Novel strategies for 3D cell culture & developmental tissue engineering

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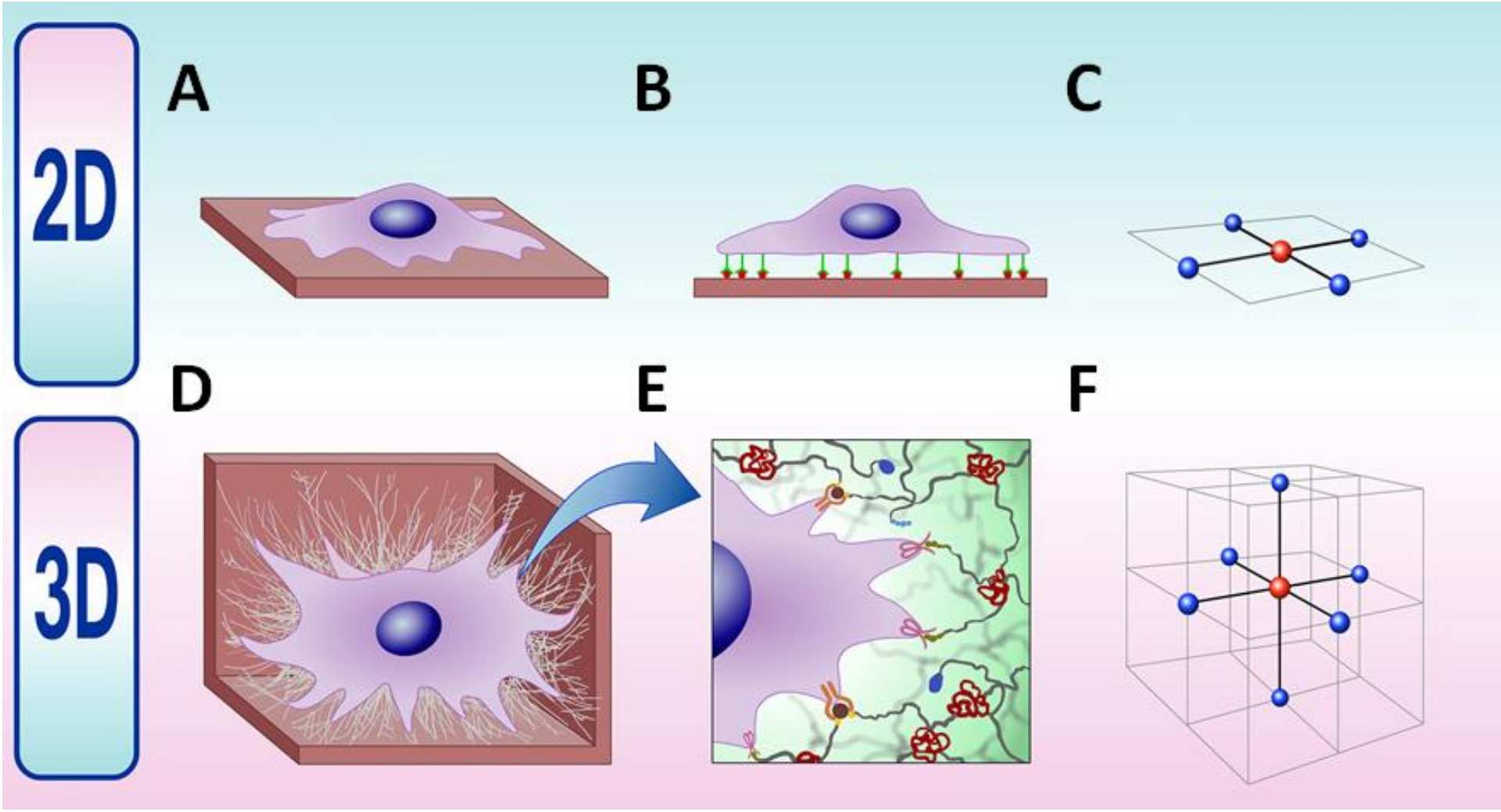
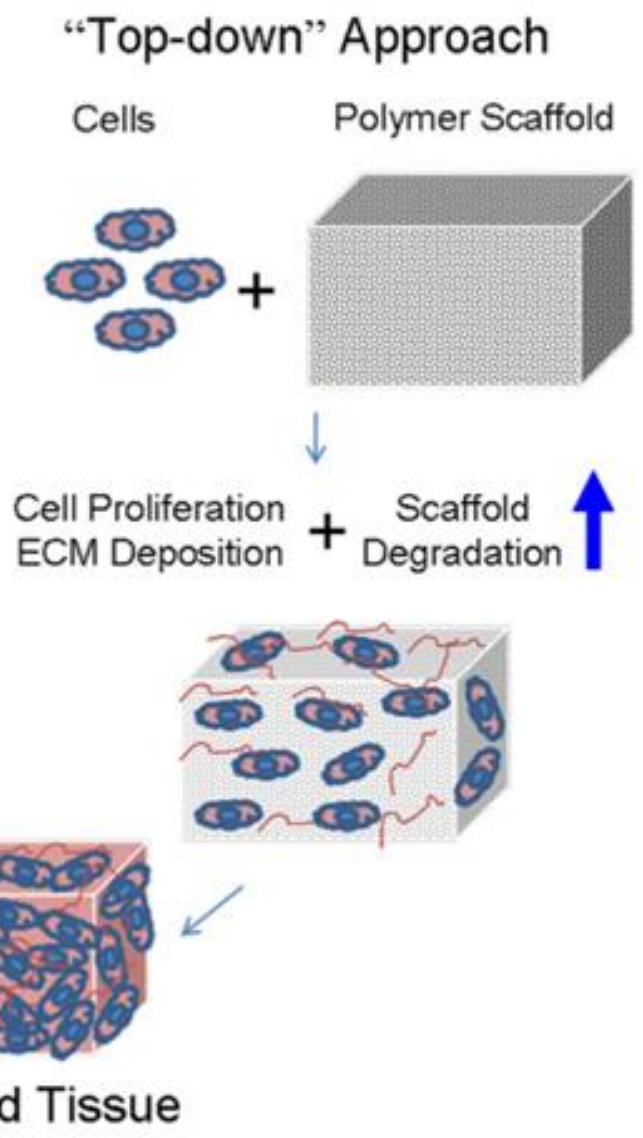
3D cell culture



Baptista LS et al. Frontiers In Bioscience, Landmark, 23, June 1, 2018. DOI No:10.2741/4683]

