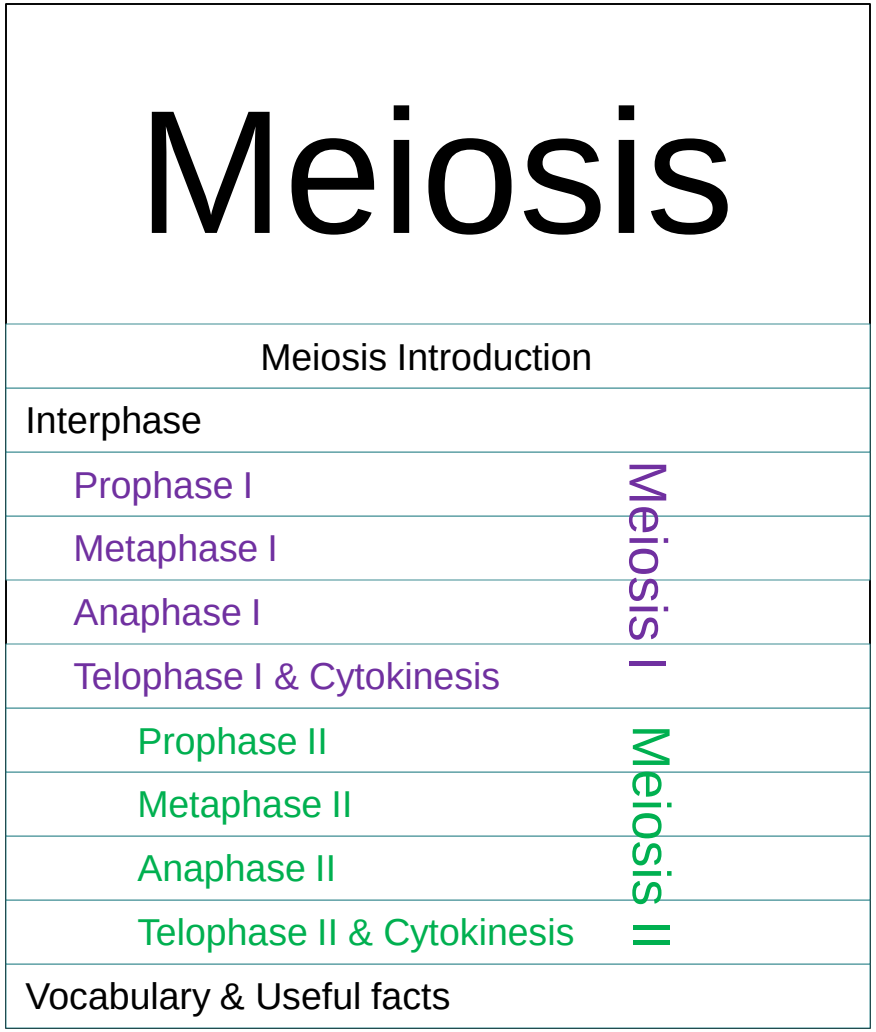
Meiosis Notes

Foldable

- You need 6 pieces of printer paper
- Stagger the pages about 1cm (width of pinky finger)
  DO NOT make the tabs too large!!!!!
- Fold the stack of pages to make the foldable as diagramed on the next slide
- On the cover write “MEIOSIS”
- On the back put your Name and Period

Foldable Layout

- Label the tabs of the foldable according to the diagram to the right
- Use some way (choice is yours) to show which tabs make up Meiosis I and which tabs make up Meiosis II



Note Taking Key

- Text in black will be copied into your flipbook

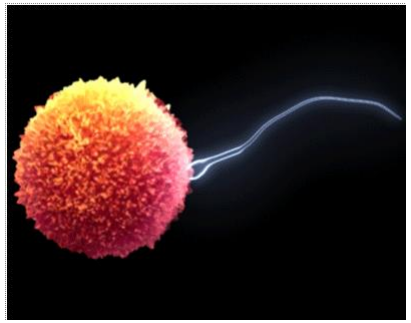
- Vocabulary words will be like this → Meiosis
  Highlight these in your notes when the text is black, you will define these in the back of your foldable

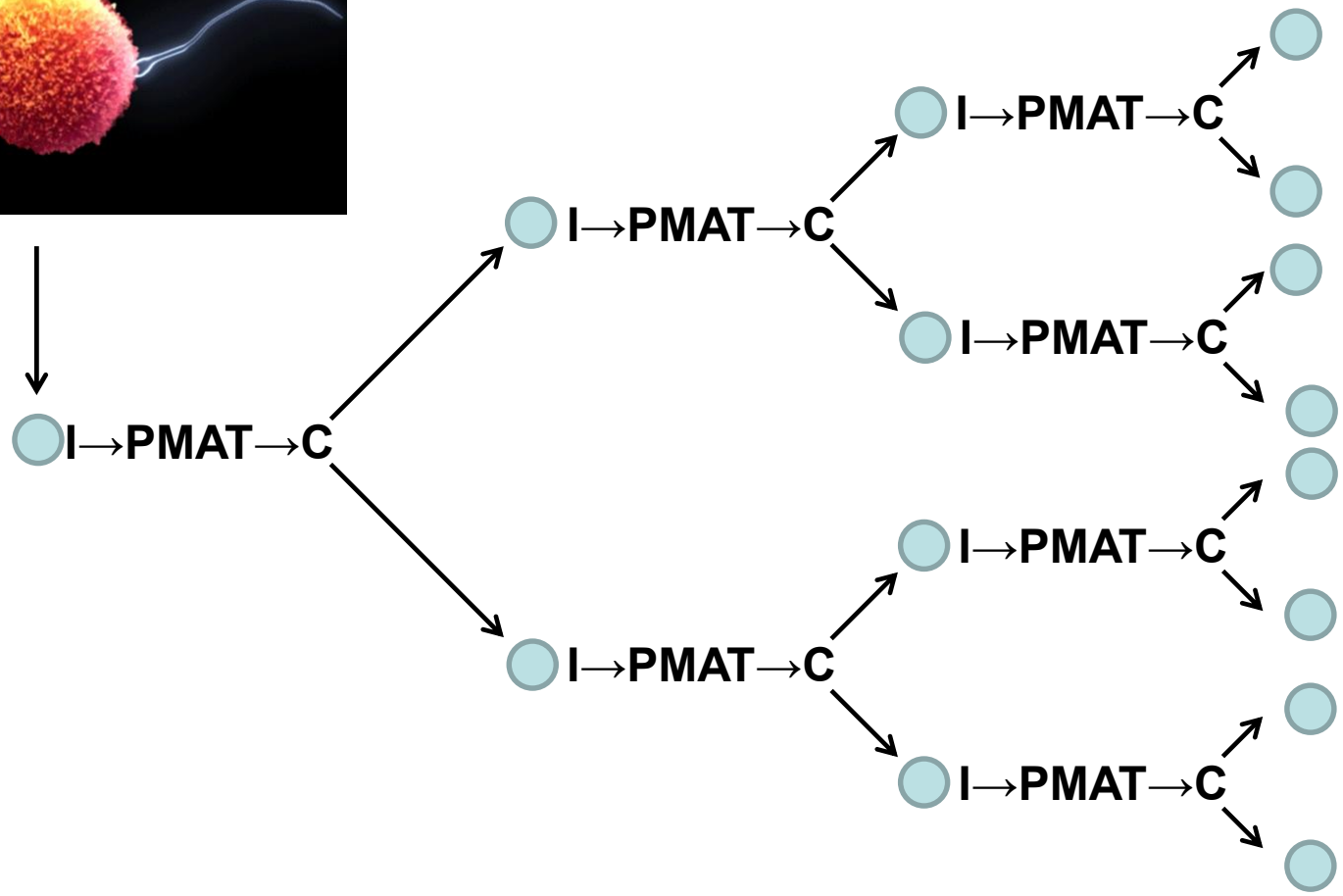
- Interesting facts will have slide Headings and text in blue like this → Mitosis vs Meiosis

You do not have to copy blue text into your flipbook unless you want to

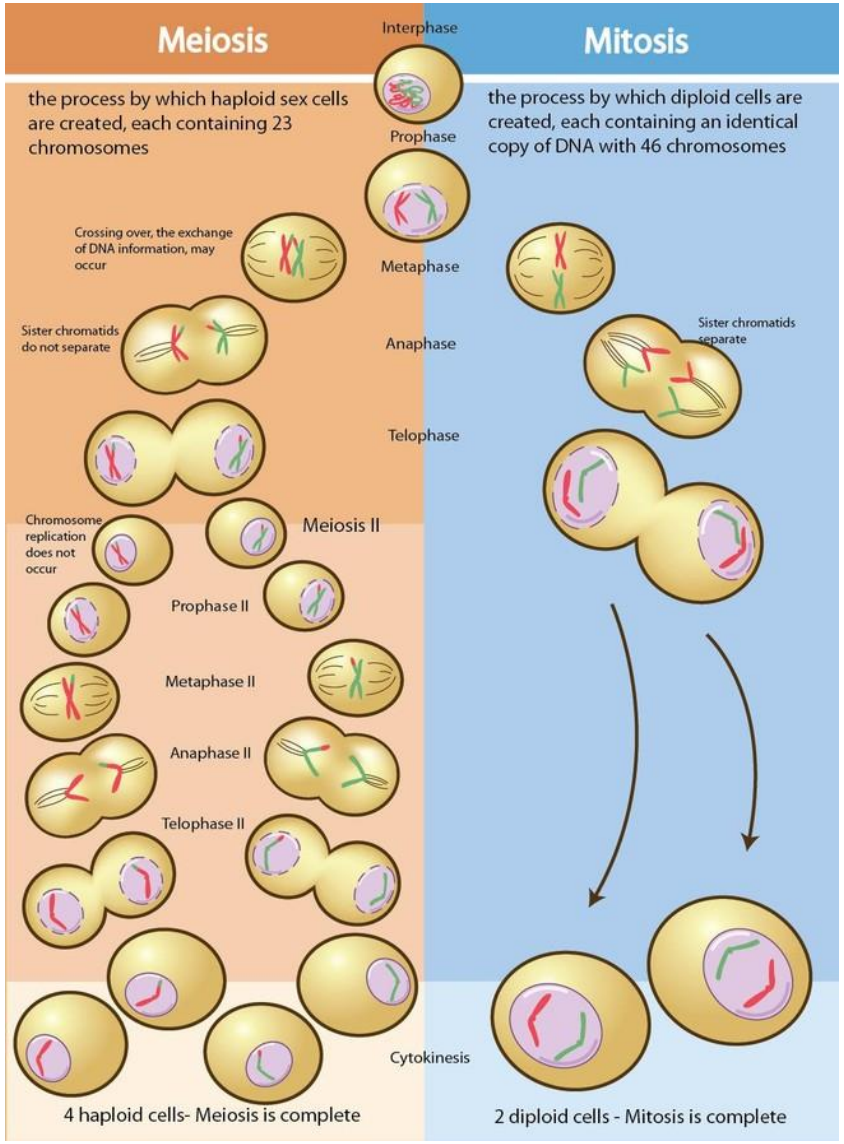
Mitosis Diagram

There is not room for you to draw this diagram, but know what it means





Meiosis vs Mitosis



Meiosis creates 4 genetically different gametes (haploid)

