Exercise no. 1.Look at the picture below and answer to the question: how long does a cell live?

CELL TYPE	LIFESPAN
Granulocytes: eosinophils, basophils, neutrophils	10 hours to 3 days
Stomach lining cells	2 days
Sperm cells	2 to 3 days
Colon cells	3 to 4 days
Epithelia of small intestine	Up to 1 week
Platelets	10 days
Skin epidermal cells	2 to 4 days
Lymphocytes	2 months to more than a year
Red blood cells	4 months
Macrophages	Months to years
Endothelial cells	Months to years
Pancreas cells	1 year or more
Bone cells	25 to 30 years

Exercise no. 2. ***The cell's replacement.*** How are dead cells replaced by new cells? How do cells reproduce themselves?

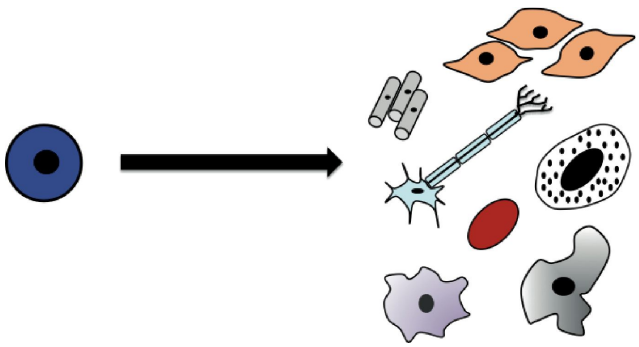
Do you remember mitosis? Fill in the gaps using the following words**:**

breaks, equal, binary fission, two identical, two daughter

Mitosis is a part of the cell cycle in which chromosomes in a cell nucleus are separated into ……. sets of chromosomes, each in its own nucleus. In general, mitosis (division of the nucleus) is often followed by cytokinesis, which divides the cytoplasm, organelles and cell membrane into two new cells containing roughly …….. shares of these cellular components. Mitosis and cytokinesis together define the mitotic (M) phase of an animal cell cycle—the division of the mother cell into …… ……cells, genetically identical to each other and to their parent cell.

Mitosis occurs only in eukaryotic cells and the process varies in different organisms. For example, animals undergo an "open" mitosis, where the nuclear envelope …… down before the chromosomes separate, while fungi undergo a "closed" mitosis, where chromosomes divide within an intact cell nucleus. Furthermore, most animal cells undergo a shape change, known as mitotic cell rounding, to adopt a near spherical morphology at the start of mitosis. Prokaryotic cells, which lack a nucleus, divide by a different process called ……..

Exercise no. 3. ***Differentiation.*** Write the definition of differentiation looking at the picture.

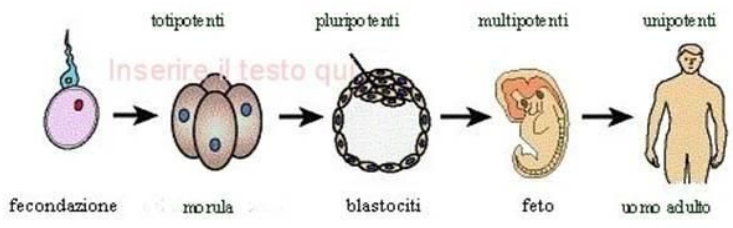


embryonic stem cells ⟶ all types of cells

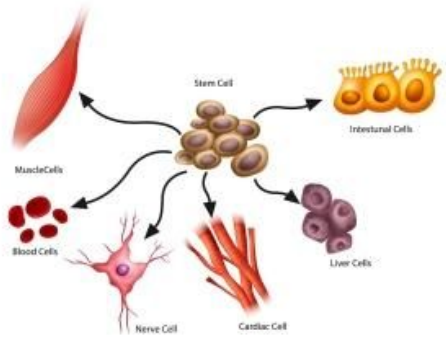
Exercise no. 4. ***Stem cells as a reservoir.*** Divide the text into three parts: one is connected to picture no. 1 and one is connected to picture no. 2 . Which part remains? Write it down and explain its meaning clearly.

"Life begins with one cell, the fertilized egg. Throughout development cells divide over and over again to produce the billions of cells that make up the body. At certain stages most cells stop making copies of themselves and start to specialize. When we are fully formed almost all of our cells are **specialized.** Stem cells are very special cells and they act as **a reservoir** really because the specialized cells can no longer make copies of themselves so if they die or get used up then they have to be replaced from somewhere and this is where the stem cells function. Stem cells are used in the blood system, we need to make millions of new blood cells every single day and these are generated from stem cells. These cells actually live in the bone marrow and altogether the blood stem cell can make eight different types of specialized cell. They are used in the skin. We need to make new skin cells all the time because we are always wearing away our skin."

