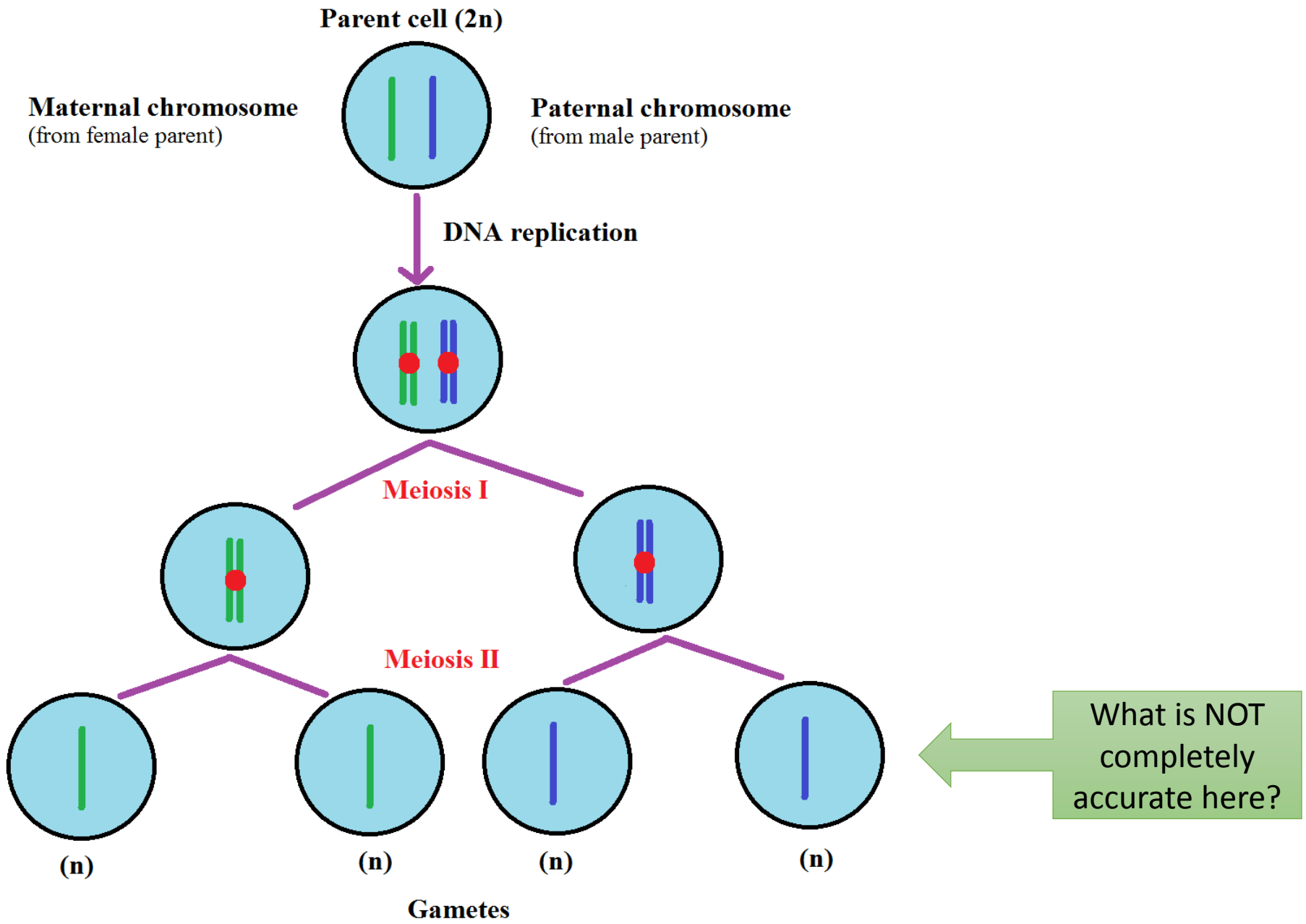
The Anatomy of a Punnett Square


Parent cell (2n)
Maternal chromosome
(from female parent)
Paternal chromosome
(from male parent)
DNA replication
Meiosis I
Meiosis II
(n)
(n)
(n)
(n)
Gametes
What is NOT completely accurate here?

