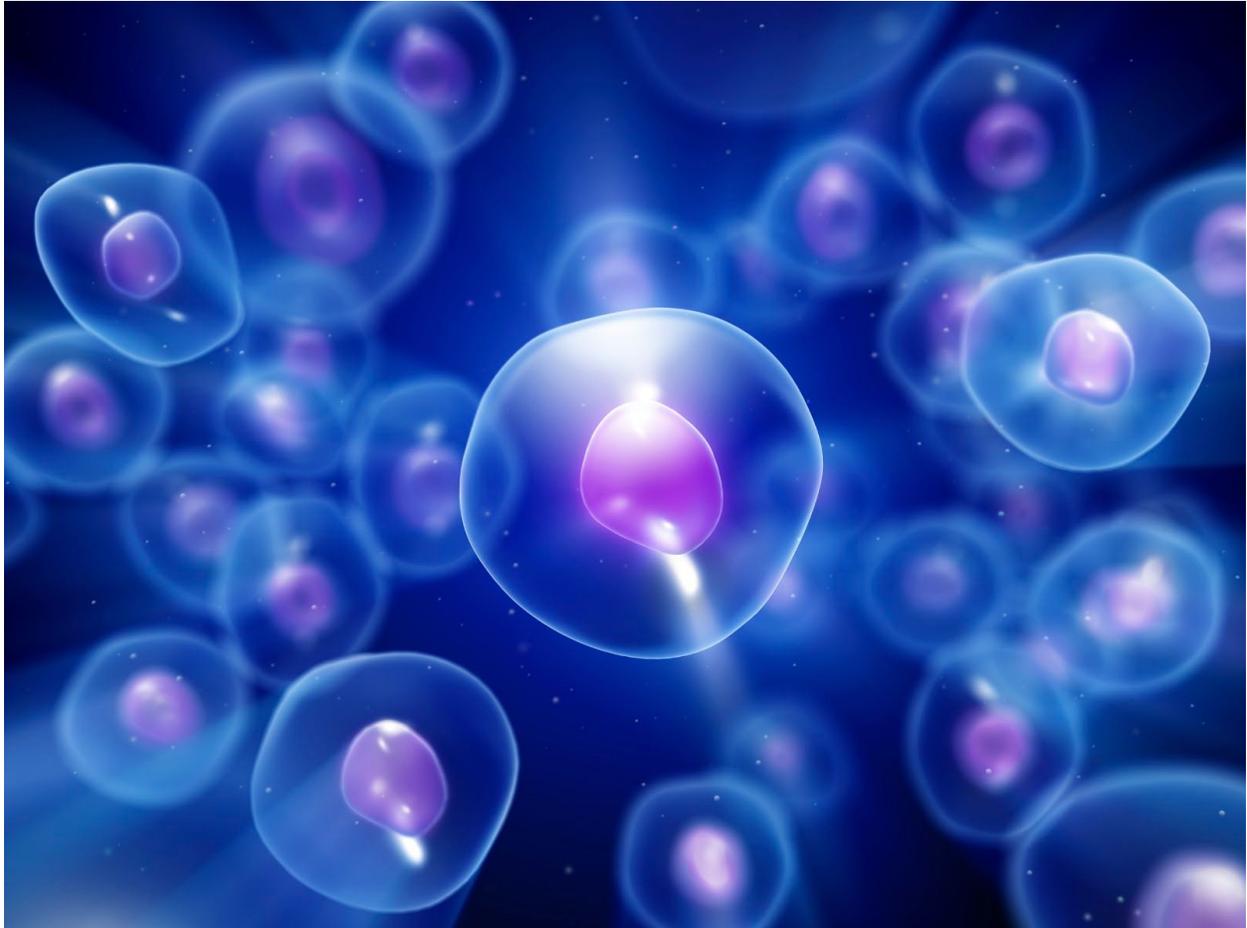


Stem cells and Possible Cure For Acute Renal Failure



What is a Stem Cell?

A stem cell is a nonspecific cell that can turn into a specific body cell. Stem cells can be found in bones or skin or other parts of the body. They are also found in embryos and umbilical cords. Research has recently discovered ways to turn specific cells, especially skin cells, back into stem cells, which then can be used for research. These induced pluripotent stem cells are still being tested for efficacy in research.

Stem cells can be grown two ways:

