Unit 5
Journal Review Rubric and Article: Stem Cells

Name

Date

Period

	Excellent	Effective, but flawed	Needs Improvement	Incomplete
Summary	Student uses own words to give description of article. Student identifies main ideas and concepts. +5	Student attempts to identify main ideas but may miss some ideas and adequately uses their own words to describe. +3	Student used wording too similar to article without using own words to describe content. +1	No Summary included +0
Evaluation I	Writing includes thoughtful responses to article regarding its relevance to the current unit of study. Use of proper spelling and grammar. +5	Written reaction includes some thoughtful correlation to unit of study. Few if any spelling and grammar errors. +3	Written reaction is too brief and/or numerous grammar spelling errors are present. +1	No Evaluation included. +0
Evaluation II	What is a stem cell line? Why could it be useful in the treatment of diseases? If you had leukemia would you want to have stem cell therapy? Explain. +5	Answers are incomplete and/or not all questions are answered. Few if any spelling and grammar errors. +3	All questions are not answered and/or numerous grammar spelling errors are present. +1	No Evaluation included. +0
Evaluation III	What are iMS cells? Why are they thought to be better than embryonic stem cells? Why are they so valuable? What are they hoped to be used for in the future? +5	Answers are incomplete and/or not all questions are answered. Few if any spelling and grammar errors. +3	Written response is not explained, incomplete and/or numerous grammar spelling errors are present. +1	No Evaluation included. +0
Evaluation IV	What are cardiosphere-derived cells? How do they work? Do you think scientists should be researching treatments that could extend our lives: after all isn't the planet already overcrowded? +5	Answers are incomplete and/or not all questions are answered. Few if any spelling and grammar errors. +3	Written response is not explained, incomplete and/or numerous grammar spelling errors are present. +1	No Evaluation included. +0

Total: _____ / 25 pts.

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Stem cells: What they are and what they do by Mayo Clinic

What are stem cell lines and why do researchers want to use them?

A stem cell line is a group of cells that all descend from a single original stem cell and is grown in a lab. Cells in a stem cell line keep growing but don't differentiate into specialized cells (so hopefully they can be later stimulated or induced to become whatever type of cell is needed). Ideally, they remain free of genetic defects and continue to create more stem cells. Clusters of cells can be taken from a stem cell line and frozen for storage or shared with other researchers.

What is stem cell therapy (regenerative medicine), and how does it work?

Stem cell therapy, also known as regenerative medicine, promotes the reparative response of diseased, dysfunctional or injured tissue using stem cells or their derivatives. It is the next chapter of organ transplantation and uses cells instead of donor organs, which are limited in supply. Researchers grow stem cells in a lab. These stem cells are manipulated to specialize into specific types of cells, such as heart muscle cells, blood cells or nerve cells. The specialized cells can then be implanted into a person. For example, if the person has heart disease, the cells could be injected into the heart muscle. The healthy transplanted heart cells could then contribute to repairing defective heart muscle. Researchers have already shown that adult bone marrow cells guided to become heart-like cells can repair heart tissue in people, and more research is ongoing.

Have stem cells already been used to treat diseases?

Yes, doctors have performed stem cell transplants, also known as bone marrow transplants. In stem cell transplants, stem cells replace cells damaged by chemotherapy or disease or as a way for the donor's immune system to fight some types of cancer and blood-related diseases, such as leukemia. These transplants use adult stem cells or umbilical cord blood. Researchers are testing adult stem cells to treat other conditions, including a number of degenerative diseases such as heart failure.

What are the potential problems with using embryonic stem cells in humans?

To be useful in people, researchers must be certain that stem cells will differentiate into the specific cell types desired. Researchers have discovered ways to direct stem cells to become specific types of cells, such as directing embryonic stem cells to become heart cells. Research is ongoing in this area. Embryonic stem cells also could grow irregularly or specialize in different cell types spontaneously. Embryonic stem cells also might trigger an immune response in which the recipient's body attacks the stem cells as foreign invaders, or simply fail to function normally, with unknown consequences. Researchers continue to study how to control the growth and differentiation of embryonic stem cells and avoid these possible complications.