Mitosis creates 2 identical daughter cells (diploid)

Meiosis Introduction (1st tab upper half)

- **Process of reduction division**
- **Purpose: Produces gametes (sex cells) – sperm & egg**
- **Meiosis is NOT a cycle like mitosis.**

Diploid vs. Haploid

- Diploid – a cell that contains homologous chromosomes (one from each parent)

  represented by the symbol 2N

  – Found in somatic or body cells (ex. Skin, digestive tract)
    - Example : Humans → 2N = **46**

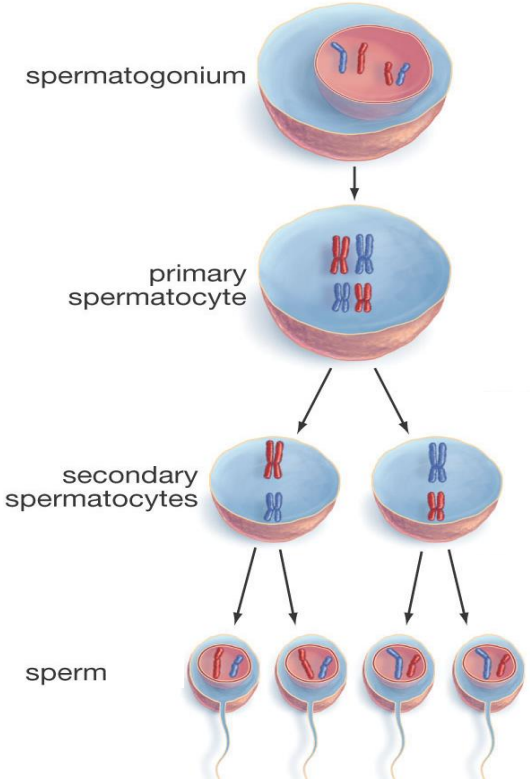
- Haploid – a cell that contains only a single set of chromosomes (one from either parent, not both);

  represented by the symbol N or 1N

  – Found in gametes or sex cells – sperm & egg
    - Example: Humans → N = **23**

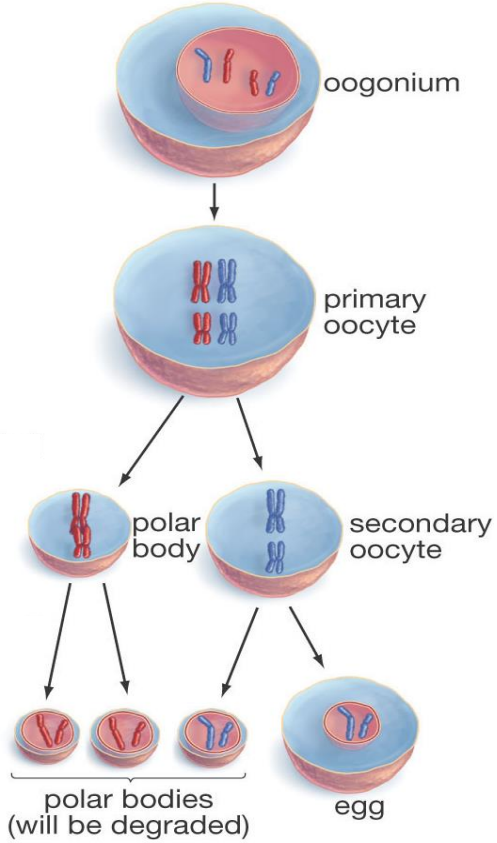
Meiosis Introduction (1st tab middle)
Chromosome Numbers

- Somatic cells: (diploid = 2N = 46 chromosomes in humans)
- Gametes: (haploid = N = 23 chromosomes in humans) – can also be called ***Germ Cells***



You DO NOT have to draw these pictures on the 1st tab for Meiosis Introduction

Just write the Somatic and Gamete info above

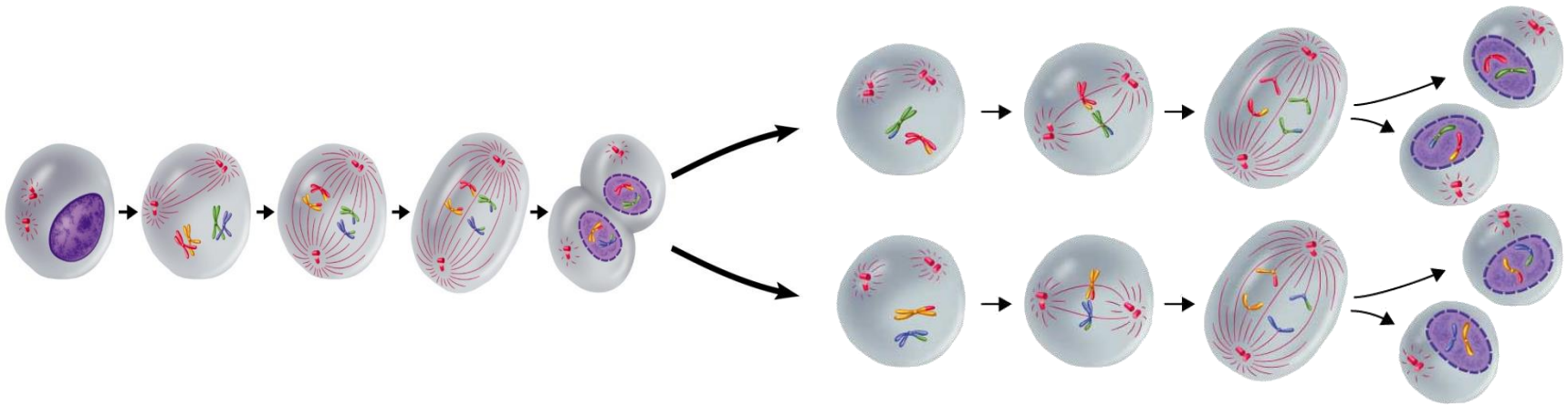


Chromosome Numbers of Some Common Organisms

Organism	Body Cell (2*n*)	Gamete (*n*)
Human	46	23
Garden Pea	14	7
Fruit fly	8	4
Tomato	24	12
Dog	78	39
Chimpanzee	48	24
Leopard frog	26	13
Corn	20	10
Apple	34	17
Indian fern	1260	630

Meiosis Introduction (1st tab middle)

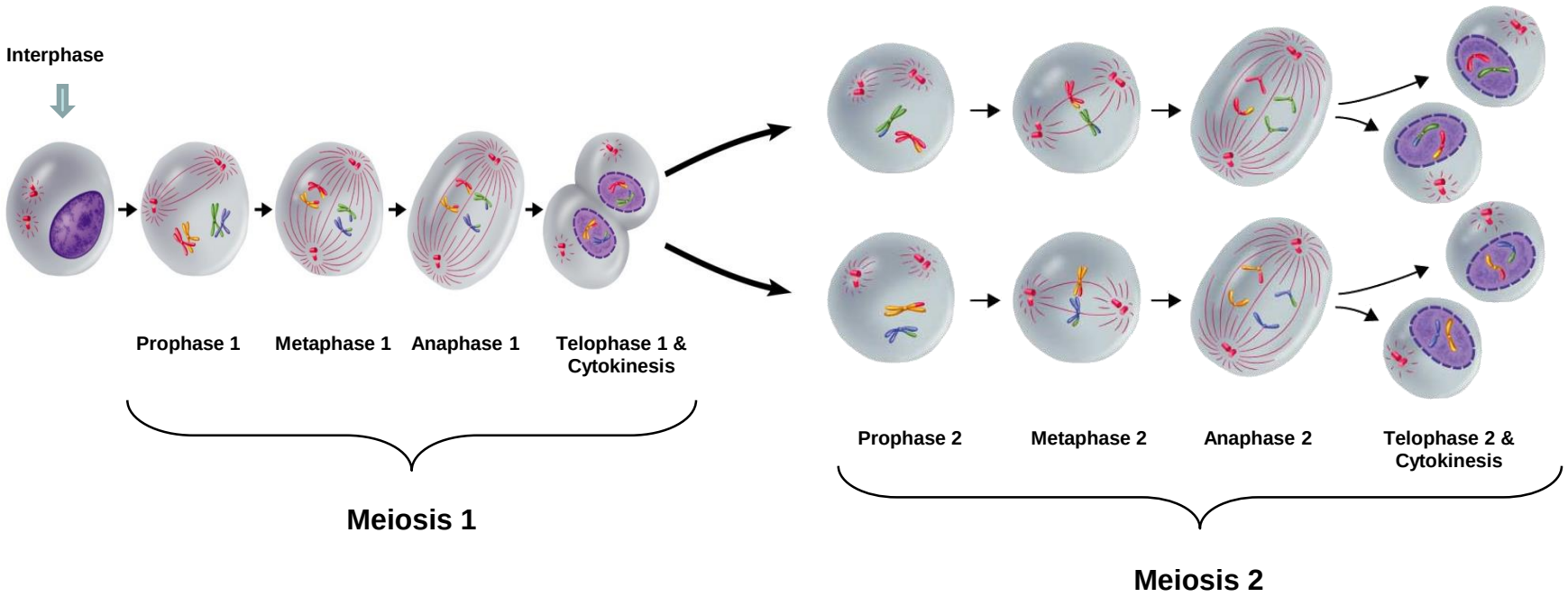
- Similar to Mitosis' IPMATC
- Meiosis involves two distinct divisions, called Meiosis I and Meiosis II
- By the end of Meiosis II, the 1 diploid cell that entered meiosis has become 4 haploid cells