3D cell culture and Tissue Engineering Approaches

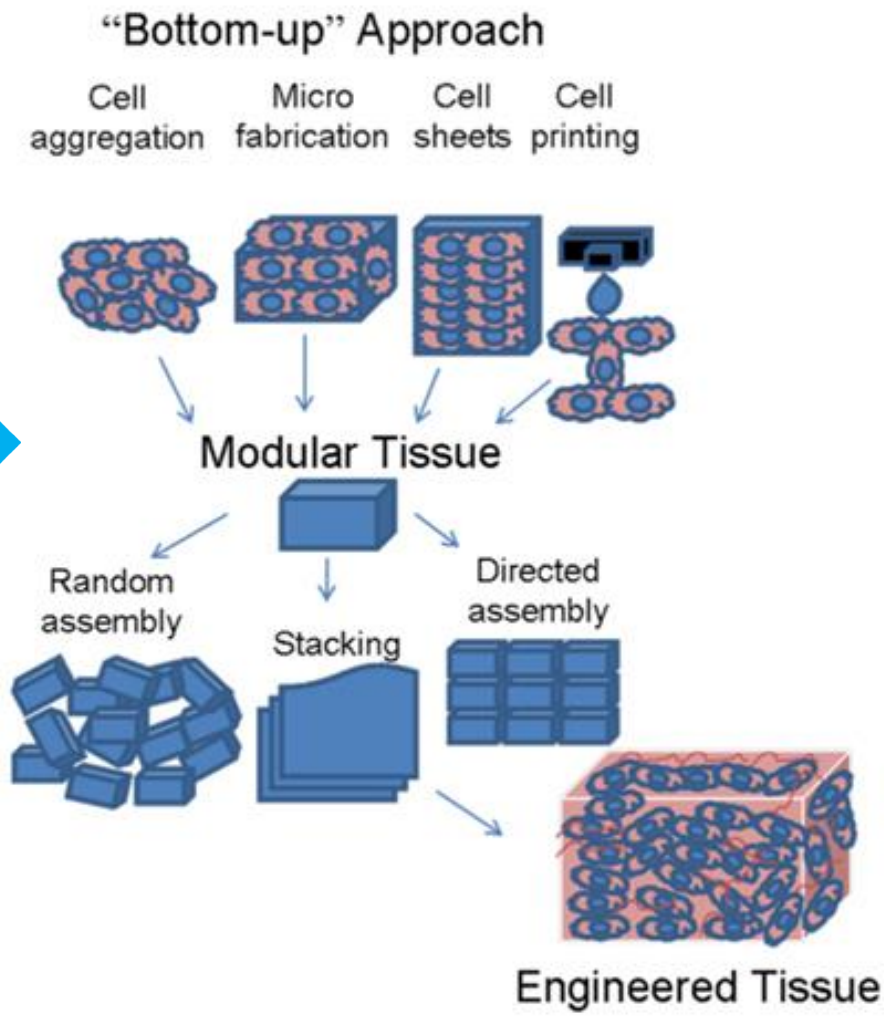
Scaffolds provide anchoring sites for individual cells.



Adapted from Nichol JW, Khademhosseini A. Soft Matter. 2009;5(7):1312-1319. doi: 10.1039/b814285h

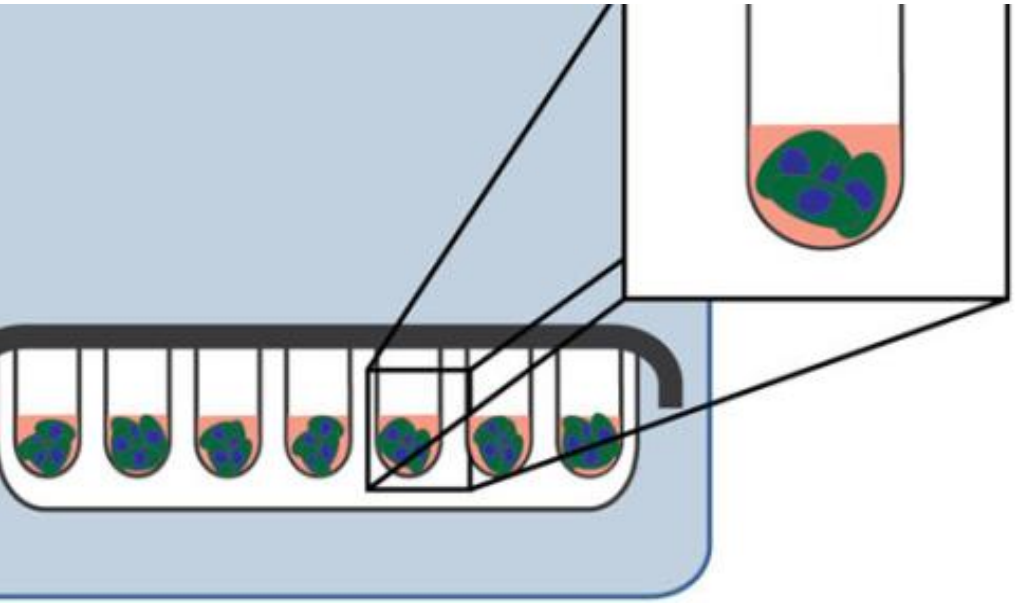
3D cell culture and Tissue Engineering Approaches

Bottom-up starts from microtissues



Adapted from Nichol JW, Khademhosseini A. Soft Matter. 2009;5(7):1312-1319. doi: 10.1039/b814285h

3D cell culture technologies



Scaffold-free 3D cell culture

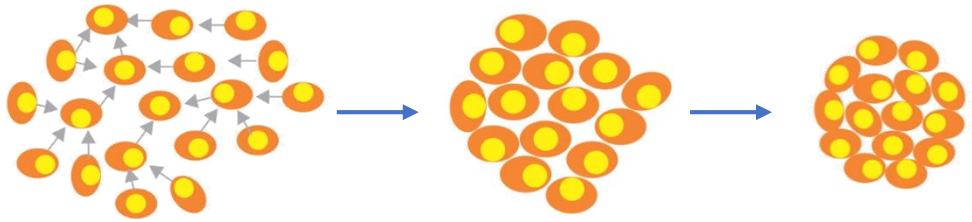
- Most of all support organogenesis
- Cells are immersed within a extracellular matrix, produced by them.
- Provides physical support for multiple cell layers

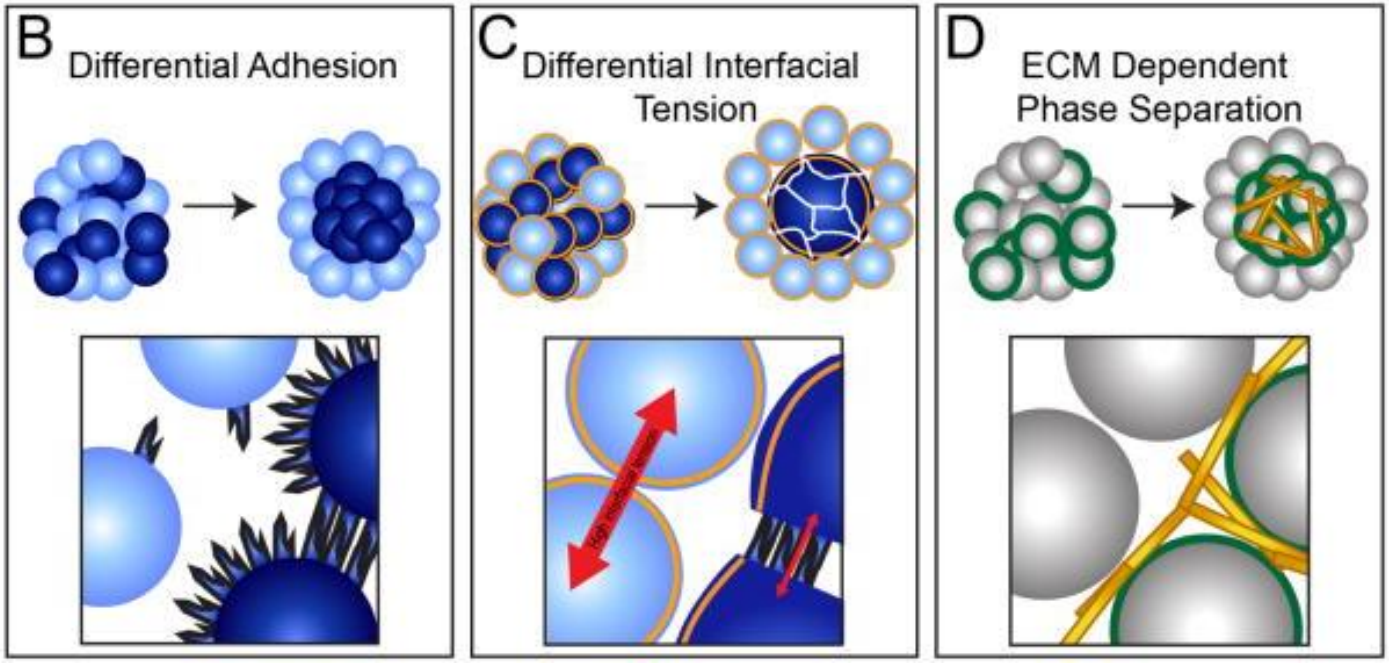
Microfluidics-based 3D cell culture
Magnetic levitation
3D bioprinting

