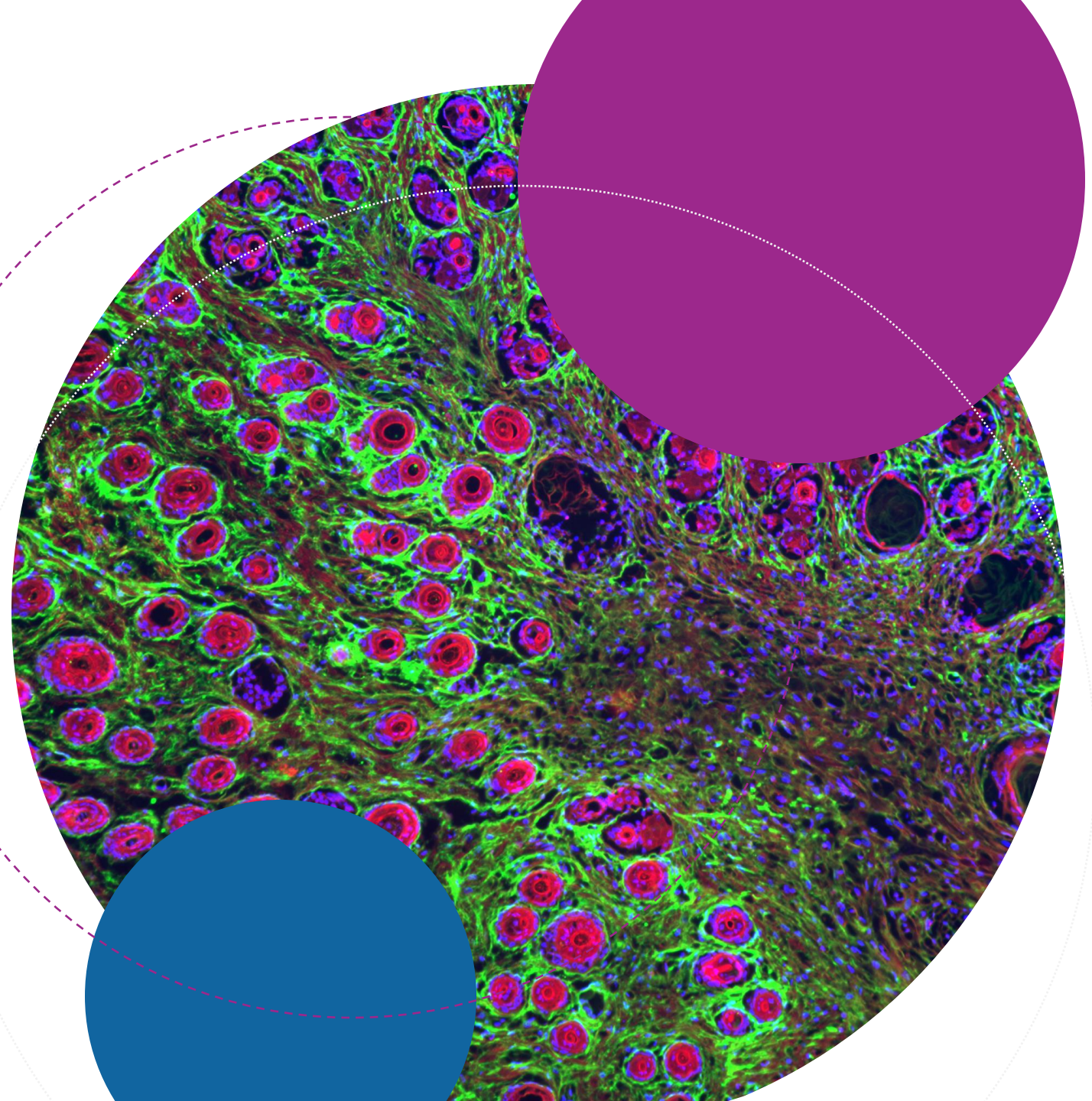
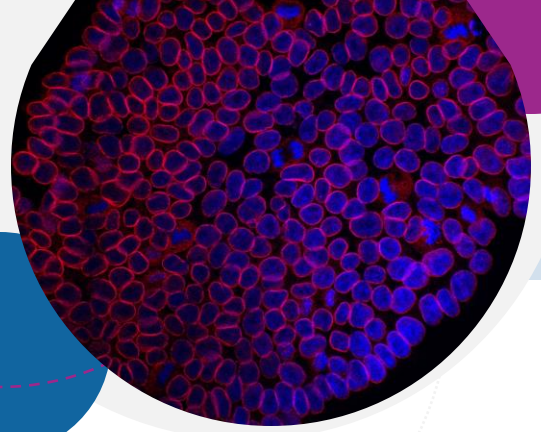