The next slide has a labeled picture for you to draw

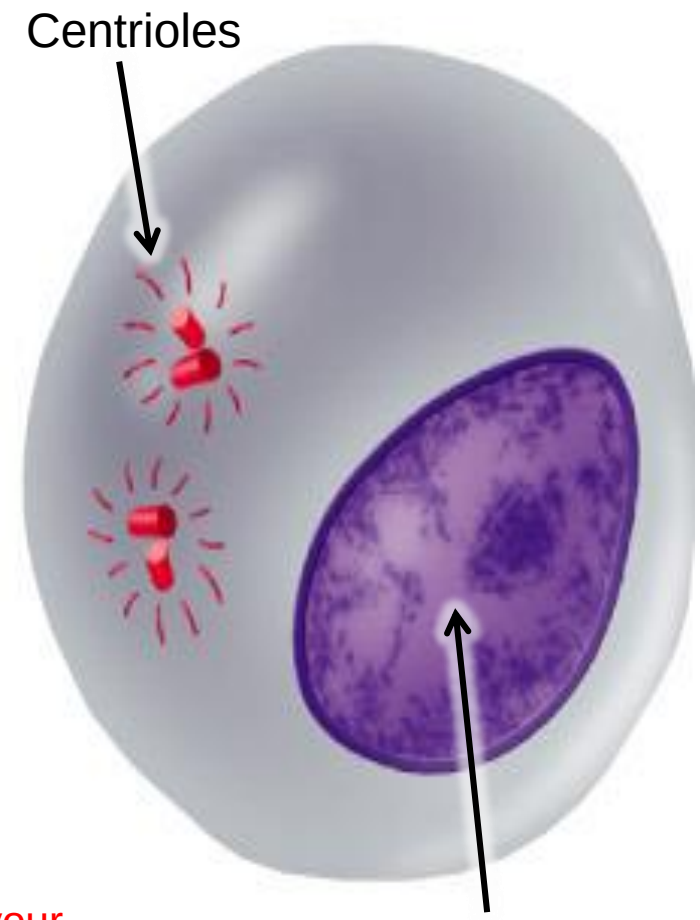
Meiosis Introduction (1st tab bottom half)

- Draw the general cell division stages and label them
- Do NOT worry about drawing the chromosomes at this time.



Interphase (2nd tab)

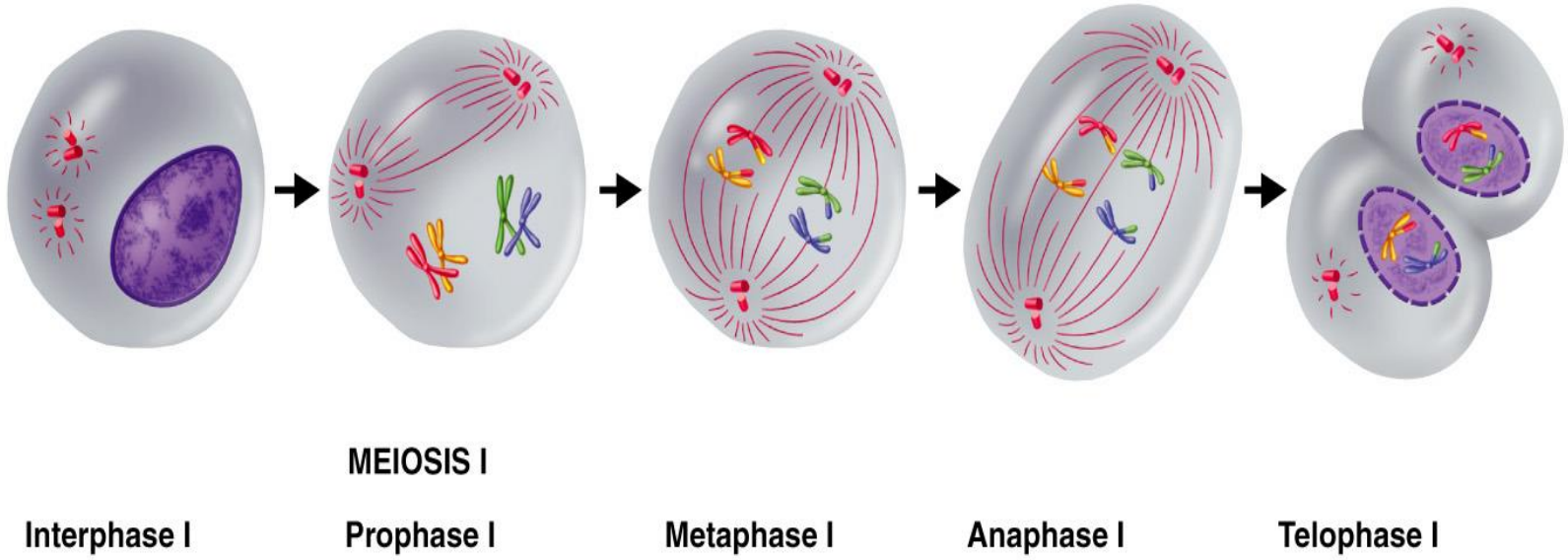
- Stage between divisions
- Contains: centrioles and chromatin
- Made of stages:
  G1 – basic cell growth
  S – replication and repair of DNA
  G2 – final preparation for cell division



Draw and label this picture in your flipbook

Meiosis I

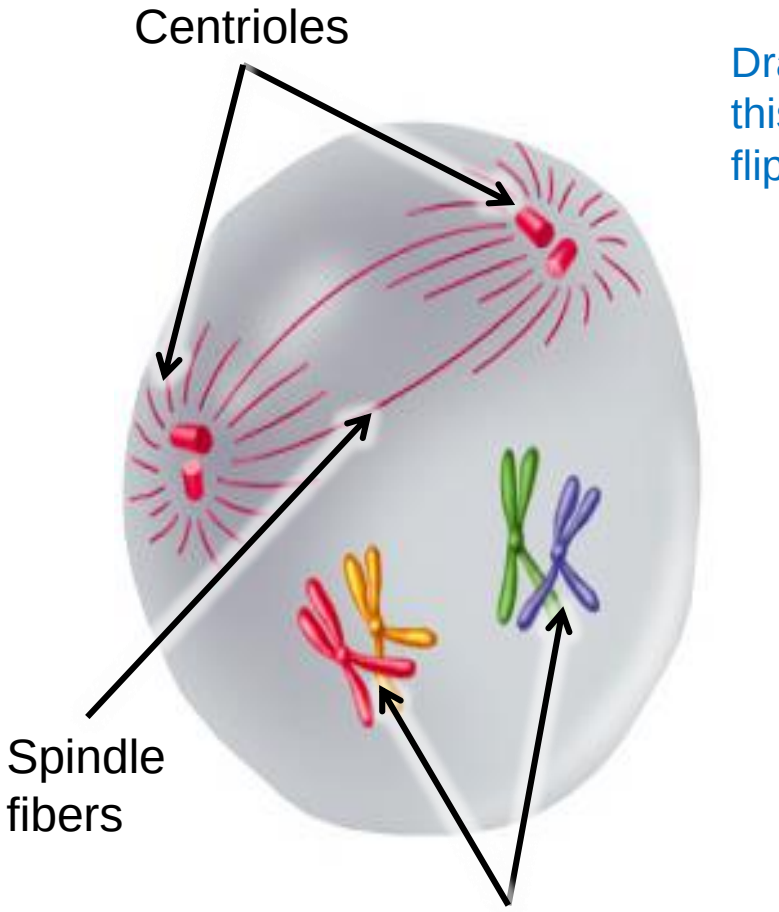
- (You do not need to draw these, Just showing you the stages)



Prophase I
(3rd tab – upper half of page)

- Corresponding homologous chromosomes from each parent pair up to form homologous pairs

- When homologous chromosome overlap its called crossing over.

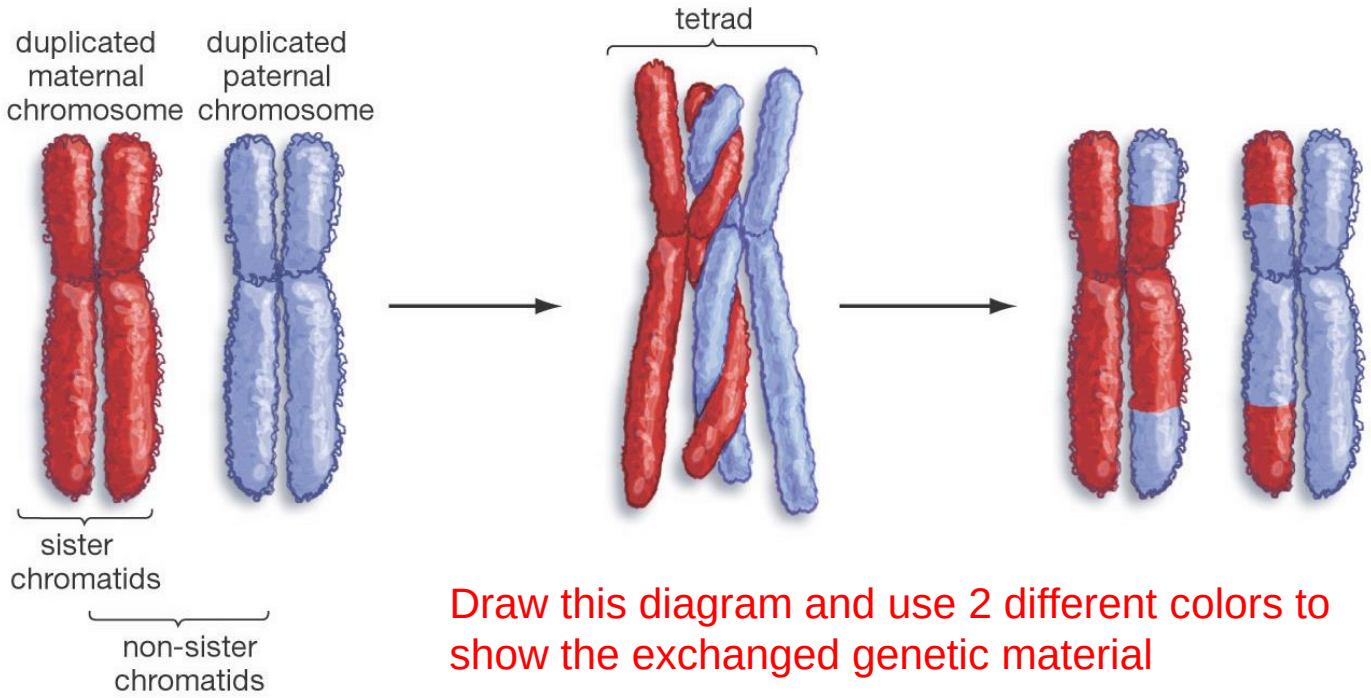


Draw and label this picture in your flipbook

Prophase I
(3rd tab lower half of page)

- Crossing over happens when parts of the homologues chromosomes switch places after overlapping

Exchange of parts of non-sister chromatids.