Meiosis is a process of cell division that results in the formation of gametes

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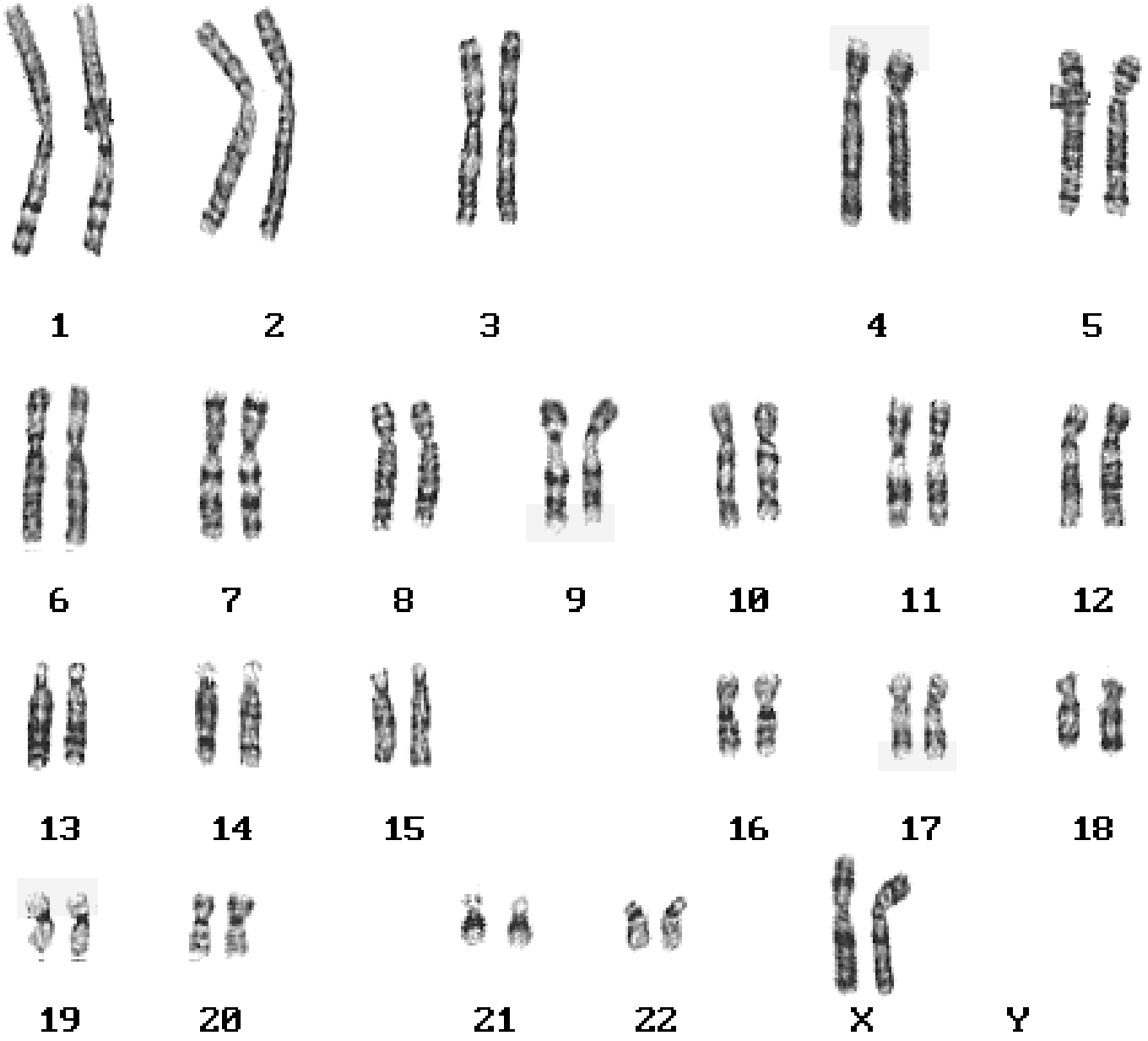
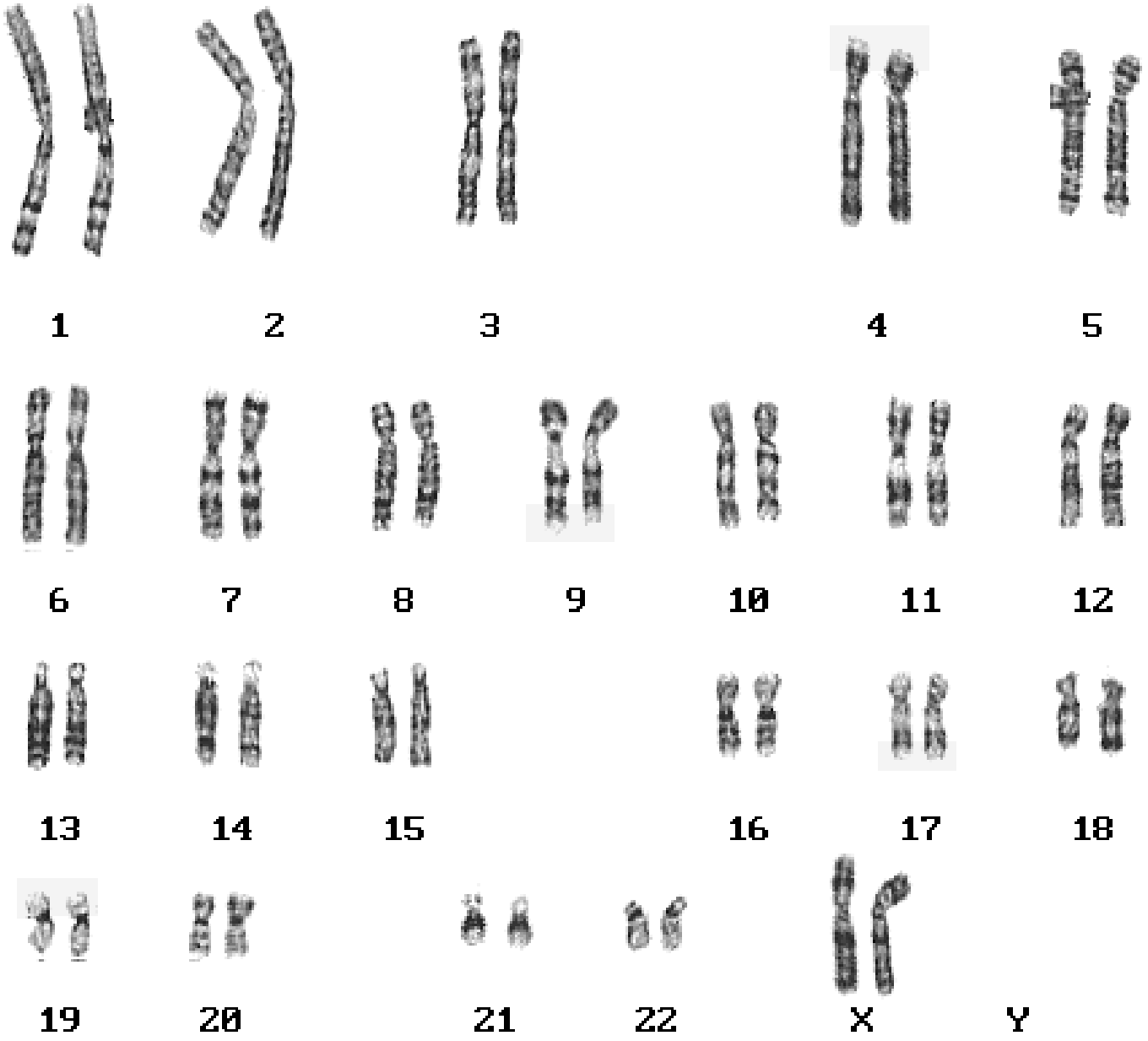
When two gametes fuse during fertilization, the resulting zygote will then have the full number of chromosomes



