Stem Cell Introduction

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Abstract: The stem cell is the origin of an organism's life that has the potential to develop into many different types of cells in life bodies. In many tissues stem cells serve as a sort of internal repair system, dividing essentially without limit to replenish other cells as long as the person or animal is still alive. When a stem cell divides, each new cell has the potential either to remain a stem cell or become another type of cell with a more specialized function, such as a red blood cell or a brain cell.
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The stem cell is the origin of an organism's life that has the potential to develop into many different types of cells in life bodies. In many tissues stem cells serve as a sort of internal repair system, dividing essentially without limit to replenish other cells as long as the person or animal is still alive. When a stem cell divides, each new cell has the potential either to remain a stem cell status or become another type of cell with a more specialized function, such as a red blood cell, renal cell, liver cell or a brain cell, etc.

Stem cells have two important characteristics: (1) They are unspecialized cells capable of renewing themselves through cell division; (2) Under certain conditions they can be induced to become differentiated adult cells with special functions, such as to became renal cells or blood cells. In some organs, such as the bone marrow, stem cells regularly divide to repair and replace worn out or damaged tissues. In other organs, however, such as the pancreas and the heart, stem cells only divide under special conditions. Stem cells can be used in the clinical medicine to treat patients with a variety of diseases (Daar, 2003). Serving as a repair system for the living body, the stem cells can divide without limit to replenish other cells as long as the living body is still alive. When a stem cell divides, each new cell has the potential to either remain a stem cell situation or become another type of cell with a more specialized function, such as a renal cell, a muscle cell, a red blood cell, a bone cell, a nerve cell, or a brain cell. Stem cell research is a typical and important topic of life science.

In 2003, it was found that fetal stem cells had the ability to multiply without limit and never grow old (Hawkes, 2003), which may make it possible to create fetal stem cells from adult cells. The gene Nanog is a regulator that controls the operation of many other genes. It operates only in embryonic stem cells, which are pluripotent. Nanog's role is to maintain stem cells and to make them grow. Nanog is a master gene that may make stem cells immortal.

Embryonic stem cells are key important in the mammalian animal's rorigin. Embryonic stem cells can go on dividing forever. This means that a cultured stem cell can be kept alive for transplantation into patients where they will diversify into necessary cells. For this to be possible, it needs to know how it is that stem cells can either divide without limit, or choose instead to differentiate into specialized cells. Nanog appears to be the key. Nanog does not disappear in adult cells, but it lies dormant, which is important for the Nanog's function. This means that if a way could be found to reactivate it, adult cells could be persuaded to become embryonic cells again. This gives a hope to reverse life timeline – reverse life. The next step is to work out how Nanog is switched on and off. To achieve that it may be necessary to continue working on embryonic stem cells and watching the process as it happens.

Many diseases are caused by the death of cells vital to the proper functioning of the organs. Heart failure, for example, is often caused by damage of the muscles caused by a blood clot. Stem cells injected into the heart could recreate the heart muscle. Which could be a powerful way for the clinical treatment.

Type 1 diabetes is caused by the destruction of the pancreatic cells that make insulin. These pancreatic cells might be obtained by stem cells.

Parkinson's disease is caused by a loss of cells. In animal experiments stem cells have been shown to reduce symptoms of the Parkinson's disease.

Some of the most notable findings are as follows: (1) The organ-specific stem-cell growth and differentiation are stimulated during the reparative phase following transient injury; (2) The organs contain resident marrow-derived stem cells, and their differentiation potential may only be expressed during repair; (3) The metamorphic mesenchyme contains pluripotent and self-renewing stem cells; (4) The epithelial-to-mesenchymal transition generates renal fibroblasts, etc (Oliver, 2004).

Stem cell researches are developing very fast. As an example in Korea, after the claims of the first cloning of patient-specific stem cells using somatic nuclear transfer as published in Science in 2004 and 2005, former Seoul National University Professor Woo Suk Hwang became a national hero of Korea and an international celebrity. His academic reputation was down after January 11, 2006 when a nine-member investigation panel at Seoul National University reported that his data were intentionally fabricated. In spite of these negative effectives from both scientific and non-scientific communities, stem cell research in Korea is bouncing back with better focus and balance as evidenced below. First, the Korean government has been reassuring by vowing to continue to support stem cell research in Korea with a long-term spending plan of $454 million over the next 10 years. This represents an even higher level of funding than before the Hwang scandal. The second, non-government sectors are also continuing to push their plans to support stem cell science. The third, despite concerns and unfounded worries, Korean biologists are performing exceedingly well and continue to publish their results in prestigious international journals (Kwang-Soo Kim, 2007). Hot research topics attract a lot of scholars and governments pay attention a lot on the stem cell studies, even created fakes.

Until recently, scientists primarily worked with two kinds of stem cells from animals and humans: embryonic stem cells and non-embryonic somatic or adult stem cells. In 2006, it was made another breakthrough by identifying conditions that would allow some specialized adult cells to be "reprogrammed" genetically to assume a stem cell-like state, which is named induced pluripotent stem cells (iPSCs). This is very important for the stem cell researches.

In the 3- to 5-day-old embryo (blastocyst), the inner cells give rise to the entire body of the organism, including all of the many specialized cell types and organs such as the egg, sperm,, renal, liver, skin, heart, lung, etc.

Stem cells offer new potentials for treating diseases such as diabetes, and heart disease. Adult stem cells typically generate the cell types of the tissue in which they reside. For example, a blood-forming adult stem cell in the bone marrow normally gives rise to the many types of blood cells.

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