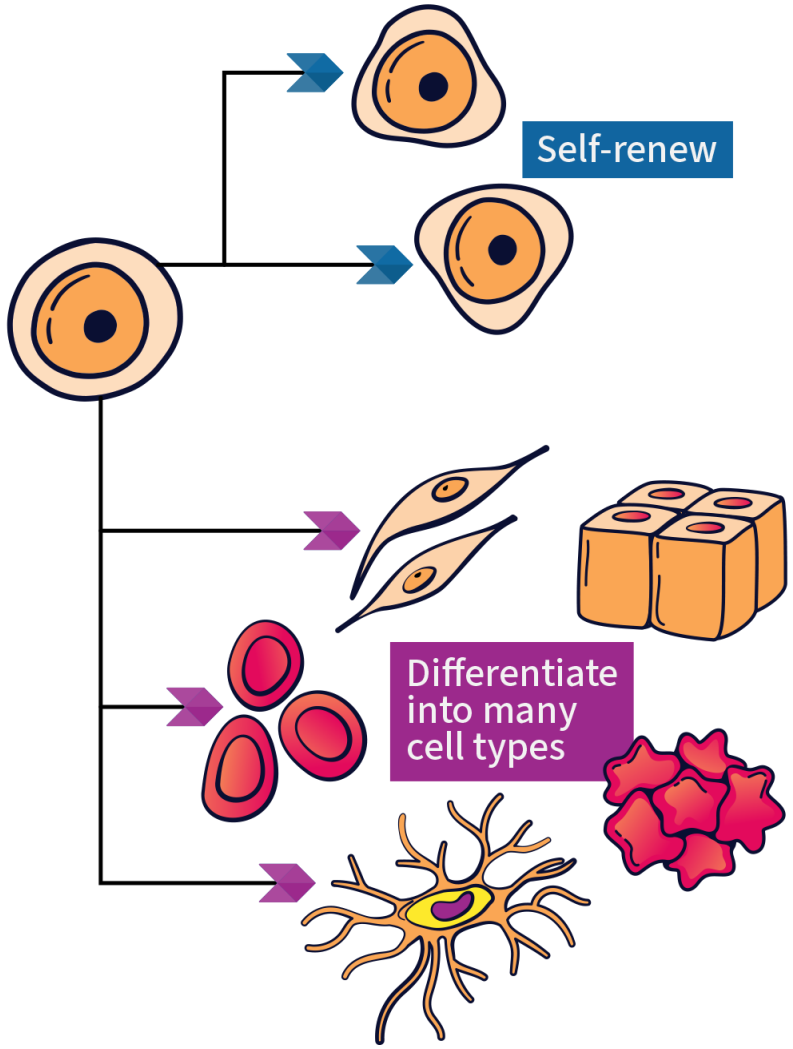
Stem Cell Network | Réseau de Cellules Souches

Stem Cells **101**



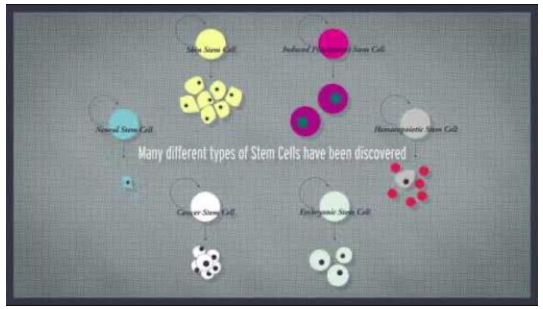
What are **Stem Cells?**

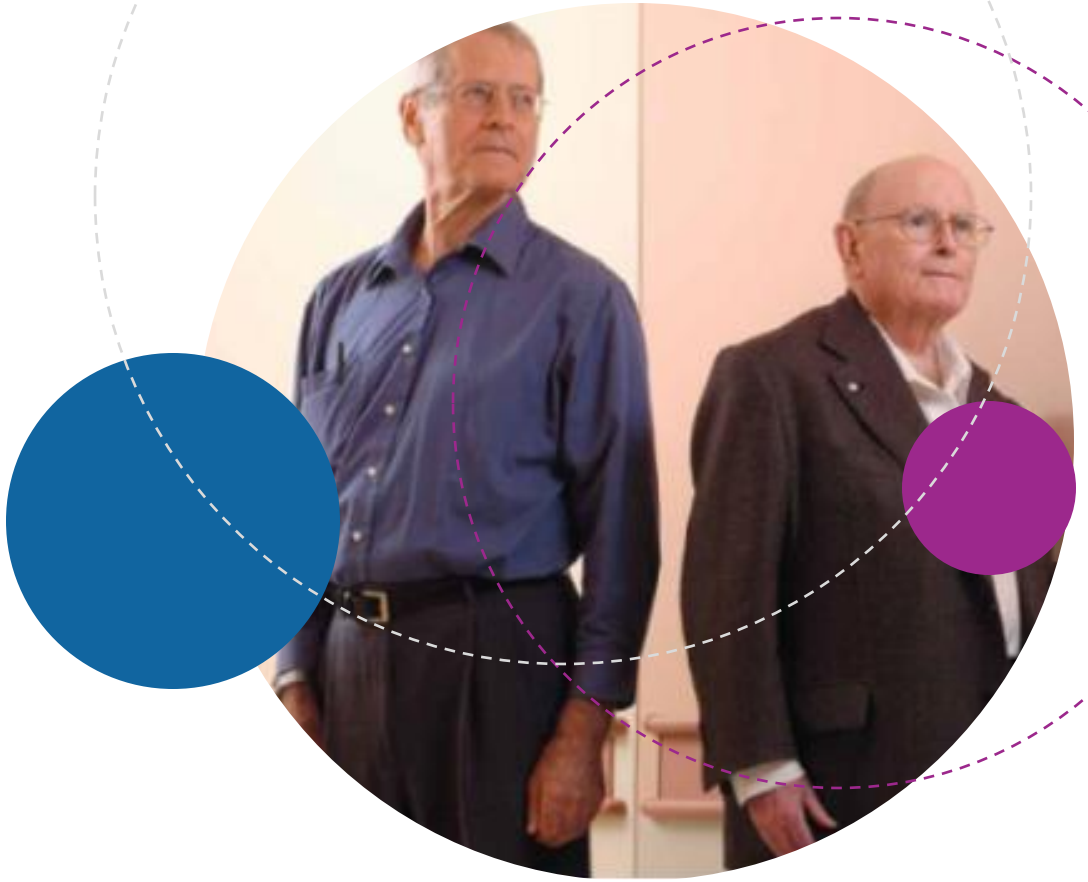
- Stem cells are our bodies' building blocks.
- They are different from other cells because they can renew themselves and can develop into more specialized cells.