Draw this diagram and use 2 different colors to show the exchanged genetic material

How can siblings look alike but not exactly the same if they come from the same parents?

Importance of crossing over

- The gene combinations that a person gets from his or her parents will be different, to varying degrees, than the combination a sibling may get.

- Crossing over increases genetic diversity

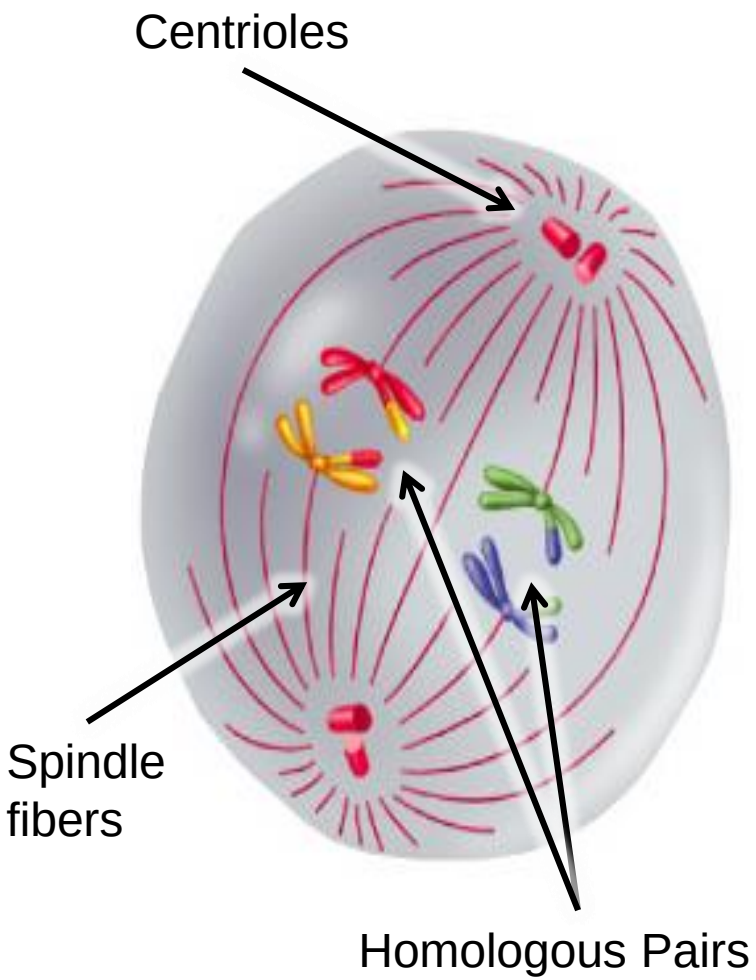
Add this statement to the Prophase 1 page on the 3rd tab

More sibling similarities

Metaphase I (4th tab)

- The centrioles send out spindle fibers to line up homologous pairs in the middle of cell along the metaphase plate

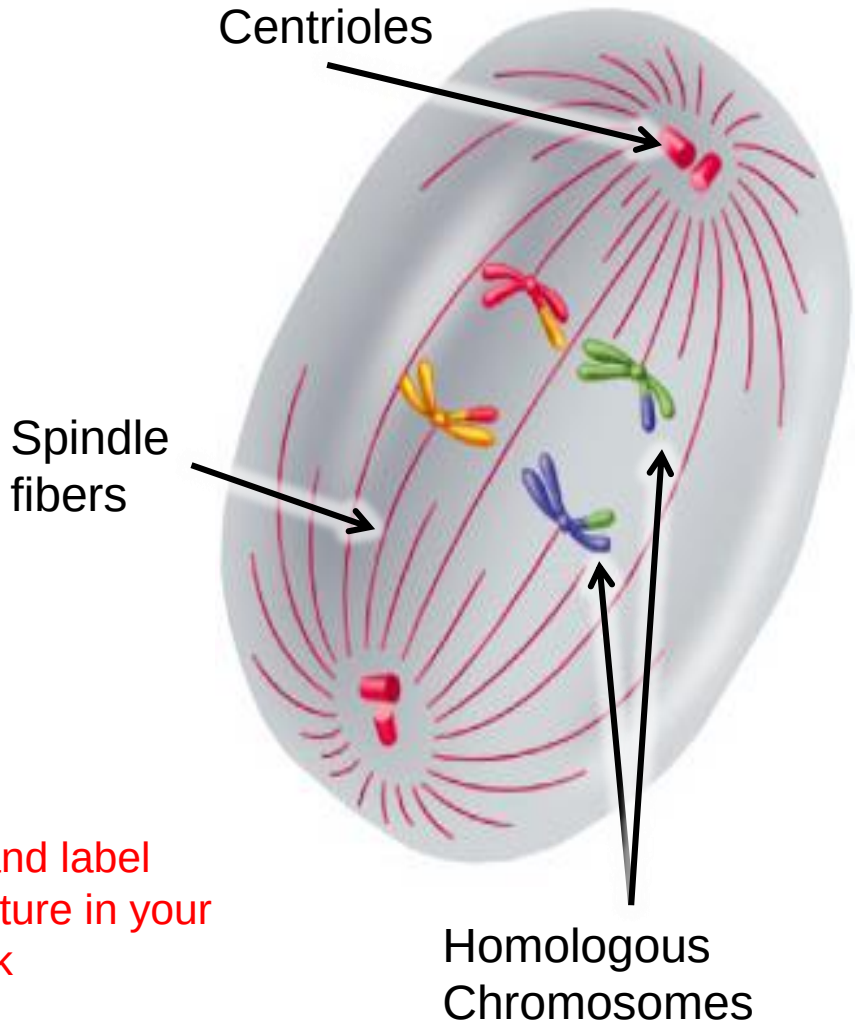
Draw and label this picture in your flipbook



Anaphase I (5th tab upper half)

- The centrioles use the spindle fibers to separate the homologous pairs

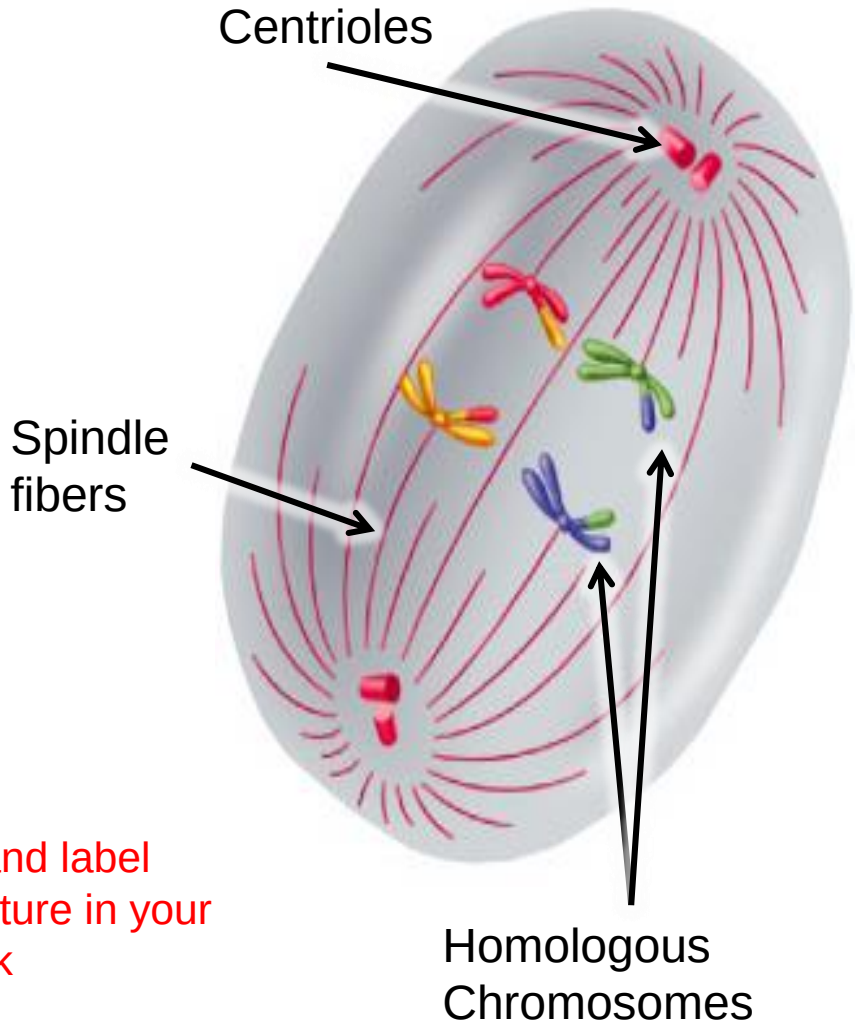
- Each homologous chromosome is pulled to the opposite pole of the cell



Draw and label this picture in your flipbook

Anaphase I (5th tab upper half)

- If the centrioles do not properly attach the spindle fibers to the homologous chromosome before they start to pull, then a Nondisjunction will occur