In vitro

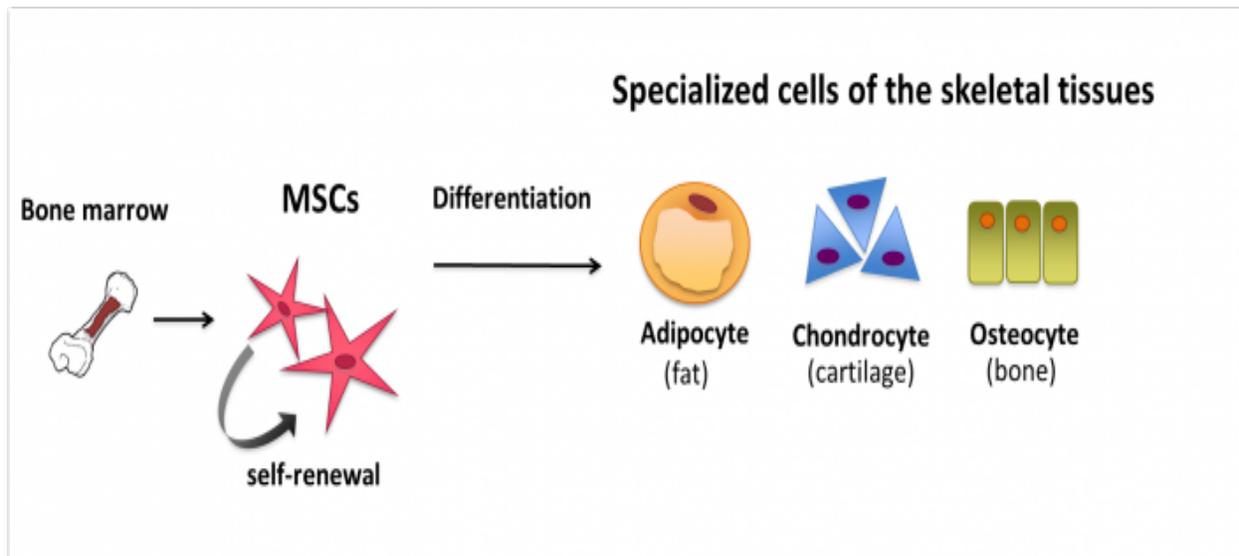
In vitro is where the stem cells are grown in a lab in a test tube, hence outside the body. This allows scientists to create a large supply of stem cells ready for experimentation at any time.

In vivo

In vivo is where the stem cells are grown in the body. Such stem cells would be embryonic stem cells.

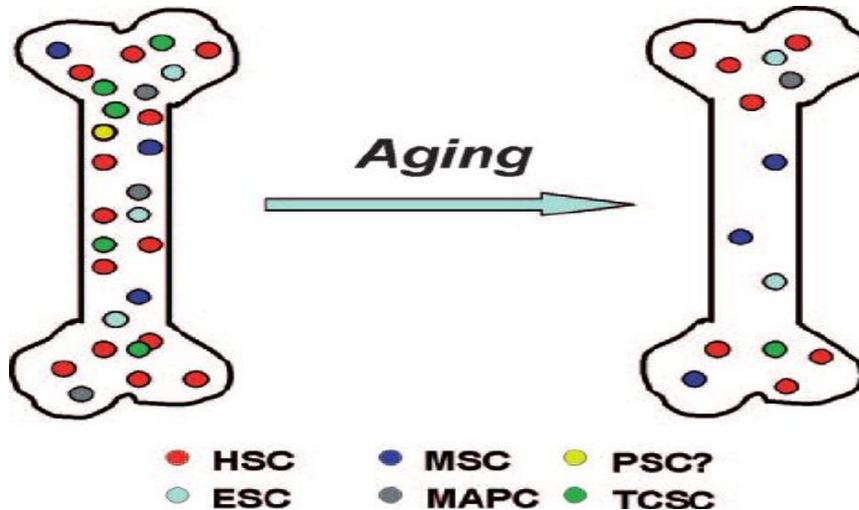
There are two main type of stem cells, both of which are derived from bone marrow:

Mesenchymal Stem Cells (MSCs)



MSCs have a tendency to transform into bone cells, smooth muscle cells, cartilage, and fat, hence its name. In damaged areas, these cells can form new blood vessels, which can be beneficial for regenerating vessels destroyed in heart attacks or in heart disease. MSCs also reduce the chance of rejection through the secretion of G5 which inhibits natural killer cells and t cells. The immunosuppression response of MSCs opens doors to finding cures using MSCs for autoimmune disorders like MS or IgAN. MSCs, however, only last for a few days, which adds to the difficulty of using MSCs to develop new treatments and cures, due to shortening telomeres which then leads to mutations and unhealthy MSCs.

Multipotent Adult Progenitor Cells (MAPCs)



MAPCs, just like MSCs derive from bone marrow. MAPCs share similar characteristics to MSCs, including having a similar immunosuppressive response. MAPCs, unlike MSCs, show no signs of deterioration even after many cell cycles and replications. MAPCs from young and old donors have telomeres the same length, suggesting there may be active telomerase keeping the MAPCs from mutating like the MSCs. MAPCs generally convert to MSCs when maintained at certain cell densities in a lab, and scientists are still experimenting how they can prevent this conversion. Hence, culturing MAPCs is much more expensive. MAPCs can diverge into many more cell types than MSCs. MAPCs have shown much stronger anti-inflammatory responses compared to MSCs.

Why Stem cell over other options?

With dialysis, the condition is treated but never cured. The person will have to continue dialysis until he or she goes through transplant. Even if the person finds a donor, which can take more than a year, there is a chance of rejection and if the transplant is successful, the person will be tied down to the side effects of immunosuppressants for the rest of their life. With stem cells, a new kidney can be crafted that has a much lesser chance of rejection. On top of that, through perfecting stem cell technology, there will be no need for immunosuppressants.

The other way stem cells can work is by exposing them to a damaged area of the kidney. MSCs have a tendency to hone in on damaged tissue. The stem cells can transform into podocytes and repair the damage.

Issues with stem cells

Stem cell treatments are still in infancy. Injecting stem cells in bones have helped bone tissue regenerate, however not always successful because these stem cells are rapidly removed from the body.

Along with this, some body cells such as cardiomyocytes are hard to obtain via stem cells, which limits their supply for people who would need them. Some stem cells especially MSCs do not last long in culture before starting to show forms of malignant transformations due to its fast replication rate.

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