27/09/22

Synthetic polymer

Polyglycolic acid (PGA) →

Poly lactic acid (PLA) →

Poly (lactic-co-glycolic acid) PLGA →

Poly caprolactone (PCL) →

Normally they give rise to natural degradation products. High / low

eg., PLA → LA —fast→ Lactic acid accumulate → other effects
pH ↓

Natural polymers :-

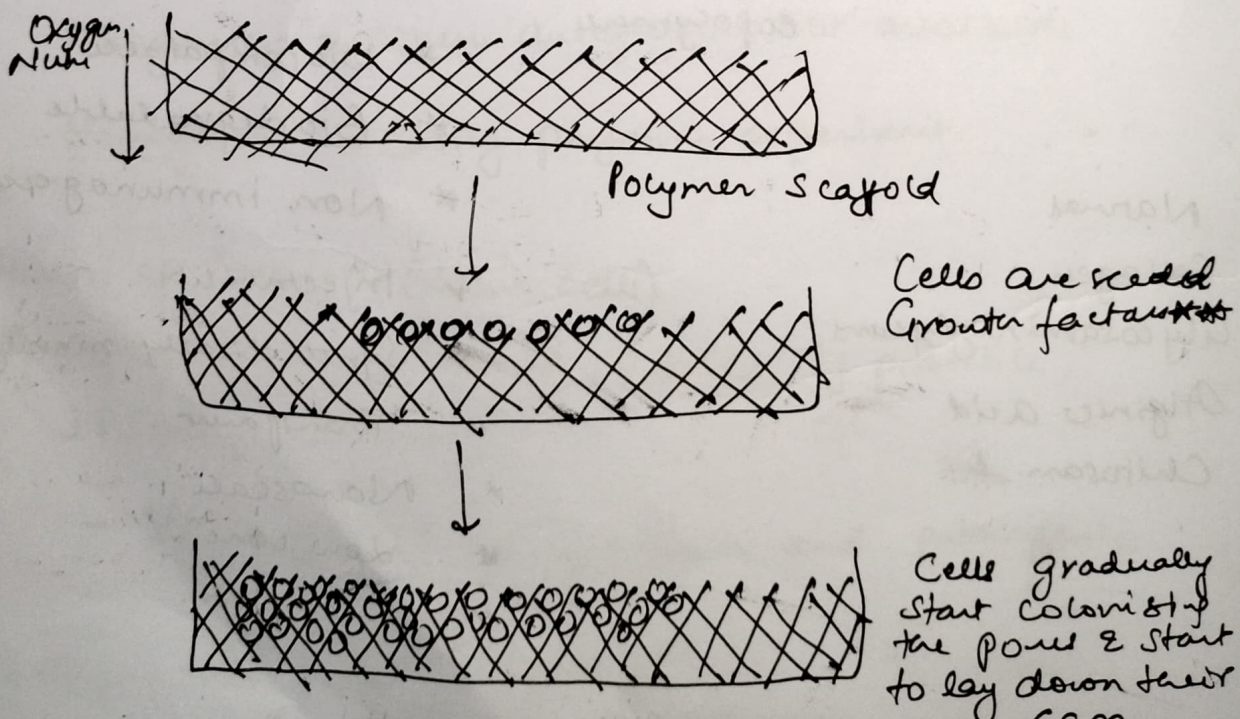
Natural biomaterials

Extracellular matrix (ECM)

Calcium phosphate ✓
Protein
Polysaccharide
Lipids

Collagen
Glycosaminoglycans
Hyaluronic acid

* Lacks physical & mechanical stability

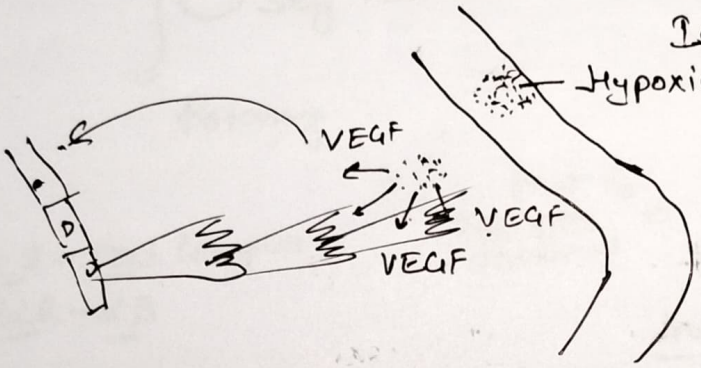


** Angiopoietin-1 — Vascular Growth factor. Embryonic & post natal angiogenesis → formⁿ of new blood vessels from existing ones — Blood vessel formⁿ; maturⁿ & Stability

Angiopoietin-2 — Stabilization dissociation migration & proliferation.

