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V-Discover

THE STUDENTS
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Theme : STEM CELLS

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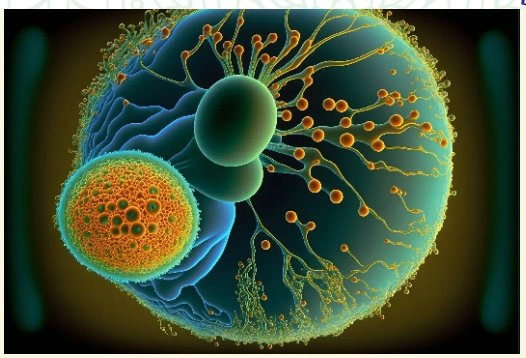
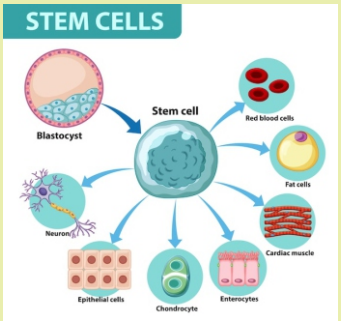
STEM CELLS



INTRODUCTION OF STEM CELLS

Stem cells are undifferentiated cells with the remarkable ability to develop into specialized cell types in the body. They have the potential to divide and renew themselves for extended periods, making them a valuable resource for tissue repair and regeneration. Stem cells are categorized into embryonic stem cells, derived from embryos, and adult (or somatic) stem cells, found in various tissues. Their unique properties hold immense promise for medical research and therapeutic applications.

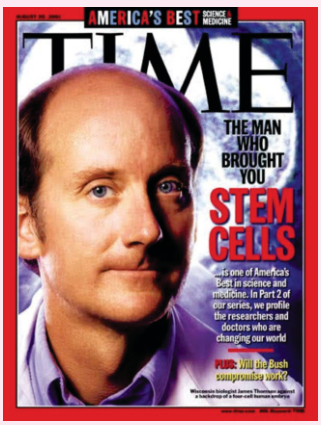
TYPES OF STEM CELLS



1. Embryonic Stem Cells (ESCs) : Derived from embryos, these pluripotent cells can differentiate into any type of cell in the human body.
2. Adult (Somatic) Stem Cells : Found in specific tissues of the body, these multipotent cells have a more limited differentiation potential compared to embryonic stem cells. Examples include hematopoietic stem cells (found in blood-forming tissues) and mesenchymal stem cells (found in various connective tissues).
3. Induced Pluripotent Stem Cells (iPSCs): Created by reprogramming adult cells, iPSCs regain pluripotency and can differentiate into various cell types, similar to embryonic stem cells.
4. Perinatal Stem Cells : Derived from tissues like the umbilical cord and placenta, these cells possess multipotent properties and are considered a valuable source of regenerative medicine.
5. Cancer Stem Cells: Found within tumors, these cells can self-renew and differentiate, potentially contributing to the growth and spread of cancer.
6. Amniotic Fluid-Derived Stem Cells : Isolated from the amniotic fluid surrounding a developing fetus, these cells exhibit both pluripotent and multipotent characteristics.
7. Adipose-Derived Stem Cells : Extracted from fat tissue, these cells have shown promise in various regenerative medicine applications due to their multipotent capabilities.
8. Dental Pulp Stem Cells: Residing in the pulp of teeth, these multipotent cells have the potential to differentiate into various cell types, making them a focus of dental and regenerative research.

K. KARTHIGA

WHO DISCOVERED THE STEM CELLS IN 1998 ?



In 1998, James Thomson, a biologist at the University of Wisconsin-Madison, along with his team, was the first to successfully isolate and culture human embryonic stem cells (ESCs).