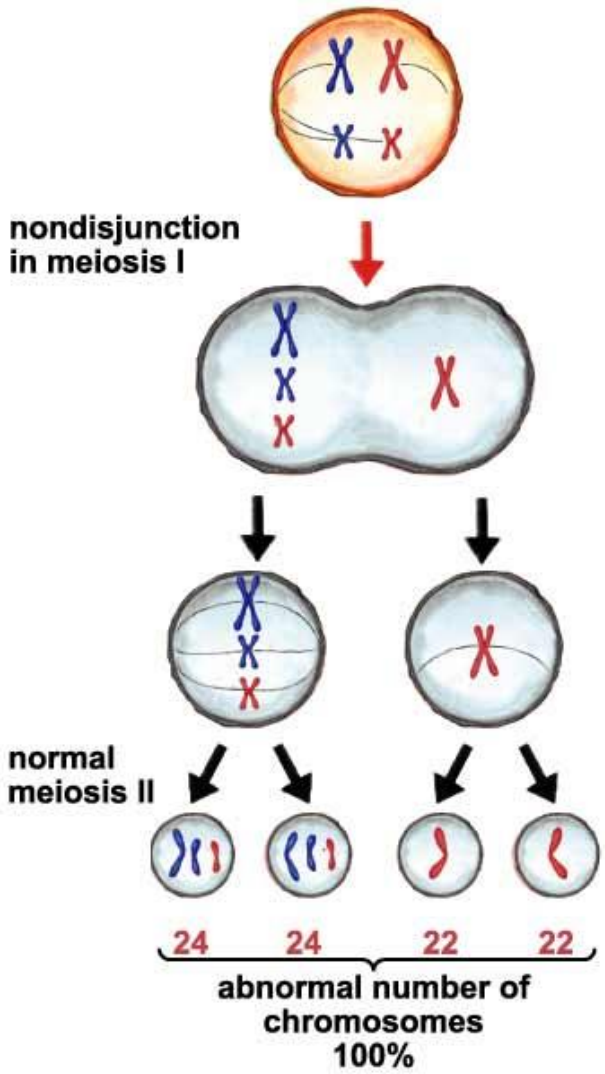


Draw and label this picture in your flipbook

Anaphase I (5th tab lower half)

Nondisjunction in Meiosis I

- In the first picture you see how the lower red chromosome is being pulled to the wrong side
- In the second picture it caused one pole of the cell to have an extra chromosome
- A Nondisjunction causes the gametes to have the wrong amount of chromosomes



Draw this picture in your flipbook and use different colors to show the different chromosomes

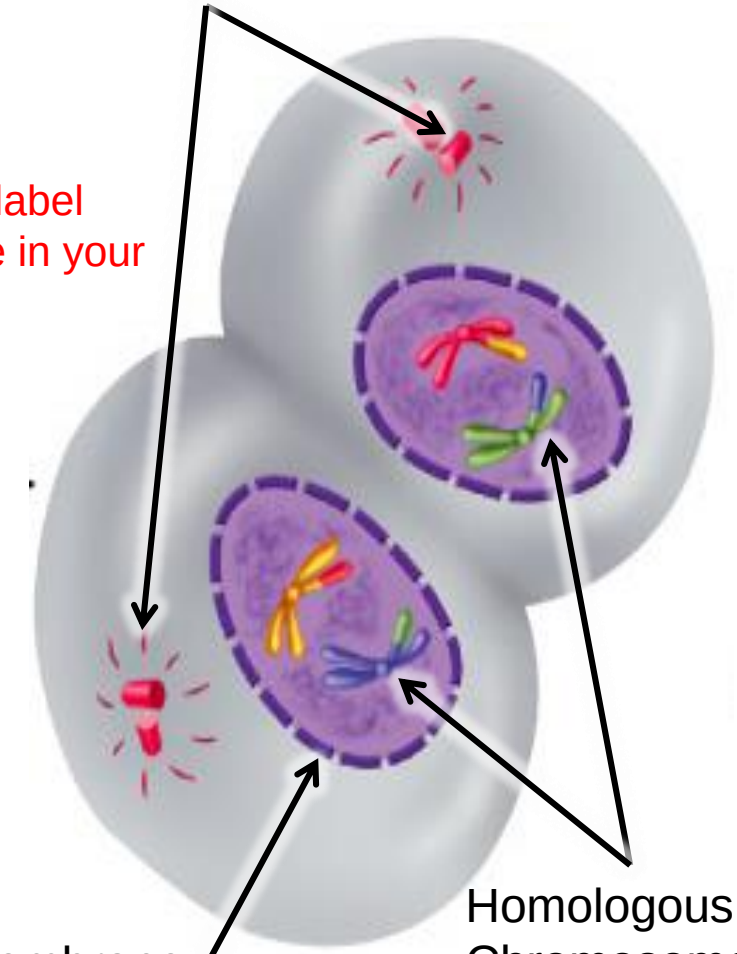
Telophase I & Cytokinesis

(6th tab)

- Telophase I – the cell creates a temporary nucleus around the two homologous chromosome sets

- Cytokinesis – the cell divides into two cells

Draw and label this picture in your flipbook



Prophase II (7th tab)

- The next slide has information about starting **Meiosis II**.
- Write this information on the Prophase II (7th tab upper half) and draw a box around it.
- **You do not have to draw the picture for all of Meiosis II because you'll draw each stage individually.**
- The **lower half** of the 7th tab will be Prophase II. Describe and diagram that slide

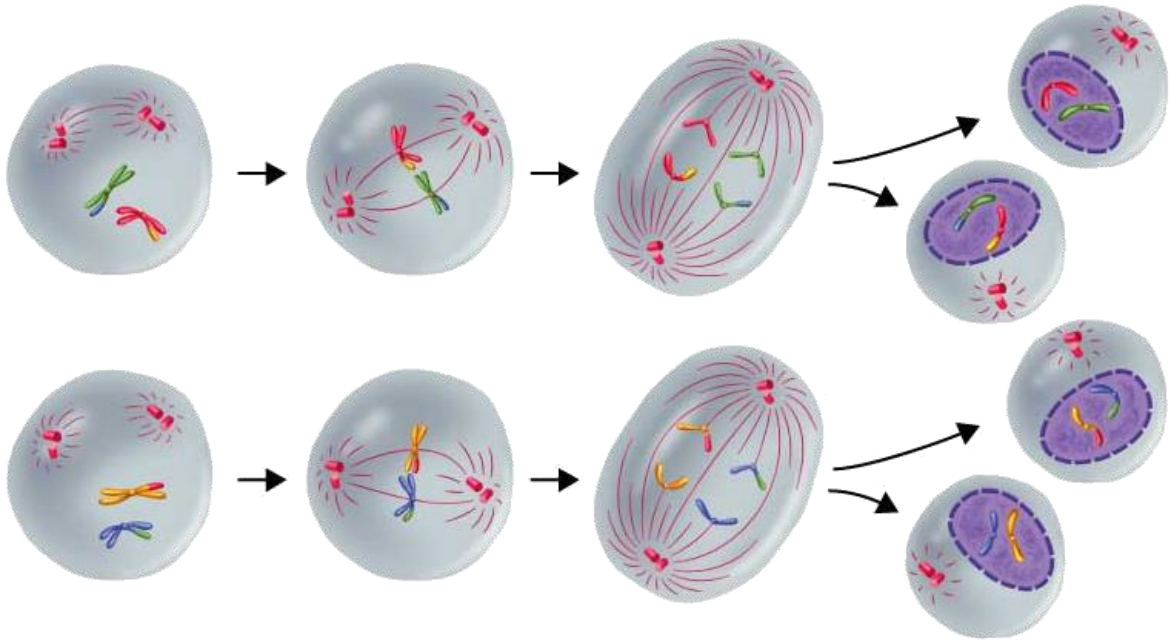
Meiosis II (7th tab upper half)

- The <u>two</u> new cells produced by meiosis I now enter a **<u>second</u>** meiotic division

- The cells do NOT replicate DNA resulting in four haploid cells

  - Each cell has half of the original DNA

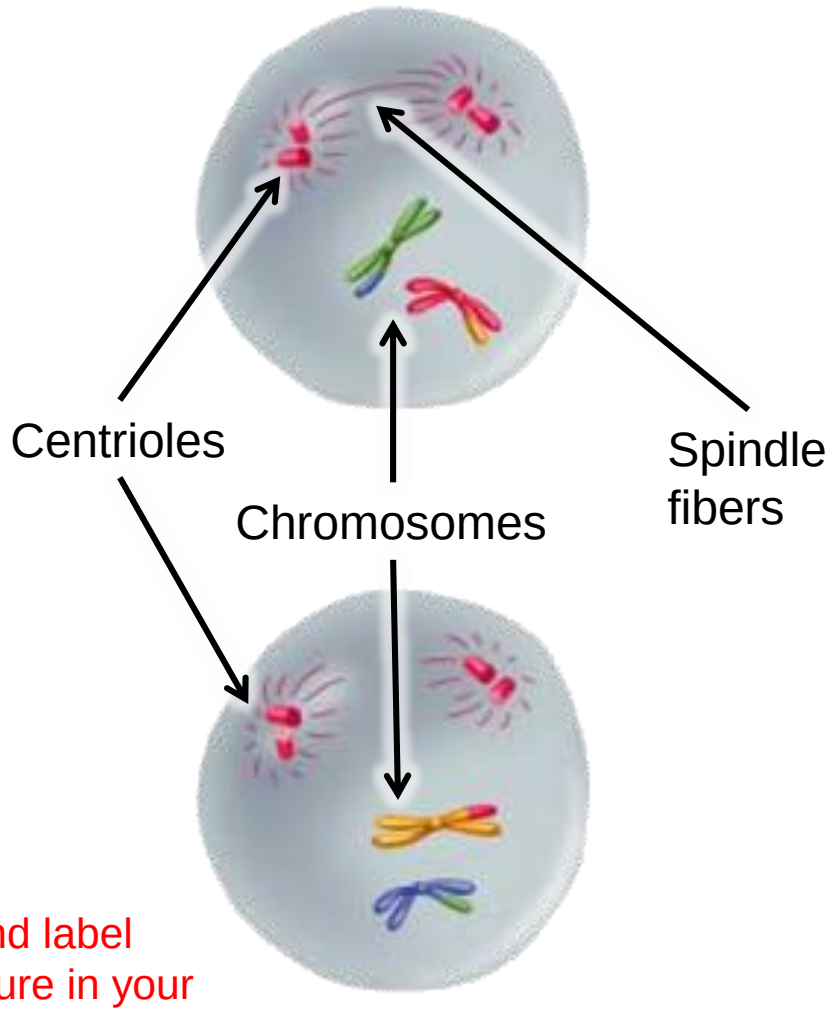
  - 2N ÷ 2 = N



Do NOT draw this picture in your flipbook

Prophase II (7th tab lower half)

