

A photograph of four surgeons in blue scrubs and masks performing a surgical procedure in an operating room. The scene is illuminated by large overhead surgical lamps, creating a focused and professional atmosphere. The surgeons are gathered around a patient, with various surgical instruments and supplies visible on a table in the foreground.

Tissue Engineering And Regenerative Therapies

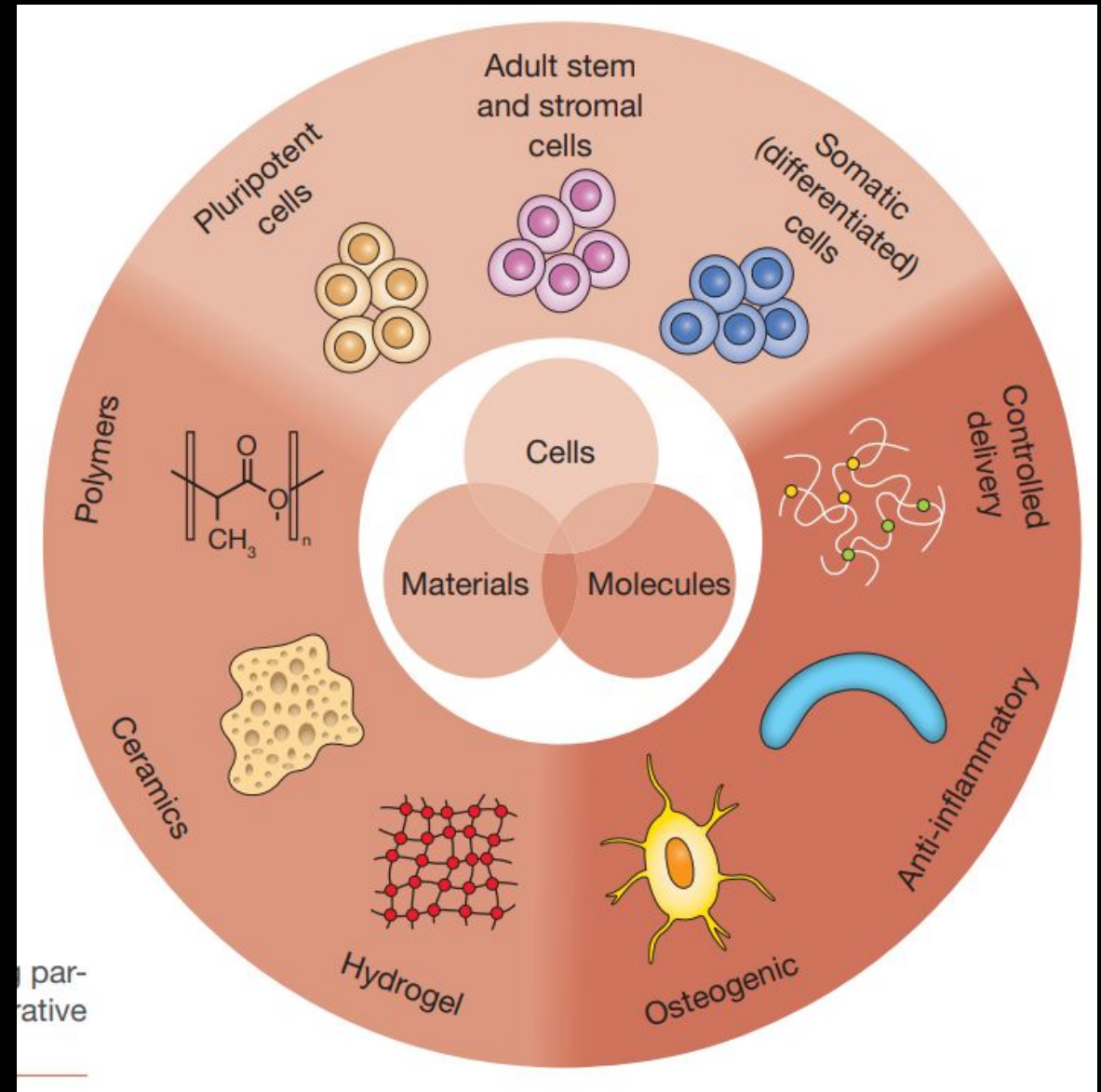
Ass. Prof. Mohammed Abd-Alhussein

Alkindy college of medicine

Department of surgery

Definition :

- approaches that harness the biology at the site of tissue damage to mediate regeneration through the localized delivery of cells, materials and molecules



- examples

TABLE 4.1 Examples of tissues created by tissue engineering and conditions they may be used to treat.

