**History and Contemporary Relevance of Stem Cell Research**

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**Abstract**

The scientific article “Updates on Stem Cells and Their Applications in Regenerative Medicine” is a discussion of stem cells and biological and tissue engineering written by Bajada, Mazakova, Richardson, and Ashammakhi. It is featured in the Journal of Tissue Engineering and Regenerative Medicine. The article covers briefly the history of stem cell research, focusing more so on the origins of these topics, some of the political, moral and ethical controversies that are currently lagging research and clinical use, and gives a baseline description of Stem cell research and tissue engineering. This article will provide a small overview of the work of Bajada et al. and give reason as to why their work and the topics of stem cell research, regenerative medicine, tissue engineering, and stem cells in the clinical setting are relevant and a note-worthy topic in molecular biology today.

**History**

The first notable research in the field of tissue engineering was started in 1933. The experiment was carried out by Biscgelie and dealt with transplanting tumors from mice into chick embryos. After implantation these tumors were recorded to release insulin when levels of glucose were experimentally heightened (Bajada et, al). These results concluded to the meaning that the tumors were, after being transplanted, still carrying out their previous biological functions. While this experiment was at the forefront of biological/tissue engineering, it wasn’t until 1985 that the term “tissue-engineering” was used and determined as a field of science by Y. C. Fung.

The history of stem cells was established around the same time period that tissue-engineering was notably established as a field of scientific research. In the year 1981, a researcher for the University of California, in San Francisco, California, started to focus his research on embryonic stem cells (Bajada et, al). It wasn’t until 1998 that the first embryonic stem cell was harvested. This harvesting took place at the University of Wisconsin-Madison. Moving forward stem cell research has made great advancements, the process has become much more efficient(Bajada et, al).

The first embryonic stem cell is harvested at the University of Wisconsin-Madison.

“Tissue-engineering” established as a field of research.

Embryonic stem cell research starts at the University of California.

Biscgelie performs tissue engineering experiments using mouse tumors and chick embryos.

1933 1981 1985 1998

**Introduction**

Bajada et al. speaks at length about tissue-engineering, stem cells, and regenerative medicine. These terms may be uncommon so this section will define and relate several words and concepts used in the article. Tissue-engineering is a collaboration of many biological science fields. Tissue-engineering uses biomaterials with existing cells to create or augment tissues or organs that have lost part or all of their functionality (Mhanna & Hason). The science of tissue-engineering encompasses the use of stem cells; that is that stem cells are part of the broad spectrum of tissue-engineering. Regenerative medicine is a field of medicine that aims to replenish the functionality of the human body from cells to organs (Mason & Dunnill). Like-wise, stem cells are a sort of tool under the field of regenerative medicine and as it will be explained, a very valuable resource in the field of regenerative medicine.

To start a description of stem cells, let it be said that human cells carry out particular functions based on the type of cell they are; for example, a nerve cell transmits nerve impulses throughout the nervous system and skin cells protect the body. These cells’ functions are particular to their cell type and do not have the ability to deviate to great extents. Stem cells on the other hand do not have a particular cell type; they are to varying degrees undifferentiated cells. Of the two types of stem cells, Embryonic stem cells and adult stem cells, adult stem cells are more differentiated and therefore are less versatile. Adult stem cells still have the ability to self-renew and to differentiate but only to a certain degree that is less than embryonic stem cells (Singh et, al).

On the other hand, embryonic stem cells have a greater ability to differentiate. In this way they are pluripotent, they can form into all three germ layers of cells giving them the ability to self-renew under any environment. These stem cells will uptake characteristics of the functioning cells proximal to them and start to self-renew. Any embryonic stem cell has the potential to function as a neurological cell, liver cell, skin cell, etc. This process allows for dysfunctional tissue and organs to be rejuvenated by the stem cells. For this purpose embryonic stem cells are, to be cliché, the “jack-of-all trades” in tissue-engineering and regenerative medicine (Singh et, al).

**Stem Cell Interests**

Stem cells are now a growing in interest for a vast subset of people. Remember that stem cells attract the interest of both researchers, those particularly in the field of tissue-engineering, and those working or needing work in a clinical study. For research purposes stem cells with both their ability to self-regenerate and differentiate are very usable. This brings aboard funding through corporations that can, will, or are benefiting via the use of stem cells. In addition to research the use of stem cells in the clinical setting is vast. The extent of clinical usage for stem cells includes but is not limited to treatment of lost or insufficient bone tissue, damaged cartilage, injured ligaments and tendons, dysfunctional neurological cells and tissue, poorly functioning cardiac muscles, and damaged or dysfunctional urinary and bladder tissue. Stem cells are effective at treating these areas because of both their characteristics and the condition that the next best treatment options in most scenarios present insufficiencies. For example, finding compatible bone marrow donors for a bone graft is rare and time consuming. Since it is difficult to find suitable bone marrow for transplants stem cells offer an effective alternative to that procedure (Bajada et, al).

An additional scenario that reveals the usage for stem cells in a clinical setting is that of spinal cord injury. Because the spinal cord and other neurological cells and tissues are not proficient at regenerating or healing, these injury make for particularly difficult recoveries. Stem cells have the potential to be implanted via injection to the damaged portions of neurological tissue and restore functionally of the neural system. This effect is because of their ability to differentiate and divide. Several clinical studies have already been completed in this manner. Park et al. treated a trial of five patients with spinal cord injuries by injection of bone-marrow stem cells. His injections led to the recorded production of stem cells in the neural system. In addition to stem cell production a greater activity of macrophages was also observed in the treated patients. These active macrophages removed debris that was previously inhibiting the neurological function. The experiment concluded to more functionality of motor and sensory functions in the patients (Bajada et, al).

**Conclusion**

Bajada et al. concludes by analyzing that the clinical trial that utilized bone marrow stem cells shines light on the future of tissue-engineering and regenerative medicine’s usage of stem cells. The use of embryonic stem cells is highlighted as having an even greater potential with the stipulation of ethical and political barriers due to the harvesting techniques. The current state is said to be at clinical and laboratory trials of introducing stem cells as cures from bone defects and cartilage reconstruction to heart disease and neurological repair. Stem cells hold great potentials and will, with their ability to reproduce and function versatilely, allow for the reparation of several condition that currently pose health problems. Several applications of stem cells are currently being put to use. With advancements in knowledge through continued studies Stem cells could become more available to those in need (Bajada et, al).

**References**

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