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Review Article

# Stem-cells Research and Therapies

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## Abstract

Studies with leucogenenol, a compound isolated from the metabolic products of Penicillium gilmanii and human liver showed that leucogenenol accelerated the rate at which the "functional" cells, neutrophils, red blood cells and lymphocytes developed in the bone marrow from their corresponding committed precursor cells. It was found that the neutrophils that appear in the peripheral blood circulation following injection of leucogenenol originated from the neutrophils in the bone marrow. A scheme was presented to show that leucogenenol and adroxazine play key roles in regulating the circulation of blood cells. Stem cells act as the building blocks for the tissues and organs of physiologic systems. Research studies have shown stem-cells potential to treat a wide range of diseases. The Stem-cells play important roles in the treatment of various medical conditions and monitoring of bodily functions. Stem-cell therapy has shown results in treating conditions via peripheral blood circulation in the growth of new blood vessels such as heart disease, diabetes, cancer, Parkinson's disease. Clinical trials are being conducted to assess the safety and efficacy of stem cell based-therapies in treating various diseases such as Chronic Myelogenous Leukemia (CML) which is a type of blood cancer that affects the bone marrow and blood cells characterized by the abnormal growth of white blood cells that affects the bone marrow and blood cells known as myeloid cells. Stem cell therapies have great potential to become one of the most important tools of regenerative medicine and untreatable diseases. In this review, different types of stem-cell-based therapies are described, which are used in treating various diseases.

**Keywords:** Blood Stem cells, therapies, clinical trials, CRISPR Therapeutics

## Introduction

Studies with leucogenenol, a compound isolated from the metabolic products of Penicillium gilmanii and human liver showed that leucogenenol accelerated the rate at which the "functional" cells, neutrophils, red blood cells and lymphocytes developed in the bone marrow from their corresponding committed precursor cells. Following the initial treatment of leucogenenol there was a temporary rise in the bone marrow of the relative concentrations of myeloblasts, rubriblasts and lymphoblasts. It was found that the neutrophils that appear in the peripheral blood circulation following injection of leucogenenol originated from the neutrophils in the bone marrow. [1] A scheme was presented to show that leucogenenol and adroxazine play key roles in regulating the circulation of blood cells.[1,2] Stem cells act as the building blocks for the tissues and organs of physiologic systems. Research studies have shown stem-cells potential to treat a wide range of diseases. These stem cells can divide and differentiate into specialized cells like peripheral blood cells, nerve cells, or muscle cells. The Stem-cells play important roles in the treatment of various medical conditions and monitoring of bodily functions. Stem-cell therapy is a form of regenerative medicine that promotes the repair of dysfunctional diseased or damaged tissues or their derivative processes such as human organs in the body. Stem-cell therapy has shown results in treating conditions via peripheral blood circulation in the growth of new blood vessels such as heart disease, diabetes, cancer, Parkinson's disease. Clinical trials are being conducted to assess the safety and efficacy of stem cell based-therapies in treating various diseases such as Chronic Myelogenous Leukemia (CML) which is a type of blood cancer that affects the bone marrow and blood cells characterized by the abnormal growth of white blood cells that affects the bone marrow and blood cells known as myeloid cells. Currently, one of the examples of cell-based clinical treatment that was reviewed and approved by the U.S. Food and Drug Administration (FDA) is hematopoietic (blood stem cell transplantation). This clinical trial was intended to treat patients with cancers and disorders that affect the blood and immune system.[3,4,5]

## Blood Stem Cells:

These are hematopoietic stem cells that are growing cells that can develop into specific cell lines present in the blood stream. These types of cells play a key role for the constant renewal of blood related physiological elements such as red blood cells, white blood cells, and platelets. Hematopoietic stem cells are essential elements of hematopoiesis (the formation of cells within blood forming sub-systems such as bone-marrow, spleen are well documented for the constant renewal of blood forming elements of physiologic systems, producing billions of new peripheral blood cells for the human body). Blood stem cells are used to treat blood cancers such as leukemia, multiple myeloma and non-Hodgkin lymphoma, blood disorders such as sickle cell anemia and bone damages. Hematopoietic stem-cells are essential in the process of hematopoiesis (differentiating into various types of blood cells such as red blood cells, white blood cells, and platelets). Recent studies are being conducted for amyotrophic lateral sclerosis (ALS) to assess the safety and effectiveness in humans.[6,7]

