MEIOSIS: GAMETE CELL DIVISION

- Recall that **GAMETES** are the **REPRODUCTIVE (SEX)** cells of the body.
- **"The BIRDS and the BEES" - The Basics**
- **SEXUAL REPRODUCTION** occurs when two different individuals (1 male & 1 female) produce a **HYBRID OFFSPRING** (a combination of both parents) by each contributing 1 **GAMETE** cell.
- Male cell: **SPERM CELL**
- Female cell: **EGG CELL**
- **FERTILIZATION** occurs when the two cells meet and form **ONE** new cell called the **ZYGOTE**. (This is the very **FIRST** cell of any sexually reproducing organism)
- The zygote will then divide **OVER AND OVER** again **VIA MITOSIS** until it grows into fully developed individual.

- In order for a sexually reproducing organism's chromosome number to stay the same generation after generation (for example: Humans- 46 chromosomes) the gamete's chromosome number must be **HALF** of the normal number.
- (Human gamete - 23 chromosomes)
- To make such cells requires a different type of cell division called **MEIOSIS**
- There are many important **SIMILARITIES** and **DIFFERENCES** between **MITOSIS & MEIOSIS**

SIMILARITIES:

- The order of phases (**P > M > A > T**) and major events that occur at each are the same for the most part
  - PROPHASE- formation of chromosomes, centrioles, & spindle fibers
  - METAPHASE- chromosomes line up on equator
  - ANAPHASE- pulling apart of chromosomes
  - TELOPHASE- separation completes, cytokinesis occurs

DIFFERENCES:

- Meiosis goes through **TWO** sets of division (not **ONE**): **MEIOSIS I and II**
- Meiosis produces **FOUR** daughter cells (not **TWO**)
- Daughter cells have been reduced to **HAPLOID (N)** cells (**23 chromosomes**) instead of **DIPLOID (2N)** (**46 chromosomes**)
- Daughter cells are **NOT IDENTICAL** to the **PARENT** cell or **EACH OTHER**

MEIOSIS I:

PROPHASE I: Same as prophase of mitosis EXCEPT

- Once chromosome are formed, they **PAIR UP** with their **MATCHING COUNTERPART.**

***REMEMBER!** You have 2 copies of each of the 23 chromosomes (1 from mom, 1 from dad), this adds up to make 46 total.

- This is called a **HOMOLOGOUS PAIR**
- **CROSSING OVER** occurs between the homologous chromosomes
- (**GENES** can **FLIP-FLOP** from one chromosome to its partner)
- Crossing over creates endless gene combinations and **GREATLY** increases **GENETIC DIVERSITY**

METAPHASE I:

Same as metaphase of mitosis EXCEPT. . .

- **HOMOLOGOUS PAIRS** line up in the middle, instead of **INDIVIDUAL** chromosomes.

ANAPHASE I:

- **SISTER CHROMATIDS** are **NOT** pulled apart
- **HOMOLOGOUS PAIRS** are pulled apart "**BUTTERFLIES**" are still intact

TELOPHASE I:

Same as telophase of mitosis EXCEPT. . .

- At this point the **CHROMOSOME NUMBER** has been reduced from **46 to 23** in the

daughter cells. (From **DIPLOID** to **HAPLOID**)

Meiosis II

Anaphase (MITOSIS)

- The events that take place in **MEIOSIS II** are exactly the same as **MITOSIS**, **EXCEPT** that there are only **23** chromosomes being separated **INSTEAD of 46**.

Check out this website for a good animation on the difference between Mitosis and Meiosis:

http://highered.mcgraw-hill.com/olc/dl/120074/bio17.swf

http://www.sumanasinc.com/webcontent/animations/content/mitosis.html

http://www.sumanasinc.com/webcontent/animations/content/meiosis.html

- **GAMETOGENESIS: The making of gametes**
- GAMETE - **SEX CELL (SPERM OR EGG)**
- GENESIS - **TO MAKE OR CREATE**

2 TYPES:

- **SPERMATOGENESIS** - Makes **MALE** sperm cells
- **OOGENESIS** - Makes the **FEMALE** egg cells