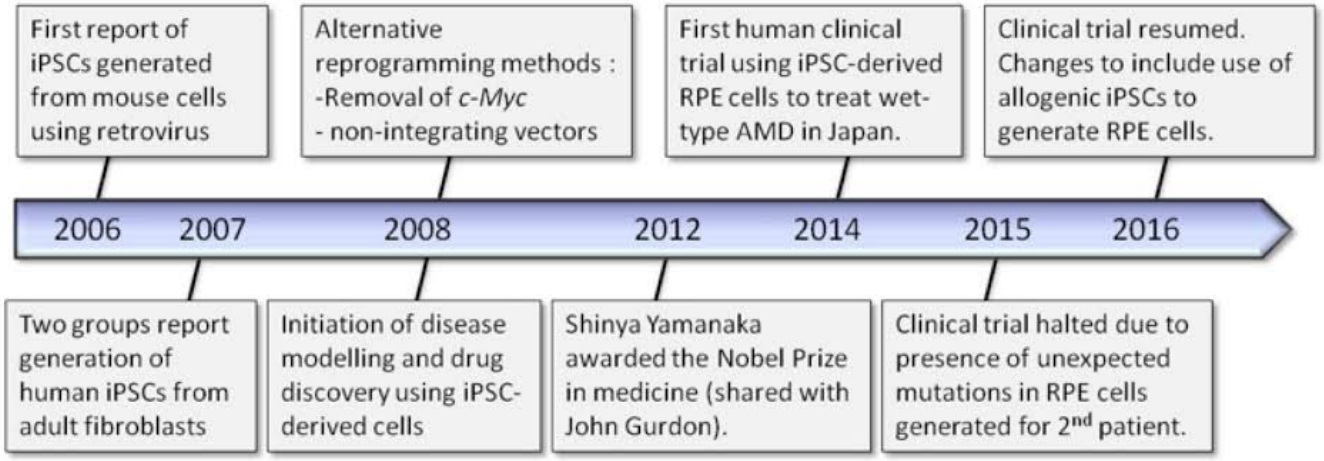
This groundbreaking achievement marked a significant milestone in the field of stem cell research and opened up new avenues for studying and utilizing these versatile cells for various medical applications.

S. ABINAYA

FATHER OF STEM CELLS

The term "Father of Stem Cells" is not attributed to a single individual, as the field of stem cell research and its development has involved the contributions of many scientists over several decades.

1. Ernest McCulloch and James Till: These Canadian scientists conducted pioneering research in the 1960s, establishing the existence of stem cells in the bone marrow and laying the foundation for modern stem cell research.
2. Martin Evans : Along with his colleagues, Evans successfully isolated and cultured embryonic stem cells from mice in the early 1980s, which was a crucial step in the development of stem cell science.
3. Shinya Yamanaka: In 2006, Yamanaka and his team reprogrammed adult cells into induced pluripotent stem cells (iPSCs), demonstrating that mature cells can be reverted to a pluripotent state. This discovery revolutionized the field of regenerative medicine.



YEAR	HISTORY
1961	Canadian scientists Ernest McCulloch and James Till demonstrate the existence of stem cells in the bone marrow, pioneering the field of hematopoietic stem cell research.
1978	Louise Brown, the first "test-tube baby," is born through in vitro fertilization (IVF), a technique that later contributes to the development of embryonic stem cell research.
1981	Gail R. Martin and Martin J. Evans independently isolate and culture mouse embryonic stem cells, a crucial advancement in stem cell science.
1988	Researchers at Johns Hopkins University discover human embryonic stem cells in fetal tissue, expanding the understanding of pluripotent cells in humans.
1997	Wilmut, Campbell, and colleagues successfully clone Dolly the sheep through a process called somatic cell nuclear transfer, demonstrating the potential for creating genetically identical organisms and opening new avenues for stem cell research.
1998	James Thomson and his team at the University of Wisconsin-Madison isolate and culture human embryonic stem cells, a milestone in human stem cell research.

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2006	Shinya Yamanaka and Kazutoshi Takahashi successfully reprogram adult skin cells into induced pluripotent stem cells (iPSCs), a groundbreaking discovery that redefines the potential of cellular reprogramming.
2010	The development of gene editing techniques, such as CRISPR-Cas9, significantly advances the field of stem cell research by enabling precise modifications to the genetic material of cells.
2013	Researchers at the Oregon Health & Science University create the first human embryonic stem cells through somatic cell nuclear transfer, a technique known as therapeutic cloning.
2020	Ongoing research focuses on advancing stem cell therapies for various medical conditions, including neurodegenerative diseases, cardiovascular disorders, and tissue regeneration.

V. KALAIYARASI

NOBLE PRIZE IN 2012

In 2012, the Nobel Prize in Physiology or Medicine was awarded jointly to Sir John B. Gurdon and Shinya Yamanaka for their discoveries related to the generation of pluripotent stem cells through nuclear reprogramming. Their work was groundbreaking in the field of stem cell biology.

CENTRE FOR STEM CELL RESEARCH :

The Center for Stem Cell Research, a unit of the Institute of Stem Research and Regenerative Medicine (instem), Bengaluru, has been established as a collaboration between inStem the Department of Biotechnology, the Ministry of Science and Technology, the Government of India, and the Christian Medical College, Vellore.

