REPAIR & HEALING

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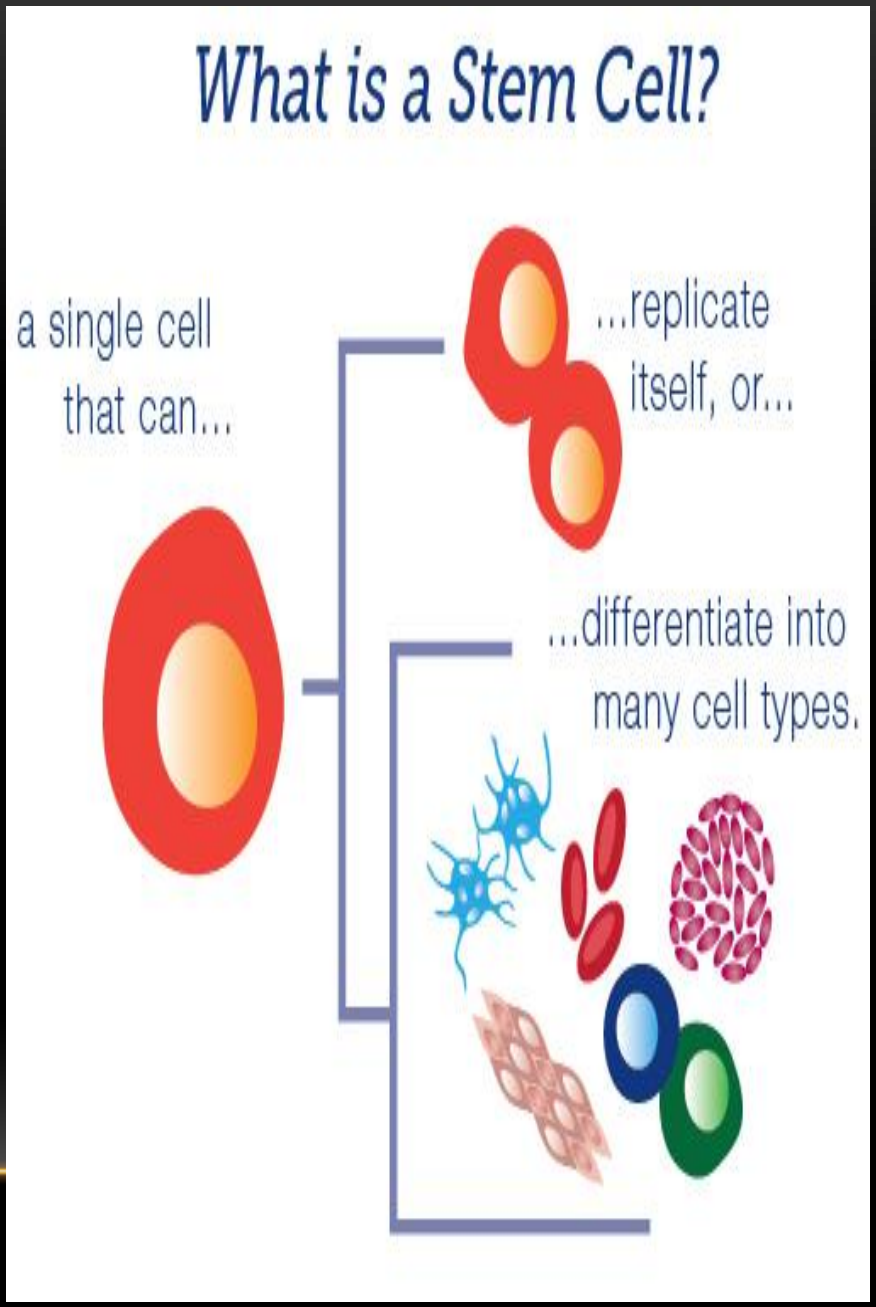
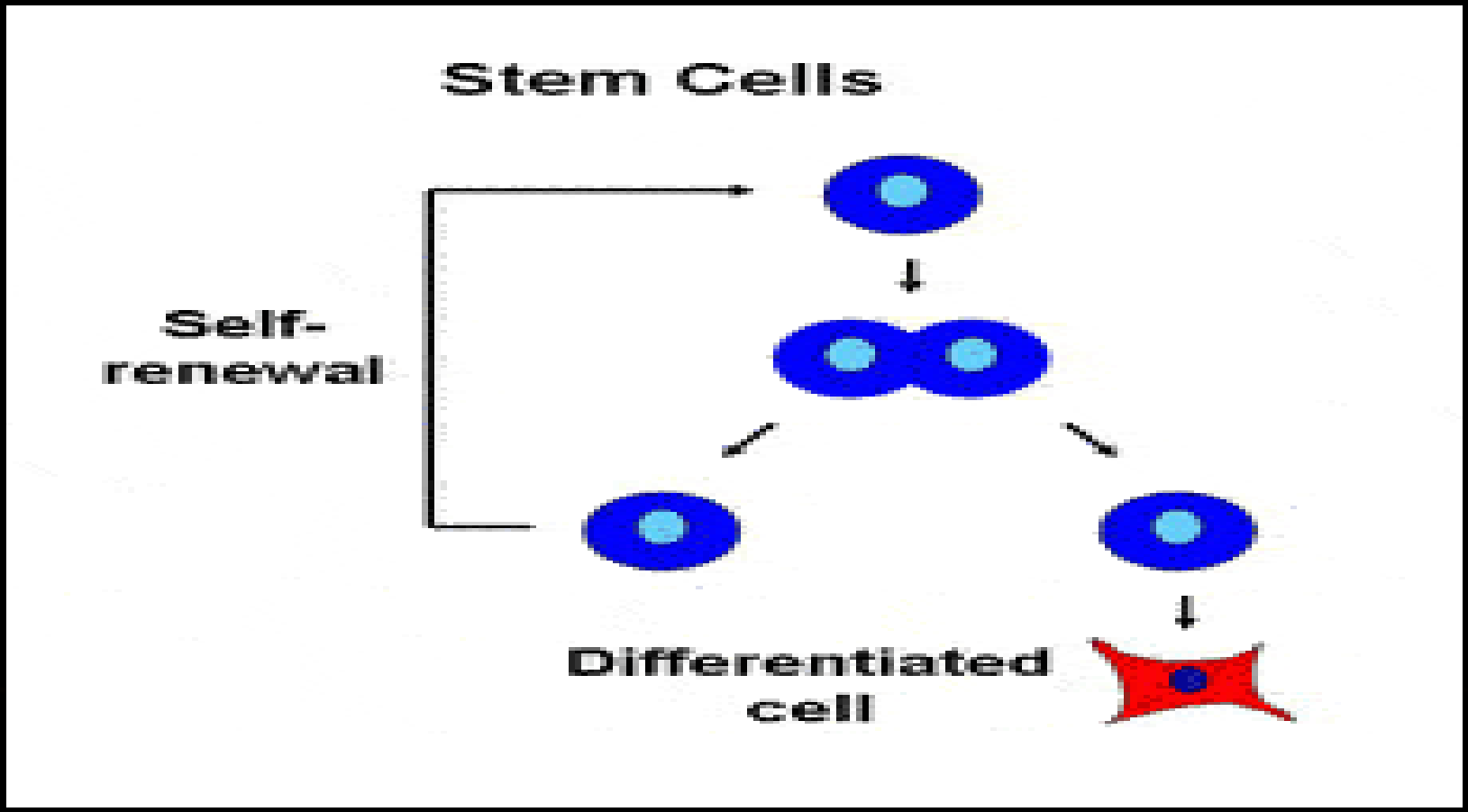
- Repair is occur by proliferation of uninjured (residual) cells and stem cells by enter the cell cycle which is regulated by stimulators and inhibitors and contains intrinsic checkpoint controls to prevent replication of abnormal cells.



