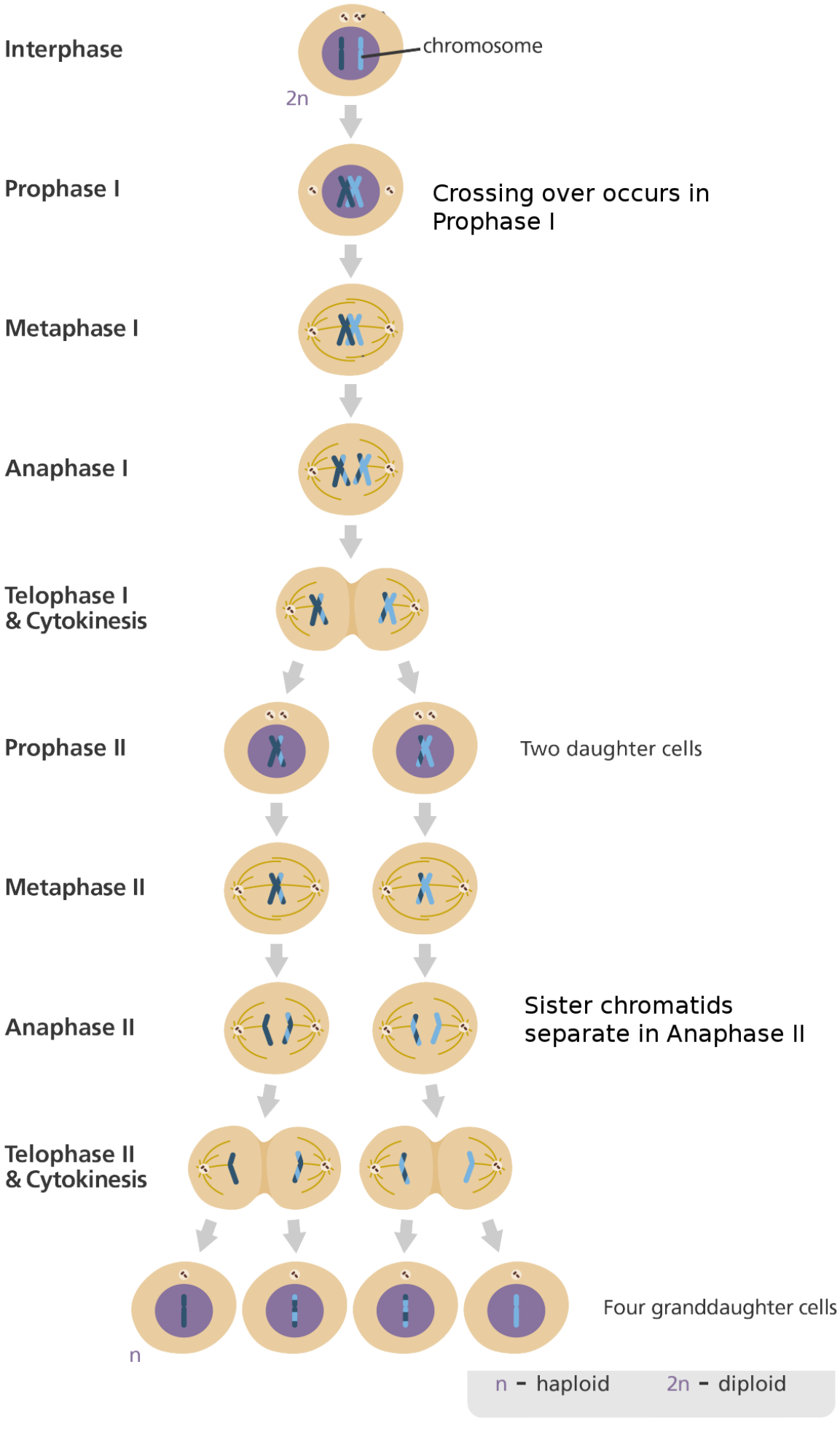
MEIOSIS


Interphase
chromosome
2n
Prophase I
Crossing over occurs in Prophase I
Metaphase I
Anaphase I
Telophase I & Cytokinesis
Prophase II
Two daughter cells
Metaphase II
Anaphase II
Sister chromatids separate in Anaphase II
Telophase II & Cytokinesis
Four granddaughter cells
n
n - haploid
2n - diploid

Meiosis vs Mitosis

Mitosis produces identical copies of cells for growth or repair.
Meiosis produces egg cells or sperm cells.

Look at the diagram of meiosis:

What happened during prophase I? _____

How many times did it go through prophase-metaphase-anaphase-telophase? _____

In mitosis the sister chromatids separate in Anaphase I.
When did the sister chromatids finally separate in meiosis? _____

How many cells are there at the end? _____

Remember when we learned about mitosis, the cells at the end of Telophase were identical to the cell we started with in G1. Mitosis produces clones of the original cell. Meiosis, however, is different.