Scaffold-based 3D cell culture

3D cell culture Technologies
3D spheroids

Self-assembly (spheroids and organoids)

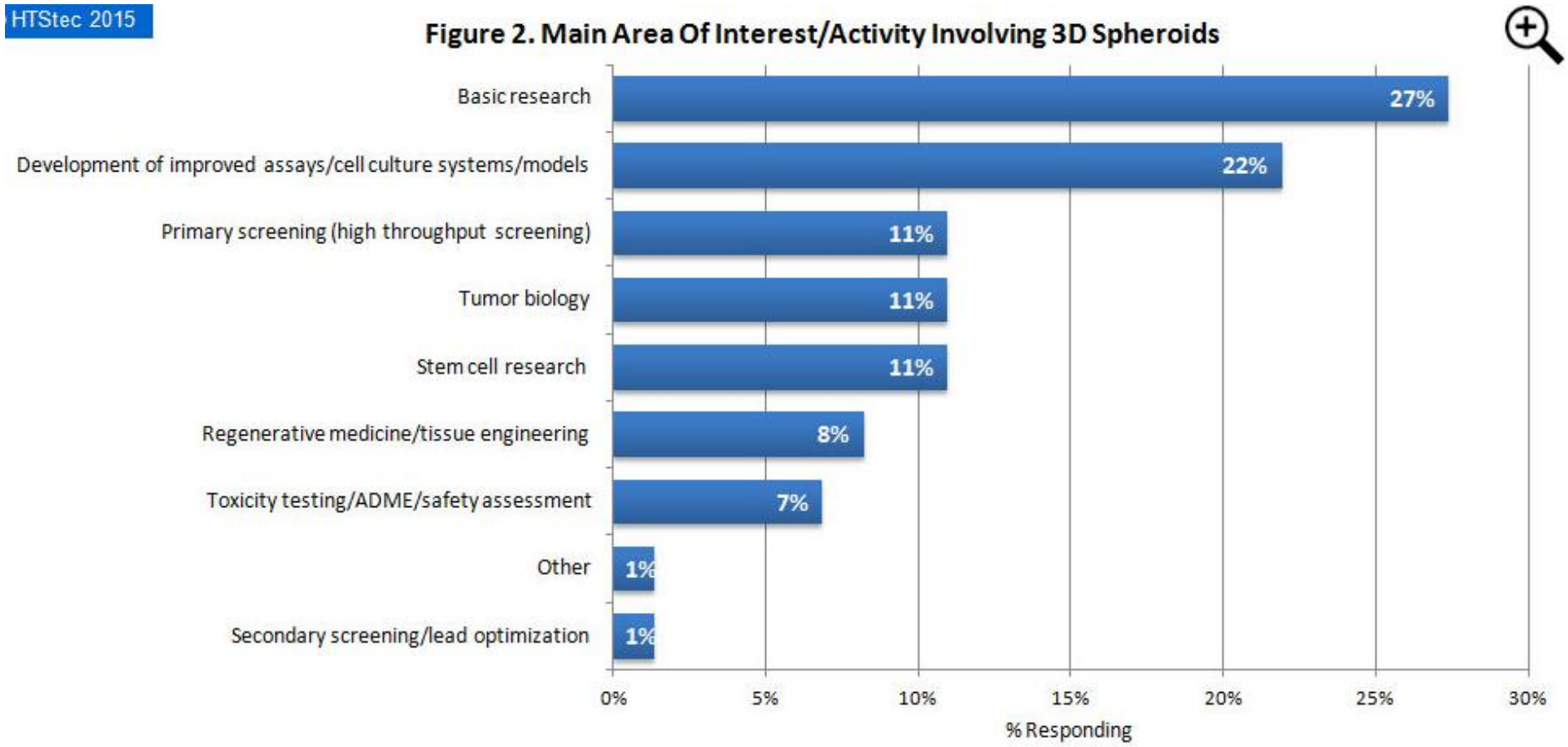




McMillen P, Holley SA. Curr Opin Cell Biol. 2015 Oct;36:48-53. doi: 10.1016/j.ceb.2015.07.002.