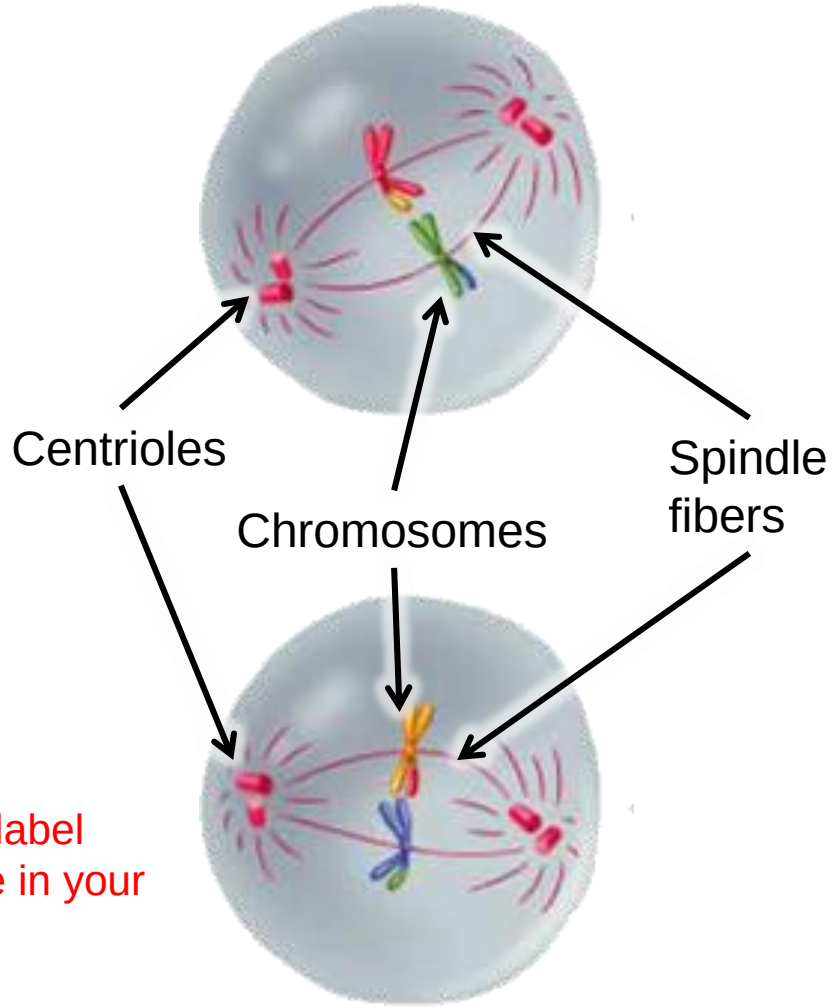
- Each of the Meiosis II stages are running in 2 cells at the same time.
- Similar to Prophase of Mitosis
- Centrioles attach spindle fibers to the chromosomes



Draw and label this picture in your flipbook

Metaphase II (8th tab)

- Similar to Metaphase of Mitosis
- Centrioles use spindle fibers to line up the chromosomes in the middle at the metaphase plate

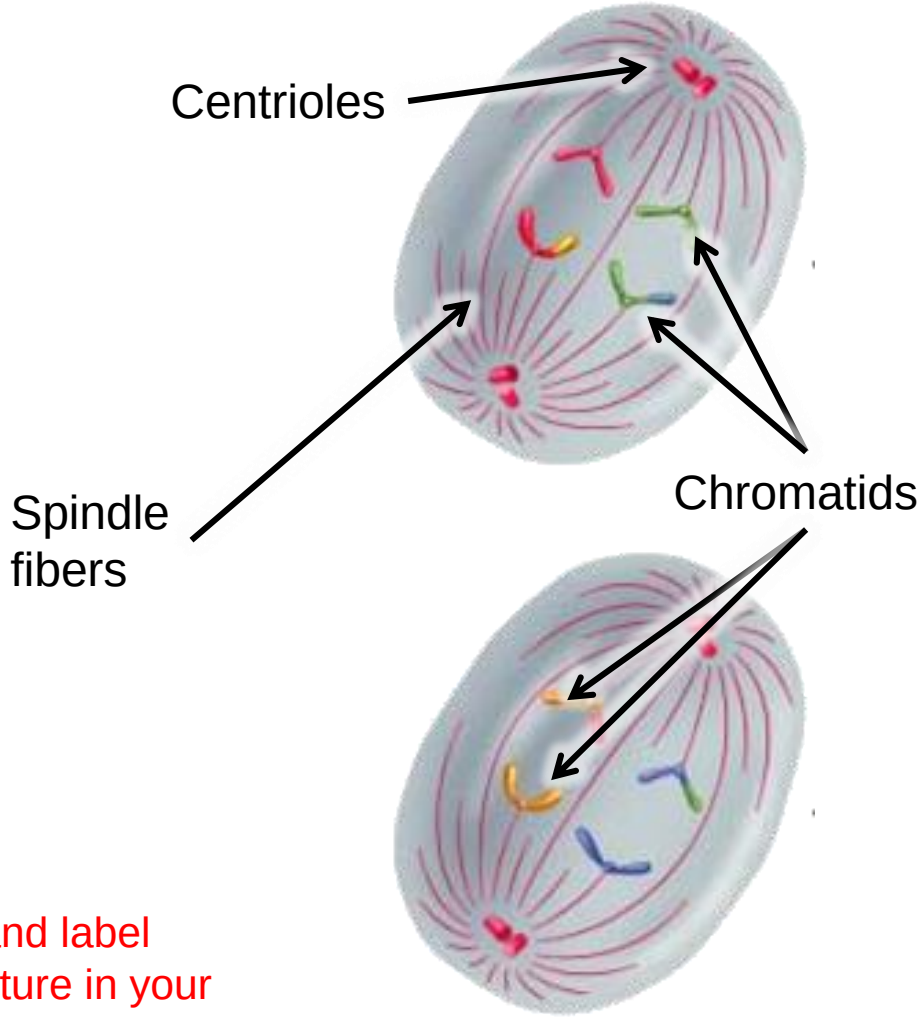


Draw and label this picture in your flipbook

Anaphase II (9th tab upper half)

- The centrioles use the spindle fibers to separate the chromosomes into individual chromatids

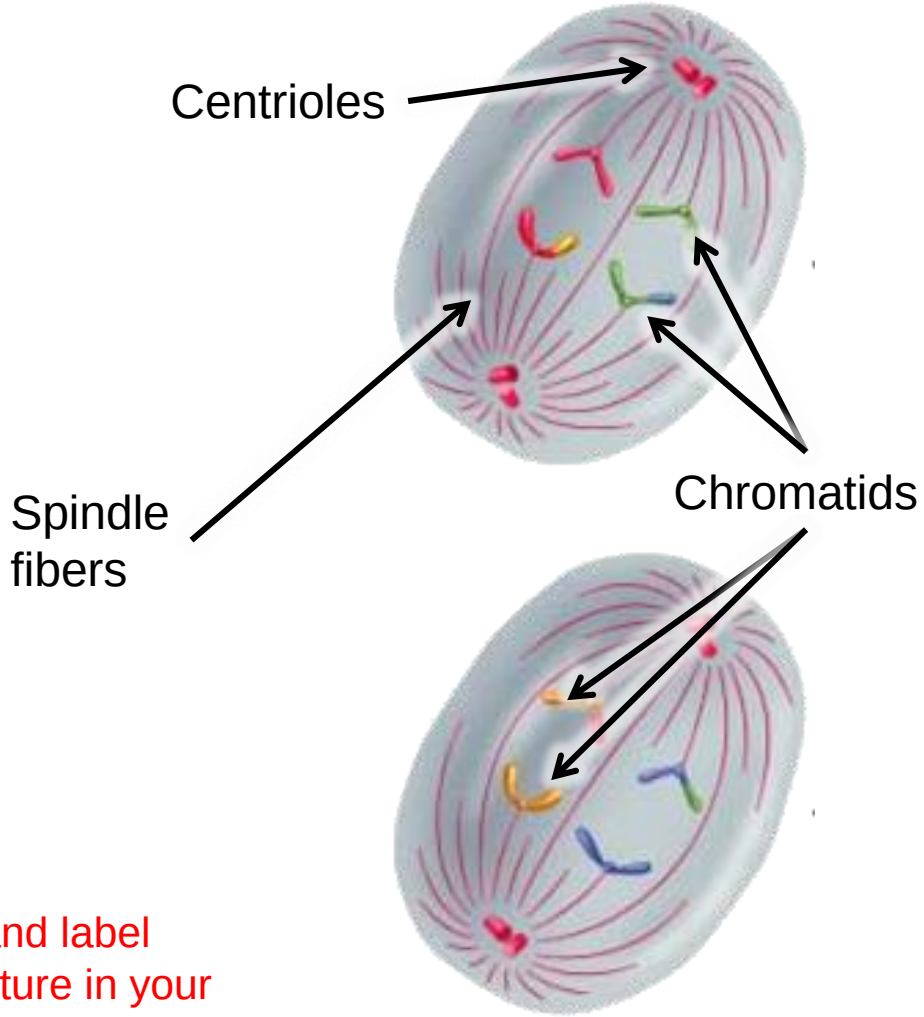
- Each chromatid is pulled to the opposite pole of the cell



Draw and label this picture in your flipbook

Anaphase II (9th tab upper half)

- If the centrioles do not properly attach the spindle fibers to the chromosome before they start to pull, then a Nondisjunction will occur