What is therapeutic cloning, and what benefits might it offer?

Therapeutic cloning, also called somatic cell nuclear transfer, is a technique to create versatile stem cells independent of fertilized eggs. In this technique, the nucleus, which contains the genetic material, is removed from an unfertilized egg. The nucleus is also removed from a somatic cell of a donor. This donor nucleus is then injected into the egg, replacing the nucleus that was removed, a process called nuclear transfer. The egg is allowed to divide and soon forms a blastocyst. This process creates a line of stem cells that is genetically identical to the donor's — in essence, a clone. Some researchers believe that stem cells derived from therapeutic cloning may offer benefits over those from fertilized eggs because cloned cells are less likely to be rejected once transplanted back into the donor and may allow researchers to see exactly how a disease develops.

Has therapeutic cloning in people been successful?

No. Researchers haven't been able to successfully perform therapeutic cloning with humans despite success in a number of other species. However, in recent studies, researchers have created human pluripotent stem cells by modifying the therapeutic cloning process. Researchers continue to study the potential of therapeutic cloning in people.

Scientists have developed a new technique which would regenerate human tissue damaged from injury, disease, and aging

04/06/2016 | ConsumerAffairs | Health

By Christopher Maynard

While certain treatments can make life manageable, there is never a guarantee that you will be able to fully recover. That is why the scientific and medical communities are always hard at work trying to come up with new advances that can help people recuperate more fully and quickly. Luckily, a recent study shows that they may be on the right path. New landmark research led by the University of New South Wales in Australia has found that a new stem cell therapy could potentially regenerate damaged human tissue caused by injury, disease, or aging. This includes problems like bone fractures, injured spinal discs, and even chronic neck or back pain. More impressive still is that this medical advancement could become accessible in the next few years.

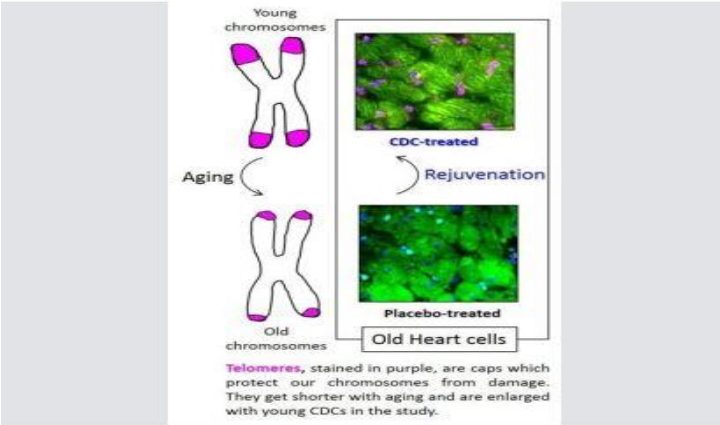
Advancements in stem cells

The way in which this technique works is not totally unlike the regenerative abilities that can be observed in salamanders; these amphibians have the ability to grow back limbs if they are severed from the body. In much the same way, scientists believe that this new stem cell therapy could have the capability to regenerate human tissue by reprogramming bone and fat cells into induced multipotent stem cells (iMS). iMS are extremely valuable because of their ability to regenerate multiple tissue types, a trait that adult stem cells do not possess. Embryonic stem cells have the ability to turn into different types of tissue, but research with them is limited because the medical community recognizes its potential to form tumors. Generating stem cells can also be very tricky because it requires the use of a virus to transform cells into stem cells, a practice that has been deemed unacceptable by the medical community. However, the new method developed by UNSW researchers does not have these problems. Instead, it takes human fat cells and treats it with a combination of a compound called AZA and a growth factor. After being treated, the new cell has increased plasticity, which allows it to be reprogrammed into iMS cells.

