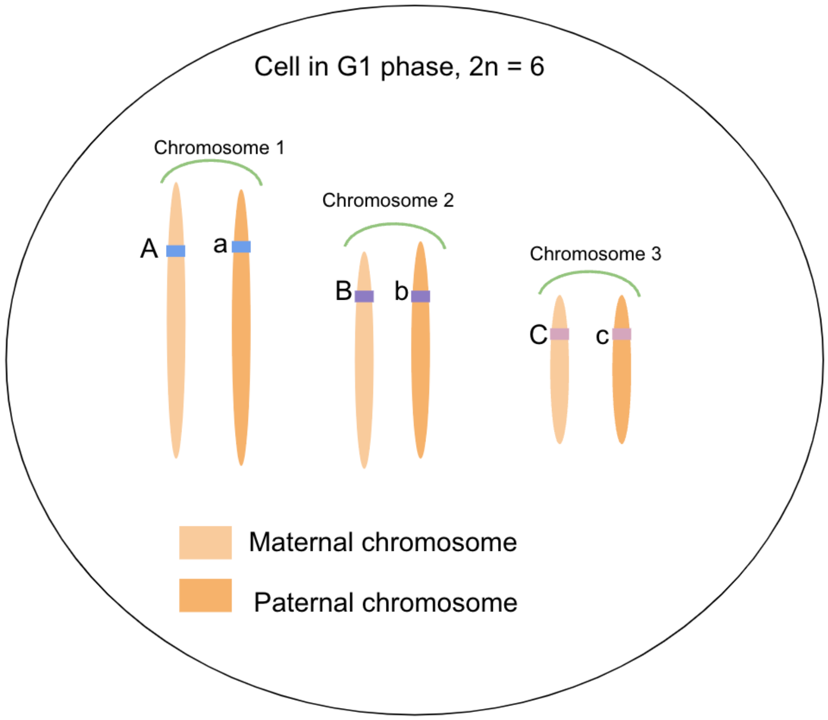
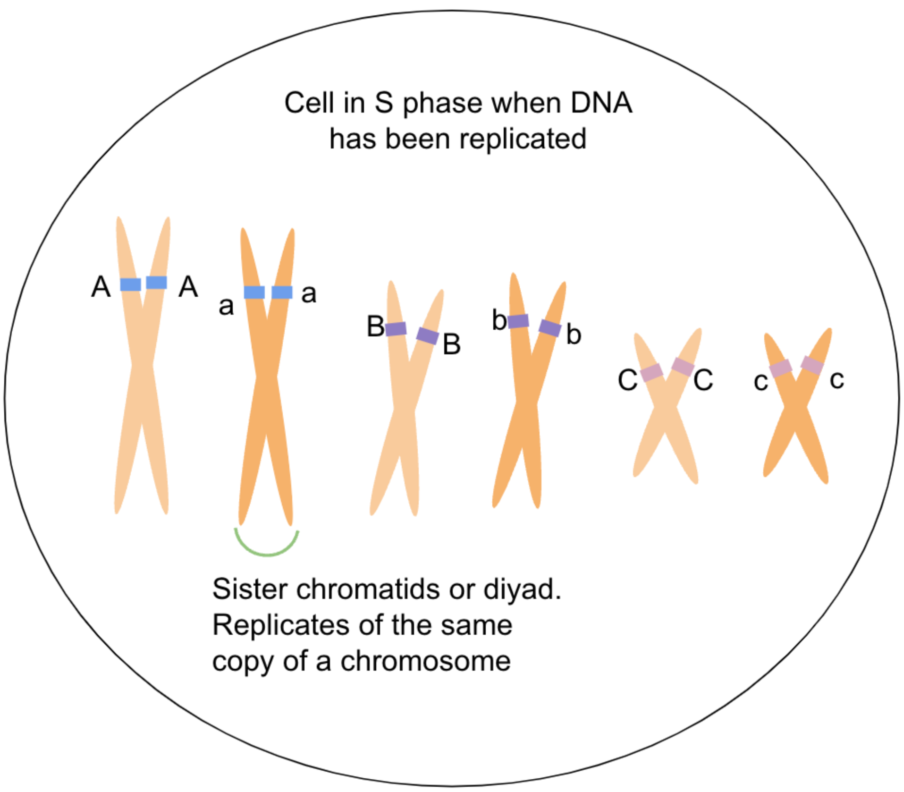
1. An organism is 2n = 6.

