

# ***BASICS OF STEM CELLS***

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# Characteristics of Stem Cells

- Stem cells have the potential to develop into many cell types during early life and growth.
- When a stem cell divides, it produces one stem cell and a specialized cell.

# Stem cells differ from ordinary cells

- A. Stem cells are unspecialized cells, which is capable of renewing themselves after a long period of inactivity
- B. Under experimental or physiological conditions, they can be induced to become tissue or organ specific cells with special functions
- C. In case of gut and bone marrow, stem cells regularly divide and repair damaged cells; however, in case of the pancreas and heart, they divide under special conditions

# Stem cells

- (a) Embryonic – mouse (1981), human (1998)
- (b) Non-embryonic, somatic or adult stem cells
- (c) In 2006, scientists could prepare induced pluripotent stem cells from adult cell reprogramming

In a 3 or 5 day old embryo, known as a blastocyst, the inner cell mass gives rise to an entire body of organisms.

## Characteristics:

- Stem cells are capable of dividing and renewing for a long period
- Though unspecialized, they can produce specialized cell types
- Specialized cells like muscle cells, blood cells and nerve cells, do not normally replicate

Scientists are keen to understand why

- (a) Embryonic stem cells proliferate for one year without differentiating
- (b) What are the factors in living organisms that regulate stem cell proliferation

# Characteristics

Stem cells are unspecialized cells; hence they cannot carry oxygen like RBC or pump blood like heart muscle

However, stem cells, through differentiation, can be converted into RBC, heart cells or neurons



# Characteristics

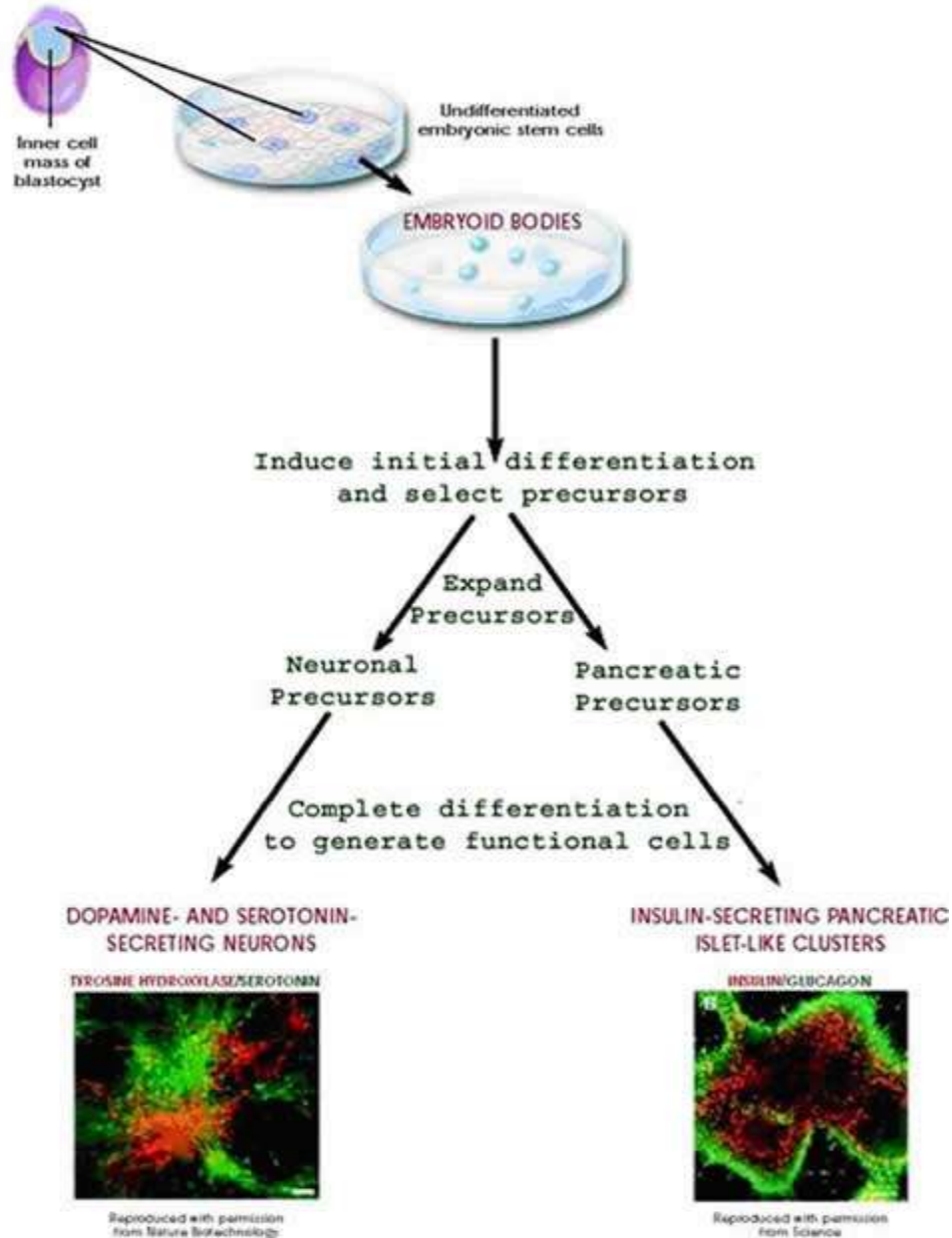
Embryonic stem cells can grow in a laboratory after putting the inner cell mass in a petri-dish, and adding a feeder layer (treated mouse embryonic skin cells that cannot grow), then culturing and sub-culturing to form embryonic stem cell lines

