The Complete Guide to Know about The Proliferation of Cells in Development and Differentiation

Creative Bioarray

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Brief Introduction

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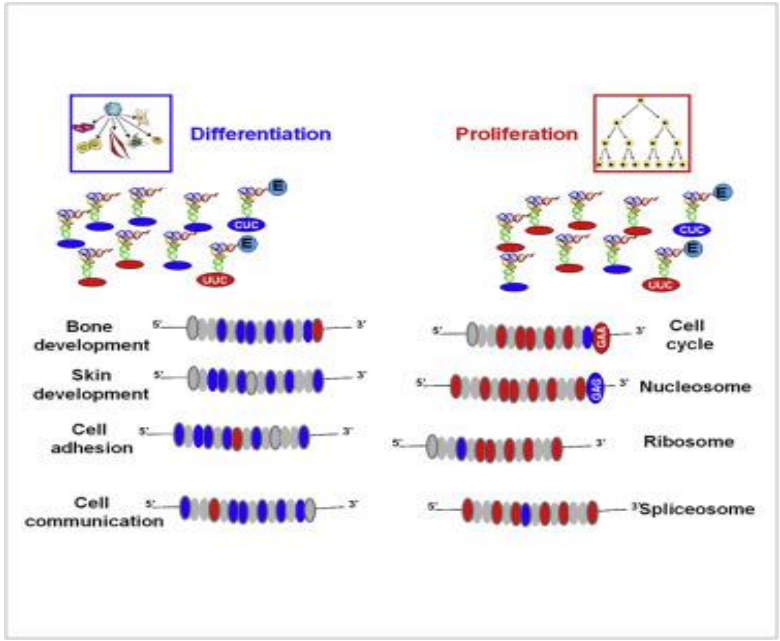
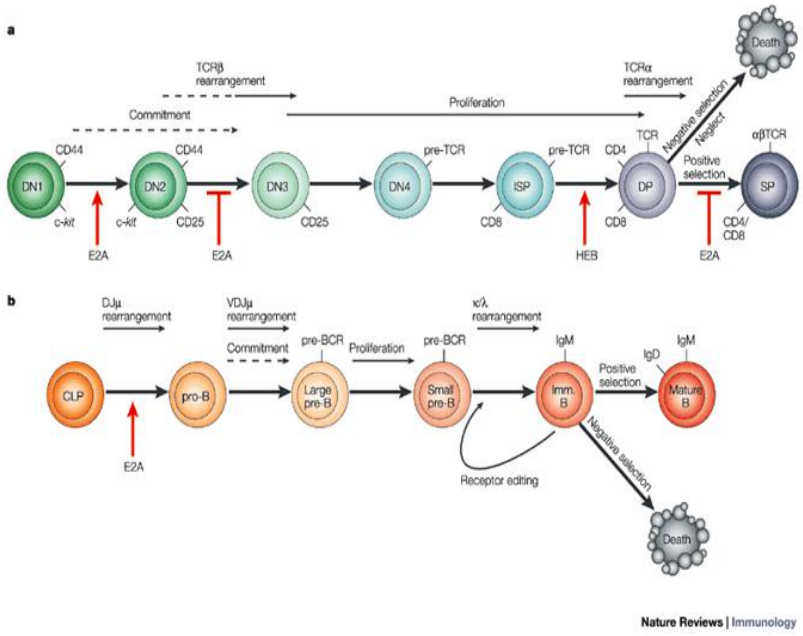
Early development is characterized by rapid proliferation of embryonic cells, which are then differentiated to produce many specific types of cells that make up the tissues and organs of multicellular animals. The cell proliferation will generally decrease with the differentiation of cells, and most cells in adult animals are blocked in the G 0 phase of the cell cycle. Some types of differentiated cells will not divide again, but most cells can regain proliferation as needed to replace cells that are lost due to injury or cell death. In addition, some cells divide throughout life to replace cells with high conversion rates in adult animals. Thus, cell proliferation and cell death are carefully balanced to maintain a constant number of cells in adult tissues and organs.