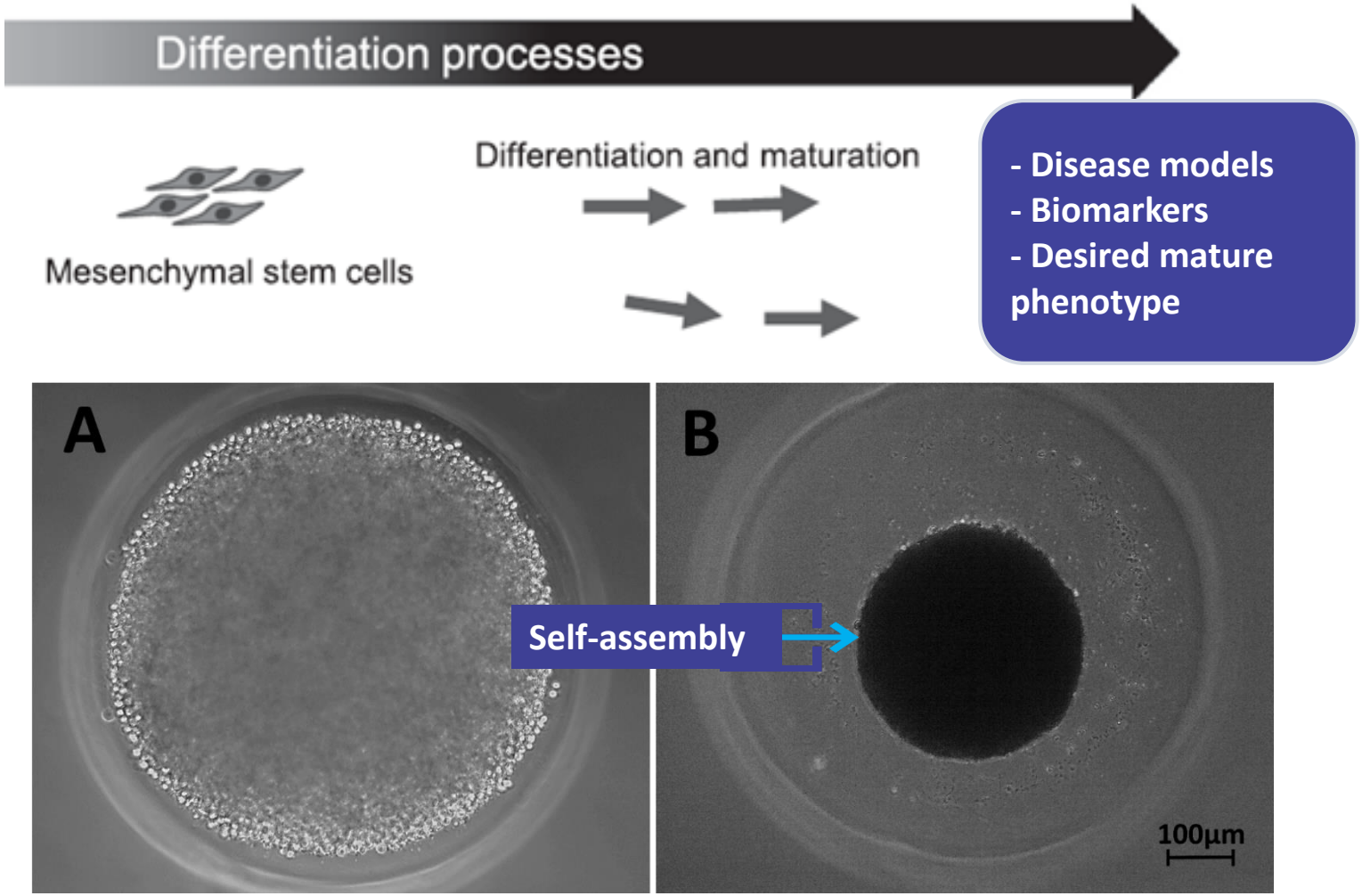
3D spheroids applications

HTStec 2015



https://www.technologynetworks.com/drug-discovery/articles/3d-spheroid-culture-trends-184234

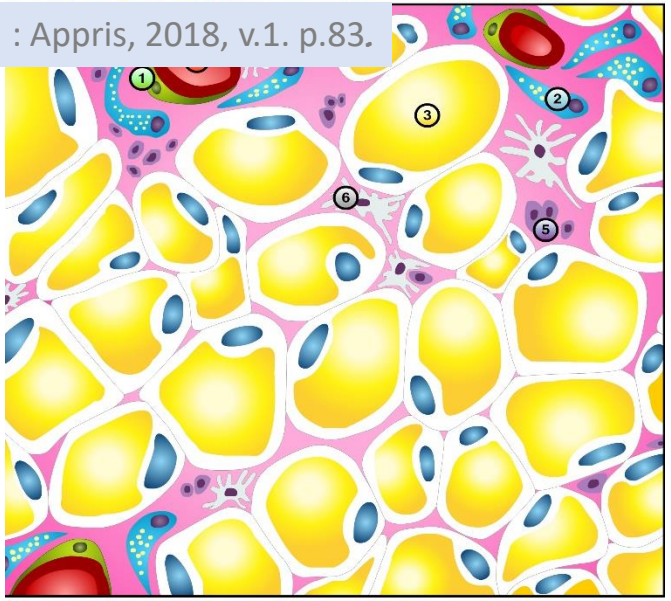
3D spheroids fron adult stem cells
Developmental tissue engineering



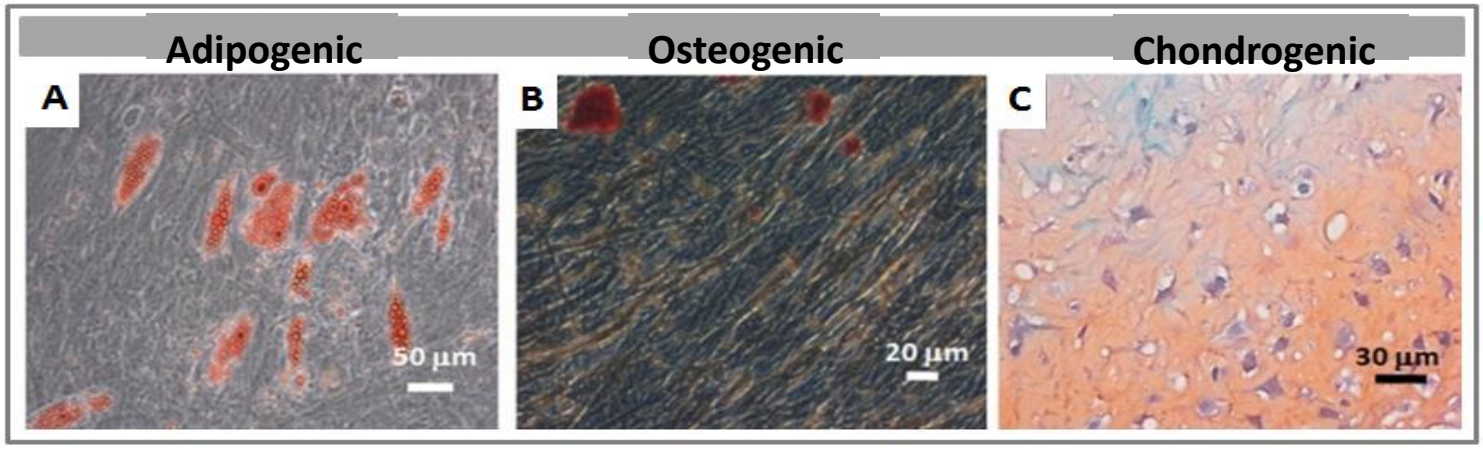
Adipose tissue derived stem cells

COSTA, C. C. P.; BAPTISTA, L. S. Tecido adiposo: vilão ou herói?. Curitiba : Appris, 2018, v.1. p.83.

Stromal vascular fraction

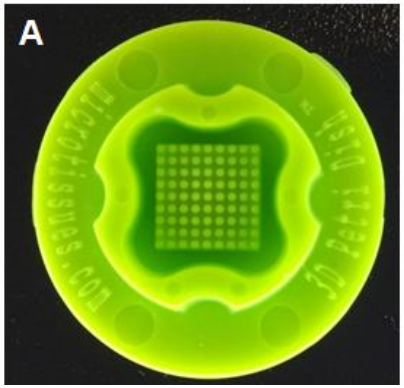


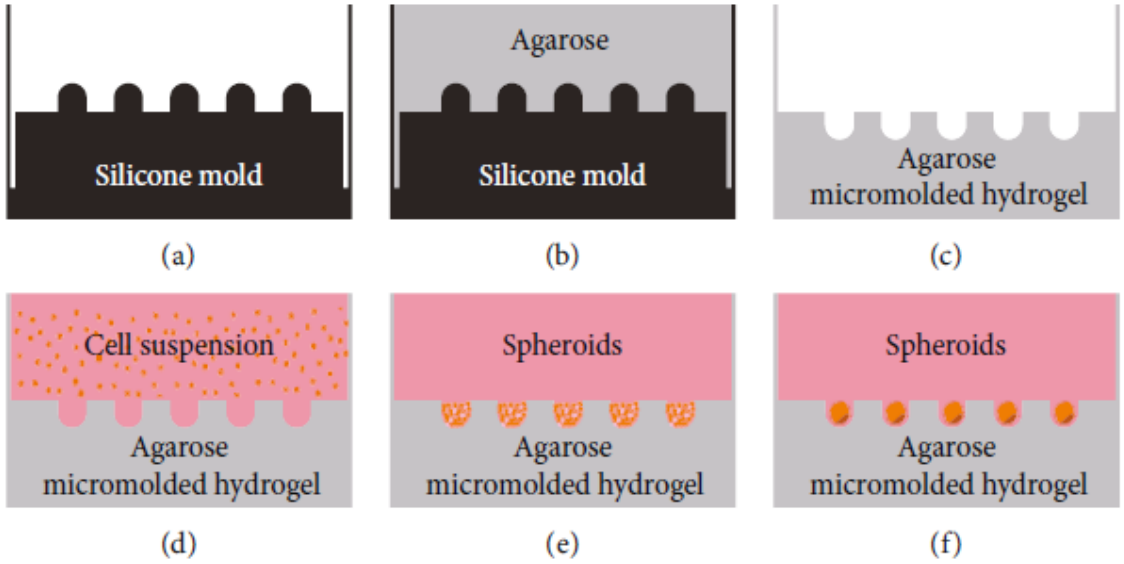
In vitro multilineage potential



Baptista et al., Processing of Lipoaspirate Samples for Optimal Mesenchymal Stem Cells Isolation. 2011.