Tissue	Conditions treated
Skin	Burns and skin defects after excision or trauma
Eye	Retinal and corneal disease
Cardiac muscle	Heart failure
Heart valves	Congenital and acquired valvular heart disease
Cartilage and bone	Degenerative and traumatic bone and joint disorders
Trachea and bronchus	Congenital and acquired stenosis and resection for malignancy
Bladder	Congenital bladder malformation and cystectomy
Anal/bladder sphincter	Incontinence
Pancreatic islets	Insulin-dependent diabetes
Large blood vessels	Atheromatous, aneurysmal and traumatic arterial disease
Oesophagus	Benign stenosis and resection for malignancy
Small intestine	Intestinal failure after surgical resection for Crohn's disease, cancer or ischaemia

Stem Cell :

undifferentiated or non-specialized cells that are able, through cell division, to renew themselves indefinitely (self-renewal). Crucially, they are also able, when provided with appropriate stimuli, to differentiate into one or more of the different types of specialized cell found in tissues and organs (potency)

Hemost

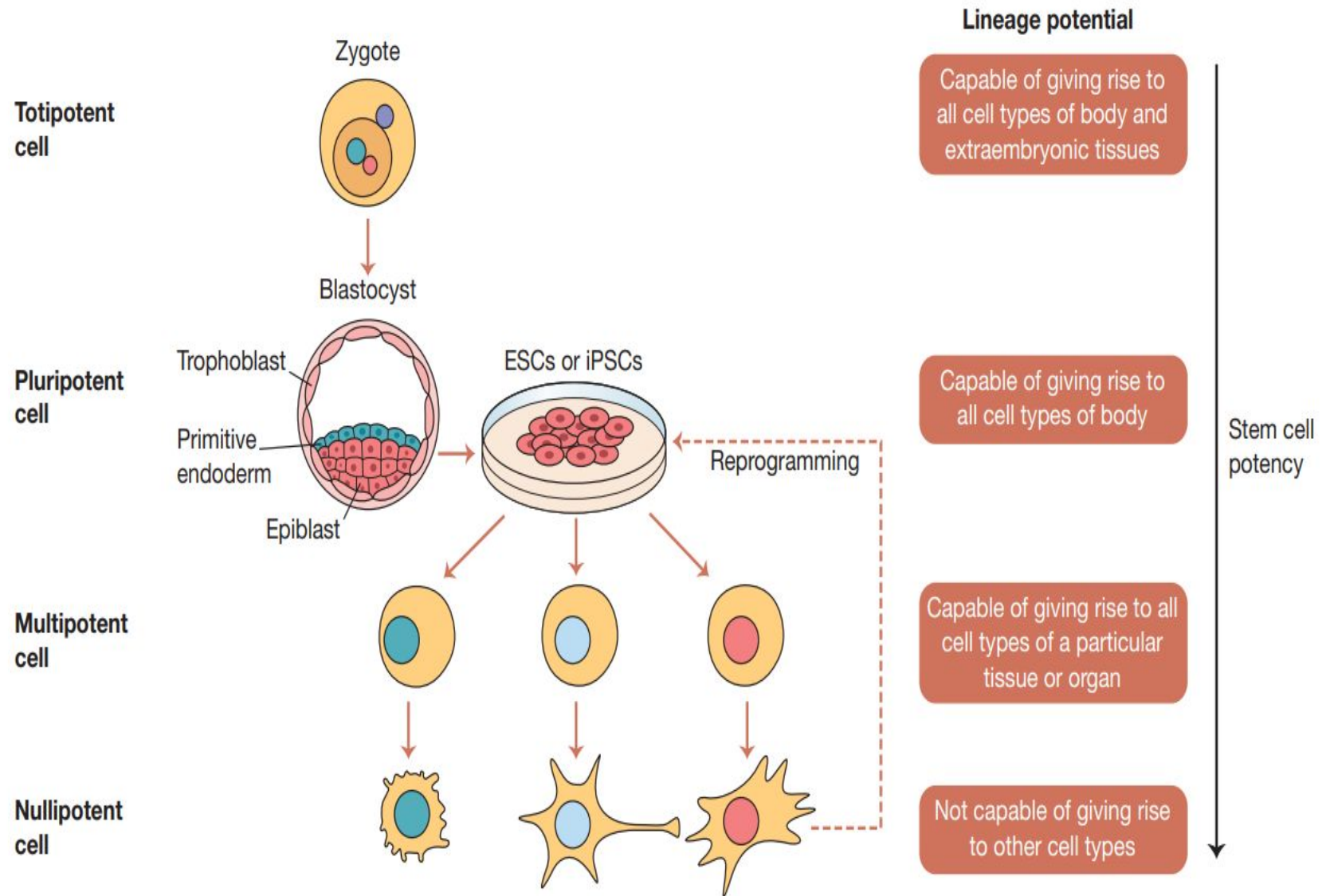
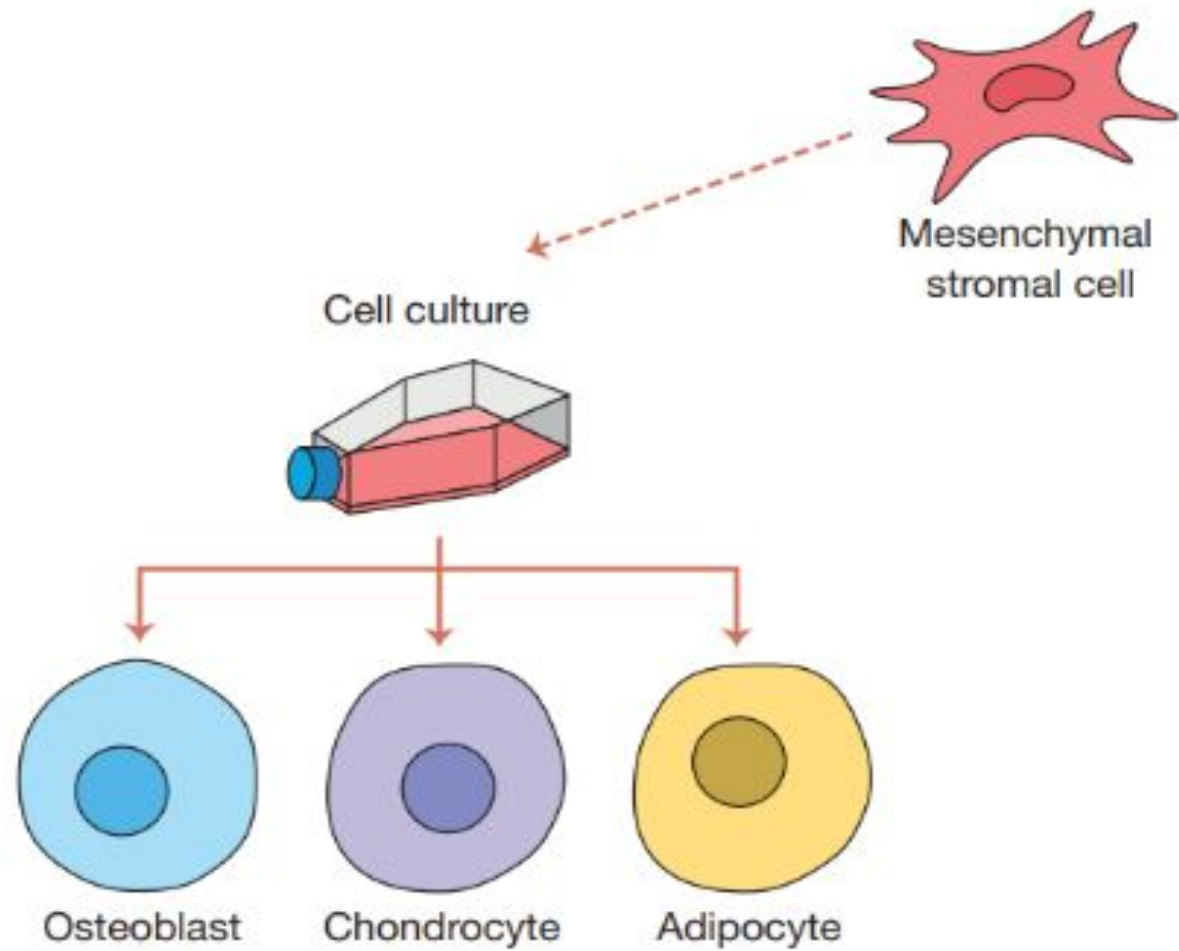


Figure 4.2 Hierarchy of cells according to potency, ranging from stem cells to specialised differentiated cells. ESC, embryonic stem cell; iPSC, induced pluripotent stem cell. (Adapted with permission from Tewary M, Shakiba N, Zandstra PW. Stem cell bioengineering: building from stem cell biology. *Nat Rev Genet* 2018; **19**: 595–614.)