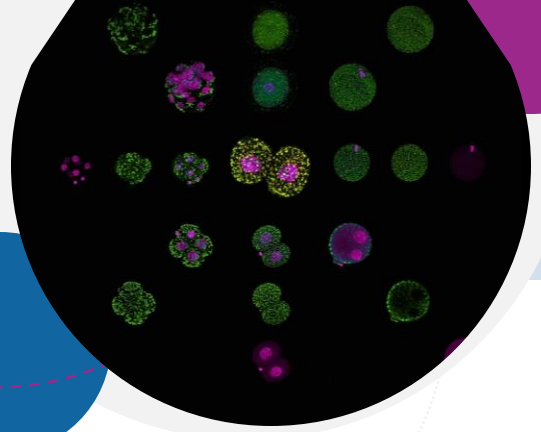


What Makes Stem Cells **So Special?**

- Video narrated by James Till, who identified stem cells in 1961 along with colleague Ernest McCulloch (both Canadian!):



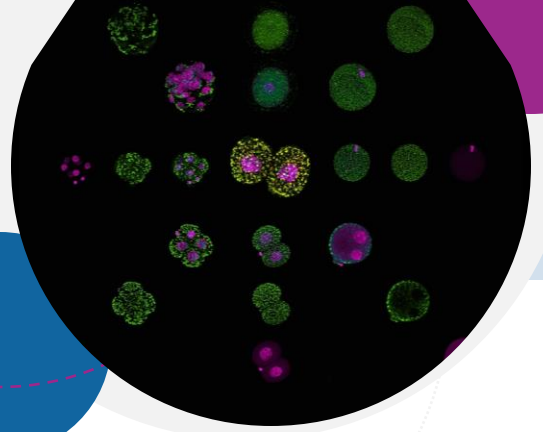




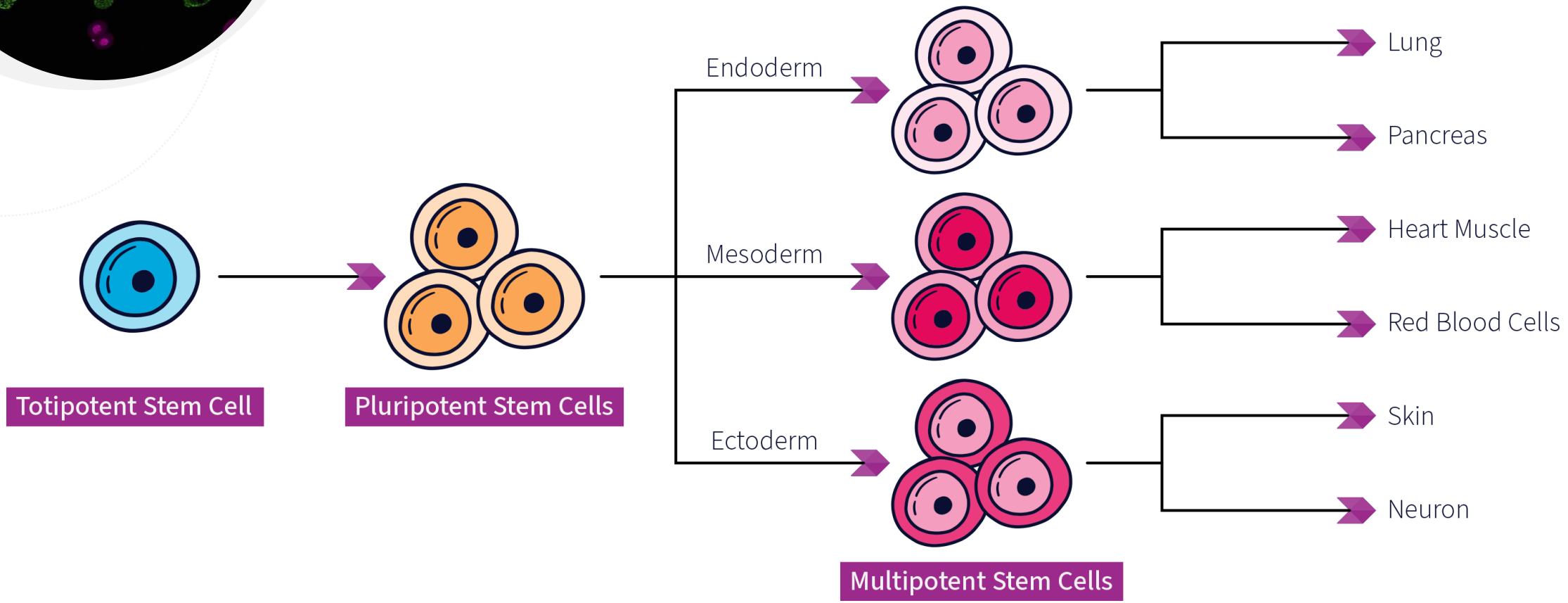
The **Stem Cell** Lineage

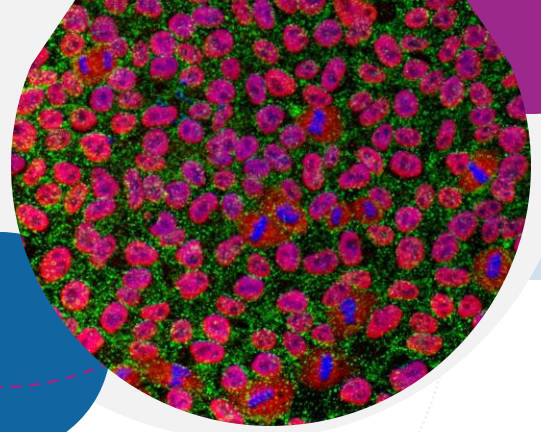
Totipotent Stem Cells

- Can differentiate into any cell type, including extra-embryonic tissues (e.g., placenta, umbilical cord)
- An example is the zygote (fertilized egg)