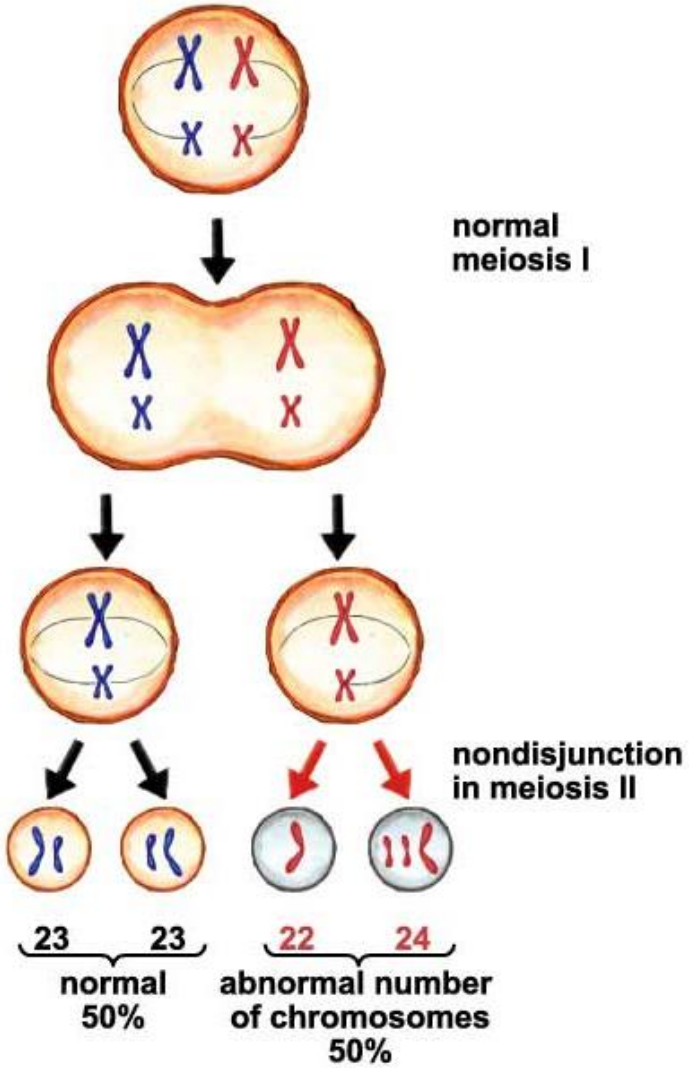


Draw and label this picture in your flipbook

Anaphase II (9th tab lower half)

Nondisjunction in Meiosis II

- In the third picture you see how the lower red chromosome only has one spindle fiber attached
- In the fourth picture it caused one gamete to have an extra chromatid and the other gamete to be missing one.
- A Nondisjunction causes the gametes to have the wrong amount of chromosomes



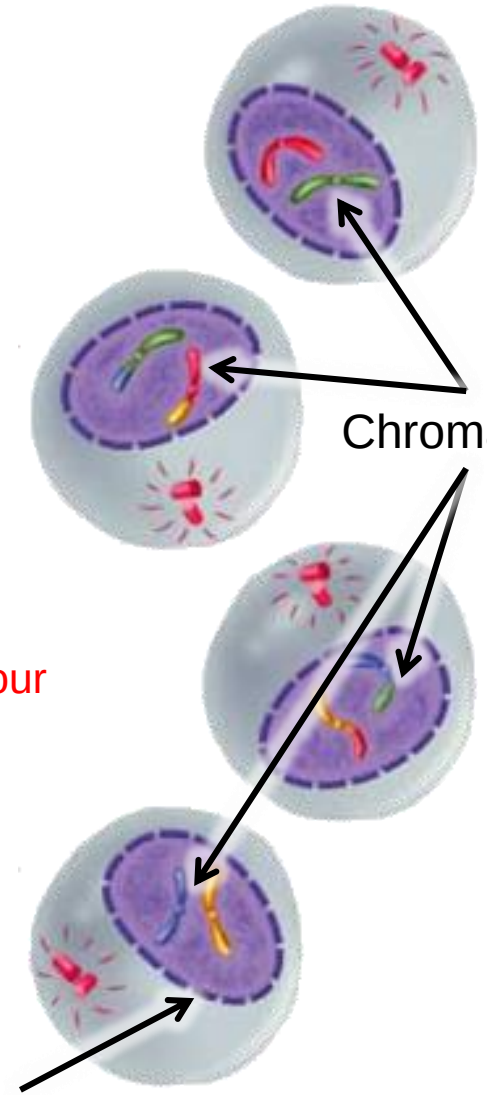
Draw this picture in your flipbook and use different colors to show the different chromosomes

Telophase II & Cytokinesis

(10th tab)

- Telophase II – the cells creates a permanent nucleus around the two haploid chromosome sets

- Cytokinesis – the cells divides into four haploid daughter cells

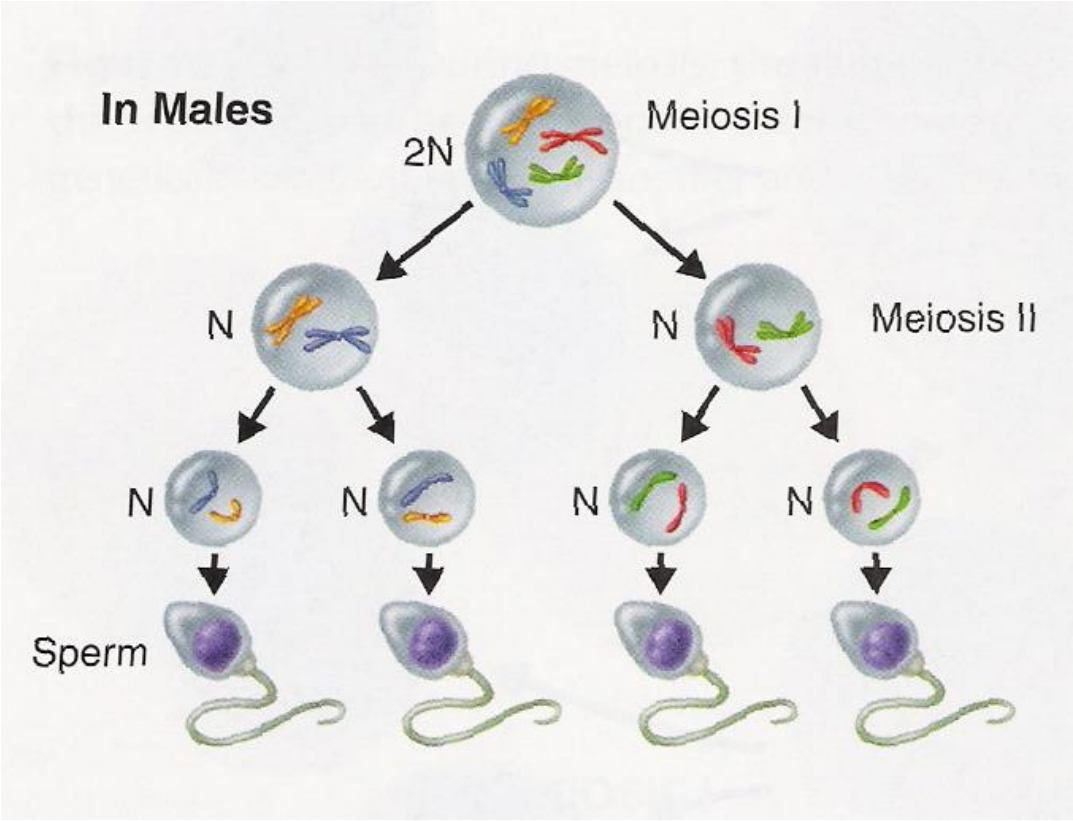


Draw and label this picture in your flipbook

Gamete (Sex Cell) Formation

- In male animals (including humans), the haploid gametes produced by meiosis are called sperm

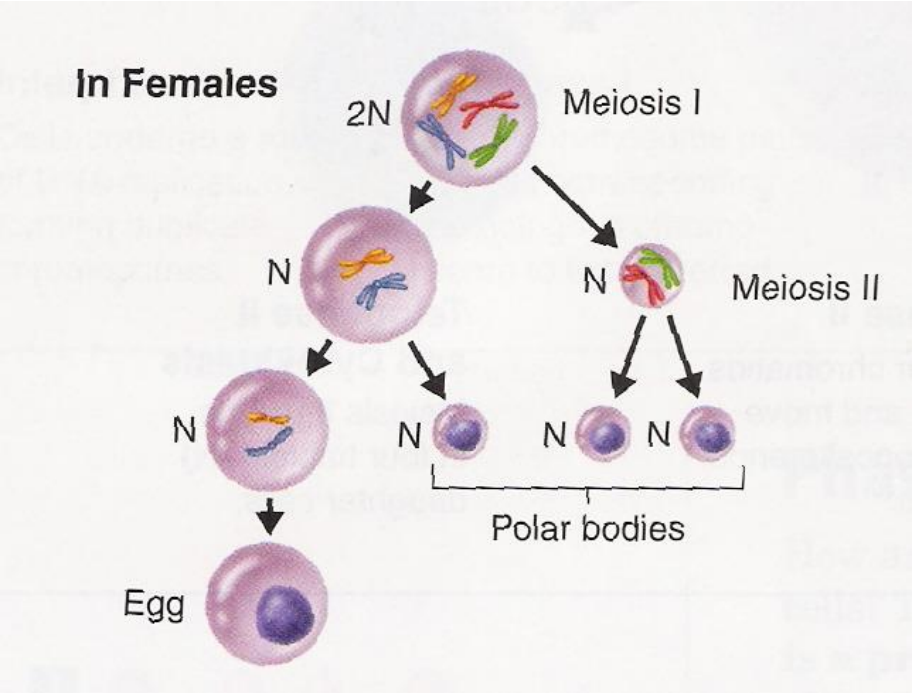
- 4 sperm cells are produced from one meiotic division