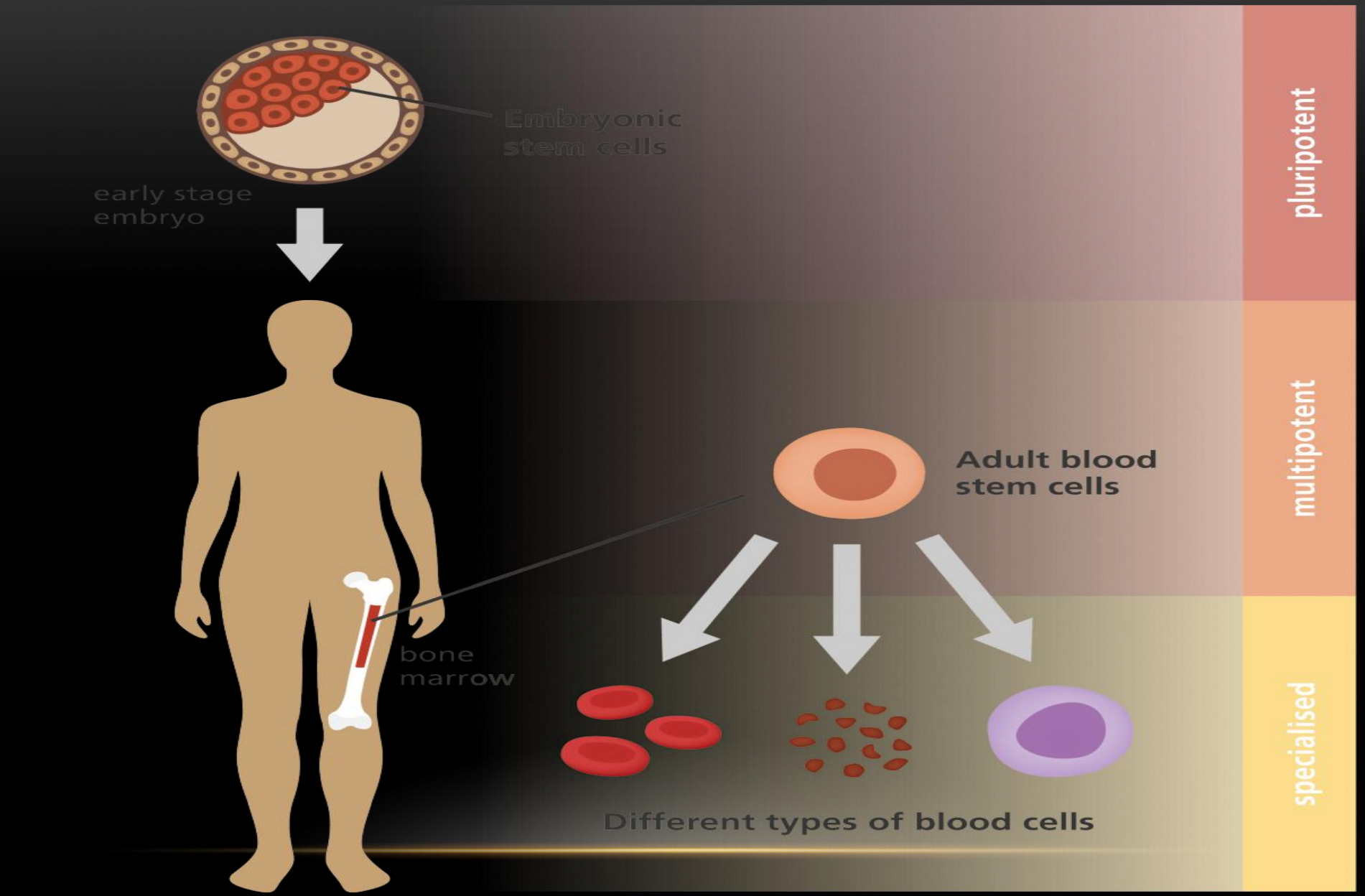
STEM CELLS ARE CHARACTERIZED BY TWO IMPORTANT PROPERTIES:

- selfrenewal capacity
- asymmetric replication



THERE ARE TWO TYPES OF STEM CELLS:

- **Embryonic stem cells**: pluripotent SC differentiated into three germ layers,
- **Adult stem cells**: multipotent SC less undifferentiated than ESc found within tissue. limited lineage potential

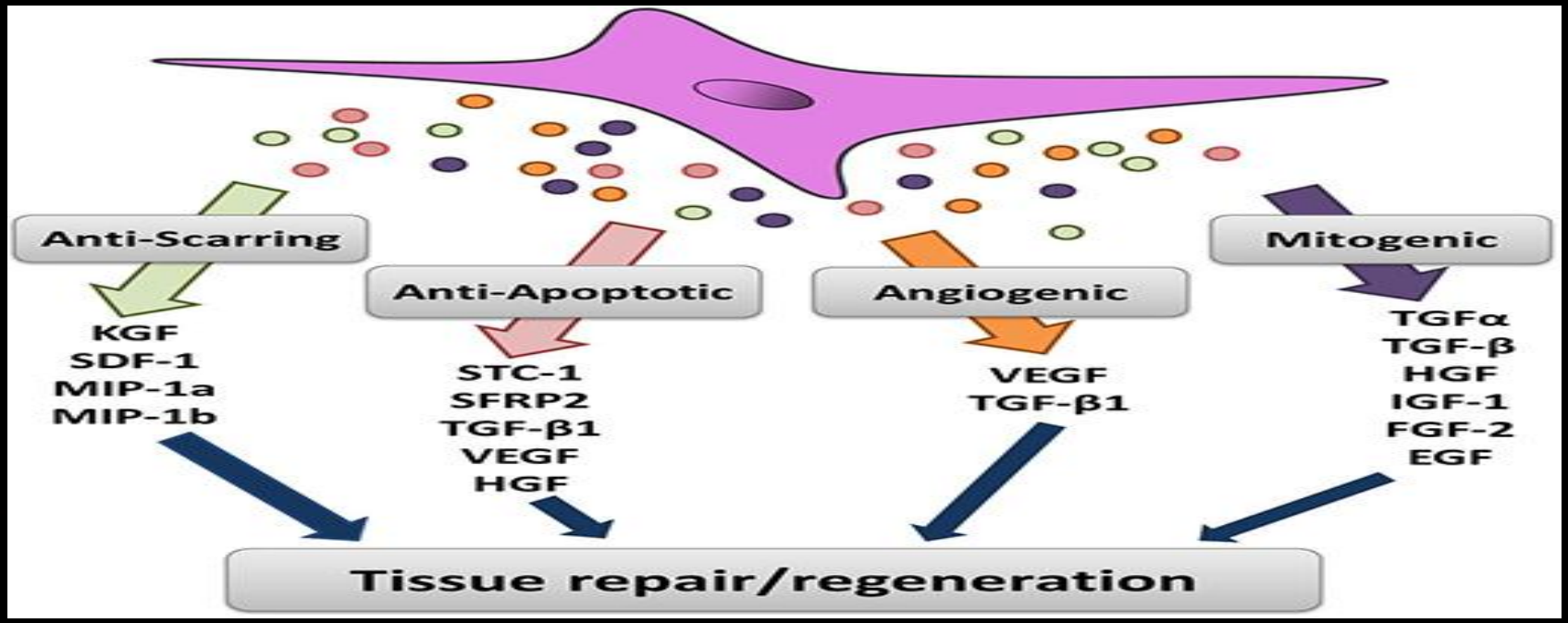

Embryonic stem cells
early stage embryo
pluripotent
multipotent
specialised
Adult blood stem cells
bone marrow
Different types of blood cells

PROLIFERATIVE CAPACITIES OF TISSUES:

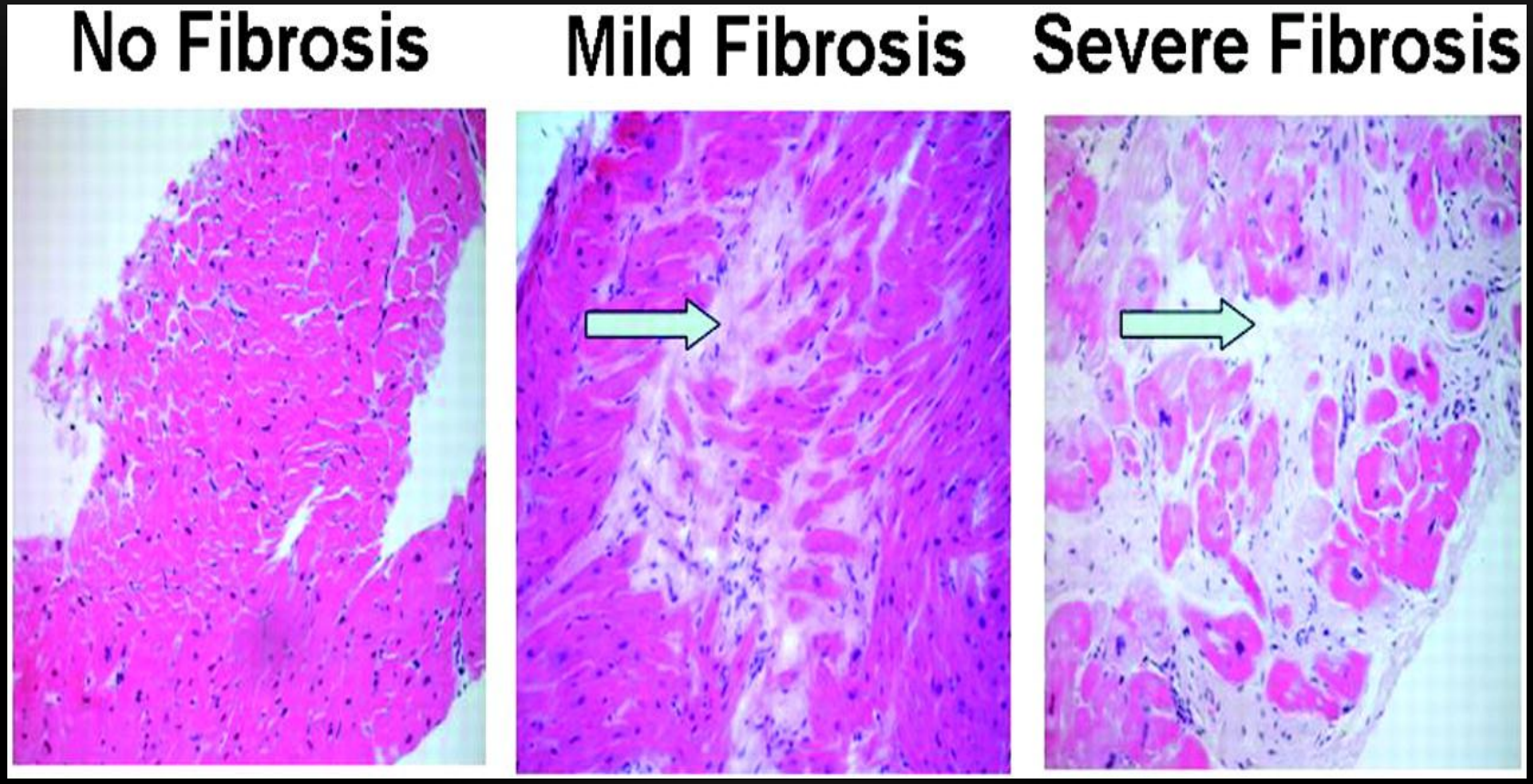
- **Labile tissues:** continuously dividing cells hematopoietic cells, surfaces epithelium
- **Stable tissues:** minimal replicative activity : liver, kidney, and pancreas.
- **Permanent tissues:** terminally differentiated and non-proliferative in postnatal life: neurons and cardiac muscle cells

GROWTH FACTORS:

- poteins that induce cell proliferation by binding to specific receptors, induce cell migration, differentiation and they promote cell cycle, cell survival and prevent apoptosis.