Human adipose tissue derived stem cells spheroids





Micro-molded non-adhesive hydrogel

SERUM-FREE MEDIUM

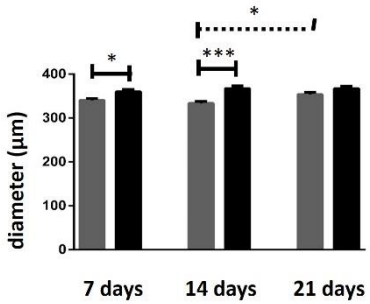
Stuart MP et al. Stem Cells International. 2017. https://doi.org/10.1155/2017/7053465

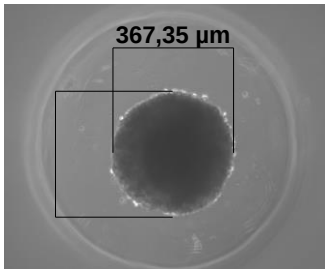
End points (analysis) of 3D spheroids

From spheroids

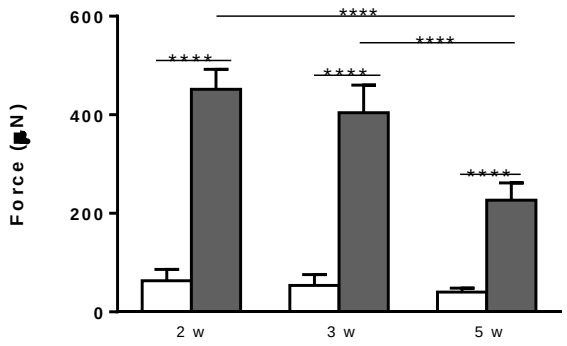
- Diameter measurement (viability)
- Eletronic microscopy (morphology)
- Biomechanical assay
- Histology/Specific targets (immunofluorescence, immunohistochemistry)
- Molecular assays (qPCR, transcriptome)
- Flow cytometry (viability, cell cycle and cell phenotype)

REPRODUCIBILITY



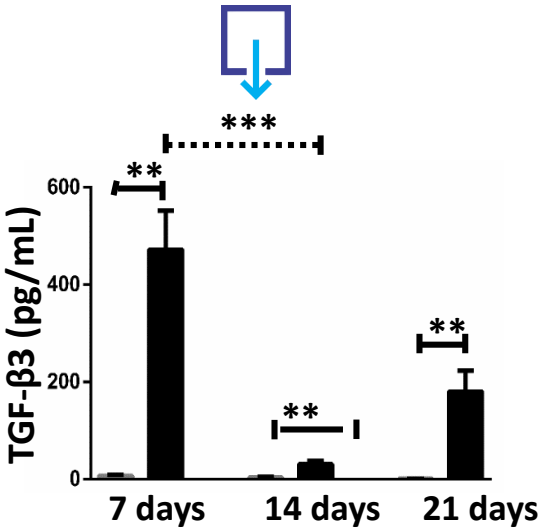


RASTREABILITY



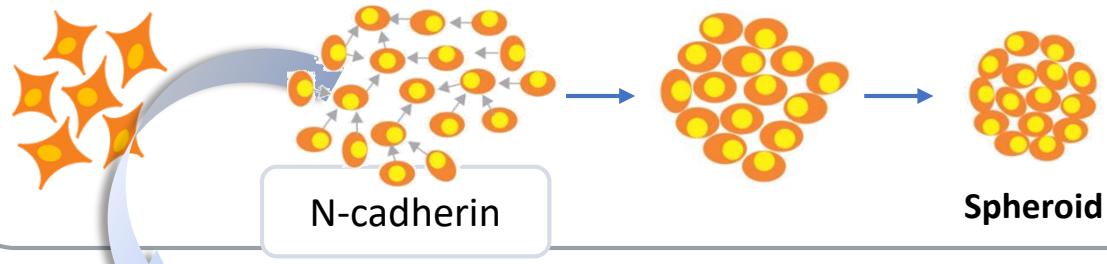
From spheroid culture supernatant

- Biochemistry assays (viability)
- Non-specif targets (secretome)
- Specific targets (multiplex, CBA)



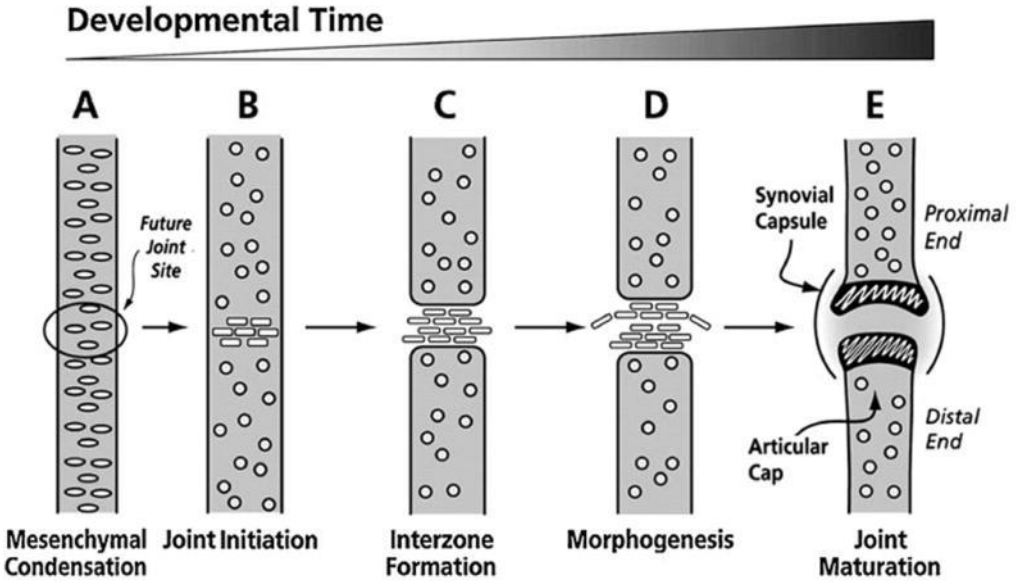
Adipose tissue derived stem cells spheroids to cartilage