Now, researchers have devised a way for growth of stem cells without the use of mouse feeder cells, to avoid AIDS like problems

# Laboratory tests to identify embryonic stem cells

- Presence of transcription factors (which turn genes on or off at the right time) Oct4 and Nanog, justifies undifferentiated embryonic stem cells

# How are embryonic stem cells stimulated to differentiate?

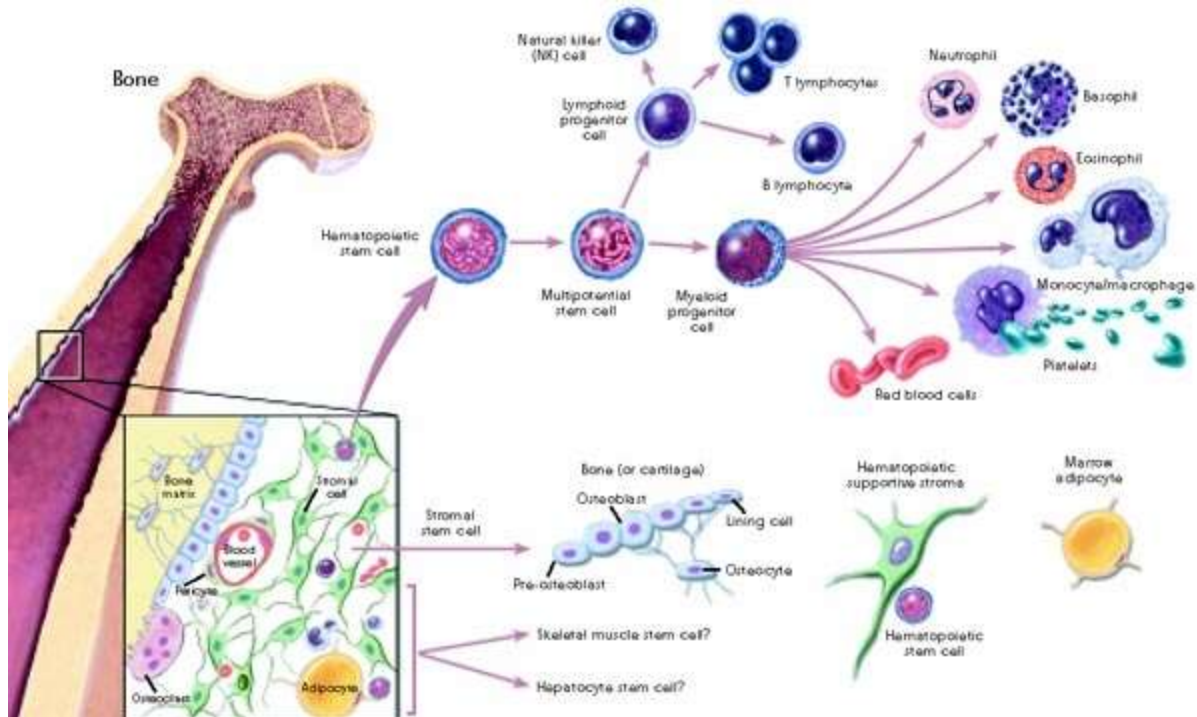


