Viewpoint

Ethical Issues in Stem Cell Research Through the Prism of Various Religions of The World: A Memoir

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Stem cells, by definition, are a type of undifferentiated cell population that may divide indefinitely and replenish themselves. These appear to originate from a single parental cell (clonal) and then go on to differentiate into various cell and tissue types (potent). Different types of stem cell sources have different levels of efficacy. Pluripotent cells, the first type, are embryonic stem cells that originate in the inner cell mass of the embryo, while induced pluripotent cells are created when somatic cells are reprogrammed. Endoderm, mesoderm, and ectoderm are the three germ layers into which pluripotent cells can differentiate. The mesenchymal stem cells that give rise to adipose tissue, bone, and cartilage are examples of multipotent stem cells that can develop into tissues originating from a single germ layer [1]. Therefore, these stem cells are the basis for the development of all other cells, tissues, and organs in the body.
Stem cells are cells with the ability to differentiate into one or more cell types and at the same time keep replacing itself so as not to become depleted. Stem cells are broadly categorised into embryonic stem cells (ES cells) and adult stem cells. Embryonic stem cells are those obtained from pre-implantation embryos while adult stem cells are undifferentiated cells found among the differentiated cells, present in most adult tissues [1]. Stem cells can be further categorised based on their potency, or the number of distinct cells types they can give rise to. They can be totipotent (can each develop into an embryo and extraembryonic tissues), pluripotent (can differentiate into all foetal and adult cell types), multipotent (can differentiate into only some distinct cell types and monopotent (also termed unipotent or oligopotent- which can only develop into a single cell type).

In general, stem cells can self-renew and undergo differentiation through asymmetrical cell division [2]. The discovery of stem cells has unquestionably widened our knowledge of the etiology and pathogenesis of human disease. In recent years, stem cell therapy has emerged as a cutting-edge research frontier with the promise to revolutionize the treatment of a wide range of human health problems. Stem cells not only play a crucial role in the future of regenerative medicine, but also provide new insights into the intricate and crucial processes at work during human development [3].

Adult stem cells, which are accessible for research and development, are capable of differentiation only into a few specific cell types. However, pluripotent stem cells can be generated from differentiated cells through the process of “reprogramming” [2]. Two methods used for this includes Somatic cell nuclear transfer (SNCT) and induced pluripotent stem cells (iPSC). In SNCT, the nucleus of an adult cell is inserted into an oocyte with its own nucleus removed [3]. iPSCs are derived from adult cells which have been reprogrammed genetically to an embryonic stem cell-like state through the forced expression of factors essential for maintaining pluripotency in embryonic stem cells [4].

Stem cells have a variety of applications in medical therapy, understanding the pathophysiology of diseases and the development of new drugs. Currently the major applications of stem cells in therapy include cancer especially haematological malignancies, for tissue repair and regeneration like in case of spinal cord injury, tendon ruptures, retinal and macular degeneration. There is also the potential to overcome the effects faulty genes responsible for inherited diseases by targeting the adult stem cells involved in the condition in the specific tissues. Stem cells are being studied in connection to restoration of all or part of limbs in amputees as well as regeneration of failed organs such as the liver [2].

Modelling of diseases helps to identify new targets, assess new therapies as well as assess the potential of gene therapy in treatment. The use of organoids developed from iPSCs serve as better models to resemble the effects of newer therapies on target tissues. It also helps give a more detailed insight into diseases especially cardiac conditions such as for long QT syndrome as well as degenerative diseases like spinal muscular atrophy, Parkinson’s disease, Huntington’s disease, and Amyotrophic Lateral Sclerosis. There is however a myriad of challenges faced by stem cell-based therapy and is represented in Figure 1. There is always potential for an infection of the cultured cells with a pathogen which must be strictly monitored and prevented, as well as the potential for the de-differentiated cells differentiating into tumours once implanted back. The third major concern is an ethical one which requires strict regulations and their enforcement when stem cells are used in health and disease.

Stem cell Therapies

Five distinct types of stem cells have been identified. First, embryonic stem cells (ESCs), which originate from the inner cell mass of a developing embryo. Second, placental cells called amniotic epithelial cells (AECs) that line the amnion. Foetal stem cells (FSCs) are the third category, and they come either from embryonic cadaver tissue organs or from embryonic stem cells that have been specialized for use in a particular tissue. Umbilical cord epithelium (UCE) is the fourth type and is distinct from the epithelial amniotic membrane. According to research [4], this can provide pluripotent stem cells (PSCs). Adult somatic stem cells are the fifth and final type [2, 5].