Gamete (Sex Cell) Formation

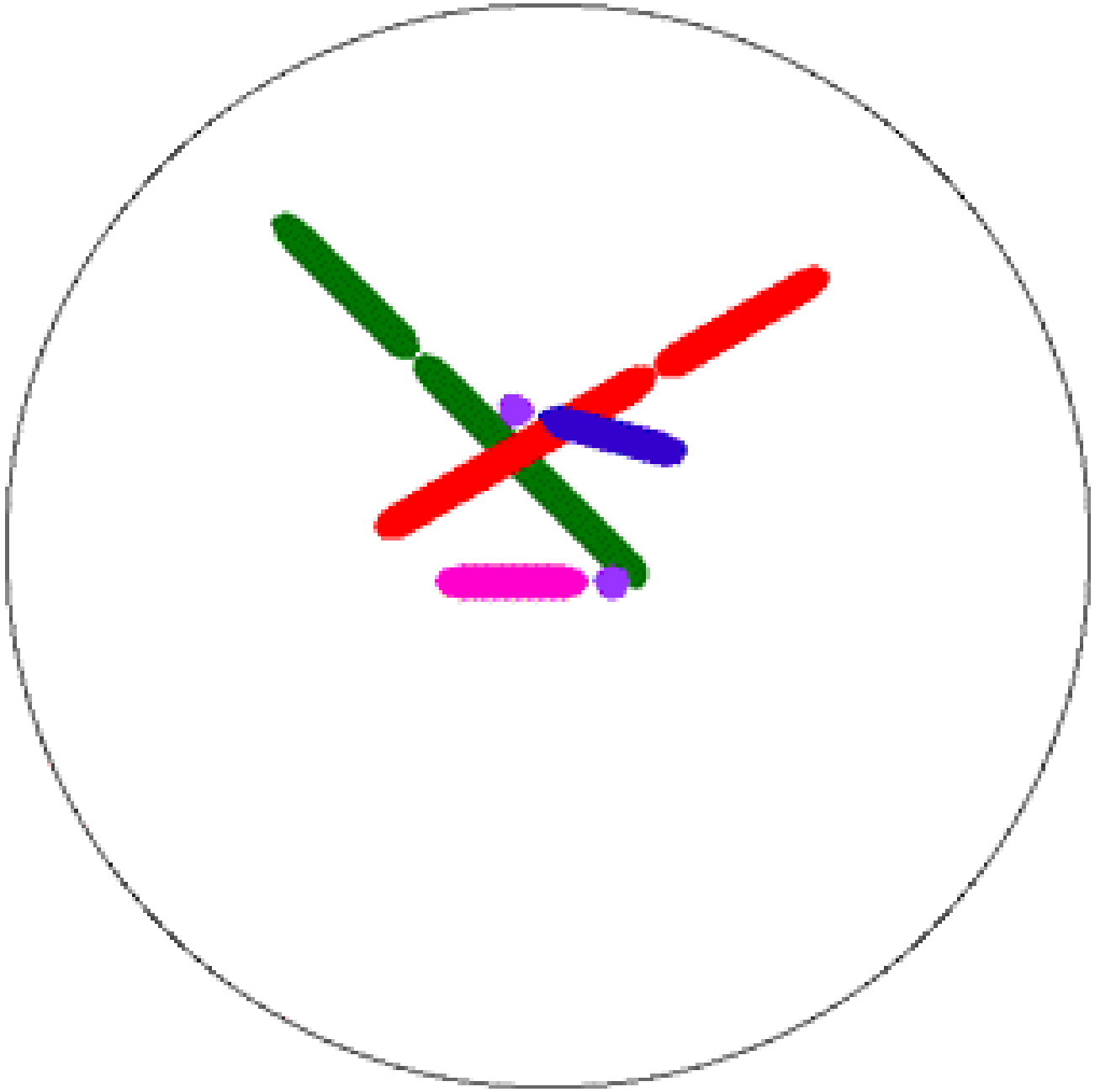
- In female animals (including humans), the haploid gametes produced by meiosis are called eggs

- The cell divisions at the end of meiosis I & II are uneven, so that 1 large egg is produced along with 3 other cells, called polar bodies, which are discarded and not involved in reproduction



Meiosis Animation

- The following slide shows a simple animation using a cell with 2 pairs of homologous chromosomes going through meiosis.



Meiosis Animation

Meiosis I Animation

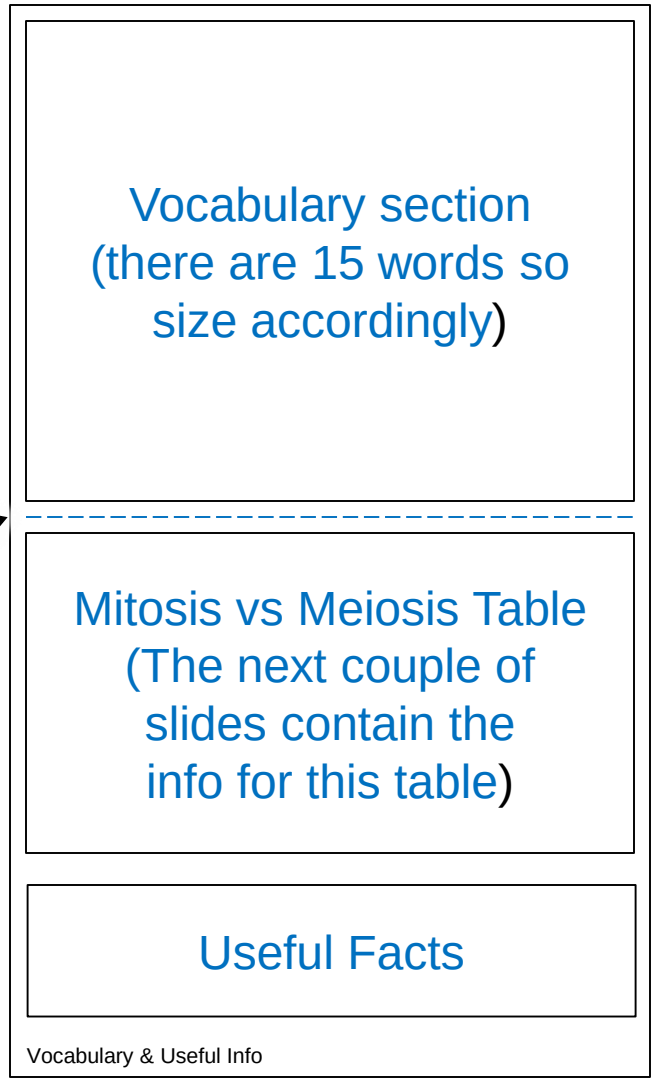
http://wps.prenhall.com/wps/media/objects/487/498728/CDA9_1/CDA9_1b/CDA9_1b.htm

Meiosis II Animation

http://wps.prenhall.com/wps/media/objects/487/498728/CDA9_1/CDA9_1c/CDA9_1c.htm

Vocaulary & Useful Info (11th tab)

- This tab will contain vocabulary, a table and some useful facts
- Set up the page like the diagram to the right
- The dotted blue line is the fold in the middle of the page



Vocabulary (11th tab upper half)

Reduction division – When the number of chromosomes per cell is cut in half

Haploid – A cell that has half the amount of chromosomes.
A cell that is “N” for chromosome amount

Diploid – A cell that has twice the amount of chromosome.
A cell that is “2N” for chromosome amount

Gamete – the *haploid* “sex” cells (in animals they are sperm and egg cells)

Somatic Cell – all *diploid* cells (body cells) that are not gametes

Zygote – fertilized egg cell formed form the joining of the gametes (sperm and egg)

Vocabulary (11th tab upper half)

Centrioles – Organelles in the cell that help to move chromosomes during cell division

Chromatin – What you call the DNA during Interphase, Very easy to access the genes for transcription and translation to create proteins

Chromosome – What you call the DNA during the actual cell division stages (Pro-, Meta-, Ana-, and Telophase).

Condensed/packed DNA for easy movement during cell division

Chromatid – One of the "arms" of a chromosome 'X'. Each chromatid is identical to the other because it is created by replication.

A chromosome is made of two *Sister Chromatids*.

Spindle Fiber – fibers created and used by the centrioles to move the chromosomes around during the division stages.

Vocabulary (11th tab upper half)

Homologous Chromosomes – the same numbered chromosome that pair up from mother and father (ex: mom's chromosome 1 and dad's chromosome 1)

Crossing Over – A kind of chromosomal mutation that happens in Prophase 1 of meiosis.
Homologous chromosomes overlap and exchange pieces of the chromosome which caused genetic variability.

Nondisjuction – Happens in either Anaphase 1 or Anaphase 2 of meiosis when one centriole does not connect to the chromosome with a spindle fiber.

Causes the gametes to have extra or missing chromosomes.

Fertilization – The process of making a zygote. When egg and sperm cells fuse and combine their genetic information (DNA)

Table (11th tab lower half)

- Set up your table as shown

	Mitosis	Meiosis
Number of Starting cells		
Number of ending cells		
Number of Human Chromosomes		
Genetic Make up of cells		
Type of cells		

- Use the following slides to complete the table you just made.
- The text is in blue so you don’t have to write it all, but you will have to include some to complete the table.

Comparing Mitosis & Meiosis

- Number of cells at beginning of process
  - Mitosis = 1 Diploid cell
  - Meiosis = 1 Diploid Cell

- Number of cells at the end of the process
  - Mitosis = 2 Diploid Cells
  - Meiosis = 4 Haploid Cells

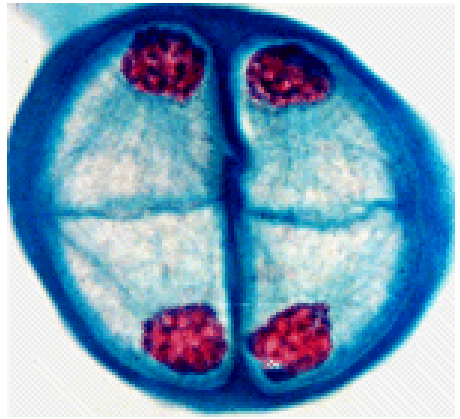
Comparing Mitosis & Meiosis

- Number of chromosomes at the **START**
  - Mitosis = 46 (***Diploid***, “two sets”)
  - Meiosis = 46

- Number of chromosomes at the **END**
  - Mitosis = 46
  - Meiosis = 23 (***Haploid***, “one set”)

Comparing Mitosis & Meiosis

- Is the genetic make-up of the daughter cells UNIQUE or IDENTICAL?
  - Mitosis produces 2 IDENTICAL CELLS
  - Meiosis produces 4 UNIQUE CELLS



Comparing Mitosis & Meiosis

- Type of cell in the human body that can undergo each phase
  - ❖Mitosis produces Somatic BODY cells (skin)
  - ❖Meiosis produces Gamete SEX cells (sperm or eggs)

Interesting Facts (11th tab bottom)

- Females produce all their eggs at once, and store them at a very early age (They release one each month during menstration)

  Why is this not necessarily a good thing?

- Males make sperm constantly from puberty until they die.