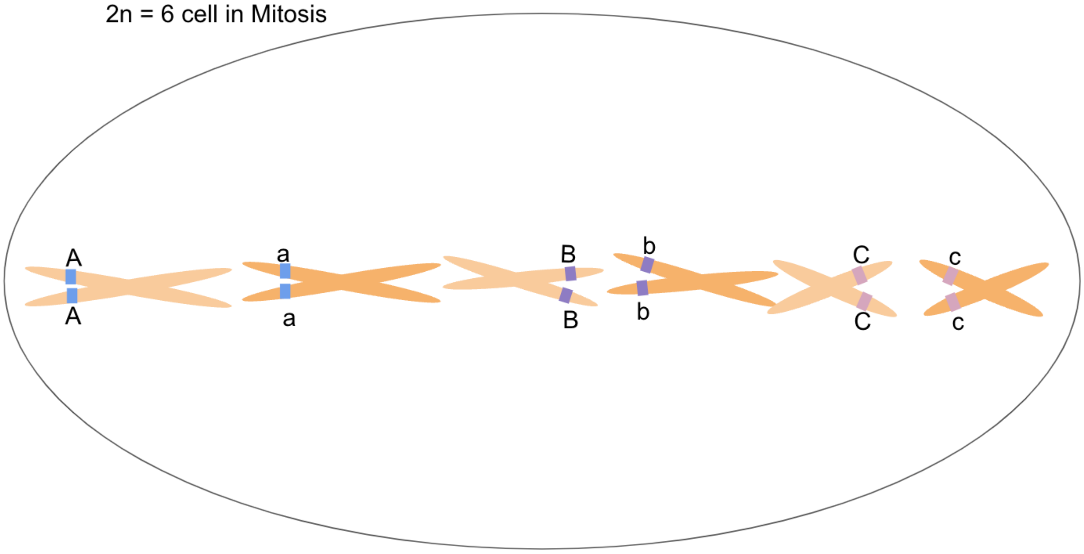


Letters are alleles at the lines which are genes. At each gene, there is a different allele between the maternal and paternally inherited chromosome



a. Draw a cell of this organism (2n = 6) in mitosis

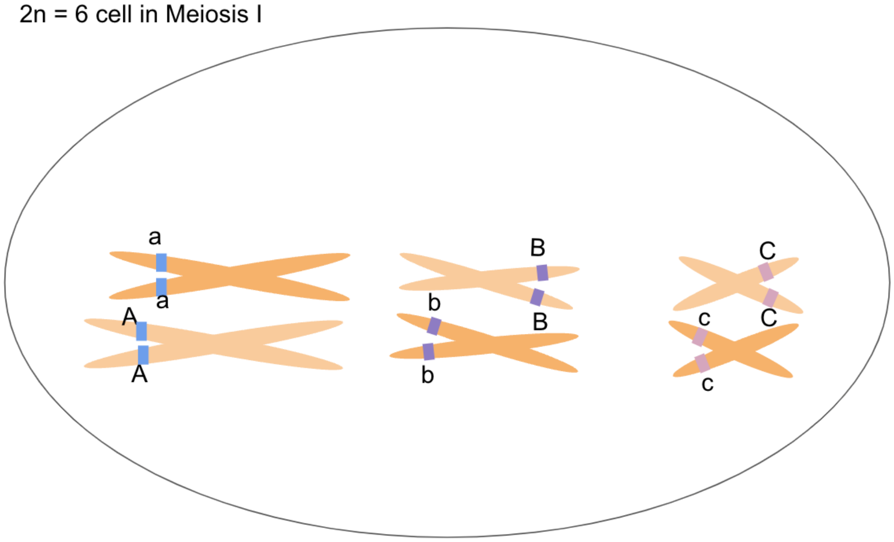
2n = 6 cell in Mitosis



Each dyad is lined up on the equator of the cell, 1 sister chromatid from each dyad will go to the daughter cell, making two copies of the original cell before replication.