CSR is supported by the Department of Biotechnology of the Ministry of Science and Technology government of India.

MISSION :

CSCR aims to use stem cell science to better understand human disease and develop novel cell-based therapies for some of them through translational research including basic science, animal models for disease, and clinical trials.

This will be done through interdisciplinary collaborations working in terms directed at specific themes of research directed at addressing unmet healthcare needs in the country. To provide training and education in stem cell research to help build human capacity in this field.

GOALS

- Establish terms for scientists to work on specific themes directed at addressing unmet healthcare needs through carefully directed translational research.
- Create cellular and animal models for disease to test hypotheses generated from an understanding of those diseases and stem biology.
- Develop a training program for students and scientists who will contribute to the manpower required for this field in the country.

S. GOWSALYA

POTENTIAL BENEFITS OF PRESERVING UMBILICAL CORD BLOOD STEM CELLS

Preserving umbilical cord blood stem cells, through a process known as cord blood banking, offers several potential benefits:

1. Source of Regenerative Cells : Umbilical cord blood contains valuable hematopoietic stem cells, which can differentiate into various types of blood cells. These cells are crucial for treating a range of diseases, including leukemia, lymphoma, and other blood-related disorders.
2. Lower Risk of Graft-Versus-Host Disease (GVHD): Cord blood stem cells have a lower likelihood of causing graft-versus-host disease compared to stem cells from other sources, making them a safer option for transplantation, especially in cases where a closely matched donor is not available.
3. Compatibility for Family Members: Since cord blood is a biological match for the baby from whom it was collected, there is a high likelihood of compatibility for immediate family members, such as siblings, in the event of a stem cell transplant.

STEM CELLS

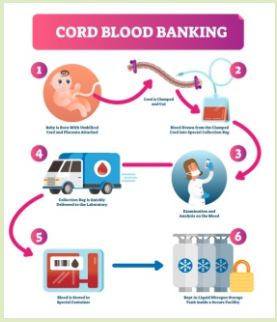
4. Potential for Future Therapies: Ongoing research in the field of stem cell biology suggests that cord blood may have applications beyond blood-related disorders. It is being explored for potential treatments in areas like neurology, cardiology, and autoimmune diseases.
5. Less Ethical Controversy: Umbilical cord blood is collected after birth and is considered ethically non-controversial, in contrast to embryonic stem cells, which involve the destruction of embryos.
6. Convenience and Accessibility : Cord blood banking provides a readily available source of stem cells for the child or family if needed in the future. This can be particularly important in cases of sudden or unforeseen illnesses.

7. Research and Clinical Trials: Preserved cord blood can be used for research purposes and may also be eligible for participation in clinical trials, contributing to advancements in medical science.

P. KAVIYARASI

METHOD OF PREPARING STEM CELL

1. **Cryopreservation :**



- Embryonic Stem Cells (ESCs) & Induced Pluripotent Stem Cells (iPSCs) : These pluripotent stem cells are often cryopreserved. They are gradually cooled to very low temperatures using a cryoprotectant solution and then stored in liquid nitrogen. This prevents ice crystal formation, which could damage the cells.

- Adult Stem Cells (Somatic or Mesenchymal Stem Cells) : These cells, derived from various tissues, can also be cryopreserved using similar techniques. The process involves controlled cooling and storage in cryogenic containers.

- Umbilical Cord Blood Stem Cells: These cells are often cryopreserved. After processing and adding a cryoprotectant, the cord blood is gradually cooled and stored in liquid nitrogen.