VEGF
Vascular Endothelial Growth factor.

VEGF



FGF
Fibroblast growth factor
Embryonic stage → Later Stages
Pleiotrophic GF

Family of GFs; Angiogenesis; wound healing Embryonic growth — Mig. of blood vessels; bone; skin; spine; nerve; muscle;

PDGF
Platelet derived Growth factor

Cell growth & division — development of muscle, bone, cartilage Skin Blood vessel migration, proliferation

BMP
Bone morphogenetic Protein

formⁿ of bone & cartilage
BMP-2 very potent GF

Bone & cartilage differat?
mig. of Osteoblast

TGF-β
Transforming Growth factor-β

Prolifⁿ & Differentⁿ of many cell types

Remodels bone & cartilage

IGF-1
Insulin like growth factor

Somatomedin C
Imp. in childhood growth
Anabolic effects in Adults

Has proliferative effects on many cells & inhibits cell apoptosis.

EGF
Epidermal Growth factors

Epidermal cell growth Prolifer" & diff.

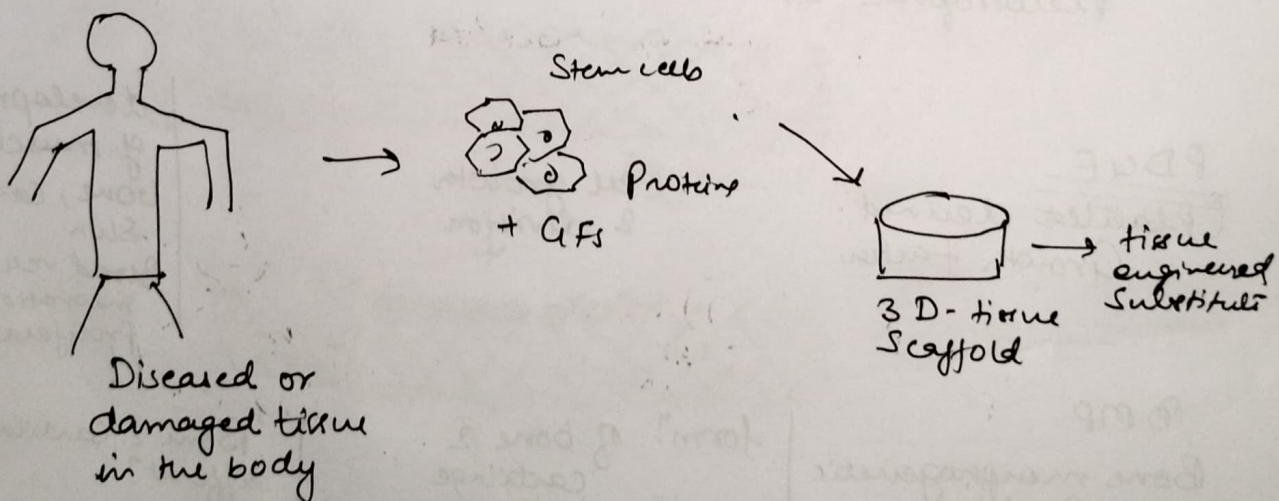
Erythropoietic (EPO)

Erythropoiesis RBC.

Nerve Growth factor (NGF)

Fabrication Technology
3-D Printing

Applications of stem cell Engineering



Allodem — Acellular dermal matrix
Apligraf — Living Keratinocyte & fibroblast cells (diabetic foot ulcer & ulcer)
Carticel — Chondrocyte for cartilage.
Surgisis — Xenogenic graft for dermal wound

Signal Transduction Pathway

Self renewal

Potency

Ligand
- Extracellular molecule
- Soluble mol.
- attached to another cell
- Environmental trigger

Part of Receptor retained

Target cell

TCR – CD3 complex
BCR – αβ

Internalised → mediate sp. function

Receptor
Extracellular
Tm
Intracellular

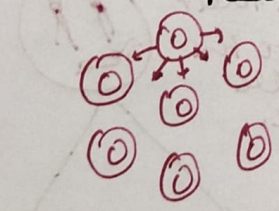
Signal → Endocrine
- Long distt
- Low
- sp. target cell
- blood