Totipotent **Stem Cells**

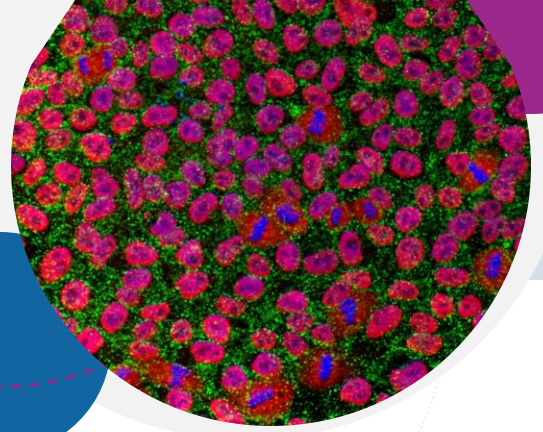




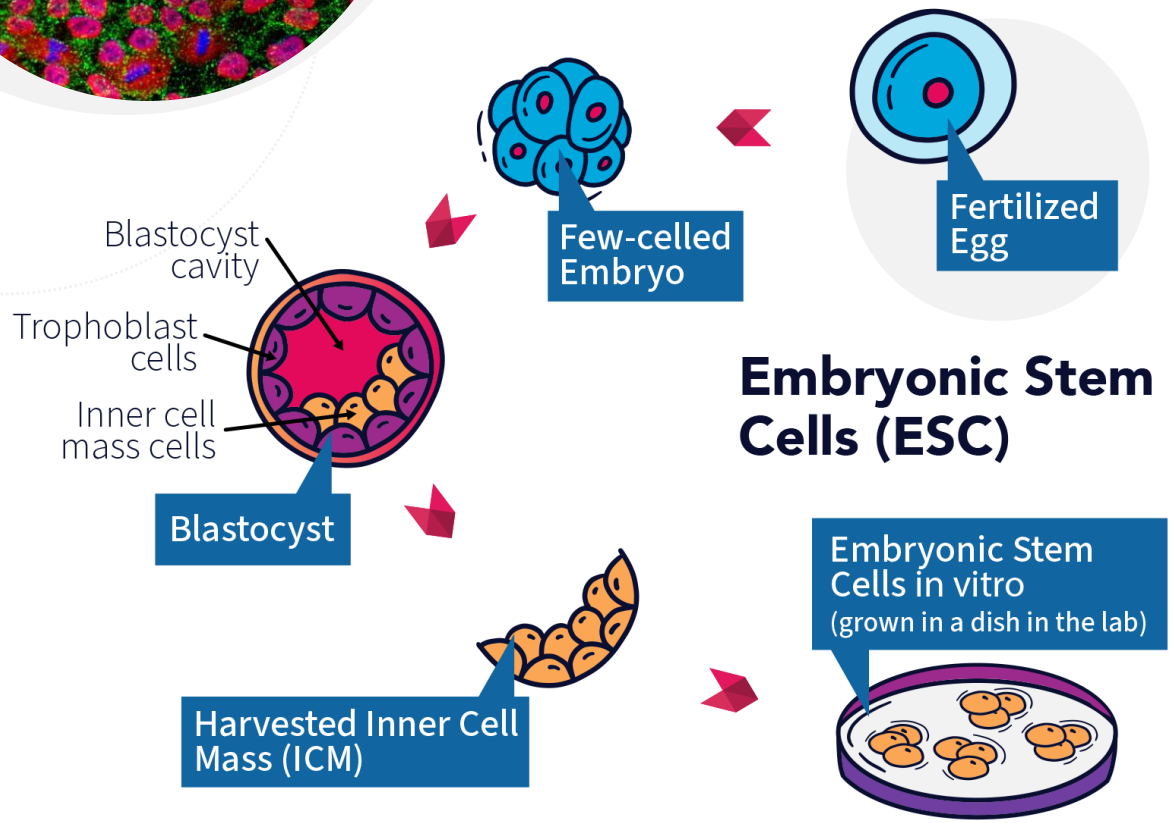
The **Stem Cell** Lineage

Pluripotent Stem Cells

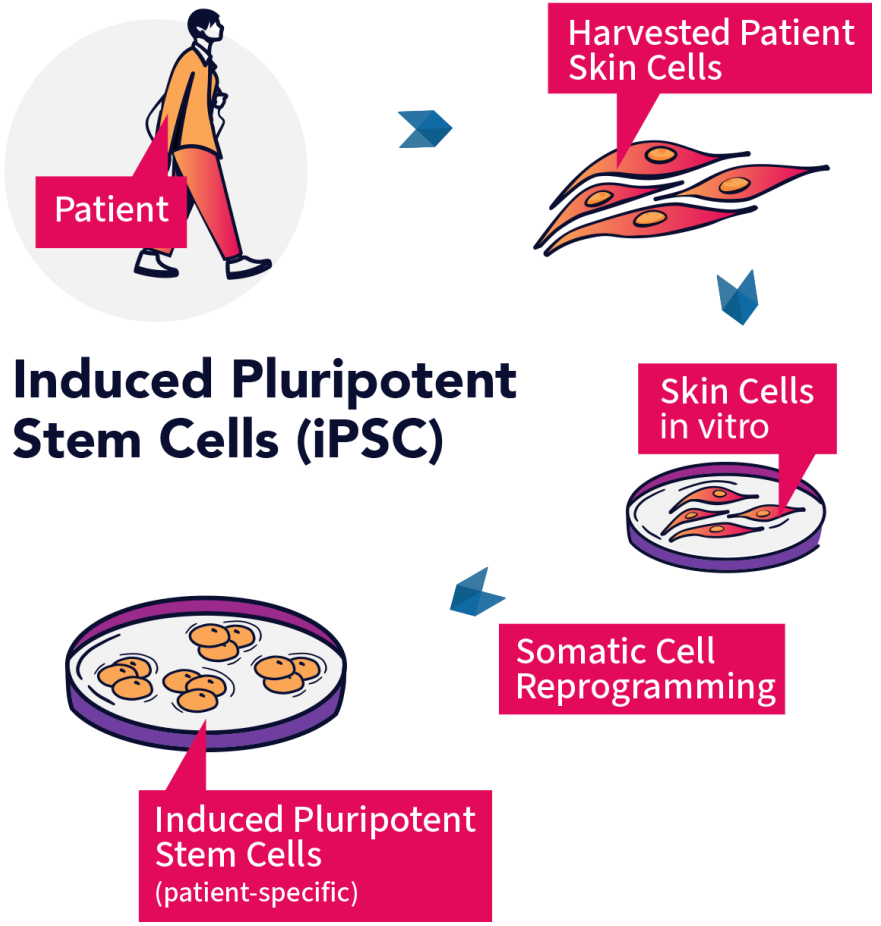
- Can differentiate into any cell types of the body, but not extra-embryonic tissues
- The two types of pluripotent stem cells are embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs)