b. Draw a cell of this organism (2n = 6) in meiosis I

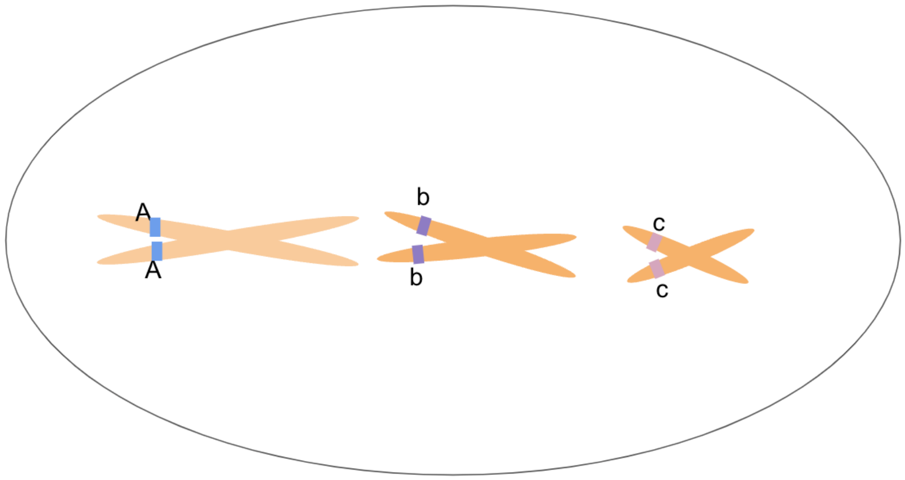
2n = 6 cell in Meiosis I



Each pair of dyads are lined up on the equator of the cell. The sister chromatids of chromosome 1 pair with each other and etc. The daughter cells from this split will have have 1 set of sister chromatids per from only 1 parent per chromosome. How they line up is random, so it is not always that the maternal ones go together

c. Draw a cell of this organism (2n = 6) in meiosis II

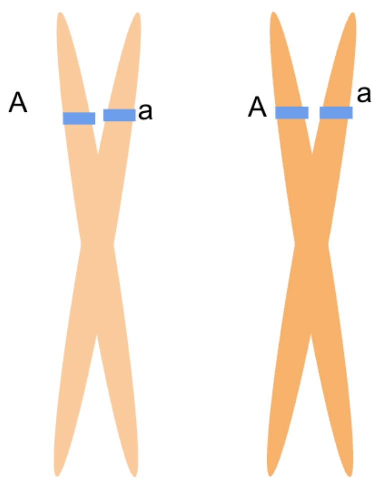
2n = 6 cell in Meiosis II



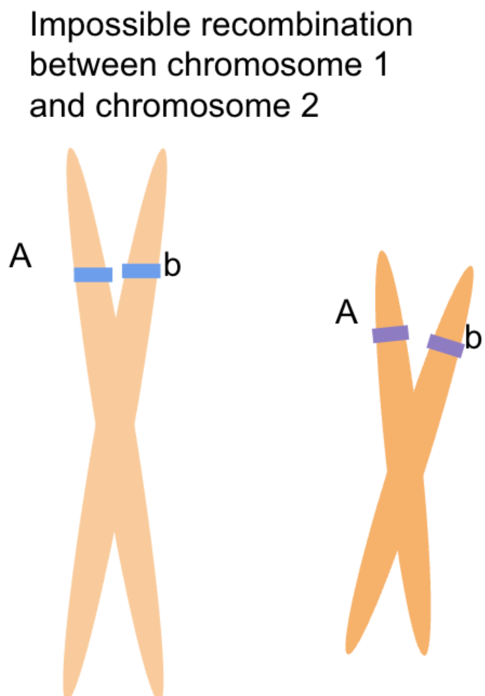
Only 1 dyad from each chromosome is present and lined up on the equator. When daughter cells are formed, only one copy of each chromosome will be present in each cell. The daughter cells after meiosis II are haploid, so n = 3

d. Draw what recombination could look like on chromosome 1 between the A|a alleles

Recombination between the maternal and paternal chromosome 1s

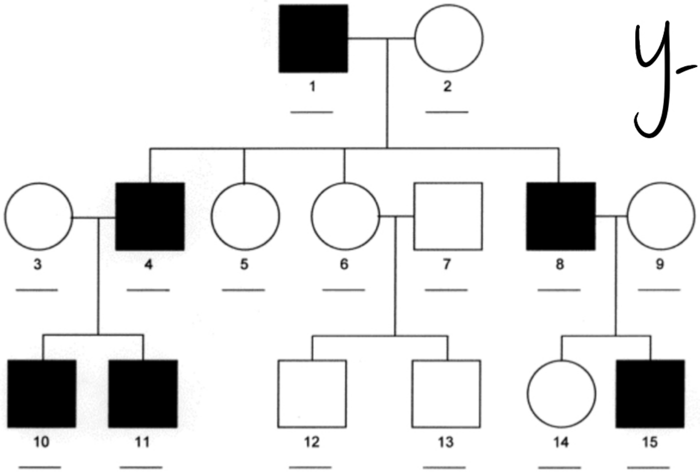


e. Draw an example of impossible recombination



2.