Bone marrow transplantation, diabetes, age-related macular degeneration, neurological illnesses, and drug discovery are just some of the many ways stem cells have been used in recent years in the healthcare and medical fields [6]. The three most common stem cell-based therapies are the result of years of research. First, the transplantation of fully matured cells, such as insulin-producing cells for the treatment of diabetes, that have been grown and differentiated in the lab from the patient's own embryonic or somatic stem cells [7], second is initiating self-repair mechanisms by stimulating an individual's own endogenous stem cells [8]. Finally, stem cells are sent directly to the patient, where they begin colonizing and eventually differentiate into the appropriate cell type after being transplanted to the affected area of the body.

In addition, blood illnesses such haematological malignancies or congenital immune deficiencies are treated using hematopoietic stem cell transplantation (HSCT) taken from bone marrow or peripheral blood. Diseases in this category include non-Hodgkin's lymphoma, Hodgkin's disease, acute and chronic leukemia, Fanconi anemia, sickle cell anemia, and several others. Haematopoietic stem cell transplantation is also being studied as a potential treatment for rheumatoid arthritis, lupus, and other autoimmune illnesses [9]. One of the most thoroughly known types of tissue-specific stem cells is the haematopoietic stem cell (HSC) [3].

Patients with advanced cancer who are undergoing intensive chemotherapy may also benefit from a stem cell transplant to protect their bone marrow [2]. Stem cells are employed in cellular therapy to repair or replace malfunctioning tissues or organs [1]. Disease-specific cell lines can be manipulated for use in pharmaceutical research. Heart failure [10], spinal cord injury, and tendon ruptures are also treated with stem cell therapy.

Embryonic stem cells (ESCs) have found widespread application in the field of neurology. Diseases of the nervous system as Alzheimer's, Parkinson's, and stroke are treated by neuronal stem cells (NSCs). The science of Regenerative Medicine has also found uses for them. These findings have tremendous promise [2]. In addition to these applications, stem cells have shown promise in the treatment and eventual cure of a wide variety of congenital birth abnormalities.

Embryonic Stem Cells (ESCs)

Scientists from all over the world have been studying human embryonic stem cells for decades to better understand them and their potential for clinical application. Pluripotent cells that can differentiate into any kind of somatic cell within the embryo are called embryonic stem cells (ESCs). In 1998, scientists used cell lines to create these for the first time. These can be kept alive in culture media for a very long time if the right growth conditions and nutrients are met [11]. These ESCs have been identified as a potential resource for learning more about the very complicated mechanisms thought to underpin the development of specialized cells and the construction of organ structures. ESCs' capacity for self-renewal also paves the way for the in vitro generation of an infinite variety of cell types. This has prompted the development of cutting-edge hypotheses in regenerative medicine.

The ability to create neural cells from human embryonic stem cells (hESCs) opens the door to a novel resource for the discovery of drugs with therapeutic potential, particularly for illnesses affecting the nervous system [12]. Human embryonic stem cells (HESCs) show the most therapeutic promise for replacing diseased or damaged tissues in patients with a variety of degenerative disorders [13]. Human embryonic stem cells have also prompted substantial study in several medical subfields. Genomic and epigenetic studies, disease modelling, tissue engineering, and other applications have all found a place for embryonic stem cells [14].

Embryonic Stem Cells (ESCs) derivation

The term "embryogenesis" refers to the process through which a human embryo grows and forms, a process characterized by cell division and differentiation [15]. There are three primary locations where human embryonic stem cells are obtained:

- One, already-established lines of embryonic stem cells
- Embryos that fail to implant during in vitro fertilization.

Somatic cell nuclear transfer–created embryos are employed in scientific studies [16]. The blastocyst is the result of many cell divisions following fertilization and the production of the diploid zygote. Embryoblasts and trophoblasts are the two cell types that make up the blastocyst's inner and outer layers, respectively [17]. The trophectoderm, or outside cell mass, contributes to the development of extra-embryonic tissue. This results in the formation of the placenta, chorion, and umbilical cord. Therefore, the embryo forms from the embryoblast, also called the inner cell mass (ICM) [17]. In the future, this will be utilized to purify stem cells.