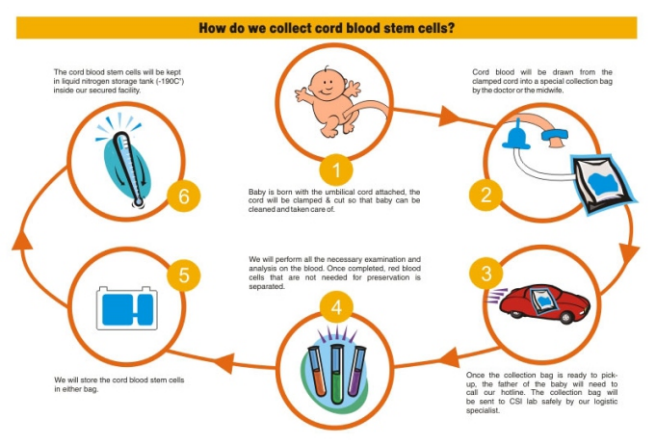
2. **Vitrification :**
   - Vitrification is an alternative to traditional cryopreservation. It involves ultra-rapid freezing of cells without the formation of ice crystals. This method is often used for oocytes (eggs) and embryos in reproductive medicine, but it can also be applied to some types of stem cells.
3. **Drying or Lyophilization :**
   - Some researchers explore techniques to preserve stem cells through desiccation (removing water) and subsequent storage. This method is still experimental and not widely used.
4. **Chemical Stabilization :**
   - Researchers are investigating methods to chemically stabilize stem cells for long-term storage without freezing. This approach aims to avoid the potential damage that can occur during the freezing and thawing process.
5. **Tissue Culture and In Vitro Expansion :**
   - For certain applications, stem cells can be continuously cultured & expanded in vitro. This process allows researchers to generate a larger population of stem cells for research or potential therapeutic use.
6. **Cryopreservation Media and Solutions :**
   - Stem cells are often preserved using specialized cryopreservation media and solutions. These solutions contain cryoprotectants that help protect cells during the freezing and thawing process.

A. NISHA

CORD BLOOD BANKING

Cord blood banking is the process of collecting and storing the blood from the umbilical cord and placenta after a baby is born. This blood contains valuable stem cells that can be used for medical purposes. Here's an overview of cord blood banking:

1. **Collection :**
   - After a baby is born, the umbilical cord is clamped and cut. The remaining blood in the umbilical cord and placenta is then collected.
2. **Processing :**
   - The collected cord blood is processed in a laboratory. It is tested for various factors, including cell count, viability, and infectious diseases.



3. Cryopreservation :

- Once processed, the cord blood is gradually cooled to very low temperatures using a cryoprotectant solution. It is then stored in specialized containers in a controlled environment, typically using liquid nitrogen.

4. Storage :

- The cord blood is stored in a cord blood bank facility. It is securely labeled and tracked to ensure proper identification and retrieval if needed in the future.

5. Future Use :

- Cord blood stored in a cord blood bank can potentially be used for medical treatments. These stem cells have the ability to develop into various types of blood cells and can be used in treatments for diseases like leukemia, lymphoma, and other blood disorders.

M. KARISHMA

TYPES OF CORD BLOOD BANKING

1. Public Cord Blood Banking:

- Purpose : Public cord blood banks collect and store cord blood units for public use. The donated cord blood is made available to anyone who needs a stem cell transplant and is a suitable match.

- Donation Process: Parents choose to donate their baby's cord blood after birth. The donated cord blood is then tested, processed, and stored in a public bank.

- Accessibility : Cord blood stored in public banks is available to anyone who is a suitable match and in need of a transplant. It is not reserved exclusively for the family that donated it.

- No Cost to Donors : Donating to a public cord blood bank is typically free for parents. The cost of collection and processing is covered by the bank.

- Regulated by Health Authorities : Public cord blood banks are often regulated by health authorities to ensure that the collected cord blood meets high-quality standards. - Research and Medical Advancements: Cord blood donated to public banks may be used for research or medical advancements that benefit a wider population.

2. Private Cord Blood Banking :

- Purpose: Private cord blood banks store cord blood for the exclusive use of the baby and their family. The stored cord blood is reserved for potential future medical treatments for the donor or their family members.

- Collection Process: Parents choose to pay for the collection, processing, and storage of their baby's cord blood. A private bank arranges for the collection and transportation of the cord blood.

- Reserved for Family: Cord blood stored in a private bank is exclusively available for the donor child and their immediate family members. It is not accessible to the public.

- Cost: There is an initial fee for collection and processing, as well as an annual storage fee. These costs are typically borne by the parents.

- Ethical Considerations: Some individuals may have ethical concerns about the privatization of biological material, and they may prefer to donate to a public bank.

- Potential Future Use: Private cord blood banking provides a source of compatible stem cells that may be used in the future for medical treatments, should the need arise.

M. KARISHMA

STEM CELLS

SIGNIFICANT ROLE OF STEM CELL THERAPY

1. Tissue Regeneration and Repair :

- Stem cells have the unique ability to differentiate into various specialized cell types. This property enables them to replace damaged or diseased cells and tissues in the body. This has implications for treating injuries, degenerative conditions, and diseases where tissue regeneration is crucial.

