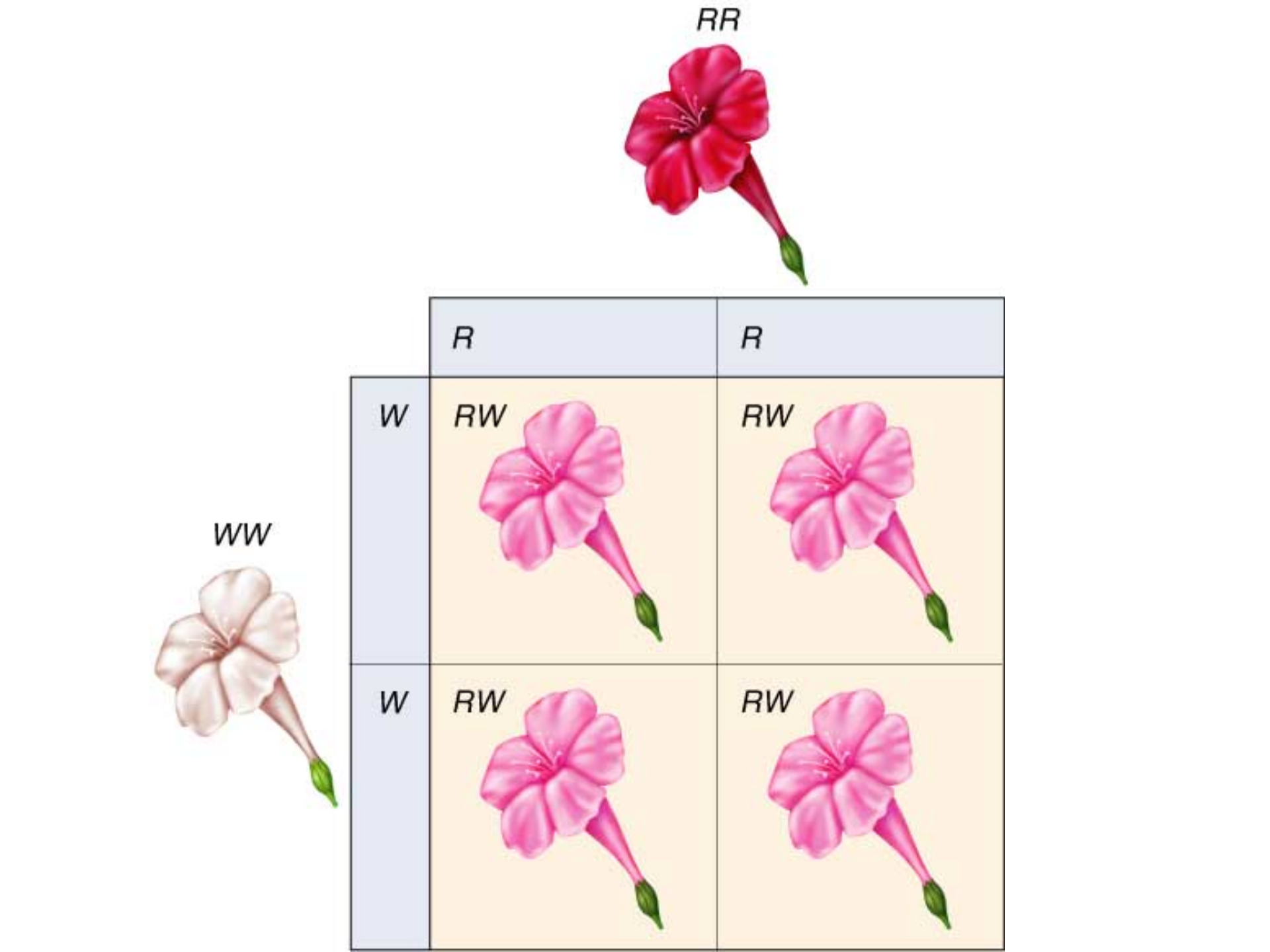
P = pink nose

p = black nose

SsPp x SsPp

Incomplete Dominance

- When one allele is not completely dominant over another allele
- Heterozygous: phenotype is a blend between two alleles
- Flower color: R – red, W – White
  - RR – red
  - WW – white
  - RW -- pink


RR
R
R
WW
W
RW
RW
W
RW
RW

Incomplete Dominance

- Pink flower X red flower
- Complete the punnett square
  - How many offspring are red? White? Pink?