Social and Religious issues on the use of Stem cells

Ethical And Social Issues

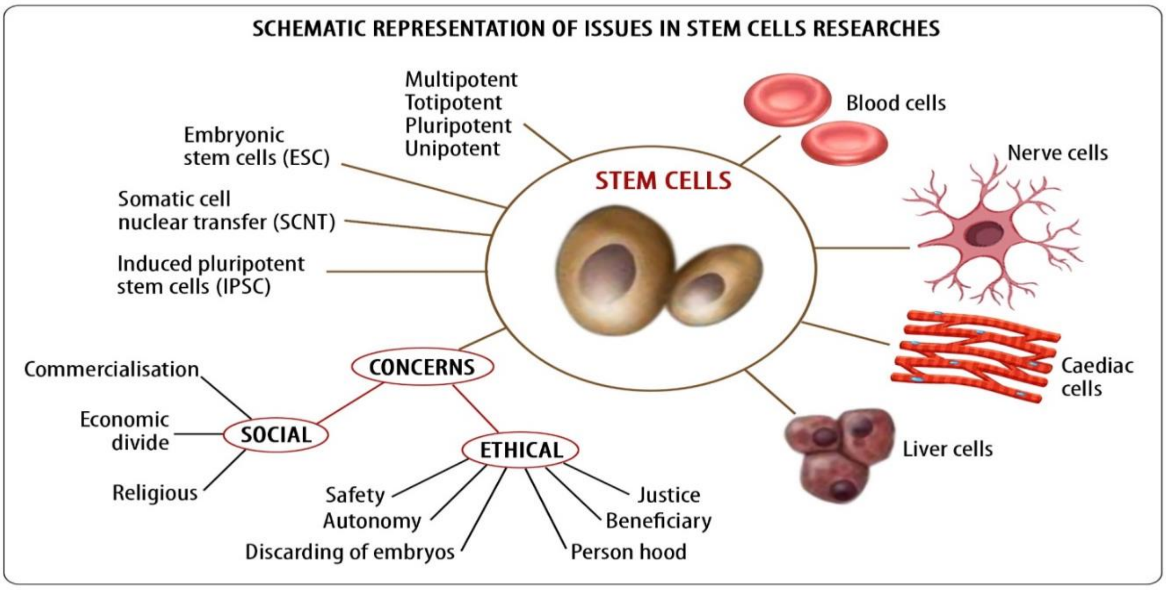
Stem cell research has been linked to a wide range of ethical and societal concerns around the world, even though it has been shown to have great benefits in the field of regenerative medicine. Stem cell research has become a global hotspot for ethical debate [18]. However, ground-breaking research has resulted from the increasing drive to discover medicines for the treatment of severe illnesses. However, the use of embryos is controversial for a variety of moral and religious reasons, which hampers research. Furthermore, concerns have been made about the availability of pharmaceutical and diagnostic technologies and the protection of intellectual property rights around the world [18]. Therefore, it is important to be aware that the privacy of the embryos used

in research is protected. The public has also raised a number of concerns about the legitimacy, safety, and effectiveness of the treatments provided [19].
Stem cell production, which involves the utilization of extra fertilized eggs leftover following in vitro fertilization, raises ethical concerns about the use of stem cell research. These eggs are discarded after being used to harvest pluripotent stem cells [20]. At this point, ethical questions start to be raised. To begin, it cannot be acceptable to eliminate fertilized eggs, each of which has the potential to develop into a unique human being. Second, it is immoral to utilize these human embryos for any purpose. The biological sciences imply that a fertilized egg does not have a life for the first fourteen days because the formation of the embryo does not begin until after this time [21].

Ethical Issues on Somatic Cell Nuclear Transfer or Therapeutic Cloning
Somatic cell nuclear transfer (SCNT), often known as "Therapeutic Cloning," was the method utilized to create "Dolly, the sheep." The adult nucleus is transferred from a somatic cell to the nucleus-less egg during this procedure. The term "therapeutic cloning" refers to the practice of creating a stem cell line from an embryo that was first cloned. The patient's own somatic cell nucleus is used [16]. Therapeutic cloning is controversial for many reasons. Widespread adoption of therapeutic cloning could lead to erroneous advances in the direction of reproductive cloning.
Another risk associated with this treatment is the potential for less regard and worth of human life because of business pressures leading to greater research on embryos [16]. Furthermore, this raises the possibility that women will be exploited. Women's eggs or ova are required if the stem cells are to come from the embryos that die during in vitro fertilization [22]. Since more oocytes are needed for this operation, women are under increased pressure to produce and contribute more eggs [23]. This could be a degrading act. The need for ova grows in tandem with the frequency with which the procedure is carried out. As a result, it could diminish women's social standing. When women are used as a source of raw materials for therapeutic cloning, they may be subjected to commercialization and exploitation. The worst-case scenario is that it will lead to international sales of human ova (eggs) [24].

