

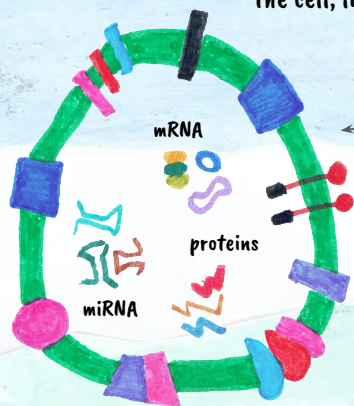
Extracellular Vesicles as an cellular approach for tissue engineering

Cells exchange information, their communication is critical in processes related to healing, immune response, cancer.

They use mechanisms like the secretion of soluble factors, direct interaction of their outer membranes and release of vesicles: small spheroids filled with molecules that carry important information to neighboring or distant cells.

- exosomes, produced inside the cell, <50 nm
- extracellular vesicles (EVs), 100–200 nm, contain proteins, factors, miRNA, mRNA

microRNA, messenger RNA, small pieces of code that start or stop specific processes in the cell, like the production of proteins



Use of EVs in tissue engineering could

- avoid some problems of using cells (immune reaction, change of phenotype after implantation, ...)
- they have all the signals needed to effect regenerative processes

Evs are known to be important in osteogenesis, acknowledged since the 90s (Landis et al), most EVs studied are bound to the ECM, but others are supposed to float around and could be potentially isolated from cells and used in regenerative applications

- MRC funding awarded to build bioreactor to produce EVs from osteoblasts

Can osteoblast EVs drive MSCs osteogenic differentiation?

- strong effect only from EVs from mineralising osteoblasts in the presence of mineralisation media, co-localisation / nucleation of Ca and phosphates, not such effect with other EVs or BMP-2 controls

How do they do it?

- they seem to nucleate P and Ca together on the ECM / collagen

Why only MO-EVs drive mineralisation?

- they have a high concentration of annexins to nucleate the mineral
- upregulation of collagen type VI and others, important as "bridge collagen" during chondrocyte / osteoblast attachment and communication, removed and substituted by collagen type I

post - talk research

- + Review paper: M Tkach, C Théry. Cell, Volume 164, Issue 6, 2016. Extracellular Vesicles: Where We Are and Where We Need to Go.
- + Companies Developing EV Products: Capricor Inc, ReNeuron Group PLC, Systems Biosciences, Inc. (SBI)



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Biomaterials Seminar 9th May 2017

Challenges

- standardisation
- scaled production, bioreactor
- better identification of primary mode of action
- study of further enhancement methods, media