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LECTURE (1)

Human Genetics

3rd stage

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What is cell?

Cells are the basic building blocks of all living things. The human body is composed of trillions of cells. They provide structure for the body, take in nutrients from food, convert those nutrients into energy, and carry out specialized functions. Cells also contain the body's hereditary material and can make copies of themselves.

Cells have many parts, each with a different function. Some of these parts, called organelles, are specialized structures that perform certain tasks within the cell.

How Many Cells Are in Your Body?

The long answer is that scientists do not yet know the exact number, but as an average man contains around 30 to 40 trillion cells. Cell types can look different and carry out distinct roles within the body. Despite their differences, cells often share certain structures. These are known as organelles or mini organs. Below are some of the most important:

- Cytoplasm

  The cytoplasm is the interior of the cell that surrounds the nucleus. It includes the organelles, and a jelly-like fluid called the cytosol. Many of the important reactions that take place in the cell occur in the cytoplasm.

- Cytoskeleton

  The cytoskeleton is a network of long fibers that make up the cell's structural framework. The cytoskeleton has several critical functions, including determining cell shape, participating in cell division, and allowing cells to move.

- Endoplasmic reticulum

  The endoplasmic reticulum (ER) processes molecules within the cell and helps transport them to their final destinations. In particular, it synthesizes, folds, modifies, and transports proteins.

- Golgi apparatus

  The Golgi apparatus packages molecules processed by the endoplasmic reticulum to be transported out of the cell.

- Lysosomes and peroxisomes

  These organelles are the recycling center of the cell. They digest foreign bacteria that invade the cell, rid the cell of toxic substances, and recycle worn-out cell components.

- Mitochondria

  Mitochondria are complex organelles that convert energy from food into a form that the cell can use. They have their own genetic material, separate from the DNA in the nucleus, and can make copies of themselves.

- Nucleus

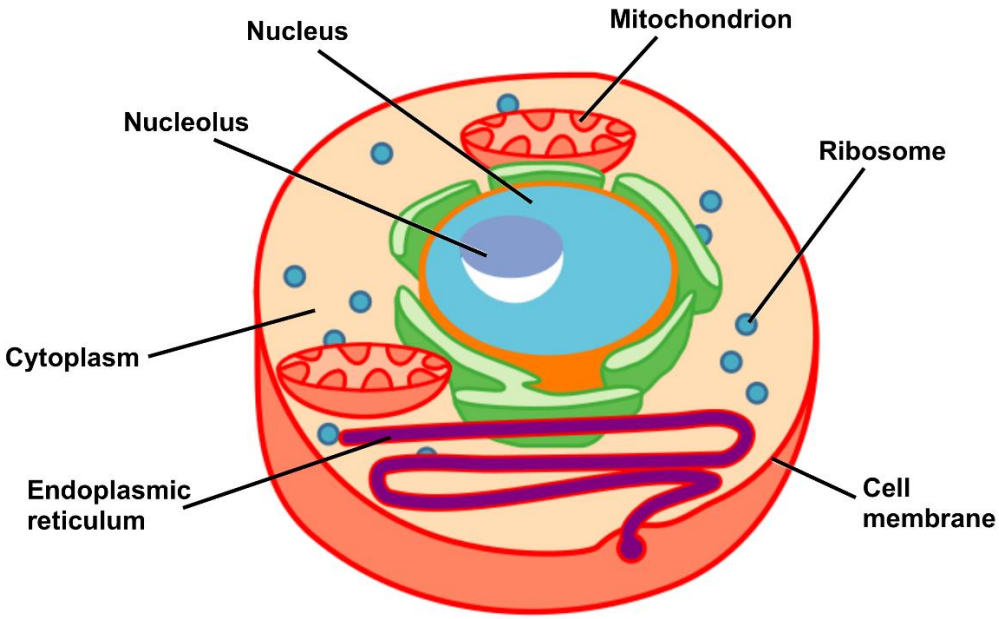
  The nucleus serves as the cell's command center, sending directions to the cell to grow, mature, divide, or die. It also houses DNA (deoxyribonucleic acid), the cell's hereditary material. The nucleus is surrounded by a membrane called the nuclear envelope, which protects the DNA and separates the nucleus from the rest of the cell.

- Plasma membrane

  The plasma membrane is the outer lining of the cell. It separates the cell from its environment and allows materials to enter and leave the cell.

- Ribosomes

Ribosomes are organelles that process the cell's genetic instructions to create proteins. These organelles can float freely in the cytoplasm or be connected to the endoplasmic reticulum



➢ Why Do Cells Need to Divide?