Religious issues on the use of Stem cells
Divergent opinions on stem cell research can be traced back to the world's greatly varied religious traditions. There is still substantial dispute over the nature of the afterlife, the nature of the soul, the origin and end of life, and the definition of life itself. This is shown again in divergent views across a wide range of religions and beliefs in different parts of the world [25]. Concerns have been voiced concerning the possible medicinal benefits of using embryos and aborted foetuses in research and treatment. Since the occurrence of fertilization and that the human embryo is equivalent to a human person, there have been ongoing debates about the nature and origin of human existence [26]. It is not an issue that embryos have a moral status [27].
Christian spiritual criteria refer to a human being who is created in the image of God, the creator, and who exists as an autonomous being from the moment of his or her conception [2]. This was the first religion to raise problems about the beginning of potential existence. However, Christian teachings diverge significantly from conventional medical practice. Embryonic stem cells, which are derived from embryos and used in medicinal methods and scientific study, have been met with opposition by the Roman Catholic Church [28]. There have also been recommendations to employ exclusively adult stem cells for this application [28].
Among Protestants, several debates have been held about the ethical use of stem cells. Theological and ethical considerations pose the greatest challenge. This starts with the idea that people are interconnected not only with God but also with one another and with themselves [29]. The concept that the developing foetus is a human being makes the use of stem cells completely out of the question and ethically incorrect, as stated by Walters [29].
The moral standing of embryos is a major factor in the Orthodox Church’s stance on embryonic stem cell (ESC) research. Its basic tenet is the belief that the gift of life's inception comes from a transcendent and benevolent deity [30]. In their view, every single living thing is of inestimable

worth. So they are humans who are capable of reason [31]. The developing fetus is accorded the same respect and protection as a human being by the higher divine spirits.



The Orthodox Church also holds that God endowed all of His creations with perfect faculties and resources [30]. God also bestowed upon them the authority to put them to good use. This suggests that humans have been endowed with divine characteristics and skills, and that all scientific progress flows naturally from this divine gift [30]. The Church also recognizes the significance of somatic stem cell therapy. But there are moral and ethical concerns with employing Embryonic Stem Cells (ESCs) because they are obtained from embryos [32].

According to the Old Testament, Jews at heart hold the view that a foetus is fully human after it has reached the 40-day mark of development [33]. This warrants reverence and a feeling of safety on your part. Since the embryo before 40 days is not an entity with a real soul in it, Jewish people find nothing morally wrong with embryonic stem cell research.

Islam's holy book, the Quran, states that a foetus's bodily structure and individual appearance are fully formed by the end of the fourth month of gestation. Therefore, since that time, he or she has been treated as an individual with full legal capacity [34]. Since the unborn is not legally recognized as a human being, stem cell research is generally accepted.

For Buddhists, the use of embryonic stem cells is permissible only if the researcher guarantees and wants to do therapeutic research that is known to improve the lives of individuals suffering from various ailments [34]. In addition to this outlook, Buddhists also hold that research done for the sake of financial gain is immoral [28].

Destruction of embryos is considered immoral and unethical in Hinduism. Nonetheless, no unified policy exists regarding the study and potential application of embryonic stem cells [32]. According to Buddhist doctrine, all forms of suffering ought to be avoided at all costs [32]. However, it might be argued that research on embryonic stem cells can be conducted because the foetus does not sense pain until 14 days [35].

Conclusion

One of the greatest advances in medicine and science is the ability to employ stem cells to treat a wide range of congenital conditions. Isolating embryonic stem cells is a complex process that calls for a high level of experience and knowledge. Due to the needless loss of embryos, the use of embryonic stem cells is very contentious. In addition, adult stem cells are favoured over their younger counterparts for treating a wide range of illnesses [2]. Stem cells' potential varies from one type of tissue or organ to another. Furthermore, stem cell therapy for various illnesses can be tailored to take advantage of their adaptability. Therefore, thanks to stem cells, regenerative medicine can reach new heights of success and growth.

Stem cell therapy has shown promise in recent years for the treatment of a variety of inherited neurological illnesses, and its use has spread to thousands of patients. It's no secret that scientists have found success in using stem cells to heal and even replace damaged organs and tissues. In conclusion, stem cells are studied and researched to learn more about human development and its problems. Additionally, it is among the most secure and well-established methods. However, there is still debate regarding how to get your hands on human embryonic stem cells. It's a central tenet of many worldviews, guaranteeing that discussions on the topic will rage on indefinitely. Though its therapeutic effects and significance in the treatment of permanent congenital defects are important, so is developing a more collaborative attitude towards its use.

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