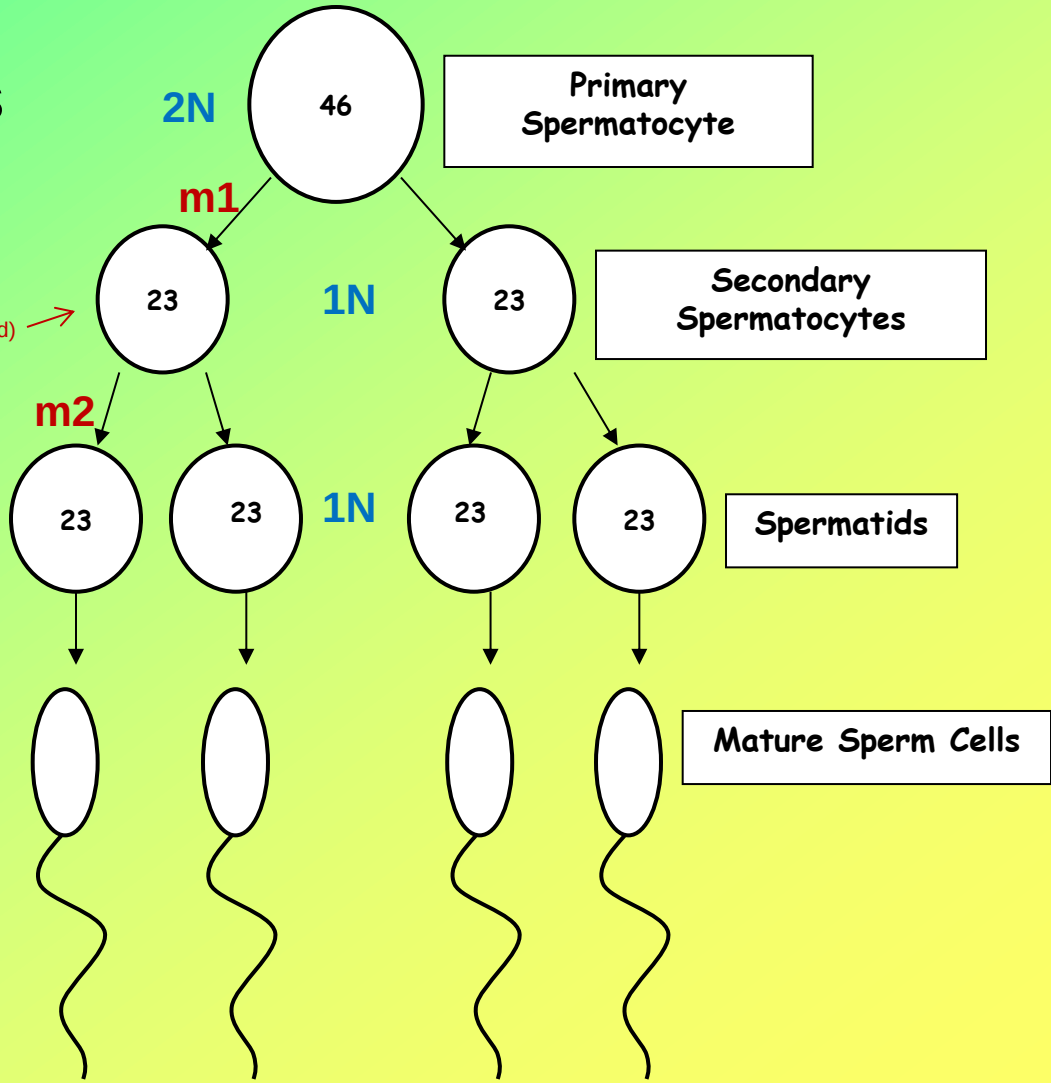
Both processes use **MEIOSIS** as their type of cell division, **HOWEVER** the results are quite different.

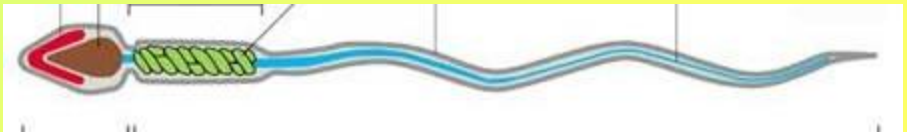
SPERMATOGENESIS

- Happens in the **TESTES**
- **GERM CELLS** in the testes are **DIPLOID (2N, 46)** just like the rest of the body cells.
- Initial germ cells are called **PRIMARY SPERMATOCYTES**