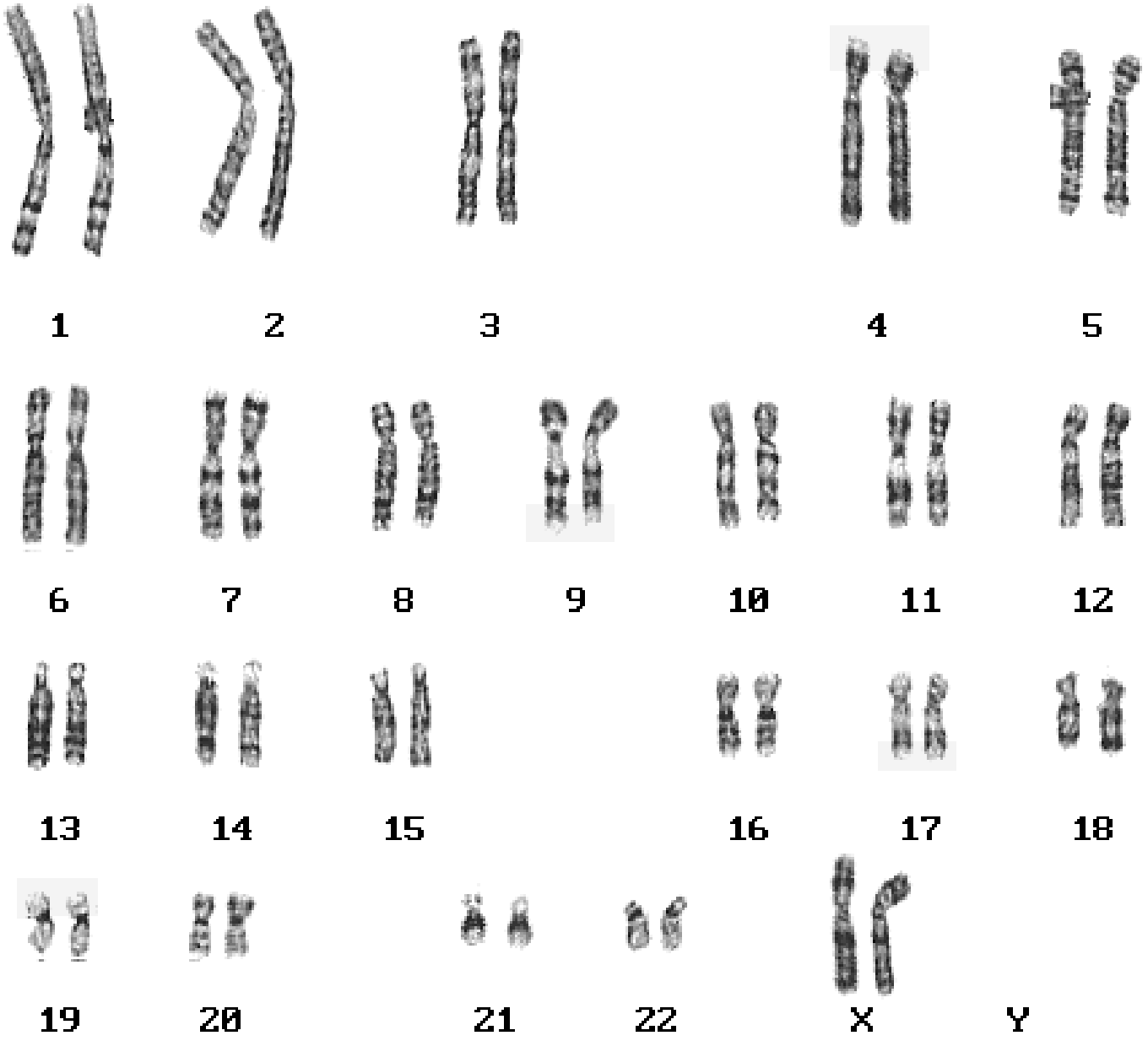
All sexually reproducing organisms have two copies of every gene.

