Man Made Stem Cells

Zuhair R. Zahid* **PhD**

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Stem cells are cells found in most, if not all, multicellular organisms. These cells are characterized by the ability to self-renew through mitotic divisions and to differentiate into a diverse range of specialized cell types to form a whole organism.
The two main types of mammalian stem cells are : Embryonic stem cells (ESCs) that are found in blastocysts(which are formed after fertilization) , and adult stem cells (ASCs) that are found in adult tissue.
In developing embryo, ESCs can differentiate into all of specialized embryonic tissues. In adult organisms, ASCS and progenitor cells can act as a repair system for the body, replenishingspecialized cells, but also maintain the normal turnover of regenerative organs, such as blood, skin, and intestinal tissues (1).
In the blood, millions of different cells die every second. To keep up with this deprivation, stem cells continuallysplit up to make the right balance of cell types, whichcontain oxygen carrying red blood cells and a menagerie (1)of immune cells (2).Biological experiments showed that removed stem cells from the mouse bone marrow looked different, allowedstoring these cells into two classes. Several hundred ofthese pre-stored types were transplanted into mice lacking stem cells.Laboratory investigations found a bright variation in productivity. One group of stem cell produced many more red blood cells than immune cellsand vice versa.As mice got older, the stem cells that create more red blood cells count made up larger ratio of all stem cells, beating out the immune-cell-based stem cells. Stemcells are distinguished from other cell types by two important characteristics. First, they are unspecializedcells capable of renewing themselves through the celldivisions, sometimes after long periods of inactivity.Second, under certain physiologic and experimental(2)conditions, they can be induced to become tissue-organ-specific cells with special functions. In some organs, such as the gut and bone marrow, stem cells regularlydivide to repair and replace worn out or damaged tissues. In other organs, however, such as the pancreasand the heart, stem cells only divide under special conditions. Until recently, scientists primarily worked with two kinds of stem cell from animals and humans.Embryonic and "somatic " or " adult " stem cells : Scientists discovered to drive embryonic stem cells fromearly mouse embryos nearly 30 years ago (3). Detailedstudy of the biology of mouse stem cells led to the discovery of method to drive stem cells from human embryo and grow cells in the laboratory, these cells are called human embryonic stem cells (4). In 2006 research-ers made another breakthrough by identifying conditionsthat would allow some specialized adult cells to be " programmed" genetically to assume a stem cell-like (3)state. This new type of stem cells is called induced pluri-potent stem cells (PSCs).
Stem cells are important for living organisms for manyreasons. In the 3-to 5- day- old embryo called a blasto-cyst, the inner cells give rise to the body of the organism,including all of the many specialized cell types and organssuch as the heart, lung, skin, sperms, eggs and other tissues. In some adult tissue, such as bone marrow, muscles and brain, discrete populations of adult stem cells generate replacements for cells that are lost through normal wear and tear, injury or disease (5)
What are the unique properties of all stem cells ?: Stem cells are capable of dividing and renewing themselves for long periods. Unlike muscle cells, blood cells , or nerve cells- which do not normally replicate themselves- stem cells may replicate many times , or proliferate. A starting population of stem cells that proliferate for many months in the laboratory can yield millions of cells. If theresulting cells continue to be unspecialized, like the (4) parent stem cells, the cells are said to be capable of long-term self renewal.The specific factors and conditions that allow stem cellsto remain unspecialized are of great interest to scientists.It took two decades to learn how to grow human embryonic stem cells in the laboratory following thedevelopment of conditions for growing mouse stem cells. Therefore , understanding the signals in a mature organism that cause a stem cell population to proliferat and remain unspecialized until the cells are needed.When unspecialized stem cells give rise to specialized cells, the process is called differentiation.
While differentiating, the cell usually goes through several stages,becoming more specialized at each step. Scientists are just beginning to understand the signals inside and outside cells that trigger each step of the differentiation process.