a. What type of inheritance is this trait (shaded boxes show presentation of the trait)?



y-linked

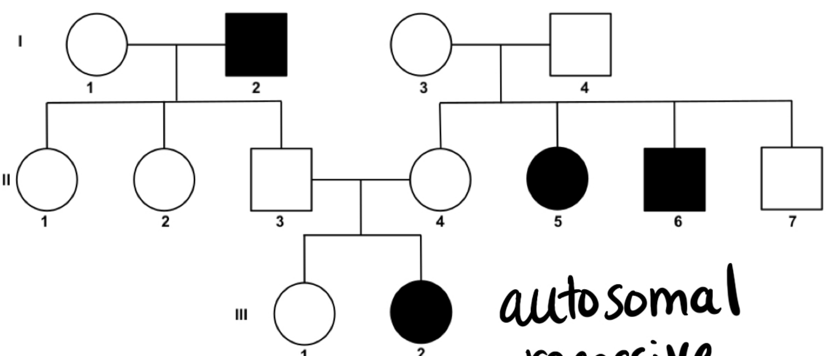
b. What is the probability that an offspring from 15 and 6 presents with the trait?

if the offspring is xy → 100%

if the offspring is XX → 0%

3.

a. What type of inheritance is this trait (shaded boxes show presentation of the trait)?



autosomal recessive

b. What is the probability that an offspring of II.1 and II.6 will present with the trait?

We Know II.6 is aa.
What is the probability that II.1 is Aa? We assume I.1 is not a carrier. And I.2 has to be aa. So II.1 results from AA x aa.

	A	A
a	Aa	Aa
a	Aa	Aa

→ 100% Aa for II.1 or 1/1

cross of II.6 x II.1

	A	a
a	Aa	aa
a	Aa	aa

→ 1/2 aa

$1/1 \times 1/2 = 1/2$
probability 1/2 aa

c. What is the probability that an offspring of III. 1 and II. 6 will present with the trait?

We Know II.6 is aa.
We Know III.1's parents have to both be Aa.
What is the probability that III.1 is Aa?

	A	a
A	AA	Aa
a	Aa	aa

Aa because we Know III.1 is <u>not</u> aa, it is 2/3 probability that they are Aa.

Cross of II.6 and III.1

	A	a
a	Aa	aa
a	Aa	aa

→ 1/2 aa

$2/3 \times 1/2 = 1/3$ probability aa from II.6 and III.1

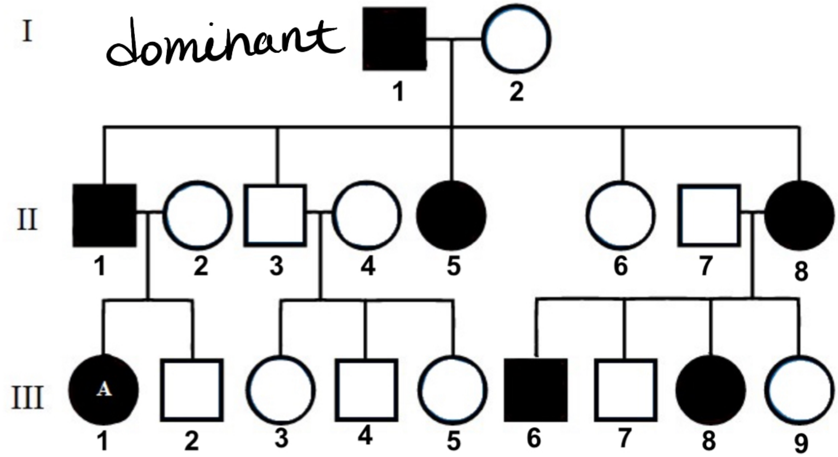
d. What is the probability that an offspring of I.2 and II.5 will <u>not present</u> with the trait?