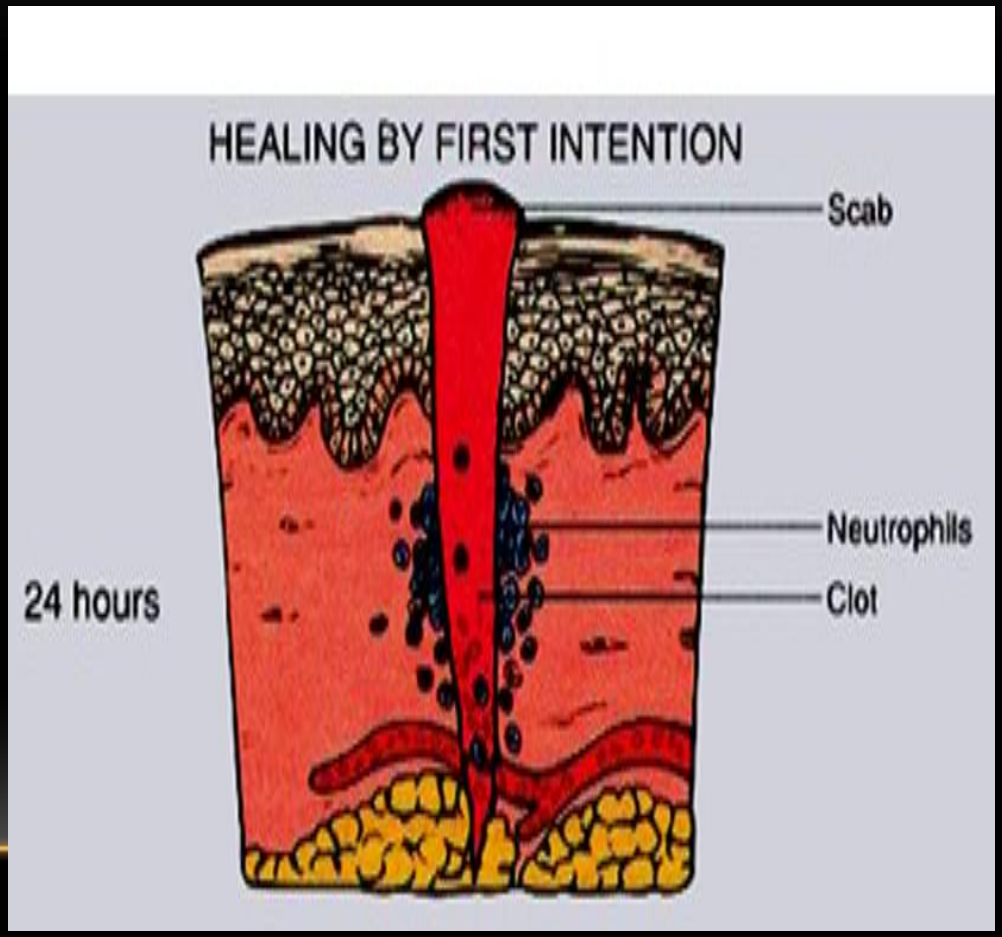
- **Repair:** restoration of tissue architecture and function after an injury
- **Regeneration:** repair process occur in labile tissues
- **Scar:** repair process occur in sever damag by laying down of fibrous CT.
- **Fibrosis:** extensive deposition of collagen as consequence of chronic inflammation, if it develops in a tissue space occupied by an inflammatory exudate, it is called organization.