(1 chromosome = 1pair of sister chromatids – still connected)

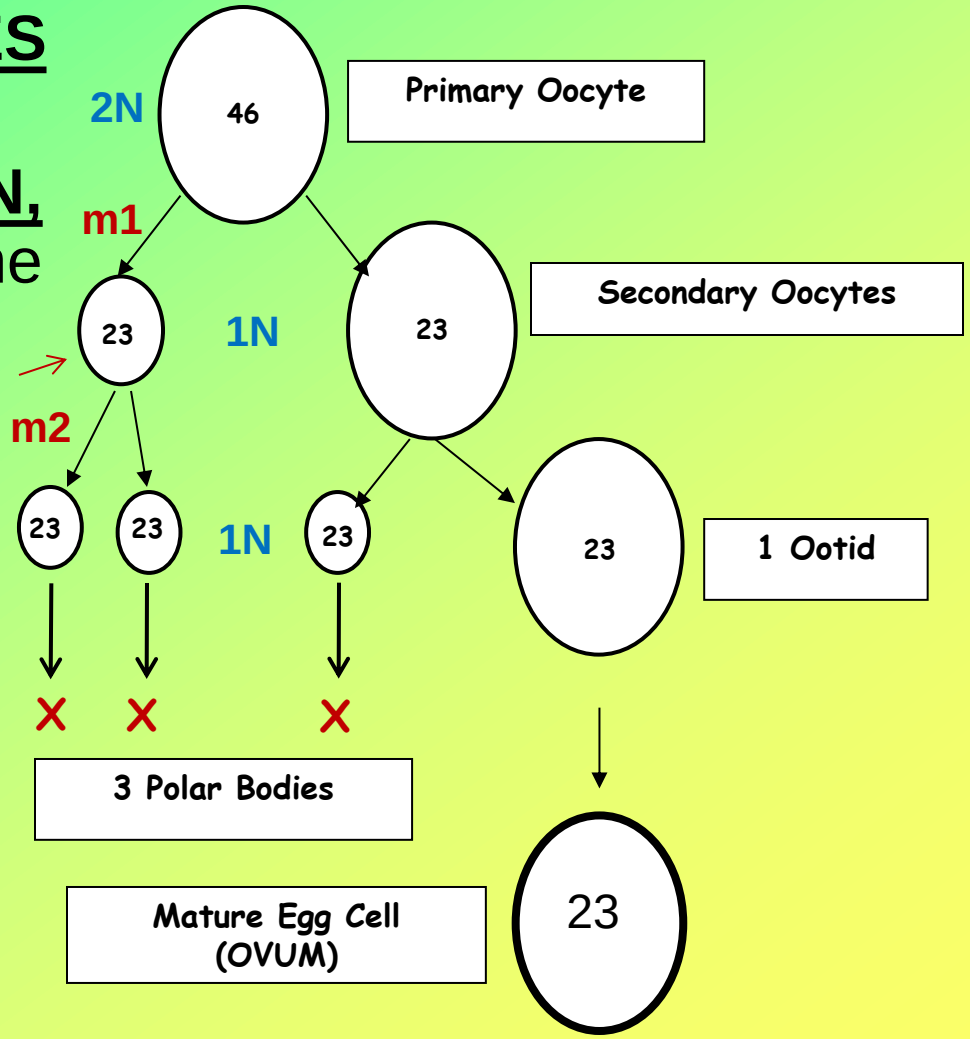
1 round of spermatogenesis produces **FOUR** healthy sperm cells. Every sperm cell contains a unique combination of genes. (**NO TWO ARE ALIKE!**)





OOGENESIS:

- Happens in the **OVARIES**
- **GERM CELLS** in the ovaries are **DIPLOID (2N, 46)** just like the rest of the body cells.
- Initial germ cells are called **PRIMARY OOCYTES**
- **1 round of Oogenesis produces ONE healthy egg cell (OVUM), and THREE POLAR BODIES. The polar bodies serve NO PURPOSE in the body.**



Sperm production begins at puberty and continues throughout life. An average of 300,000,000 sperm cells are made every day.

Females start releasing **ONE** mature egg every month beginning at puberty and ending at **MENOPAUSE** (late 40s to 50s) .

Why the difference?! Why do males make so much sperm and females make so few eggs?