## Research Perspectives:

Leucogenenol, a blood cell stimulating secondary metabolite found in human liver was reported in the research literature. These studies have been conducted on the biochemical effects of leucogenenol on regulation of blood cells. The injection of

leucogenenol, a compound isolated from human liver, induces a neutrophilia followed by lymphocytosis in peripheral blood[1] Additionally, after the injection there was a decrease in the number of myeloblasts in the bone marrow. Autoradiographic studies have shown that in the normal individuals leucogenenol stimulates increased production of myeloblasts and increases the maturation rate of all granulocytic cells. It has also been found that the neutrophils that appear in the peripheral blood circulation following injection of leucogenenol originate from progenitor cells in the bone marrow[1,2]. Structural analysis have shown that Leucogenenol is a compound that is formed by condensing l-cystine with the ethyl ester of formylphenylacetic acid. A method for the quantitative determination of Leucogenenol, a leucocytosis-inducing compound has been reported in the literature. Animal model studies have shown that treatment with leucogenenol increases the rate at which the 'functional blood cells, neutrophils, lymphocytes and red blood cells, develop from their respective precursor committed cells in the bone marrow. Autoradiographic studies of animal studies have shown that in the normal animals (i.e. rats, rabbits and dogs) injected with leucogenenol induces a neutrophilia followed by lymphocytosis. Additionally, studying the activity of leucogenenol in animal models demonstrates that leucogenenol stimulates increased production of myeloblasts and increases the maturation rates of all granulocytic ells in the bone marrow. It has also been shown that the neutrophils that appear in the peripheral circulation following injection of leucogenenol originate from the neutrophils in the bone marrow. Schematics depicting roles of leucogenenol and of adroxazine (a heterocyclic hormone ) have been shown in the research publication.[1,2]

## Background and Discussions:

Stem cells applications in regenerative medicine and disease therapies have been reported. These applications have indicated growth and repair of new blood vessels and organelles in a wide range of diseases such as Heart Abnormalities, Cystic Fibrosis, Parkinson, Duchene Muscular Dystrophy Lymphoproliferative disorders, Osteoarthritis, Chronic Myelogenous and Acute Leukemias. Stem cells are used to repair or generate new specialized stem cells with specific physiologic functions, such as brain cells, heart muscle cells, or bone cells. In multicellular systems, stem cells are undifferentiated or partially differentiated cells. They are found in both embryonic and adult progenitor cells, and precursor or blast cells, which are usually committed to differentiating into special cell type. Most stem cells intended for regenerative therapies are generated either from the patient's bone marrow or from adipose tissue. Studies have shown that stem-cells are the type of cells that can develop into many different types of cells in the body. Stem-cells applications are being developed to grow new blood vessels and organelles (i.e., heart muscles, cancer, osteoarthritis). These types of cell proliferations have the potential to treat a wide range of diseases such as Cystic Fibrosis, Parkinson's, Alzheimers, Duchene and Becker Dystrophys, Lymphoproliferative Disorders, Chronic Myelogenous and Acute Leukemias. Stem-cells can be used to regenerate and repair tissues that had been damaged or affected by certain diseases. Researchers are also studying roles of stem-cells to test new drugs for safety and effectiveness of certain diseases. These studies suggest that stem-cells can serve as raw materials from which all other cells with specialized functions can be generated. Stem-cells can become either new stem cells or specialized cells with a more specific physiologic function, such as specific blood cells (i.e., brain cells, heart muscle cells, or bone cells). Experimental studies have indicated that stem-cells can be useful in the generation and differentiation of pluripotential cells for certain disease therapies, patients with blood cancers. Stem-cells are being studied for nano-molecules and exosomes released to synthesize new medications[3]. Additionally, paracrine soluble factors produced by stem cells known as secretomes have been reported in stem cell-based therapies in degenerative, autoimmune, and inflammatory diseases. Stem cells have been reported to treat degenerative bone diseases [4]