Are the cells at the end of Telophase II identical to the cell in G1? _____

How are they different? _____

MEIOSIS AND CROSSING OVER NOTES

Meiosis produces egg cells and sperm cells that have half the regular number of chromosomes. Unlike in mitosis, 4 daughter cells are produced.
The similar chromosomes also 'cross over,' or get mixed up in meiosis, producing new combinations of genes in the final chromosomes

Chromosomes are matched in homologous pairs

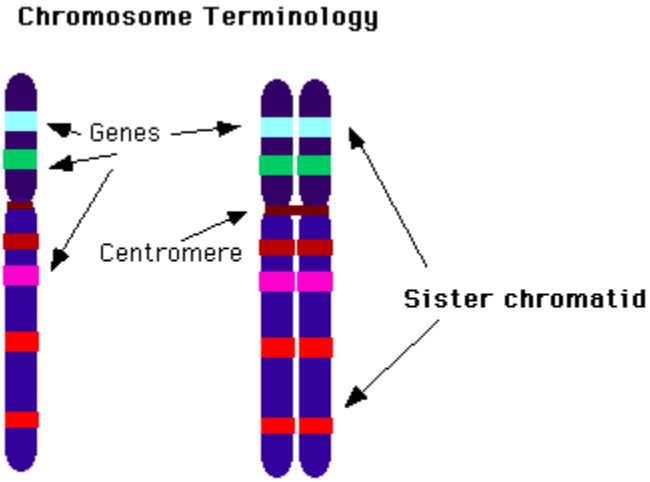
Somatic (body) cells have pairs of homologous chromosomes, receiving one member of each pair from each parent

Homologous chromosomes have the same

- Length
- Centromere position
- Gene locations

For example, your chromosome #7 from mom and your chromosome #7 from dad are homologous (similar but not identical) They have the same genes on them, but different versions of the same gene
A **locus** (plural, loci) is the location of a gene on a chromosome.
Different versions of a gene may be found at the same locus on maternal and paternal chromosomes

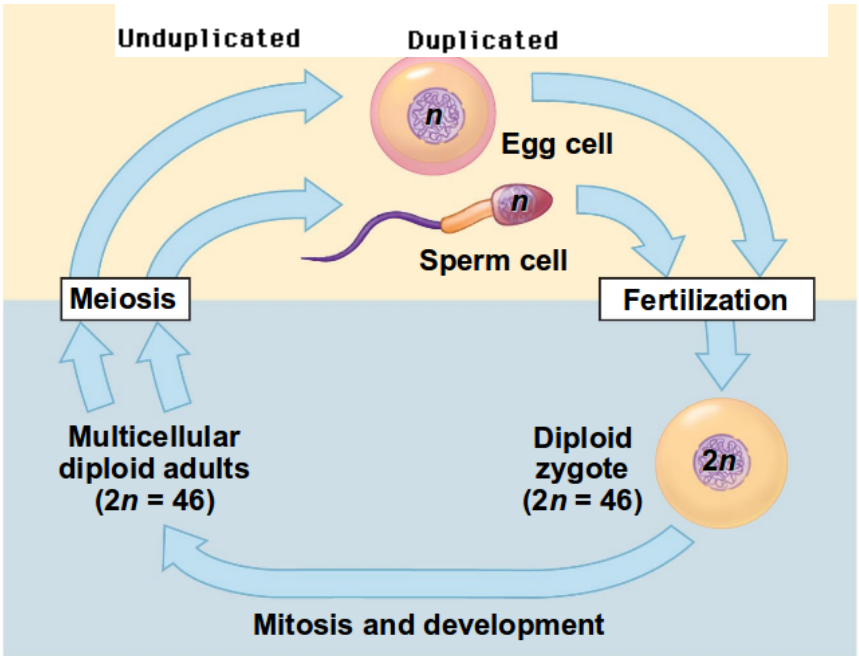
You normally have 46 chromosomes (unduplicated)
23 from your mother and 23 from your father
The chromosomes duplicate during S phase



Diploid to Haploid

Meiosis is a process that converts diploid nuclei to haploid nuclei
Diploid cells have two homologous sets of chromosomes
All human cells except sperm or egg cells are diploid (two chromosome 1's, two chromosome 2's, etc.)
Haploid cells have one set of chromosomes (one chromosome 1, one chromosome 2, etc.)
Sperm and egg cells are haploid, they have half the normal amount of chromosomes
Meiosis occurs in the sex organs, producing gametes —sperm and eggs