Proliferation in Cell Development

In terms of cell proliferation, the cells of adult animals can be classified into three major categories. Some types of differentiated cells will not be able to divide, such as human cardiomyocytes. These cells are produced during embryonic development, differentiated, and then retained throughout life.



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The Proliferation of Cells in Development

The Proliferation of Cells in Development

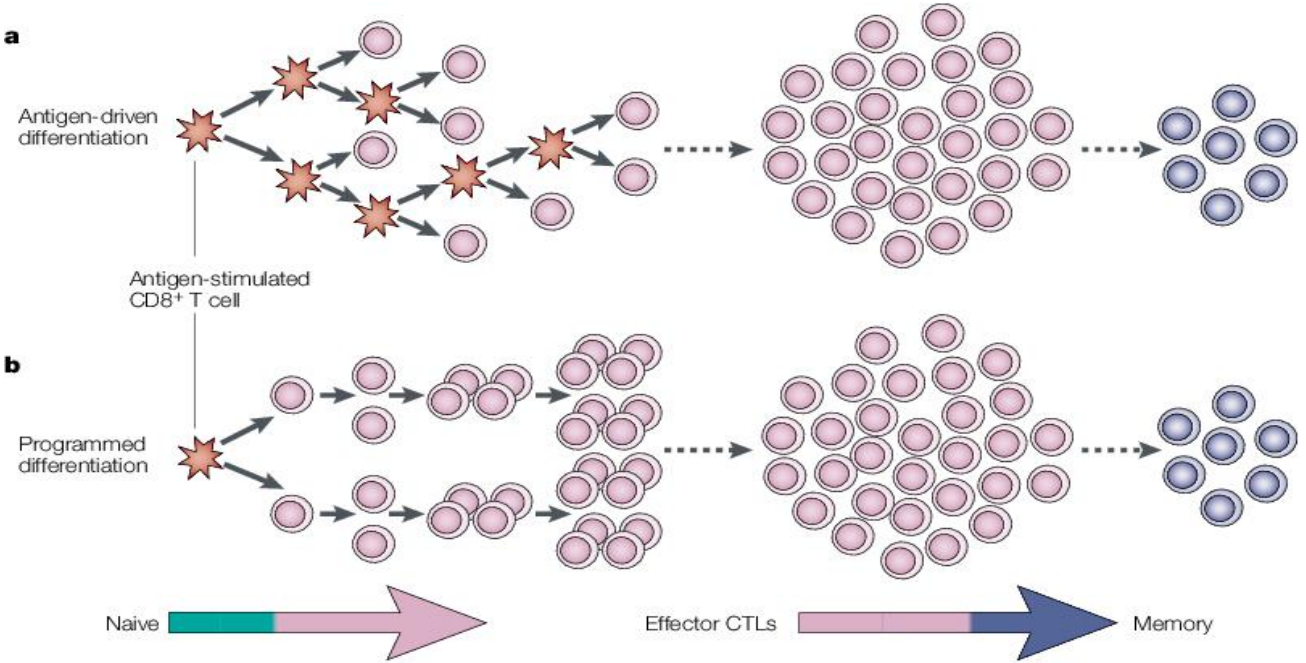
In contrast, most cells in adult animals enter the G0 phase of the cell cycle, but regain proliferation as needed to replace cells that have been injured or have died.

Cells of this type include skin fibroblasts, smooth muscle cells, endothelial cells that line the blood vessels, and most internal organs of the epithelial cells, such as the liver, pancreas, kidneys, lungs, prostate, and breasts.

An example of controlled proliferation of these cells discussed above is the rapid proliferation of dermal fibroblasts to repair damage caused by cutting or wounds.

Hepatocytes provide another striking example, with hepatocytes usually rarely dividing.