No Fibrosis
Mild Fibrosis
Severe Fibrosis

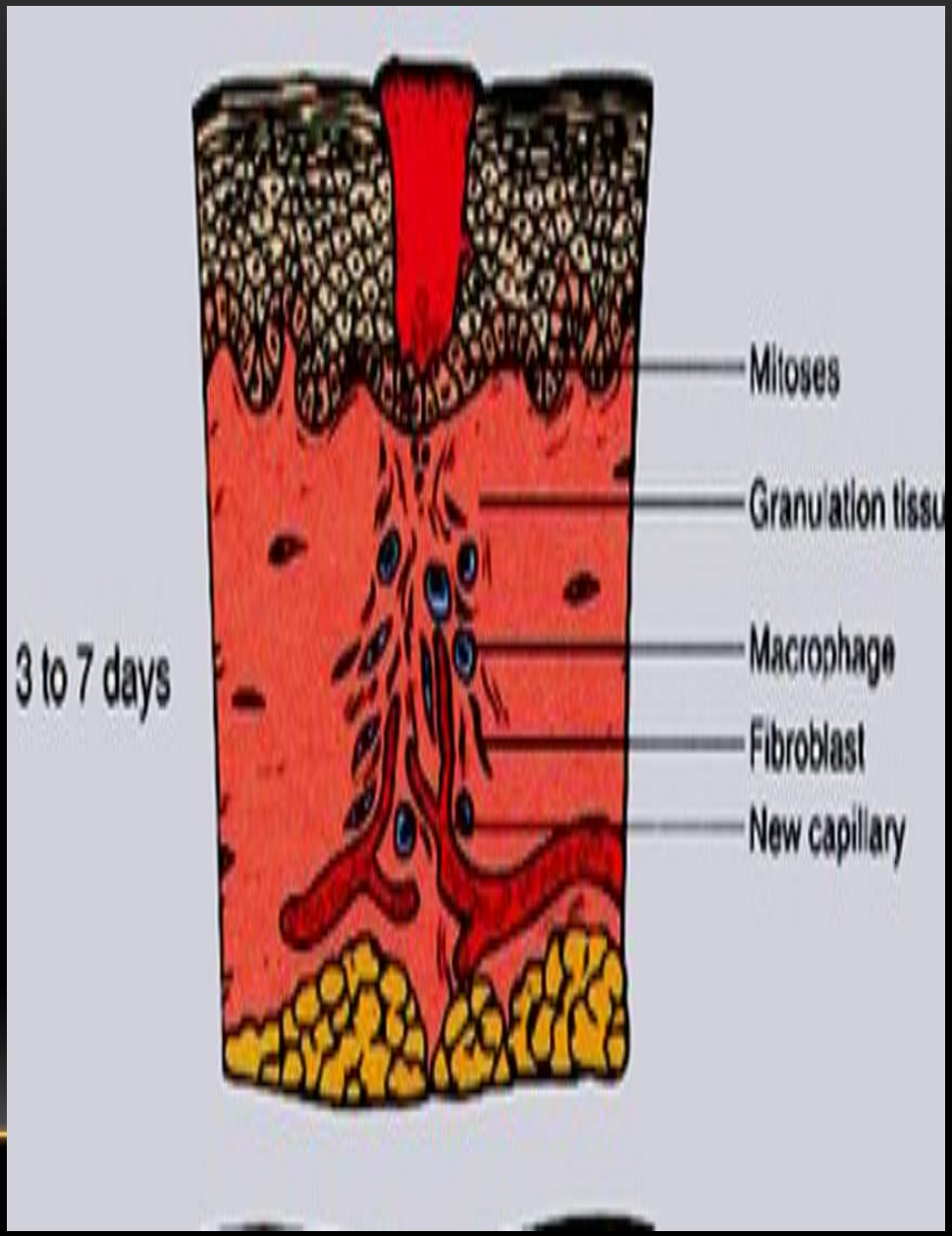
Healing by First Intention

SIMPLEST FORM OF WOUND REPAIR AND REGENERATION WITH SMALL SCAR AND MINIMAL WOUND CONTRACTION.