Pluripotent **Stem Cells**

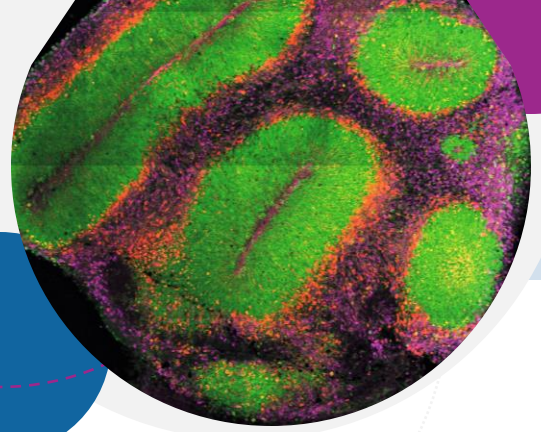


Embryonic Stem Cells (ESC)



Induced Pluripotent Stem Cells (iPSC)

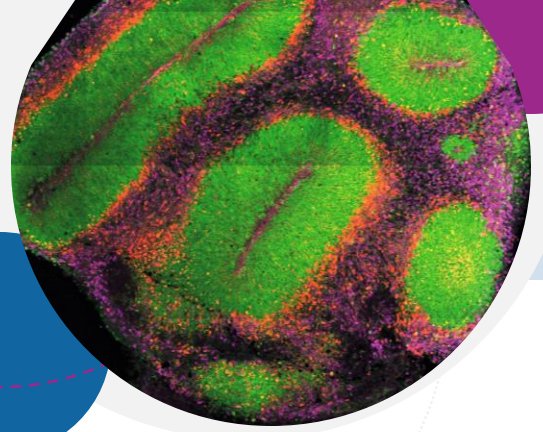
Stem Cell Network — Powering Regenerative Medicine
Réseau de Cellules Souches — Propulsons la médecine régénératrice



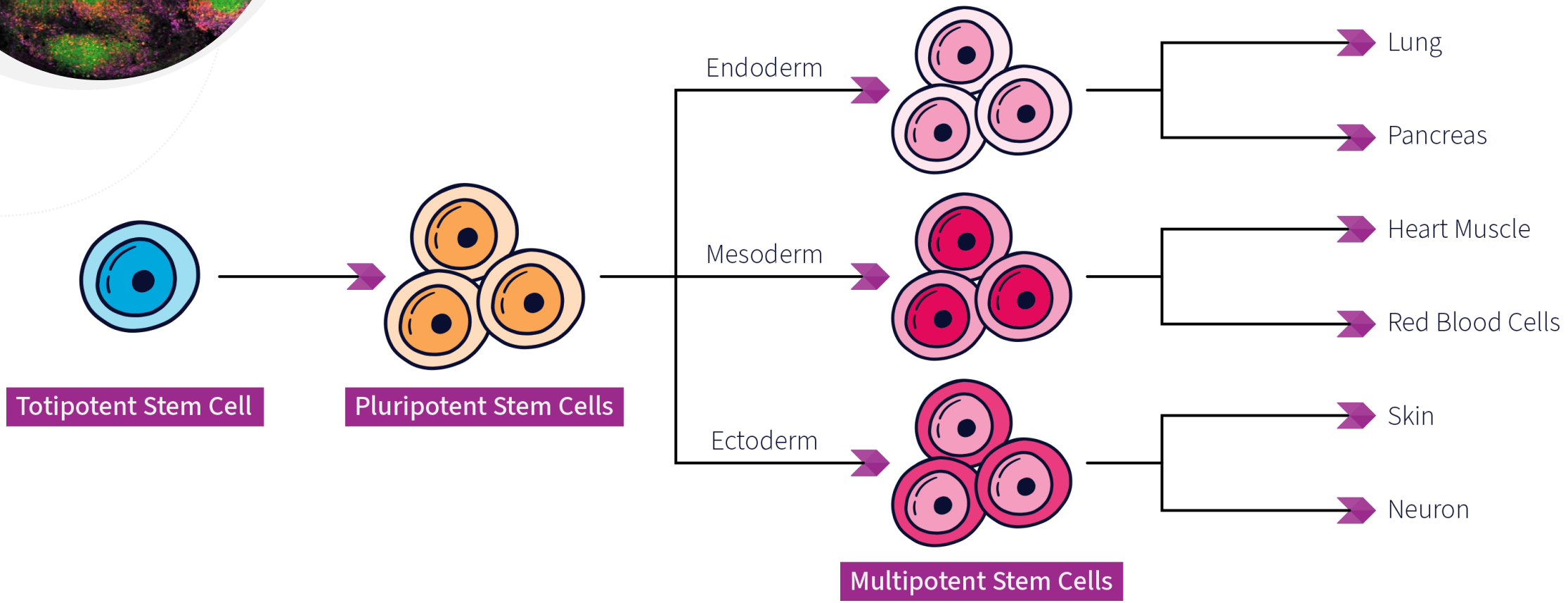
The **Stem Cell** Lineage

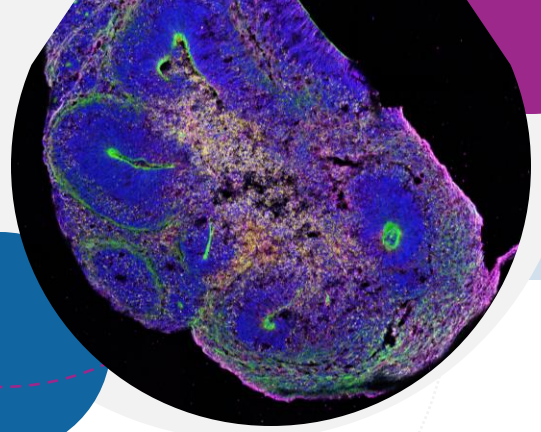
Multipotent Stem Cells

- Can differentiate into a limited number of cell types in a particular lineage
- Examples include hematopoietic (blood) stem cells (HSCs), and neural (brain) stem cells