**Baghdad College of Medicine, Clinical, Communicable Diseases Research Unit.*

The internal signals are controlled by cell's genes, which are interspersed across long strands of (5)
DNA and carry coded instructions for all cellular structures. The external signals for cell differentiationinclude chemicals secreted by other cells, physical contact with neighboring cells, and certain moleculesin the microenvironment.The emerging field of regenerative medicine will requirea reliable source of stem cells in addition to biomaterial scaffolds and cytokine growth factors. Adipose tissuerepresents an abundant and accessible source of adultstem cells. Other examples for the applications of rege-nerative medicine are for cardiovascular regeneration (6,7, 8, 9).
Stem cells and anti-aging: The twenty first century is witnessing a revolution in biotechnology and cellular medicine, stem cell therapy / stem cell treatment (SCT).Thousands of patients around the world have already benefited from this cellular high biotechnology using stem cells. The process of cellular depletion correlateswith the aging process that all people go through time,as the stem cell numbers decreases, the body's vitality andreserve capacity also diminishes. Stem cell therapy can show this process, and even rejuvenate aged and damaged tissues (10).
Stem cells and spinal cord injury: Neural stem cells offerthe potential to replace lost tissue after nervous systeminjury, secrete neurotrophic factors and promote extensive host axonal growth after spinal cord injury.Transplantation approaches using cellular bridges, fetalcentral nervous system cells, fibroblasts expressing neutrophin-3, hybridoma cells expressing protein blocking antibodies, or olfactory nerves ensheathing glial cellstransplanted into the acutely injured spinal cord haveproduced axonal or functional benefits (11, 12). Transplants of rat or cat fetal spinal cord tissue into thechronically injured cord survive and integrate with the(7)host cord, and may be associated with some functionalimprovement (11).Stem cells and artificial blood: A blood substitute fromstem cells (also called artificial blood or blood surrogat-es) is a substance used to mimic and fulfill some functions of biological blood, usually in the oxygen-carrying sense. It aims to provide an alternative to blood transfusion, which is transferring blood or blood-based products from one person into another. Othermajor advantages of artificial blood include not needing to check blood types before transfusion, and wouldcarry a much lower risk and infection than the real thingand could be given to almost every one regardless of their blood groups. Within 20 years, large scale production is to produce two million pints of artificial blood a year (12).(8)
Stem cells and Parkinson's disease: Parkinson's disease isa nervous system disorder that effects how the patientmoves, including their writing and speech. It is a progressive disorder. Parkinson's is caused by the loss of midbrain neurons that synthesize the neurotransmitter dopamine. Cells derived from the fetal midbrain can modify the course of the disease. Patients also experience stiffness and find they are unable to carry out movements, muscles become weaker and the individual often assumes an unusual posture. Parkinson's disease symptoms are caused by a loss of dopaminergic cells in the brain. Dopamine helps to transmit body controland coordination movement messages to another area ofthe brain. Parkinson's disease symptoms get worse asdopamine level drops. In 2011 scientists made a break through, they had successfully grown stem cells from theskin of a patient with rapidly progressing Parkinson's (13,14, 15).(9)
Creating sperms from skin cells : Scientists have found that a man's fertility could be restored by the growing of early stage sperm from skin sample. Research evidence suggests that adult cells , such as those of the skin, can be induced to return to more primitive state and thenturned into different cell types. A team grew stem cells from the skin samples and found they were able to generate key cells, including early stage sperm cells. Itis hoped the technique could help men who had cancer during childhood become fathers, as infertility can be a side effect of some cancer treatment (16, 17).Researchers show the crucial role of protein MOF in preserving the " stem mass " of stem cells, and priming them to become specialized cells in mice. These resultsshow that MOF play a key role in the " epigenetics" of stem cells, that is, helping stem cells read and use their DNA. In order to read their DNA cells have to unwind it a bit from those spools, allowing the gene reading mechanisms to get aces to the genetic code and transcribe it (18, 19).(10).

Conclusion:

An artificial cell (man made cell) is an engineered particle that mimics one or many functions of biological cell. The term does not refer to a specific physical entity, but rather to the idea that certain functions or structures of biological cells can be replaced or supplemented with asynthetic entity. As such nanoparticles, liposomes, poly-somes, microencapsules and a number of other particles have qualified as artificial cells. In the area of synthetic biology a " living artificial cell has been defined as a complete synthetically made cell that can capture energy, maintain ion gradient, contain macromolecules as well as store information and have the ability to mutate. Such a cell is not technically feasible yet but a variation of an artificial cell has been created in which a completely synthetic genome was introduced to genomically emptied host cells. Although not completely artificial because the cytoplasmic components as well as the membranes from the host cell are kept, the engineered cell is under the control of a man made genome and is able to replicate (20).(11)

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