The Proliferation of Cells in Development



Other types of differentiated cells

01

blood cells, epithelial skin, epithelial cells line

02

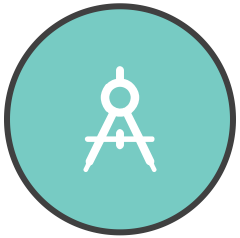
In these cases, fully differentiated cells will not proliferate, instead, they are replaced by cell proliferation called stem cells that are less differentiated.

03

Stem cell division produces daughter cells that can differentiate or remain as stem cells, thereby serving as a source of lifelong differentiated cells.

04

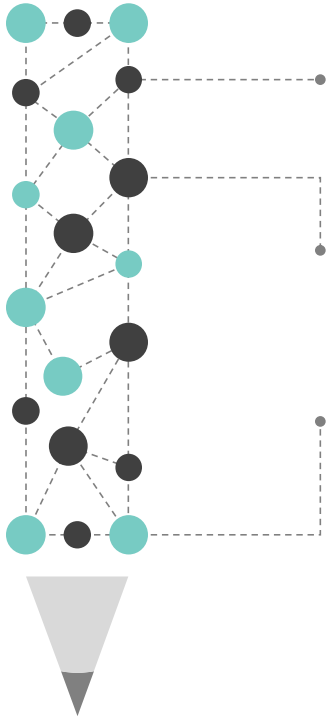
have a short life cycle and must be replaced by continuous cell proliferation of adult animals



The Proliferation of Cells in Differentiation

The Proliferation of Cells in Differentiation

Blood cell differentiation provides a good example of the continued proliferation of stem cells. There are several different types of blood cells with special functions:

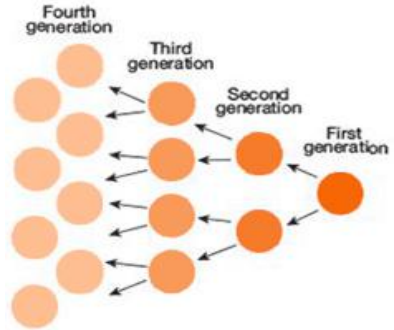


red blood cells transport O2 and CO2

granulocytes and macrophages are phagocytic cells

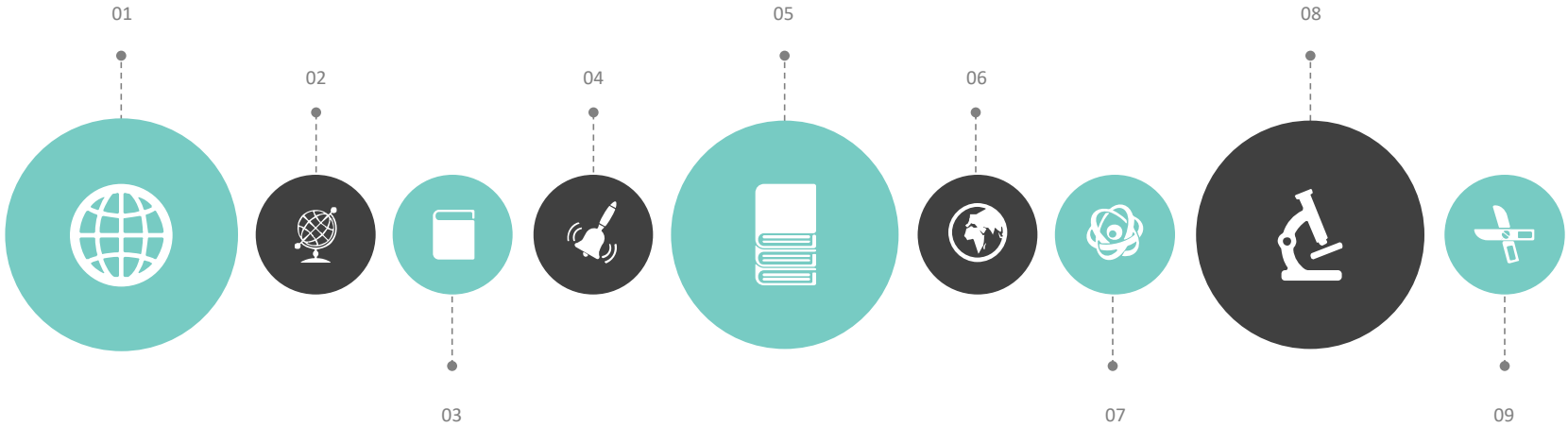
platelets (fragment of megakaryocytes)