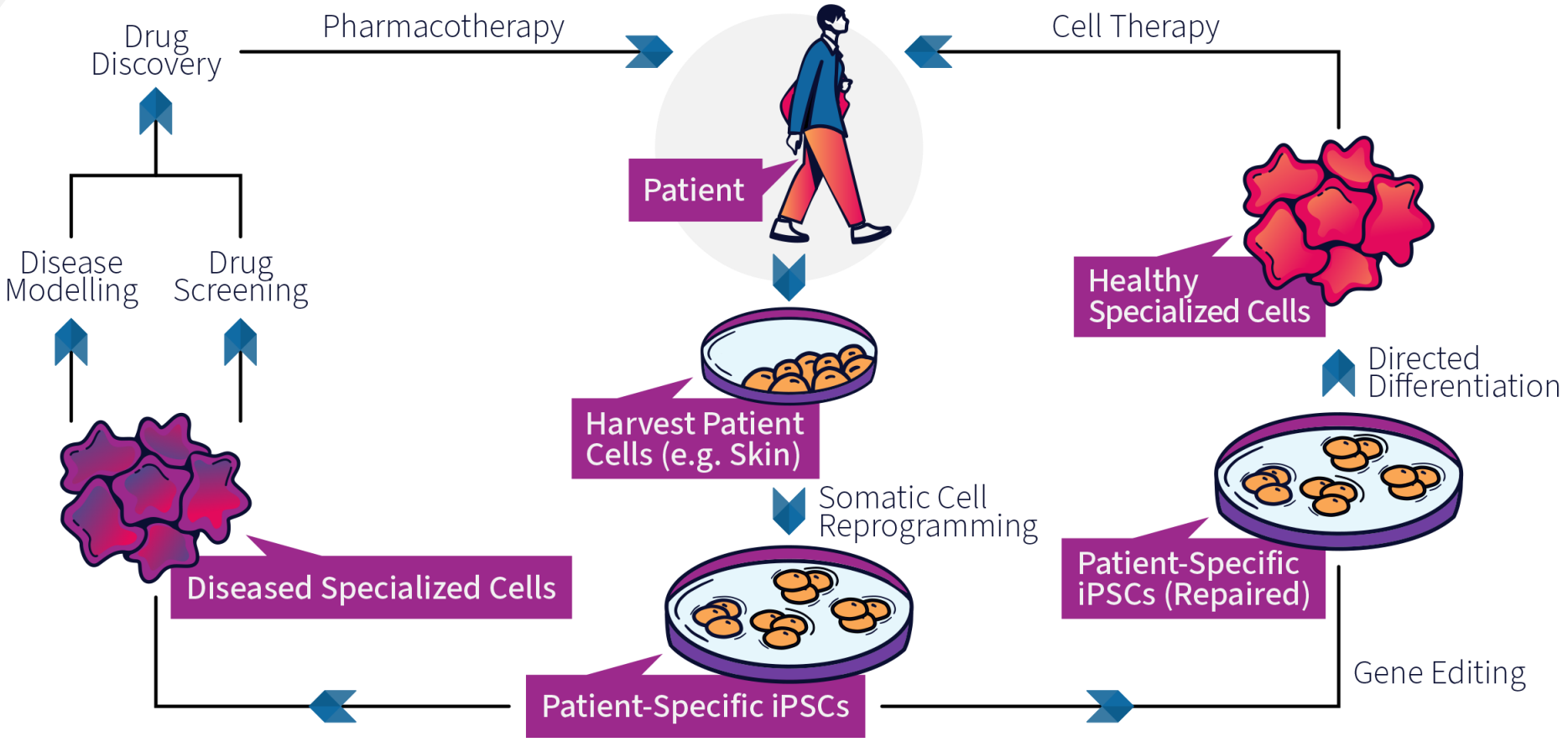


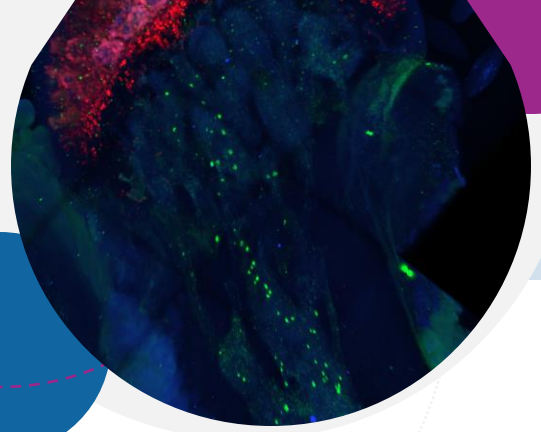
Multipotent **Stem Cells**





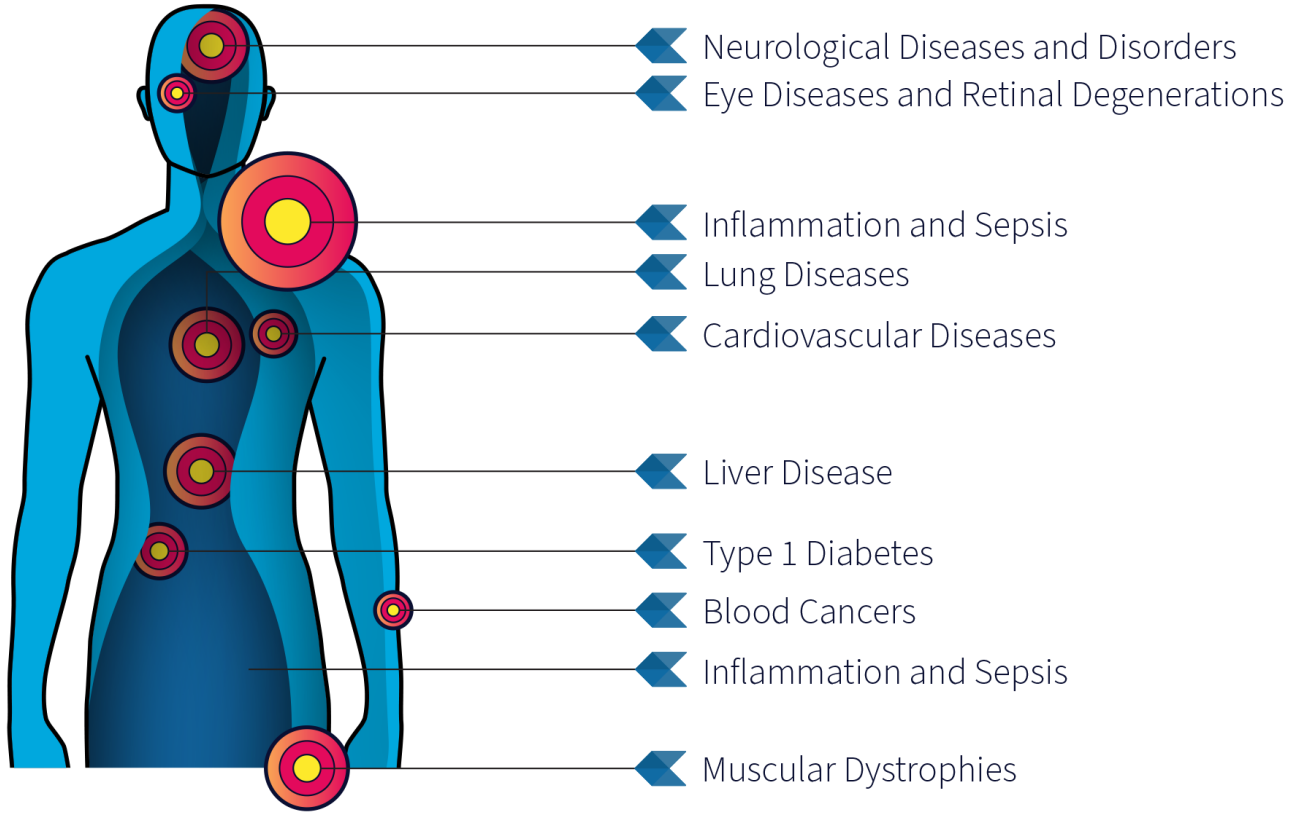
Potential Applications of Induced Pluripotent Stem Cells (iPSCs) in Personalized Medicine

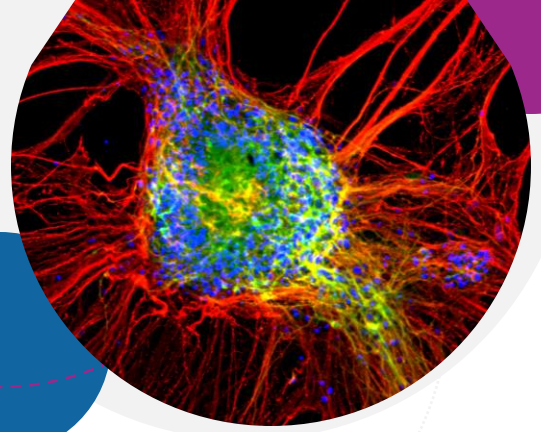




Multipotent or “Adult” **Stem Cells**

SCN Research is Making A Difference for:





What is **Regenerative Medicine?**

- Because stem cells can repair tissue and organs, they are powering regenerative medicine (RM), a new way to treat disease and injury.
- RM is considered by investors, economists and health policy experts to be the next frontier of modern medicine.
- The power of RM is in its potential to halt or reverse disease instead of simply alleviating symptoms.

A Canadian **Success Story!**

1963 — James Till & Ernest McCulloch demonstrate existence of stem cells

1992 — Sam Weiss identifies human neutral stem cells

1993 — Janet Rossant & Andras Nagy prove pluripotency of embryonic stem cells

1994 — John Dick isolates cancer stem cells

1998 — François Auger & Lucie Germain develop self-assembly approach to tissue engineering