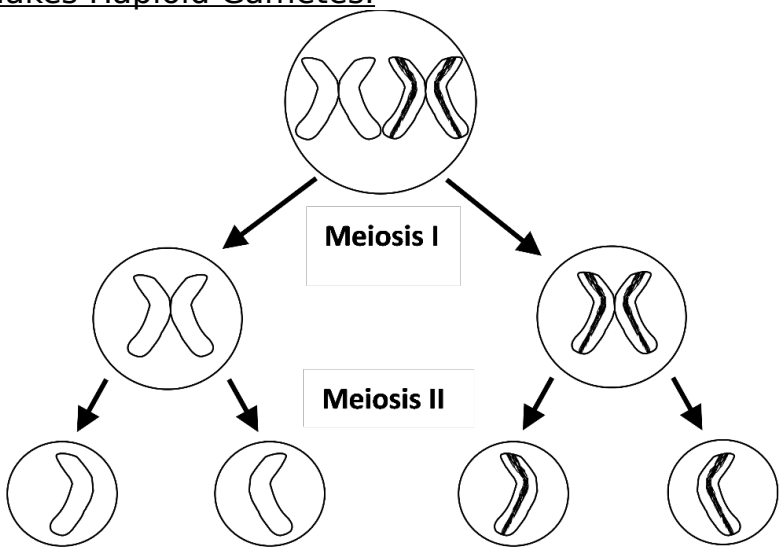
Fertilization is the union of sperm and eggThe zygote has a diploid chromosome number, one set from each parent



Meiosis reduces the chromosome number from diploid to haploid

Like mitosis, meiosis is preceded by interphase.
Chromosomes duplicate during the S phase.
Unlike mitosis, meiosis has two divisions.
During meiosis I, homologous chromosomes separate.
During meiosis II, sister chromatids separate

How Meiosis Makes Haploid Gametes.



At the beginning of Meiosis I, the two homologous chromosomes line up next to each other. Then, the homologous chromosomes are separated into two daughter cells. These daughter cells have half as many chromosomes as the parent cell, so the daughter cells are haploid.

In Meiosis II, the sister chromatids of each chromosome are separated. Meiosis II produces four haploid daughter cells, the gametes.

LABELING

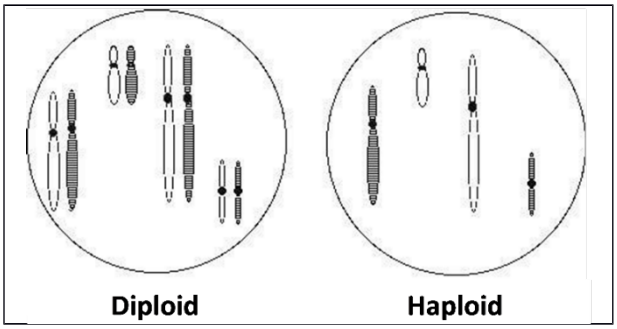
Label the diploid cell.
In the diploid cell, **label the pair of homologous chromosomes** and the **two sister chromatids in one of the chromosomes**.
Label the haploid gametes.

What difference do you notice between a dipoid cell and a haploid cell?

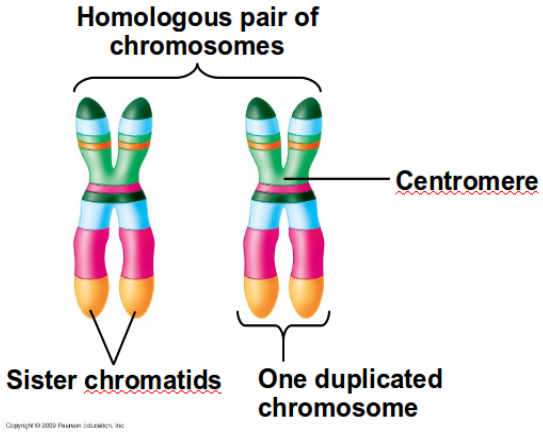
_____

_____

_____



Meiosis reduces the chromosome number from diploid to haploid



Important differences between meiosis and mitosis:

<u>Prophase I</u>

Each pair of homologous chromosomes, with four chromatids, is called a **tetrad.**

Nonsister chromatids exchange genetic material by **crossing over.**

Crossing over is a process in which segments are broken off and exchanged between homologous chromosomes.

Crossing over increases the number of possible genetic combinations in the offspring. Increasing genetic variation or difference in the traits of an organism in a population.

<u>Critical thinking</u>: Why would crossing over not change anything if it were just two sister chromatids crossing over with each other?

……

……...

<u>Anaphase I</u>

The sister chromatids stay together as X's (this is different from mitosis, where the X's were split apart. In meiosis the splitting of X's doesn't happen until Anaphase II.

<u>Anaphase II</u>

Sister chromatids (X's) separate and chromosomes move toward opposite poles

Why don't all siblings look identical?