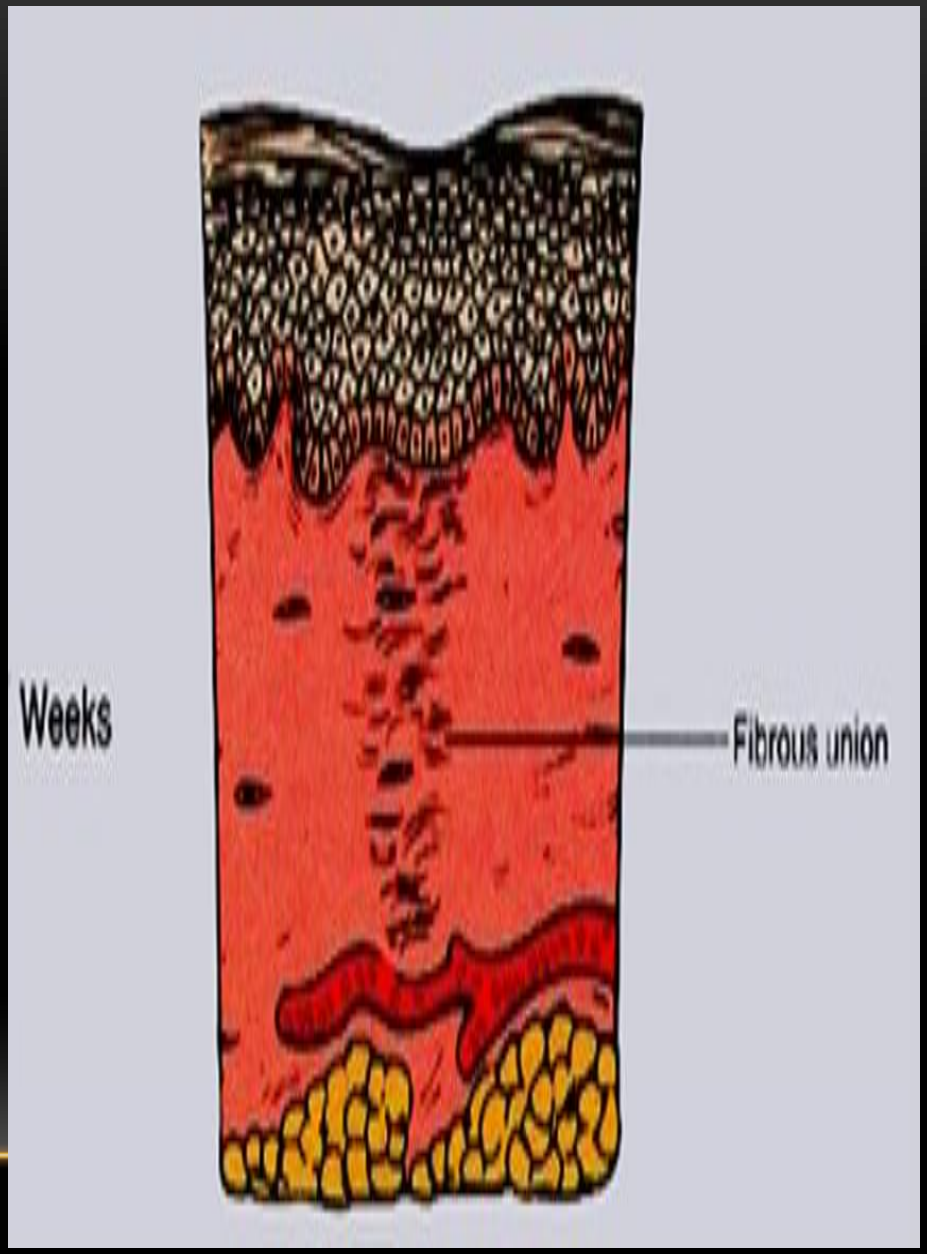
- **Within 24 hours:** neutrophils are migrating toward the fibrin clot and basal cells at the cut edge of the epidermis begin to show increased mitotic activity.



