Mitosis and Meiosis Notes

Mitosis

Pre-Mitosis (Interphase)

The chromosomes are duplicated just before mitosis, so there are two identical ('sister') copies of each one. This gives a total of 2 x 46 chromosomes (92). They remain in their 'unwound' state, and are therefore invisible.

The centrioles, a pair of cylindrical structures, are also duplicated. Each set of centrioles is surrounded by a tubule-making zone: the centrioles and the zone together make up a centrosome.

Prophase

The chromosomes become visible. The two identical copies of each chromosome are called chromatids. Each chromatid pair is joined together, forming an 'x-shaped' structure called a metaphase chromosome.

The nuclear membrane, nuculeolus, endoplasmic reticulum and Golgi complex break up.

The centrioles move to opposite ends of the cell, and spindle fibers begin to grow out from them.

Metaphase

The chromosomes are now at the middle of the cell. Spindle fibers attached to chromatids.
**Anaphase**

The two sister chromatids are separated and pulled to opposite ends of the cell. As a result, each of the daughter cells from mitosis ends up with one copy of every chromosome that was in the original cell.

The cell begins to pinch inwards in the middle.

**Telophase**

The two sister chromatids from each metaphase chromosome are now at opposite ends of the cell. At the site of the metaphase plate, the cytoplasm pinches inward.

**Cytoplasm**

The cell is divided in two cells and mitosis ends.

In each new cell, the nuclear membrane and other organelles begin to re-assemble and the chromosomes are ‘unwound’.

The result of mitosis is two cells that are identical to each other and the original cell.

**Meiosis**

Meiosis is the type of cell division by which gametes (eggs or sperm) are formed. It involves two divisions and results in four different daughter cells that have 23 chromosomes. This ensures that, when an egg and a sperm unite during fertilization, the resulting embryo will have 46 chromosomes - the normal number for a human.

The first meiotic division is called Meiosis I, and the second meiotic division is called Meiosis II.
Meiosis I

Meiosis one is identical to the stages of mitosis. The only difference is that each stage ends with an “I” to identify it is occurring during Meiosis I.

Mitosis of an Animal Cell

Meiosis II

Prophase II

Unlike Prophase I, the chromosomes are not duplicated. Chromosomes are visible. Sister chromatids are still connected to each other, but thanks to the process of crossing over (sharing of genetic material), they are no longer exactly identical.

The centrosomes move to opposite ends of the cell, and microtubules begin to grow out from them, once again forming a meiotic spindle.
As the spindle fibers grow, they once again attach to the chromosomes. As in mitosis, each chromatid becomes attached to one spindle. The spindles direct the chromosomes towards the middle of the cell.

Metaphase II

The chromosomes are now lined up along the middle of the cell. Sister chromatids are attached to microtubules from opposite ends of the cell.

Anaphase II

The two sister chromatids in each metaphase chromosome are separated and pulled to opposite ends of the cell. As a result, each of the daughter cells from Meiosis II ends up with only one copy of each chromosome.

The cell begins to pinch inwards in the middle.

Telophase II

The two sister chromatids from each metaphase chromosome are now at opposite ends of the cell. At the site of the metaphase plate, the cytoplasm begins to pinch inwards.
Cytokinesis II

In each new daughter cell, the nuclear membrane and other organelles begin to re-assemble and the chromosomes are 'unwound'.

The result of meiosis II is four unique daughter cells. Each daughter cell possesses either a paternal or a maternal copy of each original chromosome (1 copy each of 23 chromosomes). This means that each daughter cell possesses only half as many chromosomes as the original parent cell.