Picture no. 1

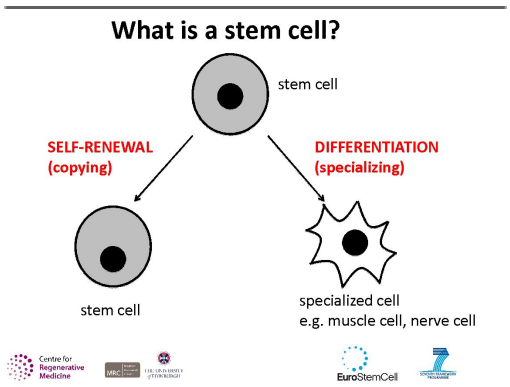


Picture no. 2



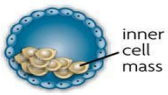
Exercise no. 5. ***Asymmetric reproduction.*** The diagram illustrates a very 'special' mitosis. Why?

Write the differences between the reproduction of a stem cell and any other cell. What is the consequence of this type of reproduction? Is it connected with the idea of stem cells as a reservoir of cells?

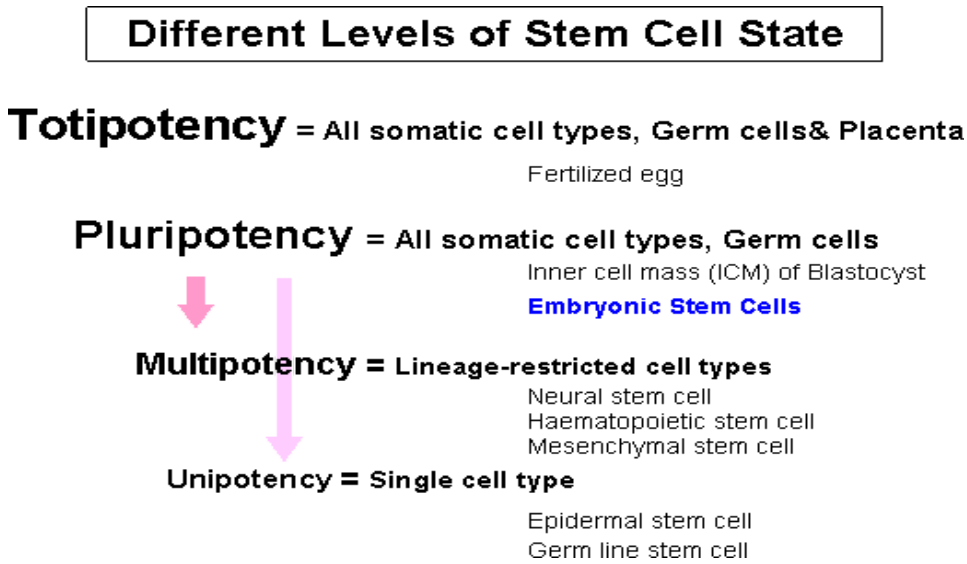


Exercise no. 6. ***Stem cell classification.*** Explain the different types of stem cell in relation to the cell potency.

Stem Cell Classification

Class	totipotent	pluripotent	multipotent
Type of cell	fertilized egg 	embryonic stem cell 	adult stem cell (example from blood) 
Can give rise to	all cells	almost any cell	closely related cells
Example	new organism	neurons, skin, muscle, kidney, cartilage, bone, liver, pancreas	red blood cells, platelets, white blood cells

Exercise no. 7. ***Cell potency***. Read the text and connect numbers with letters.



1.Totipotent Stem Cells 2.Pluripotent Stem Cells 3.Multipotent Stem Cells 4.Adult Stem Cells

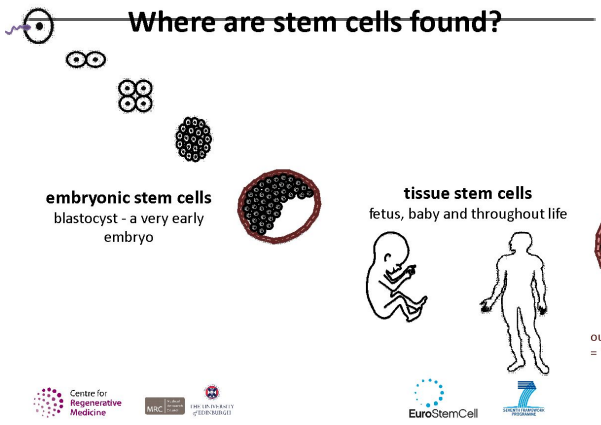
A.These are less plastic and more differentiated stem cells. They give rise to a limited range of cells within a tissue type. The offspring of the pluripotent cells become the progenitors of such cell lines as blood cells, skin cells and nerve cells. They can become one of several types of cells within a given organ. For example, they can develop into red blood cells, white blood cells or platelets.