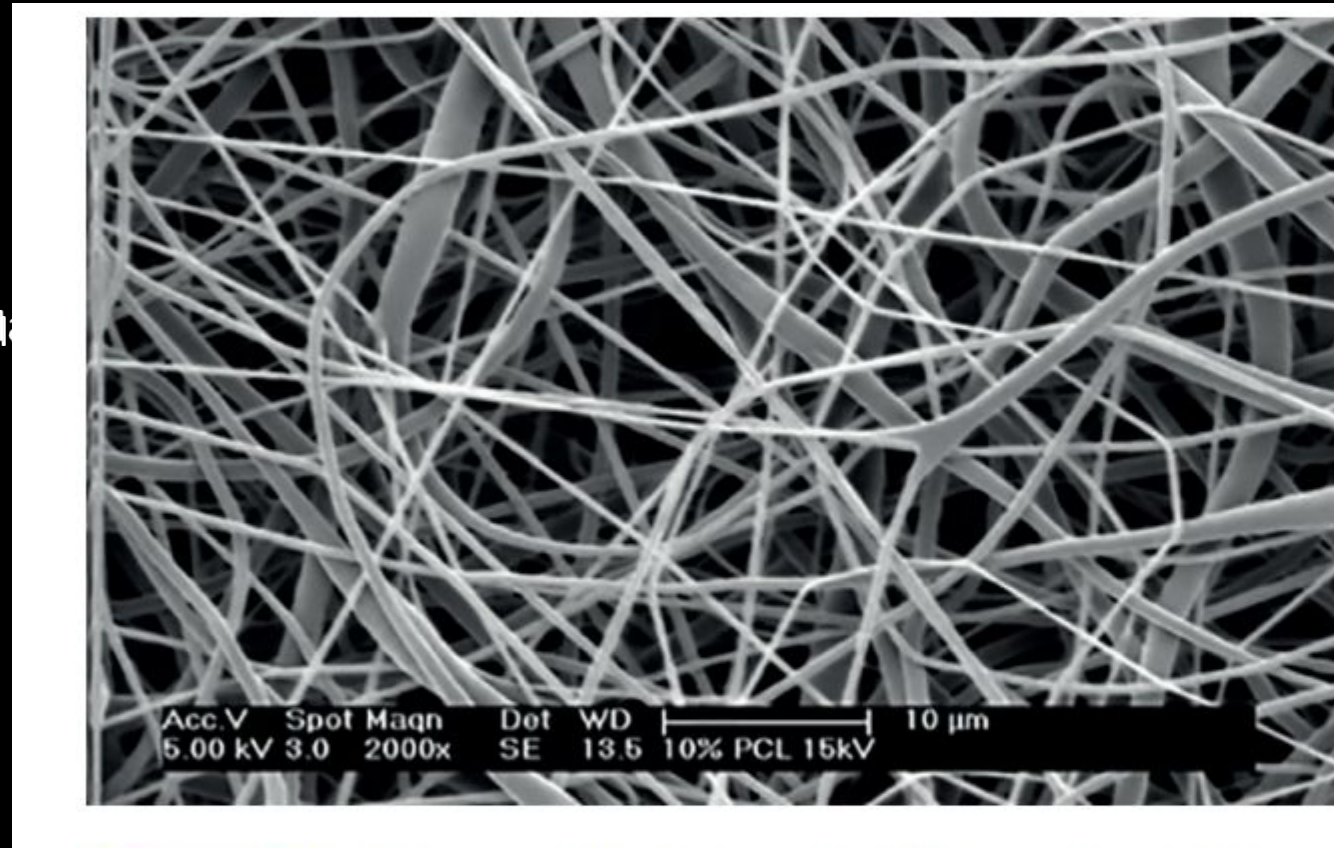


In vitro trilineage differentiation

Materials:

A large number of materials have been used in tissue engineering and regenerative medicine, either as delivery vehicles or as scaffolds; materials can be either natural or synthetic polymers, hydrogels and osteoinductive ceramics such as Bioglass[®].

M



Molecules

- Modification of the tissue environment during healing can be achieved by the delivery of molecules that are selected and able to specifically modify biological responses at the site of injury. In terms of tissue regeneration, these molecules can modulate **the inflammatory environment, either by enhancement or by inhibition of specific biological response pathways, such as angiogenesis**. This approach has been used to optimize tissue regeneration across several applications, with specific examples, for the skin TGF β 3 and the eye TGF β 1 to prevent scarring.

TABLE 4.3 Risks of cell-based therapy.

- Tumour formation
- Genetic and epigenetic abnormalities
- Transmission of infection
- Poor viability and loss of function
- Differentiation to undesired cell types
- Rejection (allogeneic cells)
- Side effects of immunosuppression (allogeneic cells)



THANK
YOU!