2000 — James Shapiro develops the Edmonton protocol for pancreatic islet transplantation

2000 — Derek van der Kooy discovers retinal stem cells

2001 — Stem Cell Network is launched

2001 — Freda Miller identifies skin-derived stem cells

2002/2004 — Molly Shoichet and team are the first to guide cells in 3D

2006 — Connie Eaves discovers breast cancer stem cells

2007 — SCN Policy Dev. Committee led by Bartha Knoppers issues a statement in support of a national cord blood bank

2007 — Michael Rudnicki identifies muscle stem cells

2011 — Derek van der Kooy demonstrates stem cells in the pancreas

2016 — Harry Atkins & Mark Freedman treat multiple sclerosis with hematopoietic stem cells

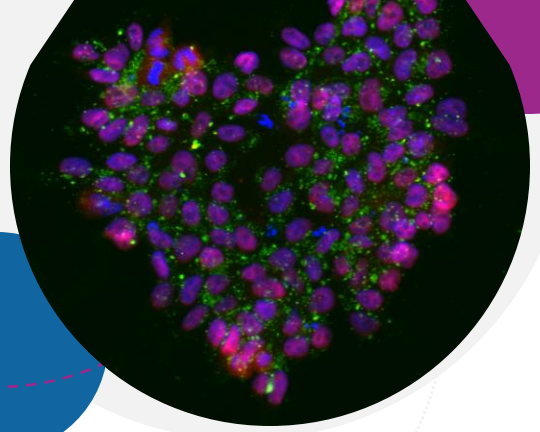
2017/2018 — Sandra Cohen, Guy Sauvageau and ExCellThera team complete Phase I/II trial with UM171-based expansion of cord blood cells

2017/2018 — Tim Kieffer & James Shapiro launch stem cell-based clinical trials for Type 1 Diabetes

2021 — Bernard Thébaud begins SCN-funded clinical trial focused on treating underdeveloped lungs for pre-mature infants