2. Treatment of Blood-Related Disorders :

- Hematopoietic stem cell transplantation, a form of stem cell therapy, is used to treat a wide range of blood-related disorders, including leukemia, lymphoma, and various genetic disorders of the blood.

3. Neurological Conditions :

- Stem cell therapy is being investigated for its potential to treat neurological disorders such as Parkinson's disease, Alzheimer's disease, spinal cord injuries, and stroke. Stem cells have the potential to replace damaged neurons and promote neural regeneration.

4. Cardiovascular Diseases :

- Stem cells, particularly mesenchymal stem cells (MSCs) and induced pluripotent stem cells (iPSCs) are being explored for their potential to repair damaged heart tissue after a heart attack or in cases of heart failure. They have the potential to differentiate into cardiac cells and promote cardiac regeneration.

5. Autoimmune Disorders and Immunotherapy :

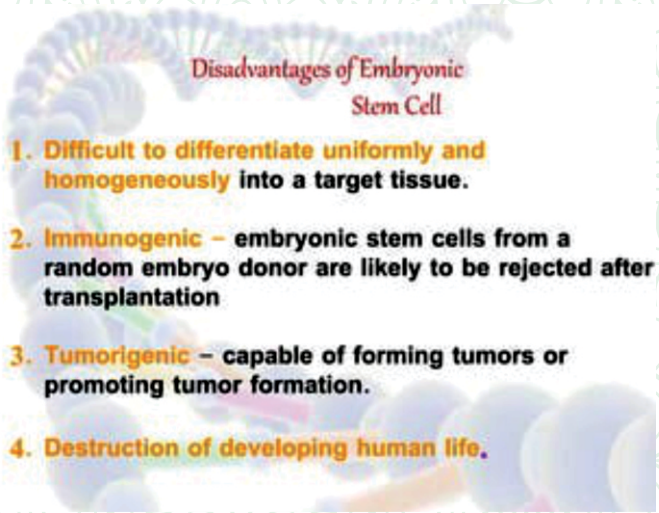
- Stem cells have the potential to modulate the immune system, making them a subject of interest in the treatment of autoimmune disorders like multiple sclerosis, type 1 diabetes, and rheumatoid arthritis. Additionally, they are being used in immunotherapies for certain cancers.

N. NATHIYA

ADVANTAGES OF STEM CELLS

1. Stem cell therapy holds potential for treating previously incurable diseases.
2. It enables tissue regeneration, offering hope for patients with damaged organs or tissues.
3. The therapy can be personalized to individual patients, increasing its effectiveness.
4. Stem cell treatments often involve minimally invasive procedures, reducing surgical risks.
5. Research in stem cell therapy contributes to advances in drug development and medical science.

R. KANIMOZHI



VIVEKANANDHA EDUCATIONAL INSTITUTIONS

TIRUCHENGODE CAMPUS

- ★ SWAMY VIVEKANANDHA MEDICAL COLLEGE HOSPITAL AND RESEARCH INSTITUTE
- ★ VIVEKANANDHA DENTAL COLLEGE FOR WOMEN
- ★ SWAMY VIVEKANANDHA COLLEGE OF PHARMACY
- ★ VIVEKANANDHA COLLEGE OF NURSING
- ★ VIVEKANANDHA SCHOOL OF ANM
- ★ SWAMY VIVEKANANDHA PHYSIOTHERAPY COLLEGE
- ★ VIVEKANANDHA ALLIED HEALTH SCIENCE COLLEGE (Co-Ed)
- ★ KRISHNA INSTITUTE OF OPTOMETRY AND RESEARCH
- ★ VIVEKANANDHA INSTITUTE OF HEALTH SCIENCE & RESEARCH (Boys)
- ★ KRISHNA INSTITUTE OF HEALTH SCIENCE (Boys)
- ★ VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (AUTONOMOUS)
- ★ VIVEKANANDHA COLLEGE OF TECHNOLOGY FOR WOMEN
- ★ VIVEKANANDHA INSTITUTE OF INFORMATION AND MANAGEMENT STUDIES
- ★ VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)
- ★ VIVEKANANDHA COLLEGE FOR WOMEN
- ★ VIVEKANANDHA COLLEGE OF EDUCATION FOR WOMEN
- ★ KRISHNA COLLEGE OF EDUCATION FOR WOMEN
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- ★ VIVEKANANDHA NURSING COLLEGE FOR WOMEN
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★★★

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