- **Within 24 to 48 hours:** epithelial cells from both edges begun to migrate and proliferate along the dermis, depositing basement membrane components as they progress. The cells meet in the midline beneath the surface scab



- **Day 3:** neutrophils replaced by macrophages and granulation tissue proliferate with Continues epithelial cell proliferation.
- **Day 5:** neovascularization with abundant collagen fibrils that begin to bridge the incision.



- **The second week:** continued collagen accumulation and fibroblast proliferation with diminished of leukocyte infiltrate, edema and vascularity.
- **The end of the first month:** the scar consists of cellular connective tissue devoid inflammatory cells and covered by normal epidermis. The dermal appendages are permanently lost. The tensile strength of the wound increases with time.

HEALING BY SECOND INTENTION

OCCUR WHEN TISSUE LOSS IS EXTENSIVE SO REPAIR IS MORE COMPLEX AND INVOLVES A COMBINATION OF REGENERATION AND SCARRING.

- **Secondary healing differs from primary healing in:**
- Clot is larger and rich in fibrin.
- Inflammation is more intense with more necrotic debris exudate
- Abundant granulation tissue and ECM → large scar.
- Wound contraction within 6 weeks (reduced to 5% to 10% of their original size) by the action of myofibroblasts.

WOUND STRENGTH:

- Wound strength is increases rapidly over the next 4 weeks. The recovery of tensile strength results from collagen synthesis exceeding degradation during the first 2 months.
- Carefully sutured wounds = 70% of the strength of normal skin in about 3 months and usually does not improve substantially beyond that point

FACTORS THAT INFLUENCE TISSUE REPAIR:

- Infection → delay healing, prolongs inflammation.
- Nutrition (protein and vit C deficiency) → inhibit collagen synthesis and retard healing.
- Steroids anti-inflammatory effects →inhibit scar and fibrosis.
- Mechanical variables → local pressure
- Poor perfusion (arteriosclerosis and diabetes or obstructed venous drainage) → impairs healing.
- Foreign bodies → fragments of steel, glass, or bone.
- The type and extent of tissue injury (stable, labile, or permanent cells) and location of the injured tissue.
- Over production of cell growth and ECM that give rise to prominent raised scars known as keloids.

Suggestive Reading

Vinay Kumer, Apul L. Abbass, Jon C. Aster. Rubbin Basic pathology, Elsevier, 9th edition, 2013


Thank You