Biological advantages of self-assembly



Embryological development of cartilage

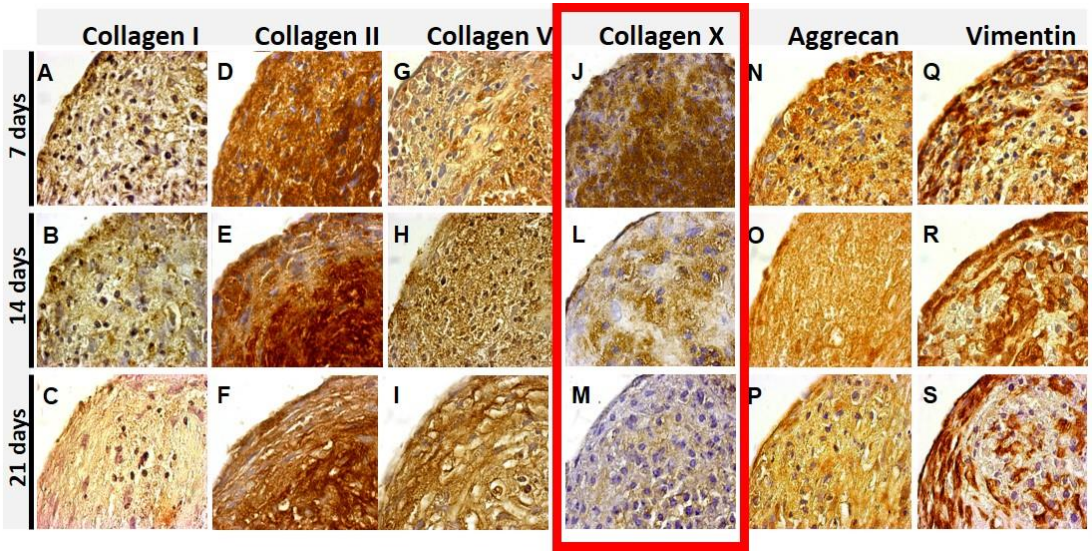
Mensenchymal condensation –started by cell-cell interaction



Pacifici M et al. Ann N Y Acad Sci. 2006 Apr;1068:74-86. DOI: 10.1196/annals.1346.010

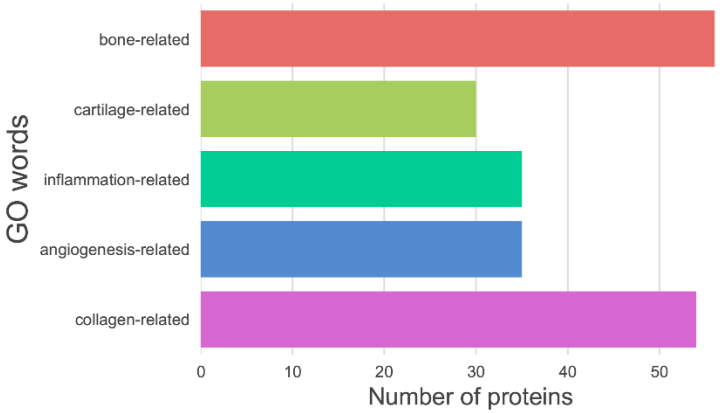
Adipose tissue derived stem cells spheroids to cartilage

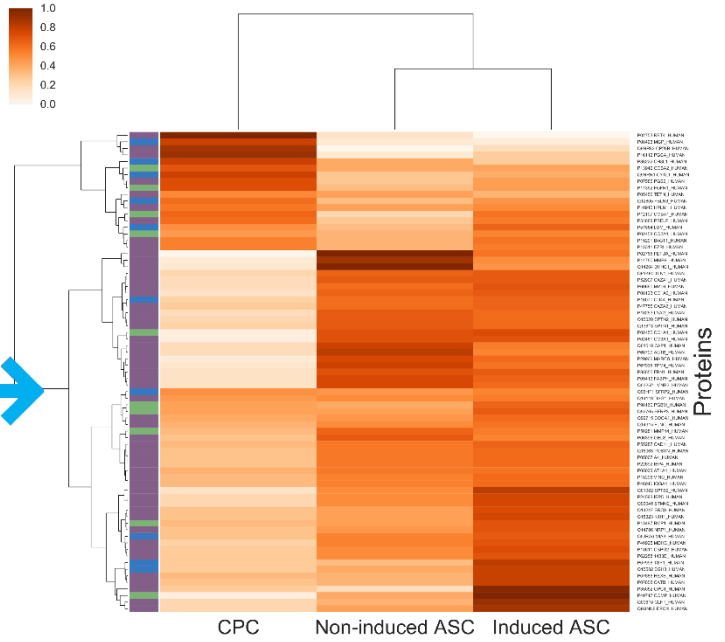
Immunohistochemistry



- Decreases marking intensity throughout the differentiation process
- It was not detected in secretome analysis

Secretome





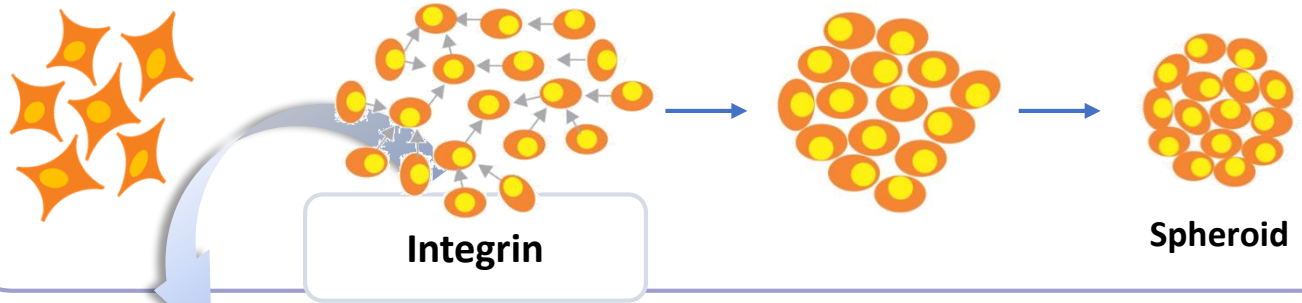
New biomarkers

Côrtes, master thesis, 2017 / Matsui, master thesis, 2017

Unsubmitted manuscript

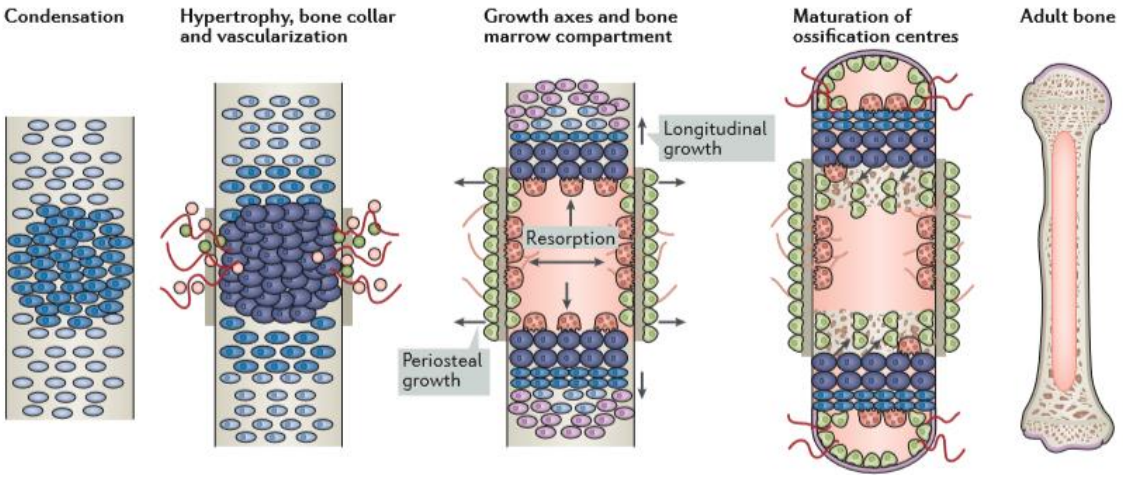
Adipose tissue derived stem cells spheroids to bone