Different versions of the same gene are called alleles.



When two individuals reproduce sexually to produce offspring, each individual will contribute only one of the two alleles they possess.

It is completely random as to which of the two alleles will be passed on.



Some alleles may be dominant, others may be recessive.

Dominant does NOT mean more common.

It simply means that it will mask, or dominate, the effects of the other allele

For example, suppose that eye color is determined by a single gene *(it's not).*

Brown eye color is dominant to blue eye color.

For notation purposes, we use letters to represent the different alleles.

B = brown eyed allele
b = blue eyed allele

A person who has two brown eyed alleles = BB

They will have brown eyes

A person who has two blue eyed alleles = bb

They will have blue eyes

A person who has one brown and one blue eyed allele = Bb

What color eyes will they have?

A person who has two brown eyed alleles = BB

They will have brown eyes

A person who has two blue eyed alleles = bb

They will have blue eyes

A person who has one brown and one blue eyed allele = Bb

They will have brown eyes

A person who has two brown eyed alleles = BB
This person is homozygous dominant for this trait

A person who has two blue eyed alleles = bb
This person is homozygous recessive for this trait

A person who has one brown and one blue eyed allele = Bb
This person is heterozygous for this trait

Phenotype: the physical appearance or expression of a trait
(example: brown eyes, blue eyes)

Genotype: the allele combination that results in a particular phenotype
(example: BB, bb, Bb)

PUNNETT SQUARES

Allow us to predict the probabilities of offspring having a particular set of traits based on the possible alleles that its parents may pass down

Let’s say we are looking at just one particular gene.

We’ll say that this gene will determine whether or not you have astigmatism (a condition involving your eyesight)

Two parents are going to create an offspring.

Both parents are heterozygous for this trait.

**astigmatism is a dominant trait*

The first step is to write down the genotypes of the two parents

Aa x Aa

The Punnett square is used to find all of the possible combinations of each parent contributing one of their two alleles to their offspring

Aa x Aa

	A	a
A		
a		

Aa x Aa

	A	a
A		
a		

Now we can calculate the probabilities of their offspring having a certain genotype and phenotype

Aa x Aa

	A	a
A	AA	Aa
a	Aa	aa

	A	a
A	AA	Aa
a	Aa	aa

Questions:

1. What is the probability of their offspring having astigmatism?

2. What is the probability of their offspring **not** having astigmatism?

3. What is the phenotype ratio of their possible offspring?

4. What is the genotype ratio of their possible offspring?

	A	a
A	AA	Aa
a	Aa	aa

Questions:

1. What is the probability of their offspring having astigmatism? ¾ or 75%

2. What is the probability of their offspring **not** having astigmatism? ¼ or 25%

3. What is the phenotype ratio of their possible offspring? 3:1

4. What is the genotype ratio of their possible offspring? 1:2:1

What do these represent?

	A	a
A	AA	Aa
a	Aa	aa

GAMETES

	A	a
A	AA	Aa
a	Aa	aa