Independent orientation of chromosomes in meiosis and random fertilization lead to varied offspring

Independent orientation at metaphase I

You never know which X will go to which side during metaphase I

Each pair of chromosomes independently aligns at the cell equator

There is an equal probability of the maternal or paternal chromosome facing a given pole

The number of combinations for chromosomes packaged into gametes is 2n where n = haploid number of chromosomes

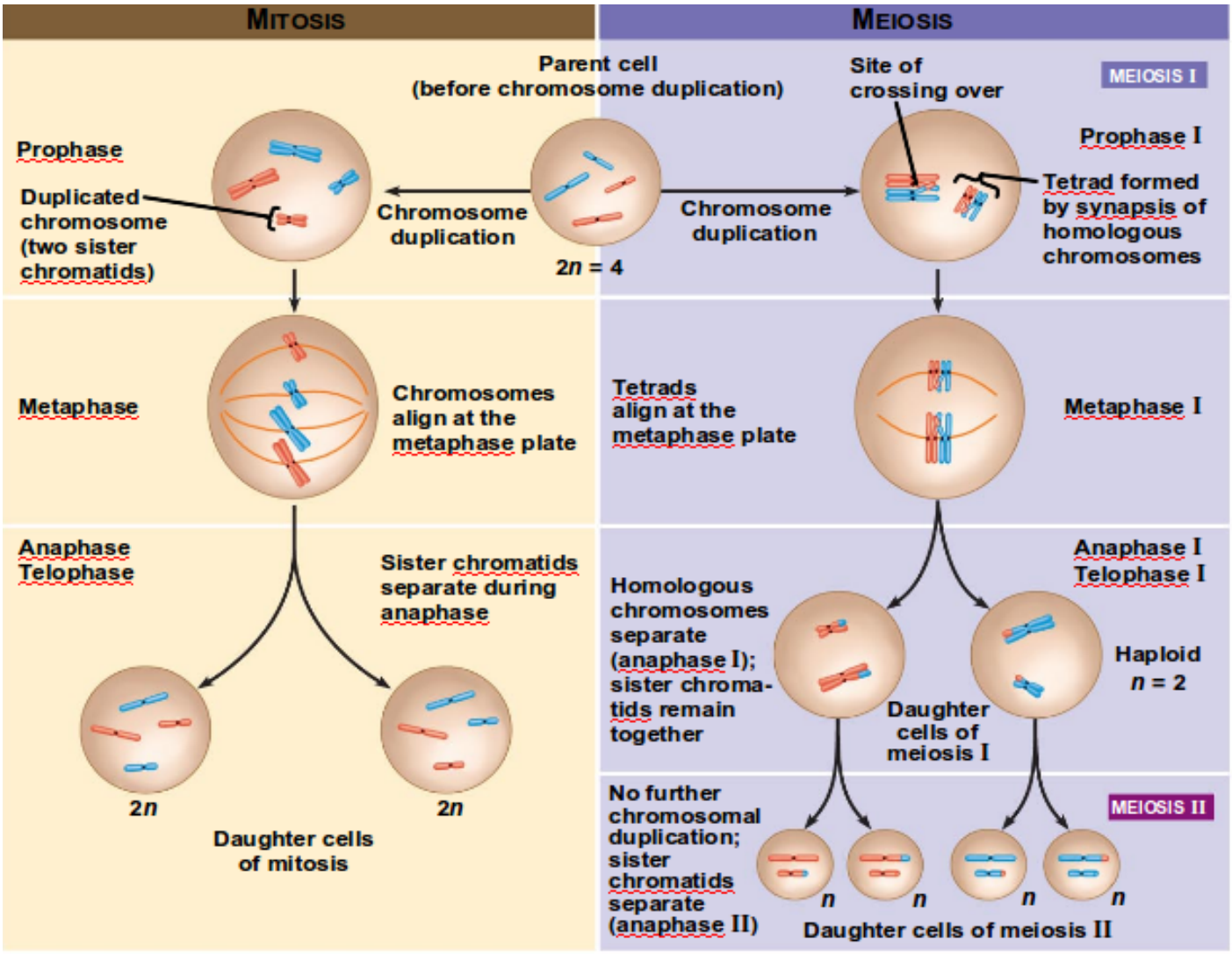
Crossing over further increases genetic variability

Genetic recombination is the production of new combinations of genes due to crossing over

<u>Crossing over involves exchange of genetic material between homologous chromosomes</u>

Nonsister chromatids join at a chiasma (plural, chiasmata), the site of attachment and crossing over

Corresponding amounts of genetic material are exchanged between maternal and paternal (nonsister) chromatids



Write down three differences between mitosis and meiosis:

……

……

……

If a body wanted to make an exact copy of a stomach cell, would it use mitosis or meiosis?

……

If a body wanted to create a sperm cell or egg cell, would it use mitosis or meiosis?

……

Give an example of homologous chromosomes: ……

Why is crossing over during prophase I important for life on earth? ……
……..