The Proliferation of Cells in Differentiation



All of these cells have a limited life span, ranging from less than one day to several months, and are constantly produced by the division of common stem cells (pluripotent stem cells) in the bone marrow. The progeny of pluripotent stem cells then become committed to specific differentiation pathways. These cells continue to proliferate upon differentiation and undergo several rounds of division. However, once they are fully differentiated, the proliferation will stop, so the maintenance of differentiated blood cell populations depends on the continued proliferation of pluripotent stem cells.

stem cells can replicate and differentiate



stem cells can replicate and differentiate to produce a variety of cell types, they have considerable potential for further medical applications.

stem cells can be used to treat human disease and repair damaged tissue. Stem cells with the broadest differentiation ability are embryonic stem cells (ES cells) present in early embryos

Stem cells can produce differentiated cell types of all adult organisms. These cells can be cultured from mouse embryos for introduction of altered genes into mice.

Conclusion

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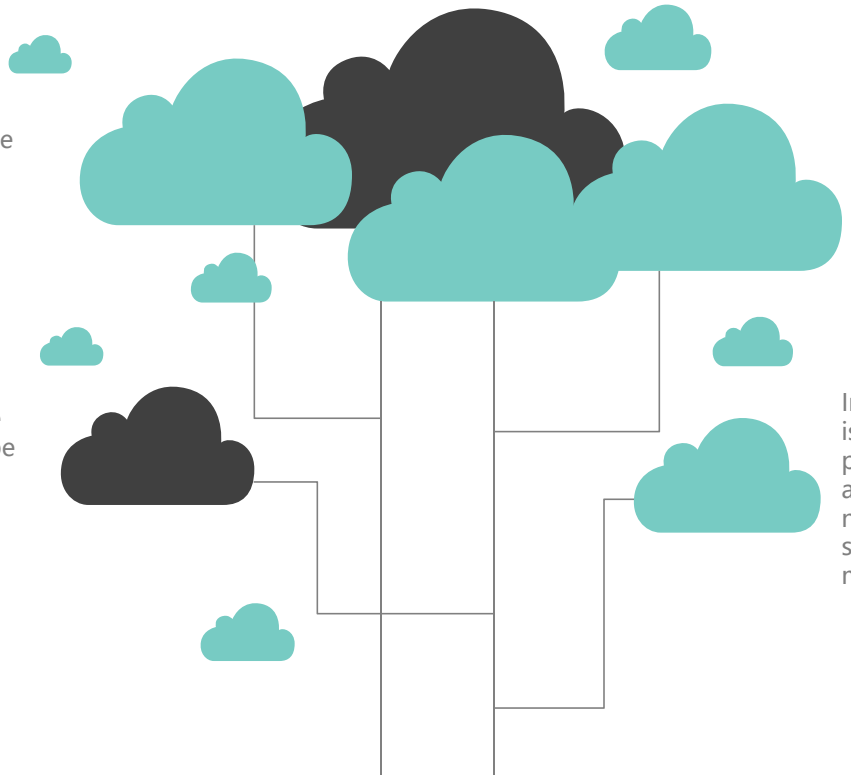
In 1998, two groups of researchers reported the isolation of ES cells from human embryos, increasing the likelihood that these human stem cells could be used in medical applications.



It is therefore theoretically possible that the nuclei of an adult cell can be used to produce ES cells, which can then provide a tissue source for treating the individual.

In addition, stem cells have been isolated from adult tissues, producing not only blood cells, but also many other cell types, including neurons and connective tissue cells such as bone, cartilage, fat and muscle.

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