1. Cells divide to allow multicellular organisms to grow.
2. Cells divide to reproduce and create identical copies of themselves.
3. Cells divide to repair damaged or dead cells in multicellular organisms.

How Do Cells Know When to Divide?

In cell division, the cell that is dividing is called the "parent" cell. The parent cell divides into two "daughter" cells. The process then repeats in what is called the cell cycle.

Cells regulate their division by communicating with each other using chemical signals from special proteins called cyclins. These signals act like switches to tell cells when to start dividing and later when to stop dividing.

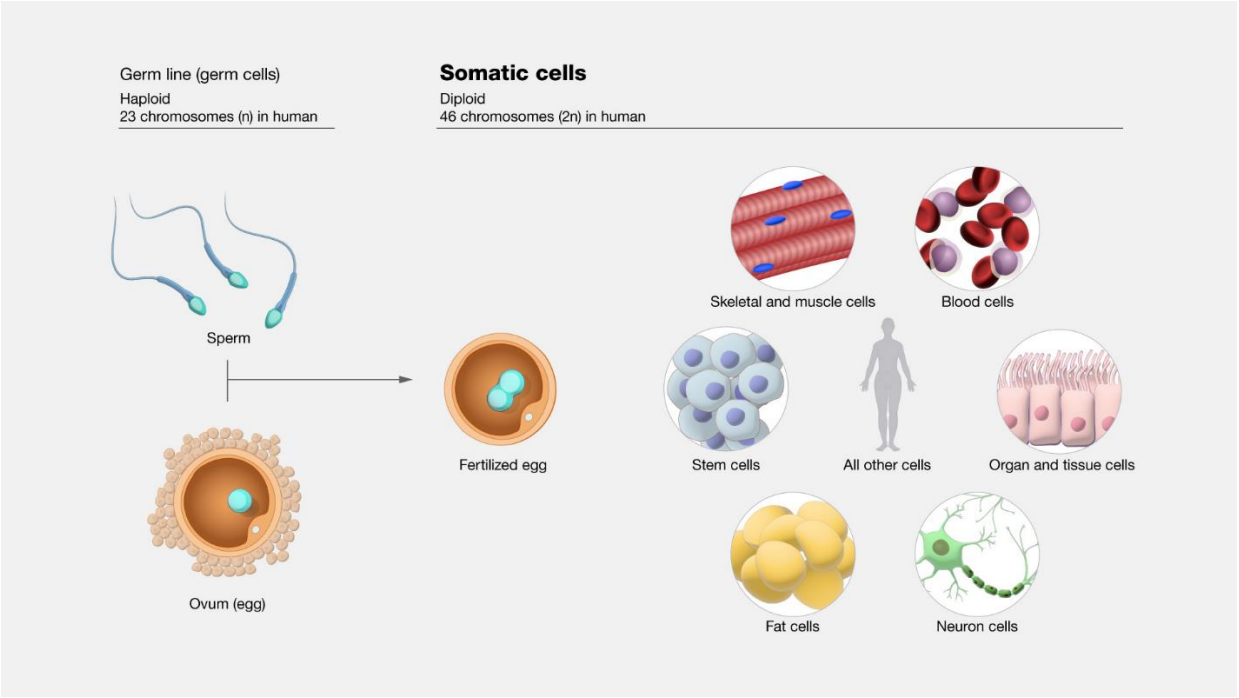
It is also important for cells to stop dividing at the right time. If a cell cannot stop dividing when it is supposed to stop, this can lead to a disease called cancer.

Some cells, like skin cells, are constantly dividing, we lose 30,000 to 40,000 dead skin cells every minute This is a lot of skin cells to replace, making cell division in skin cells is so important. Other cells, like nerve and brain cells, divide much less often.

How Cells Divide?

There are two types of cells in our body. somatic cell and sexual cell.

