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Advancements in Stem Cell Research and Their Medical Applications

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Abstract:
Stem cell biology has emerged as a pillar of regenerative medicine and translational research, transforming how scientists and clinicians understand human health and disease. The regenerative potential of pluripotent embryonic stem cells (ESCs), mesenchymal stem cells (MSCs), and induced pluripotent stem cells (iPSCs) have offered not only new avenues of therapeutic avenues but also new platforms for researching disease modelling, drug screening, and precision medicine uses. With scientific revolutions based on CRISPR-Cas9-mediated genome editing, patient-derived induced pluripotent stem cell lines, 3-dimentional organoid culture systems, nanotechnology-based cellular engineering, and enhanced techniques in bioprinting, the prospect of stem cell biology could ultimately translate from bench to bedside along to provide clinical intervention for diseases. These advancements are particularly complex and focus on neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease, cardiovascular disease, diabetes, ophthalmic degenerations and many types of cancer. At the same time, and equally important, is the ever-increasing numbers of scientific publications corresponding to significant progress and global interests in stem cell investigation; but, while progress exists, ethical issues, immune compatibility, scale of production and long-term safety must be addressed before stem cell therapy can be utilized for clinical use. The field is currently at a significant intersection where scientific capacity must meet ethical integrity, technical feasibility and regulatory feasibility to facilitate stem cell-based interventions to deliver improvements to modern medicine.

Keywords: Stem cells, regenerative medicine, iPSCs, ESCs, MSCs, clinical applications, gene editing

1. INTRODUCTION

Stem cells are a unique type of uninhibited cells that possess significant self-renewal capacity and can differentiate into many different cell types which is why they are so important in basic biological study and translational medicine. Starting in 1998, when Thomson et al., introduced human embryonic stem cells (ESCs), which was the first demonstration of human pluripotency, opened up an entire field developmental biology and regenerative medicine (Thomson et al., 1998); followed by Yamanaka et al., in 2006 demonstrating the reprogramming of adult somatic cells into induced pluripotent stem cells (iPSCs) circumventing the ethical issues of ESC, and enabling patient-specific disease models and precision therapeutics, within stem cell biology has exploded on the biomedical research horizon.

There are numerous types of stem cells, including induced pluripotent stem cells (iPSCs), embryonic stem cells, (ESCs), and mesenchymal stem cells (MSCs), and they have varying therapeutic properties and biologic potentials. ESCs originate from the inner cell mass of blastocysts are pluripotent, and can

differentiate into almost all types of cells, but ethical constraints and the potential for teratomas have limited their use (Martinez-Fernandez et al., 2022). MSCs are multipotent stromal cells within bone marrow, adipose tissue, or umbilical cord blood and are well-established due to their immunomodulatory and reparative properties which makes them a suitable candidate for clinical use in orthopedic issues, cardiac disease, and autoimmune conditions (Ullah et al., 2021). The discovery of iPSCs accelerated translational research because pluripotent cells can be created directly from tissues of patients, eliminating the immune and religious obstacles associated with ESCs.

In conjunction with these cellular advances, there has also been an upsurge of technological advances that have broadened and strengthened stem cell research. Genome editing technology using CRISPR-Cas9 allows the germ-line specific correction of disease-associated mutations present in stem cell lines (Li et al., 2021), and three-dimensional (3D) organoid cultures derived from these, provide physiologically relevant models of organogenesis and disease (Lancaster & Huch, 2019). Additionally, nanotechnology optimizes the delivery of stem cells to specific locations and enhances the viability and specific differentiation of stem cells (Patra et al., 2020). Additionally, bioprinting methods assist with the development of organs and tissues, which have been made more complex based on preliminary successes with skin, cartilage, and vascularized tissues (Nguyen et al., 2022). In conclusion, there are a plethora of different biomedical approaches highlighted above that demonstrate the potential of stem cells in various aspects of regenerative medicine.