Codominance

- Neither allele is dominant
- Both alleles are present in phenotype
- Cattle hair color: R – red, W – white,
  - RR – red
  - WW – white
  - RW – red and white hairs (roan)

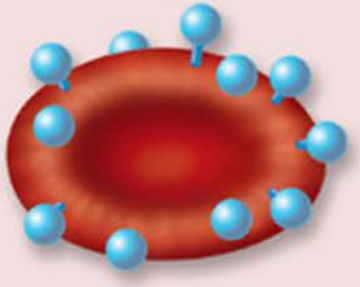
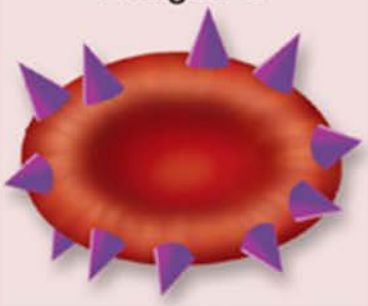
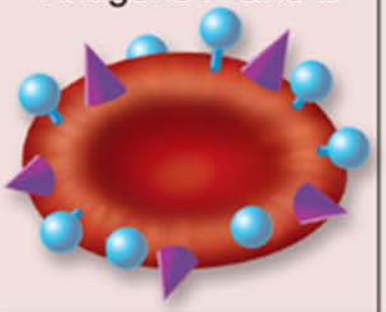
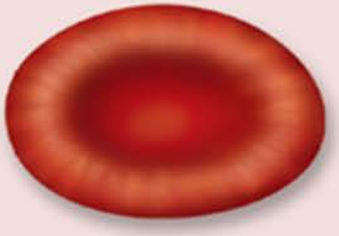
Codominance

- Roan cow X white cow
- Complete the punnett square
  - How many offspring are red? White? roan?

Multiple Alleles

- When there are more than two alleles for a gene
- Each person still only has two alleles
- Blood Type: A, B, AB, O
  - A and B are codominant
  - O is recessive
  - AA, AO = type A
  - BB, BO = type B
  - AB = type AB
  - OO = type O

ABO Blood Types

	Antigen A	Antigen B	Antigens A and B	Neither antigen A nor B
Erythrocytes				
Plasma	Anti-B antibodies 	Anti-A antibodies 	Neither anti-A nor anti-B antibodies	Both anti-A and anti-B antibodies 
Blood type	**Type A** Erythrocytes with type A surface antigens and plasma with anti-B antibodies	**Type B** Erythrocytes with type B surface antigens and plasma with anti-A antibodies	**Type AB** Erythrocytes with both type A and type B surface antigens, and plasma with neither anti-A nor anti-B antibodies	**Type O** Erythrocytes with neither type A nor type B surface antigens, but plasma with both anti-A and anti-B antibodies

(a)