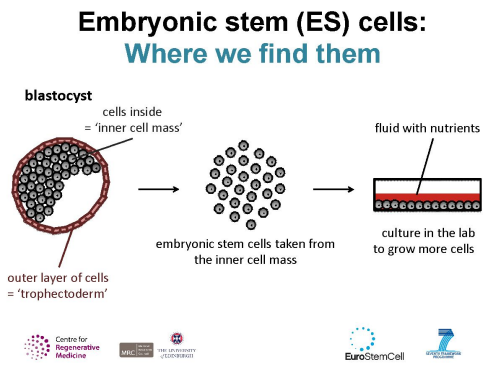
B.These cells are like totipotent stem cells in that they can give rise to all tissue types. Unlike totipotent stem cells, however, they cannot give rise to an entire organism. On the fourth day of development, the embryo forms into two layers, an outer layer which will become the placenta, and an inner mass which will form the tissues of the developing human body. These inner cells, though they can form nearly any human tissue, cannot do so without the outer layer; so are not totipotent, but pluripotent. As these pluripotent stem cells continue to divide, they begin to specialize further.

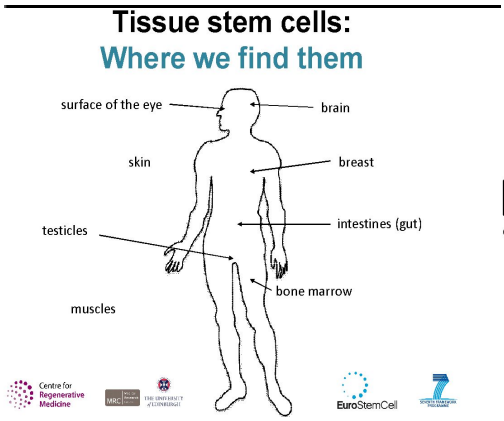
C.These are the most versatile of the stem cell types. When a sperm cell and an egg cell unite, they form a one-celled fertilized egg. This cell is totipotent, meaning it has the potential to give rise to any and all human cells, such as brain, liver, blood or heart cells. It can even give rise to an entire functional organism. The first few cell divisions in embryonic development produce more totipotent cells. After four days of embryonic cell division, the cells begin to specialize into pluripotent stem cells.

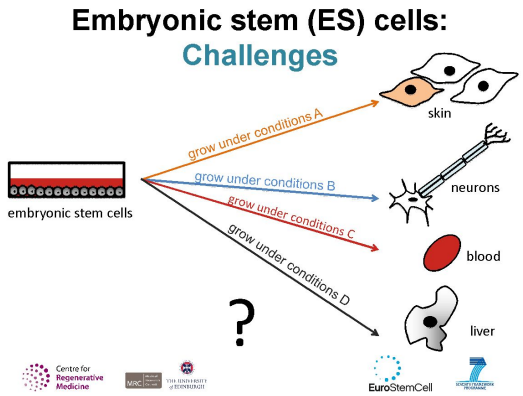
D. It is a multipotent stem cell in adult humans that is used to replace cells that have died or lost function. It is an undifferentiated cell present in differentiated tissue. It renews itself and can specialize to yield all cell types present in the tissue from which it originated. So far, adult stem cells have been identified for many different tissue types such as hematopoetic (blood), neural, endothelial, muscle, mesenchymal, gastrointestinal, and epidermal cells.

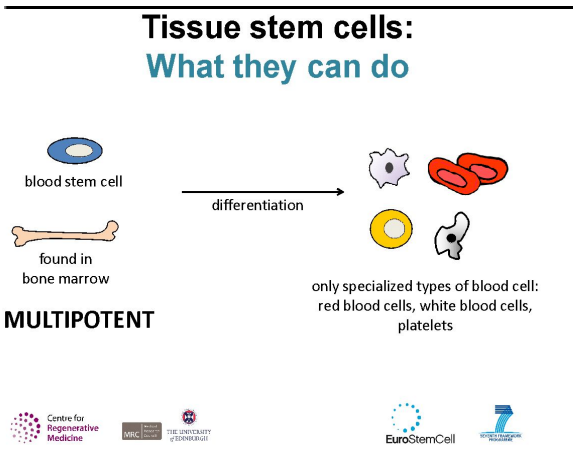
Exercise n. 8. ***Embryonic and adult stem cells.*** Describe the following images and write notes about the main concepts.











Exercise no.9. ***What is the probem?*** Identify the part of the text which speaks about the use of embryonic stem cells. Discuss your opinion with your partner.

So basically at the stage of early embryo the cells can make any tissue at all. What we have to do is isolate these cells. One way is we can remove the trophectoderm cells so that we are just left with a clean inner cell mass. So we can grow these in culture and they will grow, multiply until we have large numbers of these cells that still have the capacity, are still able, to form any tissue at all. Embryonic stem cells can become heart, blood, brain or skin cells depending on the way they are grown. These stem cells have turned into heart cells.

The embryonic stem cell area is a very exciting area. It really has opened a new world, that of regenerative medicine. We now have bridges between all the laboratories that have a particular expertise. Working together we will be in a good position to examine, to investigate its enormous potential. But the enthusiasm should not cover all the technical and scientific questions and obstacles that exist and that will have to be studied very carefully.

Stem cell research is a fast moving field. Around the world new findings are constantly reported, creating new questions and fresh challenges for scientists seeking to harness these cells and to shape future medicine.