## Blood-Cell Studies:

Stem cells are undifferentiated or partially differentiated cells that can develop into various types of cells. They have been reported in embryonic and adult organisms with different physiologic functions and characteristics. Their cell lineage is connected to progenitor cells, which are specific precursors or blast cells committed to differentiating into a particular cell type. These cells are capable of differentiating into in (vivo) pluripotent cells. However, when they isolated and cultured for in vitro testing, they can be kept in the stem cell mode known as embryonic stem cells. Most stem cells intended for regenerative therapy are isolated either from the patient's bone marrow or from adipose tissue. Diseases of hematopoietic related cells are diagnosed and identified in regard to the specificity of the human immune-cells pathogenesis of the disease. The specificity of the immune cells identified by testing and recognizing the specific antigens causes challenges in the treatment of the type of hematopoietic diseases. Researchers identifying hematopoietic stem cells originate in the human body from bone marrow and have provided insight into the possible mechanisms and methods of treatment for many of the specific diseases donors and recipients for successful transplantation treatments. Fully mature human white blood cells may be generated which are from precursors mega white blood cells from bone marrow. The embryonic stem cells are considered as a potential source for regenerative medicine and tissue replacement after injury or disease[5]. Adult stem cell research has indicated that DNA damage accumulates with age. Most of these stem cells have been reported to treat leukemia and related bone/blood cancers through bone marrow transplants.

## Stem Cell Therapies:

Bone Marrow transplantation is a form of stem cell therapy that has been established based on clinical trials approved by FDA. Hematopoietic stem cell transplantations have been used to establish treatments for neurodegenerative diseases[5]. Hematopoietic stem cell transplantation has been used to treat patients with conditions such as leukemia and lymphoma[6]. Stem cell treatments may require immunosuppression and use of stem cells from the same patient who is being treated. The safety and efficacy of these procedures requires standardization protocols[7].

## CRISPR Therapeutics:

FDA's approval of gene-editing techniques has shown freedom from severe pain episodes in patients suffering from Sickle cell disease. As reported in the literature, Sickle cell disease is caused by a mutation in a gene that contains the instructions for hemoglobin component of oxygen-carrying protein found inside red blood cells. The abnormal hemoglobin causes red blood cells, normally disc-shaped and pliable, to collapse into rigid, sickle-shaped crescents that clump together and die early. The disease varies in severity from patient to patient, but blockages caused by the clumped cells can trigger crippling pain and starve organs of oxygen. There are several therapies for sickle cell disease but only one cure: a bone marrow transplant, typically from a matched sibling. Bone marrow cells from a healthy donor produce normal hemoglobin, allowing transplant patients to live pain-free.

These types of therapies have been reported with some risks, and only about a fifth of patients are able to find a match. For gene editing the challenging aspects would be to deliver CRISPR therapy from labs to clinics with an infusion protocol to get it into the target cells and edit them inside the body. [8,9]

## Conclusion:

Stem cell therapies have become promising aspects of certain degenerative diseases described in this article. Clinical trials are being conducted to assess the safety and efficacy of stem cell-based therapies in treating various diseases. Recent studies are being evaluated to include the response and survival rates of these therapies in order to obtain a comprehensive understanding of these challenges and limitations and future developments. There are several types of stem cells which have been used in clinical trials for various diseases. In conclusion, stem cell therapies have great potential to become one of the most important tools of regenerative medicine and untreatable diseases. FDA clinical trials have guidances for premarket review and evaluation of IND's and NDA's for stem cells risk management and gene therapies.[8,9]

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## Biography:

Kaiser J. Aziz-Andersen attended Michigan State University and the American University completing his doctorate in Biochemistry and Hematology. His career in medical sciences included expertise in the development of various clinical laboratories technologies. His expertise ultimately led to a career in medical devices research and development in the Food and Drug Administration (FDA) and National Institutes of Health (NIH). He received numerous awards and commendations for his dedicated and distinguished services in clinical laboratory medicine standards and applications. Currently, he serves as a consultant for medical devices and pharmaceutical products design, development and applications.