Enormous potential

While there are no human trials scheduled for this technique in the immediate future, there is a possibility that it could happen as early as next year. "We are currently assessing whether adult human fat cells reprogrammed into iMS cells can safely repair damaged tissue in mice, with human trials expected to begin in late 2017," said John Pimanda, associate professor at UNSW. If successful, this new technique could be monumental for treating many ailments that people all over the world deal with every day. Dr. Ralph Mobbs, who will lead human trials when the research moves to that stage, explains that the medical advantages could be huge. The therapy has enormous potential for treating back and neck pain, spinal disc injury, joint and muscle degeneration and could also speed up recovery following complex surgeries where bones and joints need to integrate with the body. . . This represents a potential huge leap forward for spinal and orthopaedic procedures," he said.
The full study has been published the *Proceedings of the National Academy of Sciences* journal.

Cardiac stem cells from young hearts could rejuvenate old hearts
Animal study reveals that cardiosphere-derived cells secrete tiny vesicles that could 'turn back the clock' for age-related heart conditions Date: August 14, 2017 Source: Cedars-Sinai Medical Center



Telomeres, stained in purple, are caps which protect our chromosomes from damage. They get shorter with aging and are enlarged with young CDCs in the study.

Credit: Cedars-Sinai

Cardiac stem cell infusions could someday help reverse the aging process in the human heart, making older ones behave younger, according to a new study from the Cedars-Sinai Heart Institute. "Our previous lab studies and human clinical trials have shown promise in treating heart failure using cardiac stem cell infusions," said Eduardo Marbán, MD, PhD, director of the Cedars-Sinai Heart Institute and the primary investigator of the study. "Now we find that these specialized stem cells could turn out to reverse problems associated with aging of the heart."
The study was published today by the *European Heart Journal*. In the study, investigators injected cardiosphere-derived cells, a specific type of stem cell, from newborn laboratory rats into the hearts of rats with an average age of 22 months, which is considered aged. Other laboratory rats from the same age group were assigned to receive placebo treatment, saline injections instead of stem cells. Both groups of aged rats were compared to a group of young rats with an average age of 4 months. Baseline heart function was measured in all rats, using echocardiograms, treadmill stress tests and blood analysis. The group of older rats underwent an additional round of testing one month after receiving cardiosphere-derived cells that came from young rats. "The way the cells work to reverse aging is fascinating," Marbán said. "They secrete tiny vesicles that are chock-full of signaling molecules such as RNA and proteins. The vesicles from young cells appear to contain all the needed instructions to turn back the clock."
Results of those tests show lab rats that received the cardiosphere-derived cells:

- Experienced improved heart function
- Demonstrated longer heart cell telomeres, compound structures located at the ends of chromosomes that shrink with age
- Improved their exercise capacity by an average of approximately 20 percent
- Regrew hair faster than rats that didn't receive the cells

"This study didn't measure whether receiving the cardiosphere-derived cells extended lifespans, so we have a lot more work to do," said Lilian Grigorian-Shamagian, MD, PhD, co-primary investigator and the first author of the study. "We have much to study, including whether CDCs need to come from a young donor to have the same rejuvenating effects and whether the extracellular vesicles are able to reproduce all the rejuvenating effects we detect with CDCs." Since Marbán's team completed the world's first cardiac stem cell infusion in 2009, the Cedars-Sinai Heart Institute has made significant contributions to decoding and understanding how cardiac stem cells regenerate damaged heart muscle. The team is studying the use of stem cells to treat patients with Duchenne muscular dystrophy as well as patients with heart failure with preserved ejection fraction, a condition that affects more than 50 percent of all heart failure patients.
Journal Reference:

1. Lilian Grigorian-Shamagian, Weixin Liu, Soraya Fereydooni, Ryan C. Middleton, Jackelyn Valle, Jae Hyung Cho, Eduardo Marbán. **Cardiac and systemic rejuvenation after cardiosphere-derived cell therapy in senescent rats**. *European Heart Journal*, 2017; DOI: 10.1093/eurheartj/ehx454