Multiple Alleles

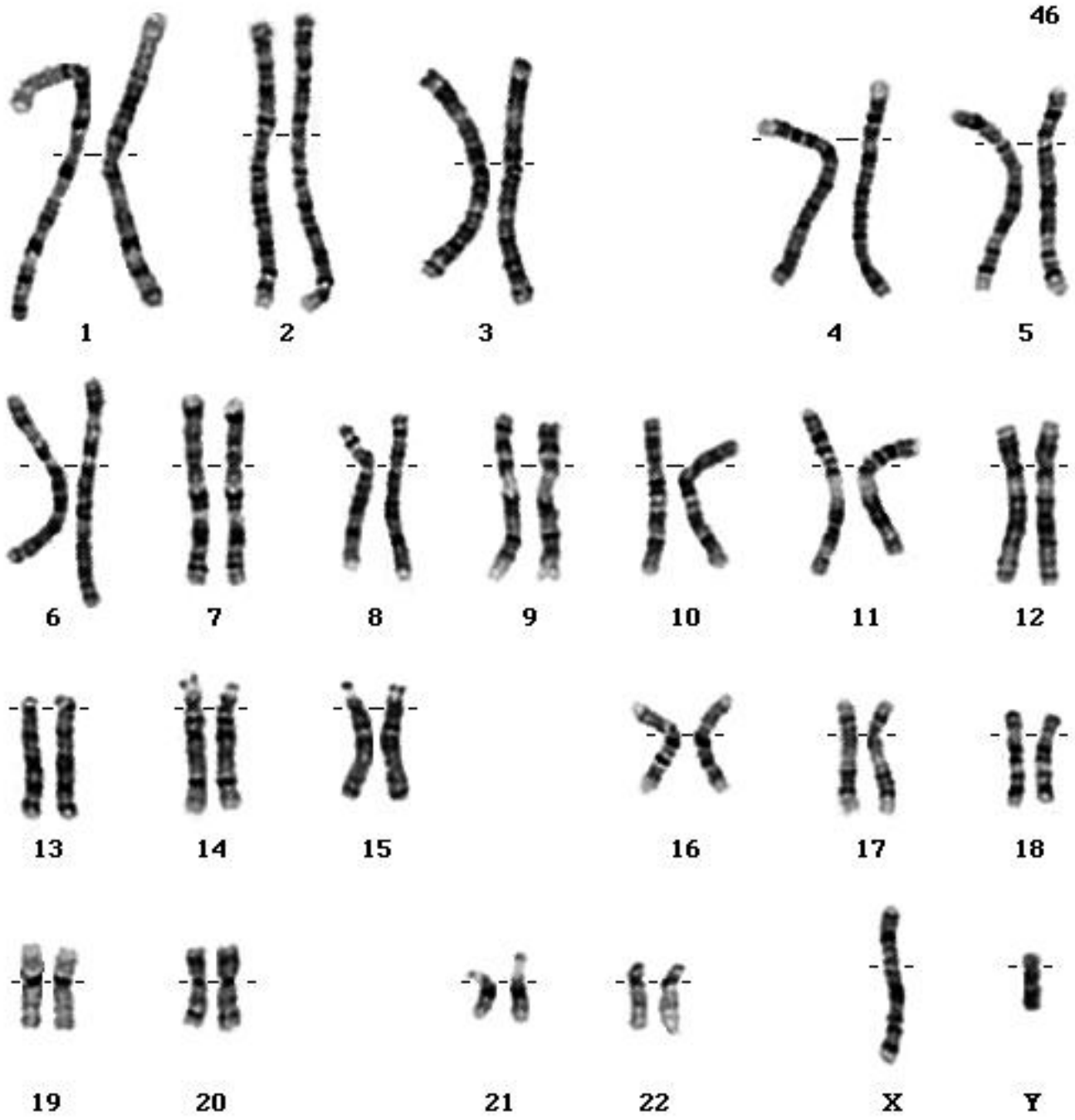
- Type AB X Type O
  - Complete the punnett square, what is the phenotype of the offspring
- Type A X Type B
  - Is it possible for this cross to produce offspring with type O blood? Show how

Polygenic Traits

- Many traits are controlled by more than one gene.
- Hair color, skin color, eye color, body type, height

https://youtu.be/JIUK2KSbvvI

https://youtu.be/-e5ODsf_TEk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15
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17
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19
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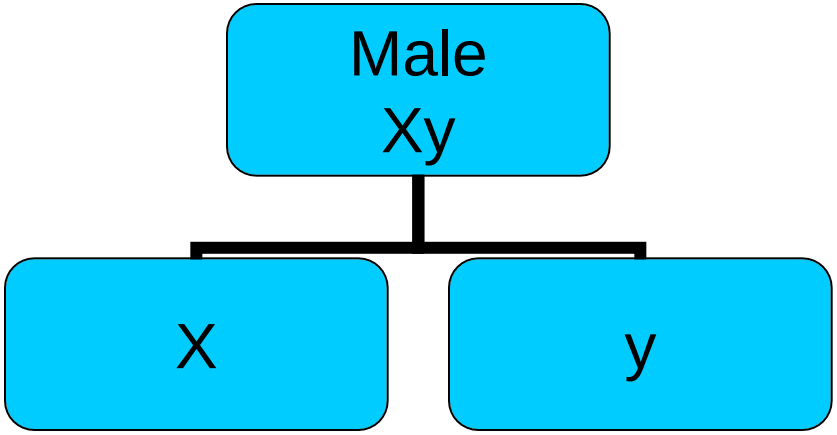
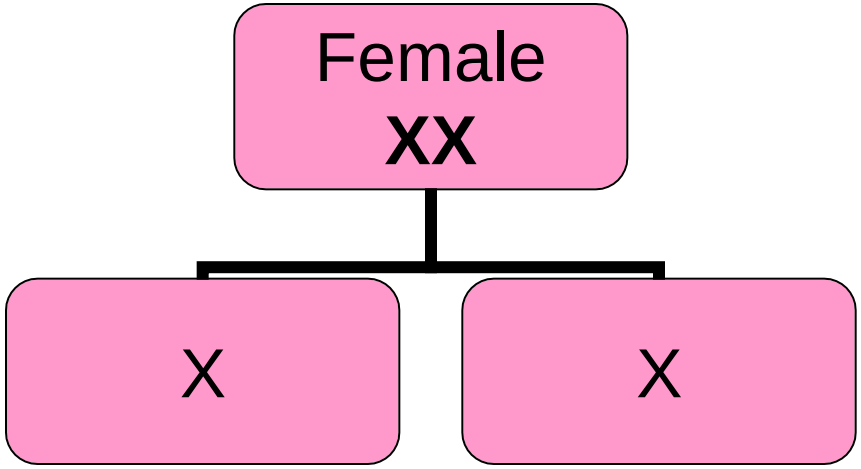
21
22
X
Y