Biological advantages of self-assembly



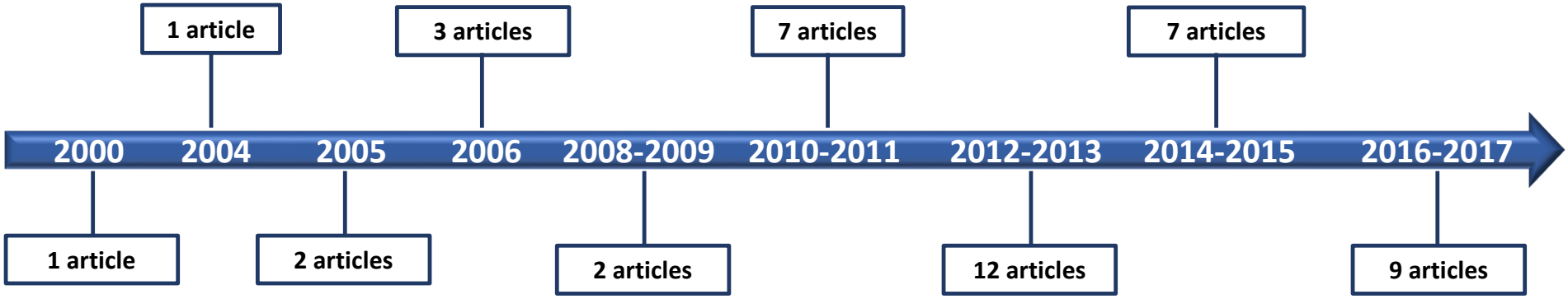
Embryological development of endochondral ossification

Mensenchymal condensation –started by cell-cell interaction

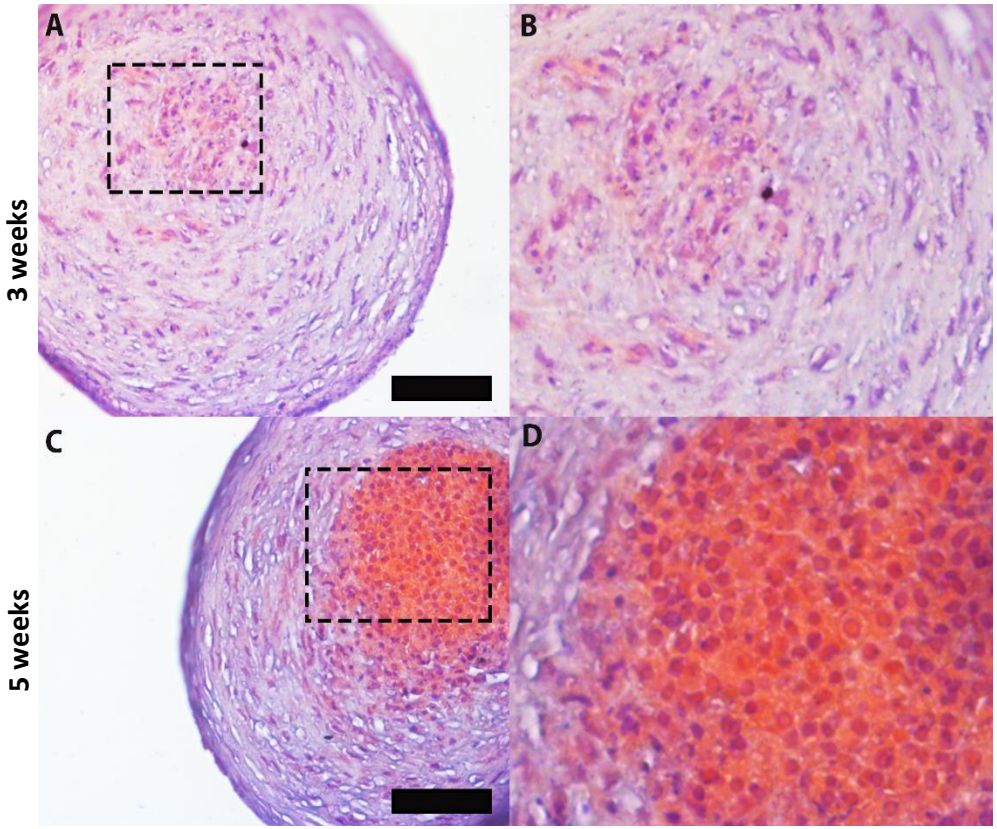


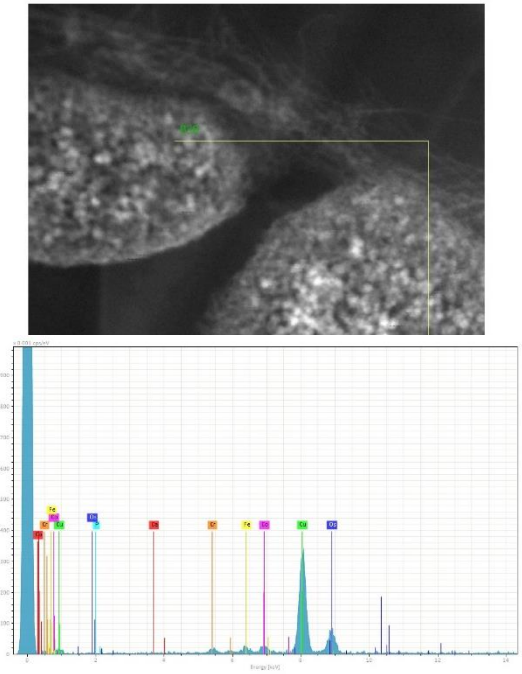
Salazar VS., et al. Nature reviews - Endocrinology. 2016; 1068:1-19. DOI:**10.1038/nrendo.2016.12**

Adipose tissue derived stem cells spheroids to bone



Baptista LS et al. Frontiers In Bioscience, Landmark, 23, June 1, 2018. DOI No:10.2741/4683].