# Adult stem cells

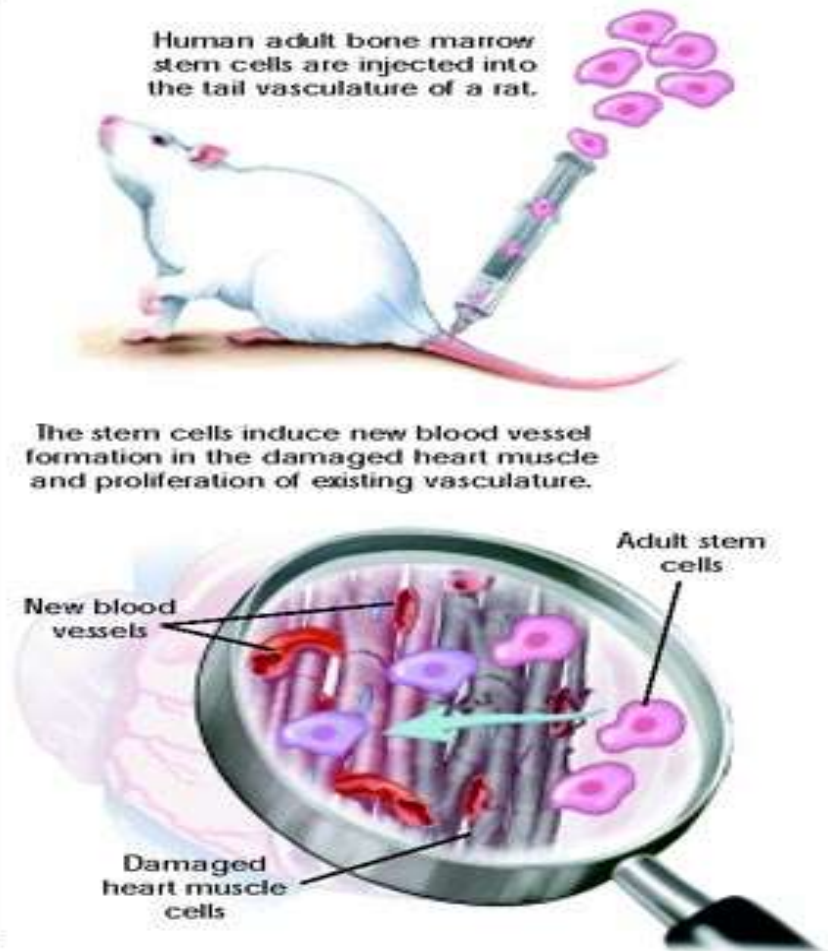
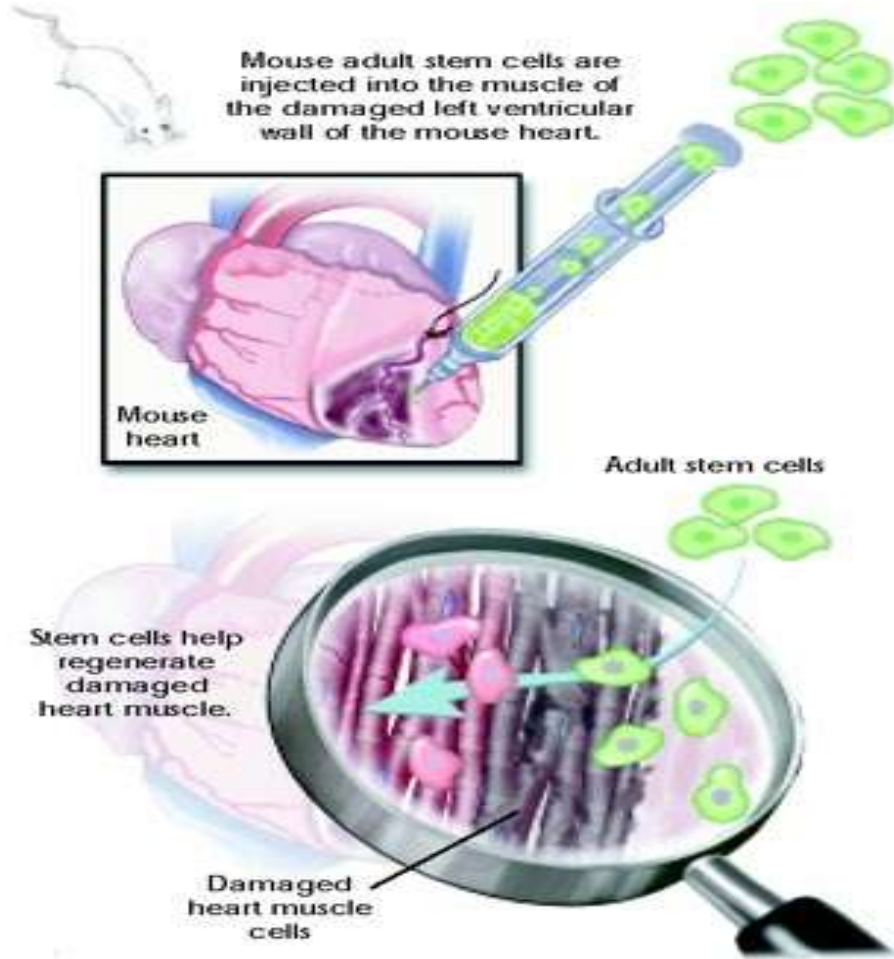
These are undifferentiated cells found in different differentiated tissues or organs.

They reside in specific areas known as stem cell niche

## What is known about adult stem cell differentiation?



# Strategies to repair heart muscles with adult stem cells



# Embryonal stem cells