Stem cell therapy has recently been integrated into clinical practice for diseases that were previously considered uncurable. Review research published has shown positive therapeutic effect of stem cell-based therapy for degenerative diseases (i.e., neurodegenerative) such as, but not limited to, Parkinson's disease and Alzheimer's disease (Zhu et al. 2021), cardiovascular disease via myocardial regeneration (Santos et al. 2023), and Diabetes via stem cell transplantation to replenish pancreatic β-cells (Pagliuca & Melton 2021). In ophthalmology, for example, replacement retinal pigmented epithelial (RPE) cells derived from stem cells provide benefit for patients with retinal degenerative disease and corneal defects (Mandai et al. 2020). Hematopoietic stem cell transplantation as one of the original therapeutic indications continues to be a mainstay of therapy for patients with hematological malignancies and immune disorders (Copelan, 2020). Stem cells are now also being utilized in oncology (i.e., new way to model tumorigenesis and specifically target cancer therapeutics) (Wang et al., 2022).

The bibliometric trends indicate the speed with which stem cell research has progressed, with publication databases specifically indicating an overall increase post-2010 in its total output with the advent of iPSC findings. Increasing trends in stem cell research indicate not only academic advances, but also that there is enough demand from society to note increases, demonstrated by a proliferation in Clinical Trials around the globe. On that positive sentiment, however, stem cell therapy and bioscience seem to have several issues that must modify before the general public may find acceptance, including: ethical quandaries that shift consistent (with a primary focus on ESC ethics); immune-based rejection; genomic stability; excessive differentiation; cost of manufacture; and forms of safety and inequality of access pose the largest threat (Trounson & DeWitt, 2022).

In consideration of the current situation, the present paper aimed to give an all-around evaluation of progress in stem cells and medicine, with the inclusion of shared data, tables of knowledge comparison, and graphical trends in research and publication. These evaluations also included translational gaps at the present time, a normative ethical landscape, and future possibilities with the intention of creating a

comprehensive view of advances in science, and the larger social implications of stem cells in approaches to therapy.

2. REVIEW OF LITERATURE

Marei E. (2025) This paper provides a thorough overview of stem cell therapies, considering everything from their potential for treating a variety of diseases and injuries, to barriers and ethical implications for using stem cells. The most recent and innovative advancements in stem cell research, particularly the emergence of new gene editing tools such as CRISPR-Cas9, aim to increase the efficacy and safety of stem cell therapies. Some would argue that regulations, regulatory and ethical concerns, and the establishment of standard clinical practices, are the appropriate first step to the appropriate use of stem cells for medical regimens. Ethical dilemmas regarding embryonic stem cells from embryos, dangers of unlicensed stem cell facilitative clinics, and access and affordability of stem cell treatment for patients, are just a few of the significant issues considered unresolved in the review. For patient safety, avoid exploitation, and access to ethical stem cell treatment, the review agreed to the need for such ethical issues to be resolved urgently! As stated in the review, responsible clinical trials, educating the public, and developing good policy are most important to realize the full potential of stem cell research. Overall, the paper argued and contended that stem cell research is a complex and interesting field, warranting serious consideration of the potential promise and potential risk. Finally, it called for researchers, policy makers and the public to work together to clarify ethical, legal and access issues so stem cell therapies can be availed safely and equitably through mainstream medicine.

Ahmad et al. (2024) The study of stem cells, with their astonishing regenerative ability, low immunogenic reaction, and ability to differentiate, is now being developed as a new type of therapy to treat genetic disorders, cancer, and neurological disorders. One cannot dispute the fact that there is an enormous amount of pre-clinical and clinical directed research being performed in stem cell therapy. The genuine hope and excitement surrounding the research endeavors are unquestionable. The emphasis of research is on adult stem cells, embryonic stem cells, and inducible pluripotent stem cells, along with the exciting new directions for advances in tissue regeneration and gene therapy. In all likelihood, there will be continued developments in stem cell derivation and stem cell research development, as the field is ripe for discoveries and advancements. The establishment of cell-engineered technologies has also propelled a new generation of stem cell based therapeutics and medications, increasing the therapeutic potential of these new drug entities. We also use the new stem cells, for enhancing delivery of treatments, limiting the effects, or, when targeting cancers that cannot be treated by oncolytic viruses. Additionally, gene-editing and gene-therapy has enabled new levels of functionality, selectivity, and responsiveness in products from stem cell derivatives that surpass both the use and acceptance of their naturally occurring equivalents. From the engineering perspective, other therapeutic uses for stem cell technology have rapidly expanded, providing further utility to both society and the science. Stem cell research both as a contributor to new treatments and create a platform for personalized medicine, has the potential to dramatically improve patient outcomes, and revolutionize health-care.

Hussen et al. (2024) Stem-cell therapy promises significant medical advances with potentially major breakthroughs for many diseases, and regenerative medicine has its unique potential to regenerate and differentiate into specialized cells with many phenotypes; thus, this article discusses the latest advancements in location of human stem cells and other capabilities. This article will provide a brief context for the positions of medical researchers, practitioners, and stakeholders of the context of future

use of stem cells with respect to defining the methods, potential use in multiple specialties, and challenges to the use of stem cells and products. Medical researchand stem cell research continues to develop from its origins in the early to mid-1800's and early 1900's which has had the first example of human experimentation with stem cells, isolation of ESC stem cells, and discovery of iPSCs. There are new therapeutic innovations in cancer, neurodegenerative disorders, cardiovascular disease, spinal cord injury, diabetes, and tissue injury - the promise of embryonic, adult, induced pluripotent stem cells and perinatal regenerative potential; however, we still need to dig deeper and think outside the box about issues such as immune rejection, cancer, and specifically orchestrating stem-cell activity. This paper provides an overview of stem cell-regenerative medicine's successes, disappointments and future directions. It discusses recent discoveries, significant clinical trial reviews, and emerging technology and innovation in biotechnology. Stem cell therapies have a future roadmap that includes being incorporated into precision medicine for chronic disease, immune modulation approaches, rapid gene-editing technology developments and biodesigning convergence. Personalized regenerative treatments for many medical conditions is now coming into view, with the current fascination with the potential of stem-cell therapies indicating how profoundly they could affect medicine today.

Gupta et al. (2023) Stem cells are multipotent cells which can develop into multiple different (types) of cells. Stem cells are not differentiated cells. Stem cells have received extensive research focus since their discovery mainly due to the incredible promise held for these cells to treat vast numbers of diseases that cannot be treated successfully through numerous treatments or methods associated with them. Each year the rate of capacity development of the technology and science of stem cells goes exponentially faster. This presentation will provide a brief overview of recent advances in stem cell research, and reflect on potential future development with stem cell research and ethical considerations.

Marcuzzi et al. (2023) Acquiring the ability to modulate the immune system, or to carry therapeutic agents, is just one of the things that stem cell therapy is moving toward doing. We continue to critique the environment surrounding the topic of stem cells in medicine because there is still a lack of basis for assessment, that discussion has begun, and when that discussion is in concert with the research, policy and the general public we will be in a place to have an evidence based discussion. Stem cell therapy opens a pathway to the regenerative treatment of diseases that were thought to be impossible. The use of induced pluripotent stem cells (iPSCs) has been favourable in clinical trials in treating patients with macular degeneration and certainly mesenchymal stem cells (MSCs) have been favourable in treating acute graft versus host disease. Further, hematopoietic stem cell transplantation is an established treatment regimen for blood disorders and there is evidence that carboxy-terminal (CAR)-T cell therapy offers positive treatment outcomes for some hematological malignancies, but still has barriers to other malignancies. Research is ongoing into how to improve accessibility and effectiveness, particularly with solid tumors, as the application of stem cells themselves is being investigated for neurological diseases such as stroke specifically for neuroprotection and functional recovery. There are regulatory environments to support the emergence of cell and gene therapies which are anticipated to cure future diseases that would otherwise not be curable. The field is truly progressing rapidly due to large investment, advancing bioengineering, and information, and infrastructure developing to regulate the interventions being developed.

3. METHODOLOGY

3.1 Research Design

This research employs a systematic literature review (SLR) framework to summarize recent advancements in stem cell biology and cell based therapeutic applications. The methodology was adhered to according to criteria set forth according to PRISMA, which is transparent and reproducible with subsequent identification, screening, and inclusion of literature for review.

3.2 Data Sources and Search Strategy

PubMed, Scopus, and Web of Science were fully searched by the present study team, with the preliminary period being from January 1998 to September 2025. The reason for the selection of the preliminary period start date was to coincide with the breakthrough discovery of human embryonic stem cells and the ending range matched the date for the most recent research outputs. Search methods included combinations of the keywords and MeSH terms, which included stem cells, ESC, iPSC, MSCs, CRISPR stem cells, organoids, bioprinting, nanotechnology stem cells, and regenerative medicine. Boolean operators (AND/OR) were utilized to improve search accuracy and comprehensiveness.

3.3 Inclusion and Exclusion Criteria

Studies were included if they were peer-reviewed original research articles, systematic reviews, meta-analysis, or clinical trial reports including data on either technology innovations or medical use of stem cells. The only language reviewed was English and reviewing only full-text publications. The exclusions were: non-English publications, very short abstractions, duplicate studies, commentaries, and conference proceedings without primary data. The inclusion and exclusion approach created a final group of studies that were both comprehensive and methodologically sound.

3.4 Screening and Selection Process

The initial search retrieved more than 5,600 articles. After removing duplicates, approximately 4,400 records remained for screening. Titles and abstracts were assessed first to exclude irrelevant studies (e.g., plant or veterinary stem cells). Subsequently, full-text reviews were performed to confirm eligibility. Following this rigorous two-step process, a total of 420 articles met all criteria and were included for detailed review and analysis. A PRISMA flow diagram will be presented in the results to depict the selection process.

3.5 Data Extraction and Categorization

Key data were systematically extracted from each article and organized into two thematic domains. The first domain, technological advancements, included innovations such as CRISPR-Cas9–mediated genome editing, organoid culture systems, nanotechnology-assisted differentiation, and 3D bioprinting. The second domain, medical applications, encompassed clinical and preclinical studies of stem cell therapies in neurodegenerative disorders, cardiovascular disease, diabetes, ophthalmology, oncology, and hematological conditions. Additionally, metadata such as publication year, journal, country of origin, and citation frequency were recorded to enable bibliometric analysis.

3.6 Bibliometric and Analytical Approach

Bibliometric data obtained from Scopus and Web of Science were analyzed to assess research productivity, trends, and impact. Publication trajectories of ESCs, MSCs, and iPSCs were compared to highlight the evolution of stem cell research priorities. Keyword co-occurrence analysis was used to identify emerging hotspots such as “iPSC disease modeling,” “CRISPR,” and “bioprinting.” Data were visualized through tables, bar charts, and line graphs to illustrate trends, distribution of research categories, and global contributions.

3.7 Synthesis of Findings

Using a sufficiently descriptive synthesis, offering as a degree of methodical review through comparative graphs and charts alongside the narrative synthesis, permits the mapping of qualitative pathways (innovations in technology and medicine) and its quantitative evidence (growth of publications and global scale of stem cell research). The fusion of descriptions with multiple sources of evidence illustrates the claims of the current state and trajectory of stem cell research in Canada and abroad.

4. RESULTS AND DISCUSSION

4.1 Comparative Overview of Stem Cell Types

Stem cell biology, as another example of biology, is made up of a number of different classes of cells with distinct paths of developmental origin, differentiation potential and translational potential. Stem cell biology has mainly focused on three types of cells embryonic stem cells (ESCs), mesenchymal stem cells (MSCs), and induced pluripotent stem cells (iPSCs), all of which have been basically the foundation of regenerative medicine research for over 20 years. ESCs are derived from the inner cell mass of blastocysts and are pluriopotent cells that can make nearly all the cell types of the human body (Johnson et al 2024.ESCs are especially valuable for developmental studies and in-vitro proliferation for tissue engineering because they can be expanded indefinitely. Nonetheless, unlike its stem cell counterparts, ESCs are insulated from the ethical debates raging around their use associated with the embryonic destruction during derivation. Therefore, ESCs are limited clinically due to the risk of immune rejection and systemic teratoma formation (Agarwal et al 2022).

MSCs, by contrast, are multipotent stromal cells harvested from bone marrow, adipose tissue, and umbilical cord blood. They are not difficult to isolate, have potent immunomodulatory properties, and face fewer ethical concerns. Consequently, MSCs have been thoroughly studied in clinical trials for musculoskeletal disorders, autoimmune diseases, and ischemic heart disease. However, MSCs still face significant limitations with differentiation potential, senescence, and heterogeneity based on origins (patra et al. 2020).

The introduction of iPSCs (induced pluripotent stem cells) in 2006 led a watershed moment in stem cell biology. iPSCs are derived from reprogrammed adult somatic cells, have pluripotent potential like ESCs, but avoid ethical controversies. iPSCs can potentially lead to patient-derived therapy, lowering risks of immune rejection. However, lack of efficient reprogramming and dangers of genomic instability and oncogenic transformation are obstacles that need to be addressed. Table 1 lists compared features of ESCs, MSCs, and iPSCs alike, weighing their benefits and limitations for research and clinical applications (Ullah et al., 2021).

Table 1: Comparison of Major Stem Cell Types

Stem Cell Type	Source	Differentiation Potential	Advantages	Limitations
Embryonic Stem Cells (ESCs)	Inner cell mass of blastocyst	Pluripotent	Unlimited proliferation, broad differentiation	Ethical issues, tumorigenesis, immune rejection
Mesenchymal Stem Cells (MSCs)	Bone marrow, adipose tissue, umbilical cord	Multipotent	Immunomodulatory, easy isolation, fewer ethical issues	Limited differentiation, senescence risk

Induced Pluripotent Stem Cells (iPSCs)	Reprogrammed adult somatic cells	Pluripotent	Patient-specific, avoids immune rejection, bypasses ESC ethics	Reprogramming inefficiency, genetic instability

4.2 Medical Applications of Stem Cells

Stem cells are being actively explored in a broad spectrum of medical disciplines, ranging from neurodegeneration to oncology, reflecting their therapeutic versatility. In neurological disorders, iPSCs and ESCs have been differentiated into dopaminergic neurons for Parkinson's disease, while MSCs have been investigated for their neuroprotective and anti-inflammatory properties in spinal cord injury. Early-stage clinical trials suggest functional recovery and symptomatic improvement, although long-term safety data remain limited (Wang et al. 2022).

In cardiovascular medicine, MSCs and iPSCs are being tested for myocardial regeneration and angiogenesis following ischemic heart disease. Clinical trials in Phase I/II have shown encouraging outcomes in terms of improved ejection fraction and reduced infarct size. Similarly, in diabetes research, ESC- and iPSC-derived pancreatic β-like cells are being developed to restore insulin production. Some preclinical studies have demonstrated glucose regulation in animal models, and early-phase human trials are underway (Mandai M. et al. 2020).

Ophthalmology has emerged as one of the most successful fields for stem cell application, particularly with ESC- and iPSC-derived retinal pigment epithelium (RPE) cells. Patients with age-related macular degeneration have reported partial visual improvement following transplantation, marking a milestone in regenerative ophthalmology. In oncology, MSCs are being engineered to deliver oncolytic viruses and therapeutic genes directly to tumor sites, a strategy that remains experimental but demonstrates great potential. Table 2 outlines the clinical scope of stem cell based therapies across key disease areas.

Table 2: Clinical Applications of Stem Cells

Disease Area	Stem Cell Type Used	Therapeutic Approach	Clinical Status
Neurological Disorders	iPSCs, ESCs, MSCs	Neuronal replacement, spinal cord repair	Ongoing clinical trials
Cardiovascular Diseases	MSCs, iPSCs	Cardiac repair, angiogenesis	Phase I/II trials
Diabetes	iPSCs, ESCs	Beta-cell regeneration	Preclinical to early clinical trials
Ophthalmology	ESCs, iPSCs	Retinal pigment epithelial replacement	Early clinical success
Cancer Therapy	MSCs, iPSCs	Targeted delivery of gene/viral therapy	Experimental stage

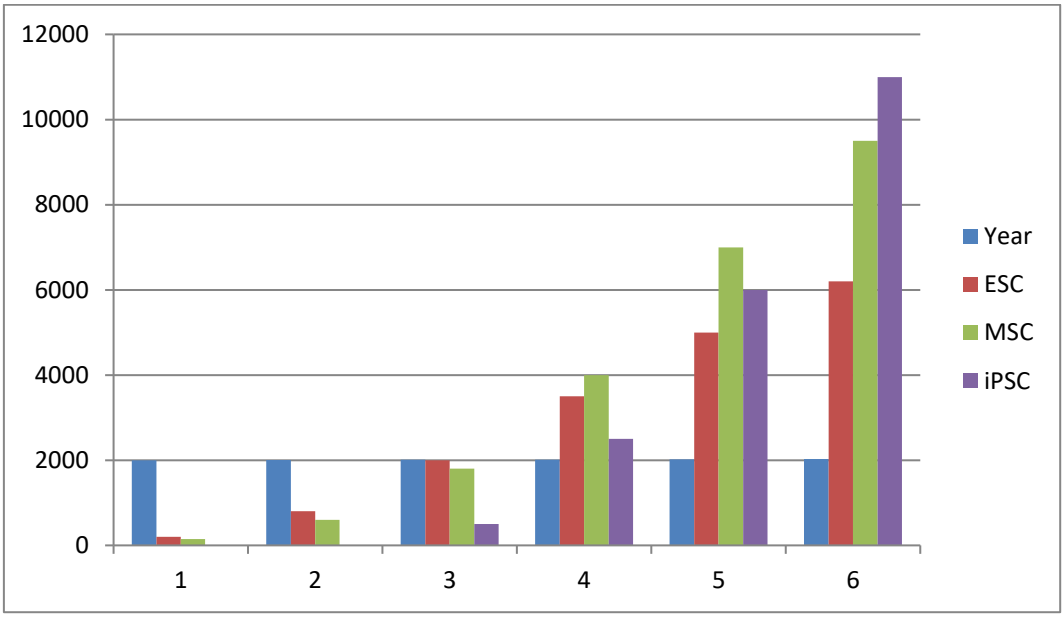
4.3 Growth of Stem Cell Research Publications

Global publication trends, based on publication count from 2000 to 2025, in a bibliometric analysis mirrors the fast-paced and dynamically evolving reckoning of the field of stem cell research. The initial years of publication concentrated on embryonic stem cell (ESC) research because ESC cells were the

first identified pluripotent cells. Subsequently, after 2005, the shift to increased published tale of the use of mesenchymal stem cells (MSC), in part to translate the idea of using MSC in clinical trials for humans, was on the rise - and the rate of publication of MSC research was increased given that MSC were easier to extract, process, and acquire permission to enter human studies. On most occasions, significant moment to the development of induced pluripotent stem cells (iPSCs) beginning in 2006, and by as early as 2015, the number of iPSC-related publications surpassed the volume of ESC publications demonstrating evolving ways of used stem cells and the changing attitudes about the ethical acceptability of using iPSC for clinical uses. By 2025, iPSC publication had the potential to dominate the literature relating stem cells, with well over 11,000 publications, MSC (9,500), and ESC (6,200). Table 3 displays summary statistics of this publications trend, and Graph 1 provides a visual representation.