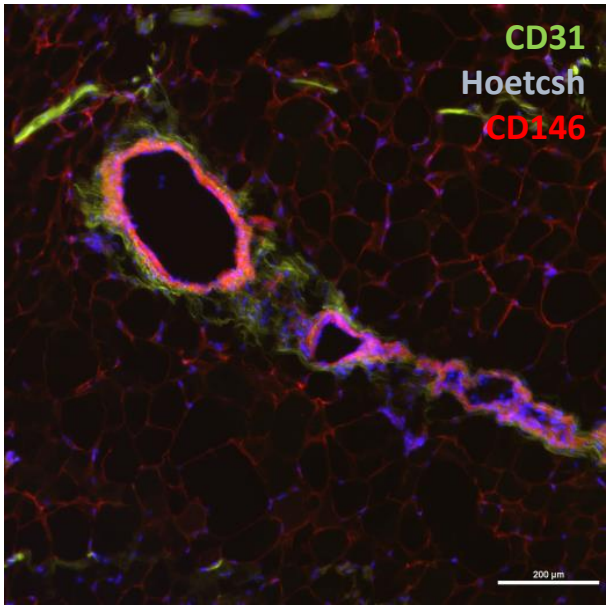
Kronemberger, master thesis, 2017

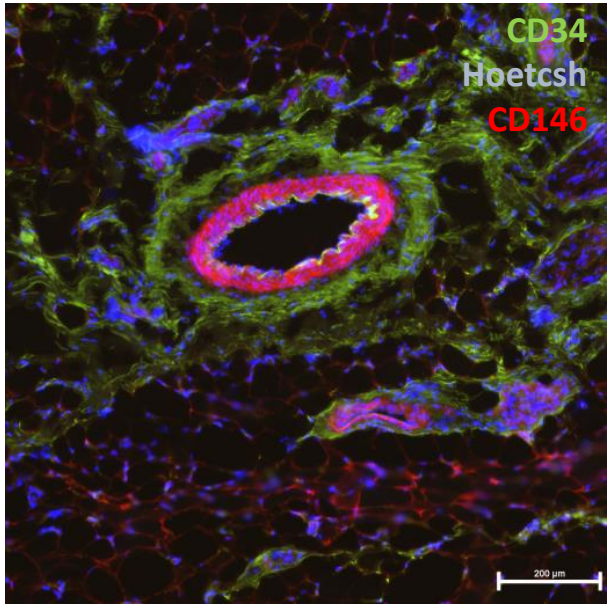
Unsubmitted manuscript

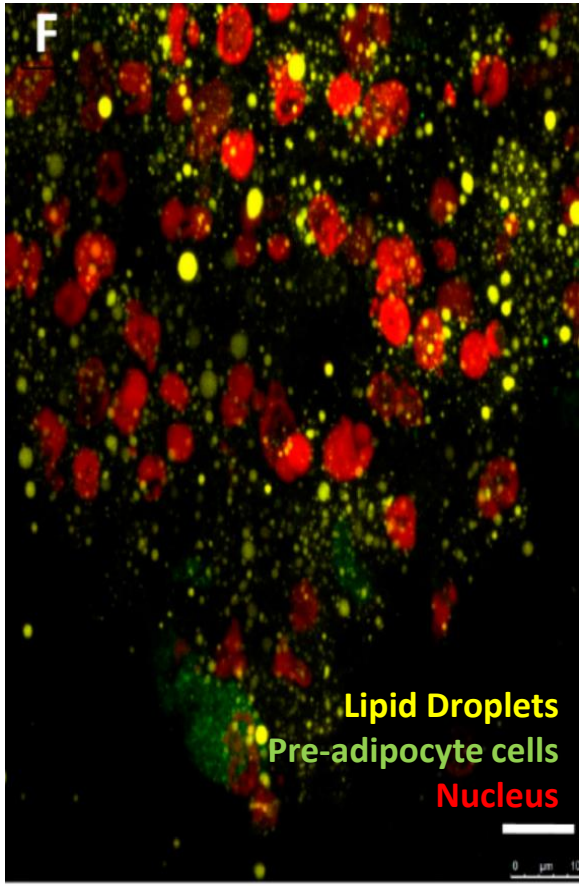
Adipose tissue derived stem cells spheroids to adipose tissue

In situ

In vitro



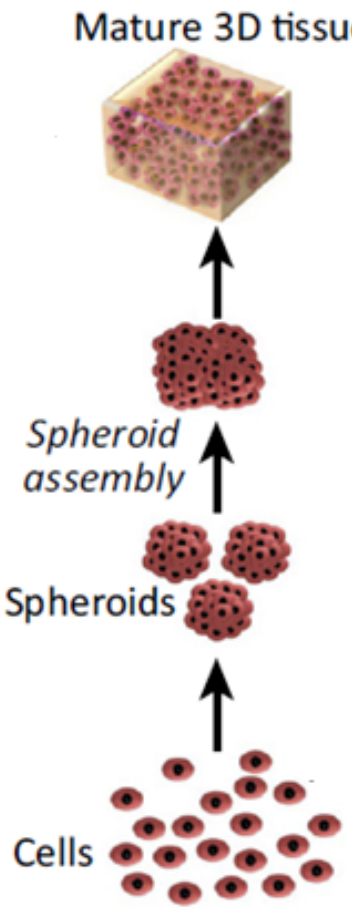


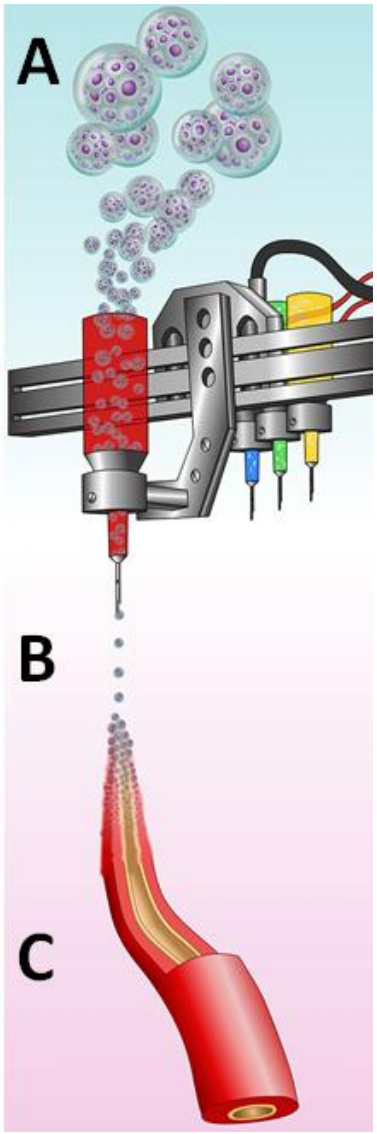


- Obesity
- Lost and re-gain of weight

Unsubmitted results

3D cell culture perpectives Bioprinting





Adapted from Guven S et al., Trends Biotechnol. 2015. 33(5):269-279. doi: 10.1016/j.tibtech.2015.02.003.

Baptista LS et al. Frontiers In Bioscience, Landmark, 23, 1969-1986, June 1, 2018. DOI No:10.2741/4683]

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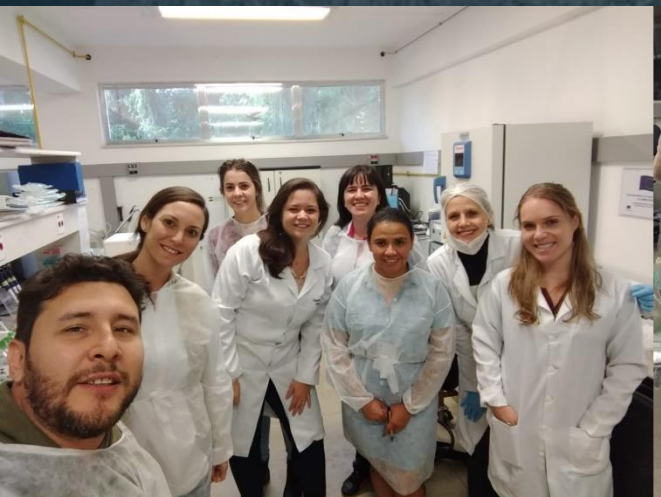

Workshop Impressão 3D e Bioimpressão

Oportunidades e desafios das convergências tecnológicas na Indústria 4.0

Palestrantes confirmados:

- Prof. Dr. Ricardo Michel (Instituto de Química – UFRJ)
- Profa. Dra. Rossana Thiré (MetalMat – UFRJ)
- M.SC. José Manuel Baena (CEO REGEMAT 3D)
- Profa. Dra. Leandra Baptista (Numpex-Bio – UFRJ)
- Prof. Dr. Tiago Albertini (PENt/COPPE – UFRJ)
- Dra. Janaina Dernowsek (CTI Renato Archer)

Data: 03 de agosto de 2018
Local: Campus do Inmetro (Xerém) – Auditório do Prédio 6

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Realização

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- Gabriela Kronemberger, Inmetro

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- Thais Barreto, UFRJ-Xerém
- Bianca Montenegro, UFRJ-Xerém
- Marcela Marins, UFRJ-Xerém

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Thank you!

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