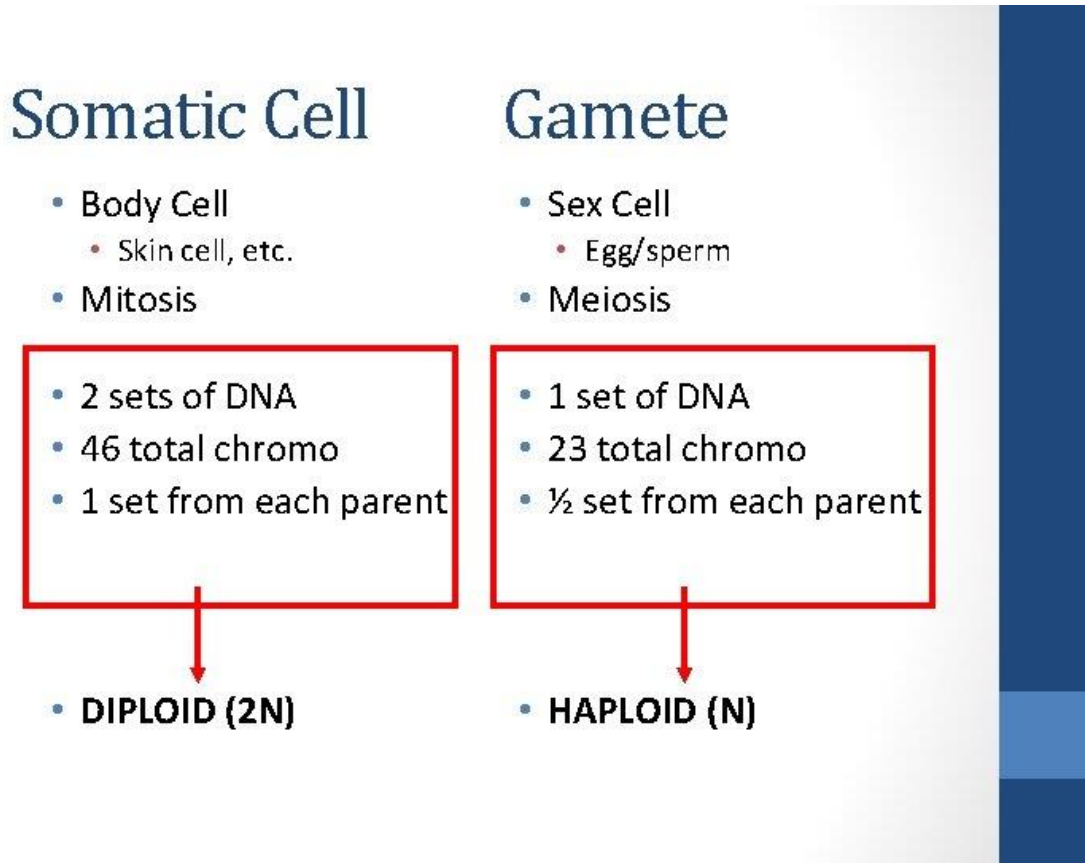
Somatic cells are the cells in the body other than sperm and egg cells. In humans, somatic cells are diploid (2n), meaning they contain two sets of chromosomes (23) pairs (total=46 chromosome), one inherited from each parent. DNA mutations in somatic cells can affect an individual, but they cannot be passed on to their offspring.



Which means: There are 23 pairs of chromosomes in somatic cells; one member of each pair is paternal (from the father) and one maternal (from the mother). There are 22 matched pairs of autosomal chromosomes, plus one pair of sex chromosomes.

Sexual cells refer to the (eggs and sperm) that sexually reproducing organisms use to pass on their genomes from one generation to the next (parents to offspring). Egg and sperm cells are called germ cells. In humans, the gametes are called the sperm (in the male) and the egg (in the female).

Since two parents are necessary to create individuals for the next generation of the species, gametes are typically haploid cells (n).



Depending on the type of cell, there are two ways cells divide—mitosis and meiosis. Each of these methods of cell division has special characteristics. One of the key differences in mitosis is a single cell divides into two cells that are replicas of each other and have the same number of chromosomes. This type of cell division is good for basic growth, repair, and maintenance. In meiosis a cell divides into four cells that have half the number of chromosomes. Reducing the number of

chromosomes by half is important for sexual reproduction and provides for genetic diversity.

- Cell cycle

To divide, a cell must complete several important tasks: it must (1) grow, (2) copy its genetic material (DNA), and (3) physically split into two daughter cells. Cells perform these tasks in an organized, predictable series of steps that make up the cell cycle. The cell cycle is a cycle, rather than a linear pathway, because at the end of each go-round, the two daughter cells can start the exact same process over again from the beginning.

In eukaryotic cells, or cells with a nucleus, the stages of the cell cycle are divided into two major phases: interphase and the mitotic (M) phase.

- During interphase, the cell grows and makes a copy of its DNA.
- During the mitotic (M) phase, the cell separates its DNA into two sets and divides its cytoplasm, forming two new cells.