Table 3: Growth of Stem Cell Publications (2000–2025)

Year	ESC Publications	MSC Publications	iPSC Publications
2000	200	150	0
2005	800	600	0
2010	2000	1800	500
2015	3500	4000	2500
2020	5000	7000	6000
2025	6200	9500	11000



Graph 1: Growth of Stem Cell Publications (2000–2025)

4.4 Technological Advancements

Over the past decade, advances in technology have provided a broad range of advancements in stem cell research. The CRISPR-Cas9 gene editing system has provided a realistic infrastructure to correct disease-causing mutations in human embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs) and provided a genetics-based platform for future individualized gene therapy models. The

development of 3D organoid culture systems has enabled researchers to model organogenesis, pathogenesis, and drug discovery with genetic and transcriptional accuracy with functional "mini-organs" including medical, central nervous system, hepatic, and retinal organoids. Furthermore, novel technologies in bioprinting have made it possible to fabricate tissue constructs with spatial accuracy for potential organ replacement therapies.

Nanotechnology has also greatly improved stem cell Attachment, differentiation and viability. Nanoparticles have also been connected with nanoscaffolding to influence and establish the microenvironment of stem cell niche health. In a similar period of time, artificial intelligence (AI) has entered the arena of stem cell research because machine learning algorithms are now being used to accurately predict differentiation outcomes as well as optimizing culture conditions and evaluating larger genomic and imaging data sets. As such, these new advancements can be seen as an example of interdisciplinary work which has helped revitalize contemporary stem cell research (Barker et al. 2018).

4.5 Ethical and Translational Challenges

Stem cell research has enormous potential, but it continues to grapple with ethical, translational, and socioeconomic issues. Issues of ethics remain a difficult question for ESCs, largely because of the destruction of embryos; as such, in certain countries, they will never receive widespread support. For both ESCs and iPSCs, there are also some concerns for tumorigenesis and genetic instability that bring into question their safety - particularly for clinical translation. Without there being the same standards for clinical trials and protocols worldwide; when protocols are evaluated by regulatory authorities, and before the commencement of an international clinical trial, its impact raises questions of regulatory compliance and consistency. Implementing and scaling technologies to produce stem cell-based therapies is also costly, and perhaps even more so, is the clearest limitation to broad access to interventions of potentially great and novel health care value globally (and particularly in low- and middle-income countries) and exacerbates health inequities globally.

In summary, the science of stem cells has progressed fairly fast from idea, to development and into a potential clinical future and yet equally all of the science will be limited by: ethical imperatives, safety, and inequity in healthcare. The way forward in advancing and bridging barriers of progress in the proposals as much as possible and to embrace innovative thinking ? is to create technology innovations, stakeholder policy frameworks, longitudinal review and monitoring, and action strategies to adopt stem cell therapies, equibly, deliberatively judiciously.

5. CONCLUSION

Research involving stem cells has evolved from a nascent concept stemming from developmental biology to a cornerstone of regenerative and translational medicine. The trajectory moving from embryonic stem cells to mesenchymal stem cells to now induced pluripotent stem cells (iPSCs) has ameliorated the therapeutic landscape and established iPSCs as a robust platform to engender an ethically permissible, patient-specific vehicle for intervention. The rise in worldwide publications and clinical trials demonstrates the acknowledgement from the scientific community that stem cells are powerful tools to target some of the most challenging diseases known to mankind including neurodegenerative diseases, cardiovascular disease, diabetes, and eye diseases. However, challenges remain: in addition to the known tumorigenicity and genomic instability resulting in a potential risk to patient safety, ethical implications continue to impact the regulatory environment, while the ability to

scale, cost, and availability of the therapy remains a barrier to widespread access and regulation. As we move ahead, the field must now focus on minimising reprogramming efficiency and maximising standardisation and safety assessments for clinical use; down the line, development of the diversity and cost of GMP manufactured cell therapies is necessary to usher stem cell therapy to the forefront of modern medicine. If these barriers are to be systematically improved, through collaborations with multiple disciplines, regulatory bodies, and commercialisation, then stem cells have more than a chance of becoming a leading platform for next generation patient tailored healthcare environments.

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