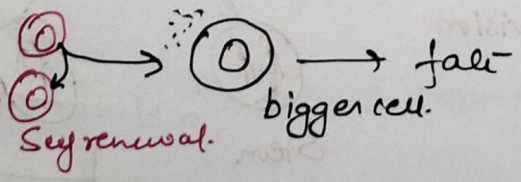
GPCRs
G protein coupled receptor

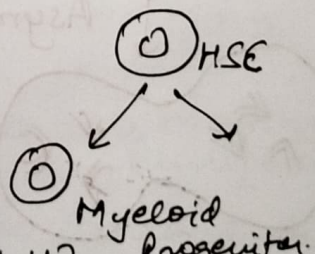
Paracrine
- close vicinity
- nearby target cell

Signal does not travels far

Inhibitors/ Proteins.

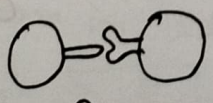






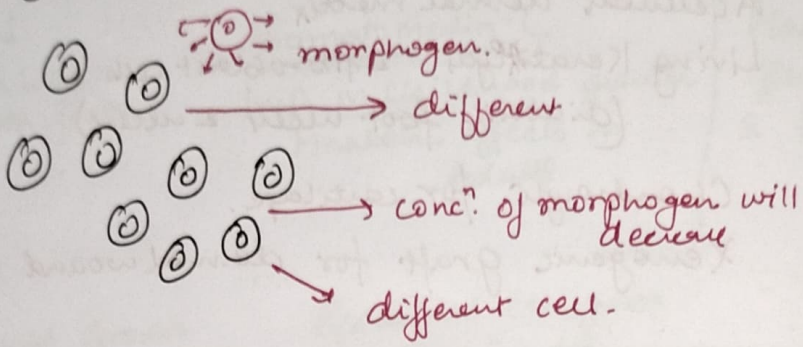
{IL-4, IL-7} → Monocyte

Paracrine signalling agents



Paracrine.

Cell is residing



Autocrine

released by same cell acts on same cell.

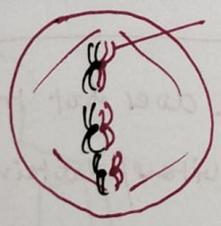
Transit Amplifying Cell

Stem cells divide upon signal

frequently divide.
But with fixed lifespan.

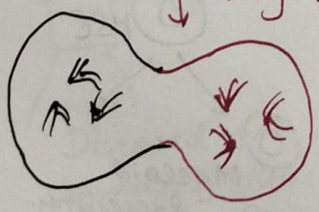
Stem cells proliferation very fast.

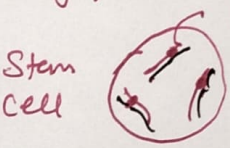
DNA replication.

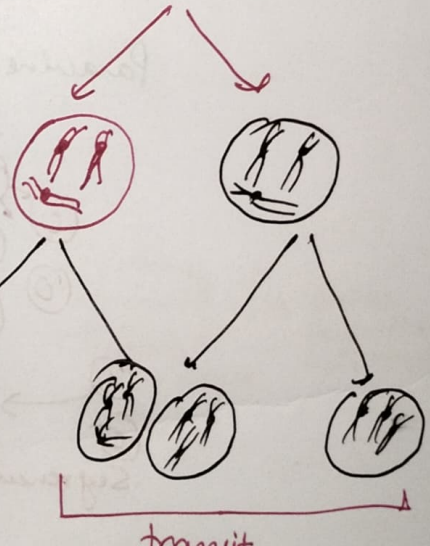


Chromatids Inheriting tagged strands all attach through their Kinetochores to the same spindle pole.

Asymmetric division







* Label retaining cells.
* Segregating their DNA strands asymmetrically
* Original label Strand → Daughter stem Stem cells.
  → freshly synthesized → Potency Strand

* Old labeled Strand → retained in stem cell generations after generation.

↓

"Immortal Strand"

Cancer → Radioisotope
Chemotherapy
Immunotherapy

Cancer

* Stem cells maintain/retain labeled DNA indefinately.
* Asymmetric cell division in fundamental stem cell Property.

Stem cell Signaling

→ Self renewal and differentiation potential

→ Yamanaka factor – Sox-2, Oct 4, Klf-4, & C-Myc.

i) Octamer binding transcription factor-4 (Oct 4)
ii) Sex determining region Y box-2
iii) Kruppel-like factor-4. (Klf-4)
iv) c-myelocytomatosis (c-Myc).

plays key role in maintainence of pluripotency.

→ ○ → Terminally differentiated cell → Yamanaka factors

Stem cell