Determining Sex of the Offspring

Sperm + Egg (ovum) = zygote



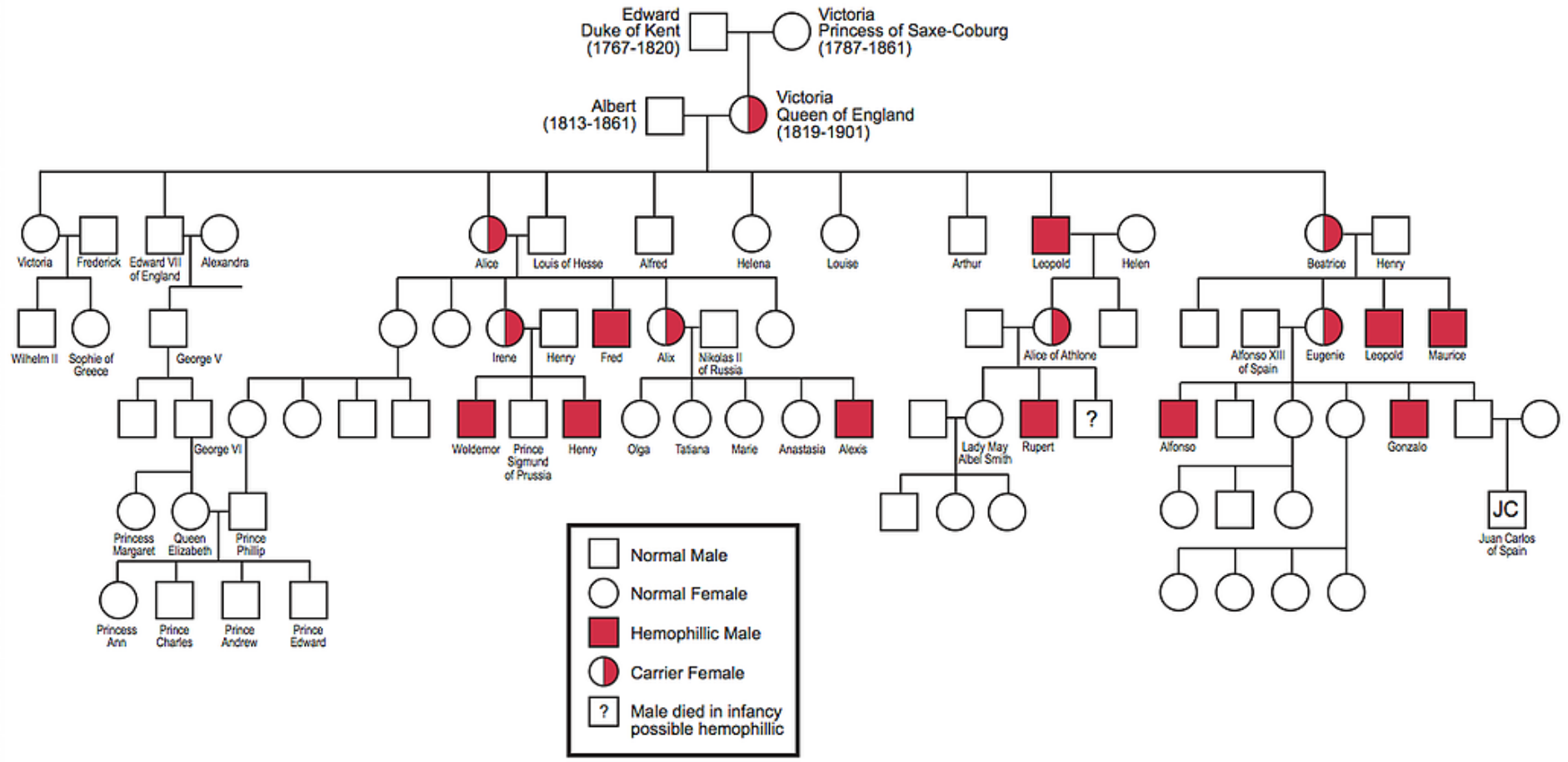


	X	X
X		
y		

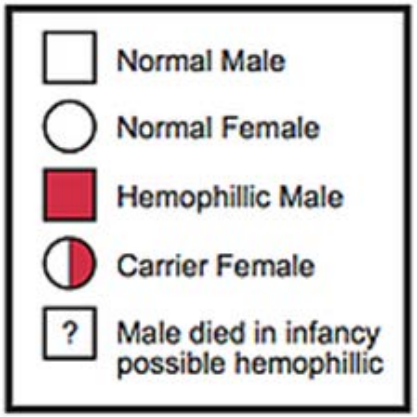
X Linked Diseases

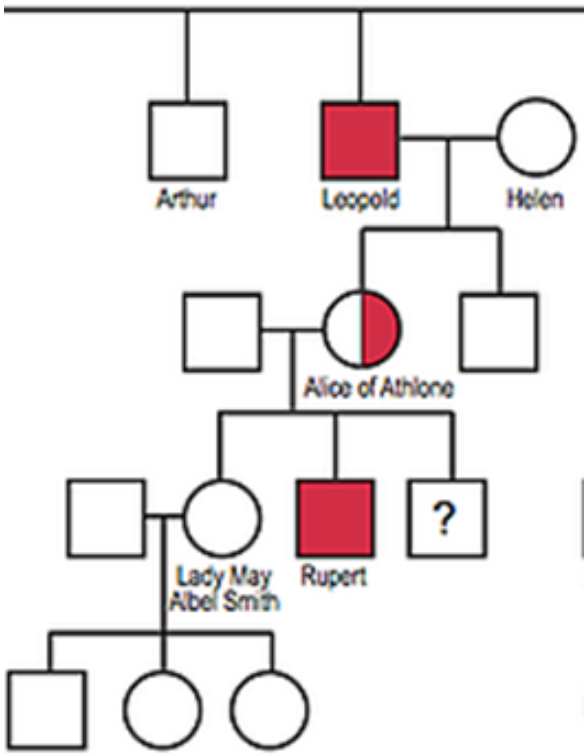
- Genes for baldness, colorblindness, hemophilia and muscular dystrophy are only located on the X chromosome
- These diseases are caused by a recessive allele
- Woman can have one recessive allele and one dominant allele = carrier of disease
- To have the disease, woman needs two recessive alleles, man only needs one

Hemophilia in the royal family



1. If a mother is a carrier, but the father does not have hemophilia, what is the probability of their daughters being carriers? Having hemophilia? What about their sons?
2. What if the mother is normal, but the father has hemophilia?





colorblindness

- Think about family members, are any colorblind? What are your chances of inheriting the colorblind allele?
- http://enchroma.com/test/instructions/

- Blood Type: A, B, AB, O
  - A and B are codominant
  - O is recessive
  - AA, AO = type A
  - BB, BO = type B
  - AB = type AB
  - OO = type O
- Type AB X Type O
  - Is it possible for this cross to produce offspring with type O blood? Show how

Incomplete Dominance

In roses, red (R) is incompletely dominant with yellow (Y). Heterozygous roses (RY) are orange.

Cross a red rose with an orange rose. What is the genotypic ratio? What is the phenotypic ratio?