We Know that both I.2 and II.5 have to be aa. So if you cross 2 aa individuals, all the offspring will be aa. So 0% will not present with the trait.

4.

a. What type of inheritance is this trait? (shaded boxes show presentation of the trait)

autosomal dominant



b. What is the probability that an offspring of II.4 and III.6 will present with the trait?

We Know II.4 cannot have a copy of the allele. Lets call them aa. III.6 has to have at least 1 A, but we Know that their parent II.7 didn't have a copy, so we know they only got one copy from II.8. So they are Aa.

	A	a
a	Aa	aa
a	Aa	aa

→ ½ Aa presenting with the trait

c. What is the probability that an offspring of III.9 and III.2 will present with the trait?

Both of these people are not presenting with the trait. Because the trait is dominant, they cannot have an allele for it, they are both aa. So they will have 0 offspring presenting with the trait.

6. An organism has a gene on an autosome that encodes for pointed ears. The unmutated gene produces pointed ears. A dominant mutation causes curved ears.
   a. If a heterozygous curved eared male mates with a homozygous pointed eared female, what are the proportions of genotypes in the offspring that you can get from this cross? What are the phenotype proportions?

e → pointed ear allele E → curved ear allele

mom

dad	e	e
e	ee	ee
E	eE	eE

1/2 ee pointed ears

1/2 eE curved ears

   b. If a homozygous curved ear female mates with a homozygous pointed eared male, what are the proportions of genotypes in the offspring that you can get from this cross? What are the phenotype proportions?

mom

dad	E	E
e	Ee	Ee
e	Ee	Ee

100% curved ear offspring

5. An organism has a gene on the X chromosome that encodes for a spotted phenotype. An unmutated gene produces a spotted phenotype (complete dominance). A recessive mutation causes an unspotted phenotype.
    a. If a homozygous spotted female is crossed with an unspotted male, what are the proportions of genotypes in the offspring that you can get, separated out by male and female?

T → spotted allele t → unspotted allele

mom

dad

	T	T
t	Tt	Tt
Y	TY	TY

→ daughters are 100% Tt spotted
→ sons are 100% TY spotted

gene is on X chromosome. father has only 1 X, the other is a Y

    b. If a heterozygous female is crossed with a spotted male, what are the proportions of genotypes in the offspring that you can get, separated out by male and female?

mom

dad

	T	t
T	TT	Tt
Y	TY	tY

50% of daughters are TT spotted.
other 50% of daughters are Tt spotted

50% of sons are TY spotted.
other 50% of sons are tY unspotted

7. In flitcher birds, a yellow tail feather color is encoded by a dominant allele on an autosome. A recessive mutation causes orange tail feathers. Similarly, a dominant allele on a different autosome causes a spotted phenotype. Recessive mutations cause non-spottiness. A pure yellow tail and spotted female is crossed with a pure orange tail and non-spotted male to produce and F1. Their F1s are crossed to produce F2. What are the genotypic and phenotypic proportions of each generation? Invent your own symbols.

F → yellow tail allele   f → orange tail allele
T → spotted allele   t → spotless allele

P:
female : F/F ; T/T spotted + yellow
male : f/f ; t/t spotless + orange

F1 : all heterozygous F/f ; T/t
100% spotted and yellow

F2 : start w/ tail color | spottedness

	F	f
F	FF	Ff
f	Ff	ff

1/4 FF
2/4 Ff
1/4 ff

	T	t
T	TT	Tt
t	Tt	tt

1/4 TT
2/4 Tt
1/4 tt

F/F ; T/T = 1/4 × 1/4 = 1/16 yellow + spotted
F/f ; T/T = 2/4 × 1/4 = 1/8 yellow + spotted
f/f ; T/T = 1/4 × 1/4 = 1/16 orange + spotted
F/F ; T/t = 1/4 × 2/4 = 1/8 yellow + spotted
F/f ; T/t = 2/4 × 2/4 = 1/4 yellow + spotted
f/f ; T/t = 1/4 × 2/4 = 1/8 orange + spotted
F/F ; t/t = 1/4 × 1/4 = 1/16 yellow + spotless
F/f ; t/t = 2/4 × 1/4 = 1/8 yellow + spotless
f/f ; t/t = 1/4 × 1/4 = 1/16 orange + spotless

9 genotypes

4/9 yellow spotted
2/9 orange spotted
2/9 yellow spotless
1/9 orange spotless

phenotype proportions