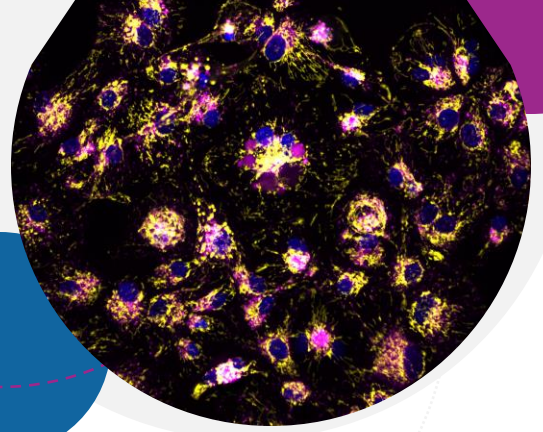
2021 — Véronique Moulin leads successful SCN-funded clinical trial using a tissue-engineered skin substitute for acute burn wounds

2020 — Duncan Stewart and team awarded SCN funding to launch COVID-19 clinical trial



Why is Stem Cell Research **so Important?**

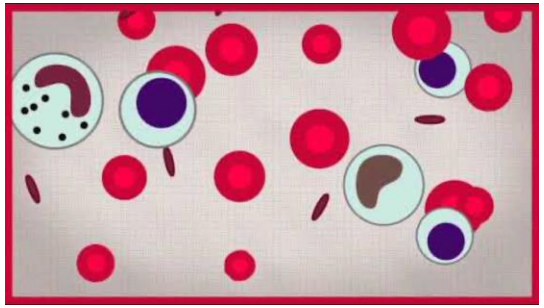
- Regenerative medicine relies on stem cell investigation to discover better ways of treating and healing people.
- Today, diseases and injuries are mainly treated with drugs, surgery and rehabilitation.
- Stem cell therapies offer the hope to move away from our reliance on expensive, long-term drug treatments to stopping the progression of a disease or even curing it.



What Diseases or Conditions do Stem Cell Therapies **Treat or Could Possibly Treat?**

- Hematopoietic (blood) stem cells are currently the most frequently used stem cells for the treatment of leukemia, lymphoma and inherited blood disorders.

- Video narrated by Professor Connie Eaves – What is a haematopoietic stem cell?



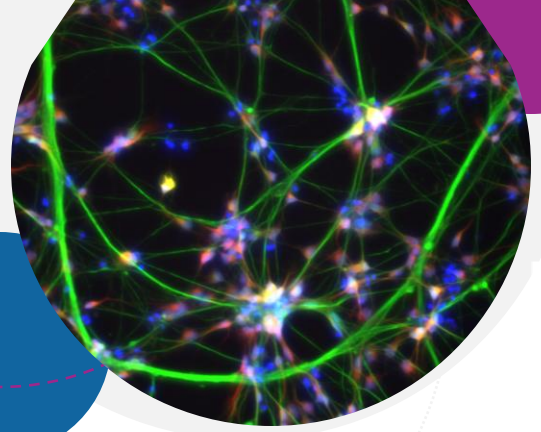
- I use stem cells to …

Clinical Trials **Offering Hope** for the Future

Tyler Rabey was not yet 25 when he was diagnosed with an aggressive form of leukemia that seemed to defy all standard treatments. He was enrolled in an SCN-funded trial that used stem cells expanded from umbilical cord blood using a technology referred to as UM171. It changed his prognosis and the trajectory of his health. Today he's in remission, graduated university and has launched his own business.

Kevin Bolusi was a teenager when he severed severe burns to 75% of his body. After arriving at the hospital, he was placed into a coma and his parents consented to his participation in an SCN-funded clinical trial. The research was testing an autologous tissue-engineered skin substitute. The treatment is faster than skin grafting, and the risk of rejection is much lower due to the use of personalized skin cells. Kevin's recovery has been remarkable, and he is back at Concordia studying aerospace engineering.

Jennifer Molson was a 21-year old aspiring police officer when she was diagnosed with aggressive multiple sclerosis. Within five years, Jennifer was unable to manage everyday tasks, including cutting her food and taking a shower. After multiple failed therapies, she took part in an innovative clinical trial that took her own stem cells, purified and fortified them, and after extreme chemotherapy to knock out her immune system, returned the stem cells to her body to rebuild a new, disease-free immune system. Today, with all traces of the disease eradicated, Jennifer enjoys an active life with her family.



The Stem Cell Network Funds Research in **26+ Disease Areas**

Epidermolysis Bullosa
Multiple Sclerosis
Wound Healing
Stroke
Cystic Fibrosis
Sick sinus syndrome
Atrial fibrillation
Chronic Wounds
Liver Disease
sepsis
Heart Disease
Hypertrophic Cardiomyopathy
Burns
Diabetes
Lung Disease
ARVC
Eye
Regulatory
Osteoarthritis
Policy
Neurological Disease
Myocardial Infarction
Blood Cancer
Muscular Dystrophy
Patient Engagement
Parkinson's Disease
CPVT
LSCD
Neurodevelopmental Disorder
Macular Degeneration

What are Some **Challenges** of Stem Cell Therapy Today?

1. 

Scaling Up Production:
Identifying reliable methods to grow enough stem cells for treatments.

2. 

Reducing Rejection Risks:
Strategies include better donor-recipient matching, genetic modifications, or using a patient's own cells.

3. 

Targeted Delivery:
Ensuring stem cells reach and function properly in the right part of the body remains a challenge.

4. 

Safety Concerns:
Preventing issues like unintended mutations or uncontrolled cell growth (both during manufacturing and once implanted into the patient) is essential for safe therapies.

What is Stem Cell **Tourism?**

- A form of medical tourism, where internet-based companies/clinics advertise curative and unproven stem cell therapies to the public.
- Travelling, especially to another country, to undergo an experimental treatment can be expensive, ineffective and even dangerous.
- When considering a stem cell therapy, it is important to have the right information and ask questions before the procedure.
- Video narrated by Professor Timothy Caulfield: