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Can glass be the answer for in-vitro bone differentiation?

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University of Sharjah, UAE

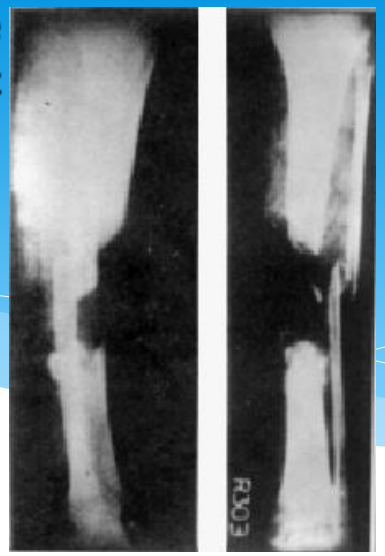
aelserafy@sharjah.ac.ae

Non united fracture



www.cmj.hr/1999/40/3/10411974.htm

Bone defect



http://orthopaedicstudent.com/tibia.htm

Bone tumor

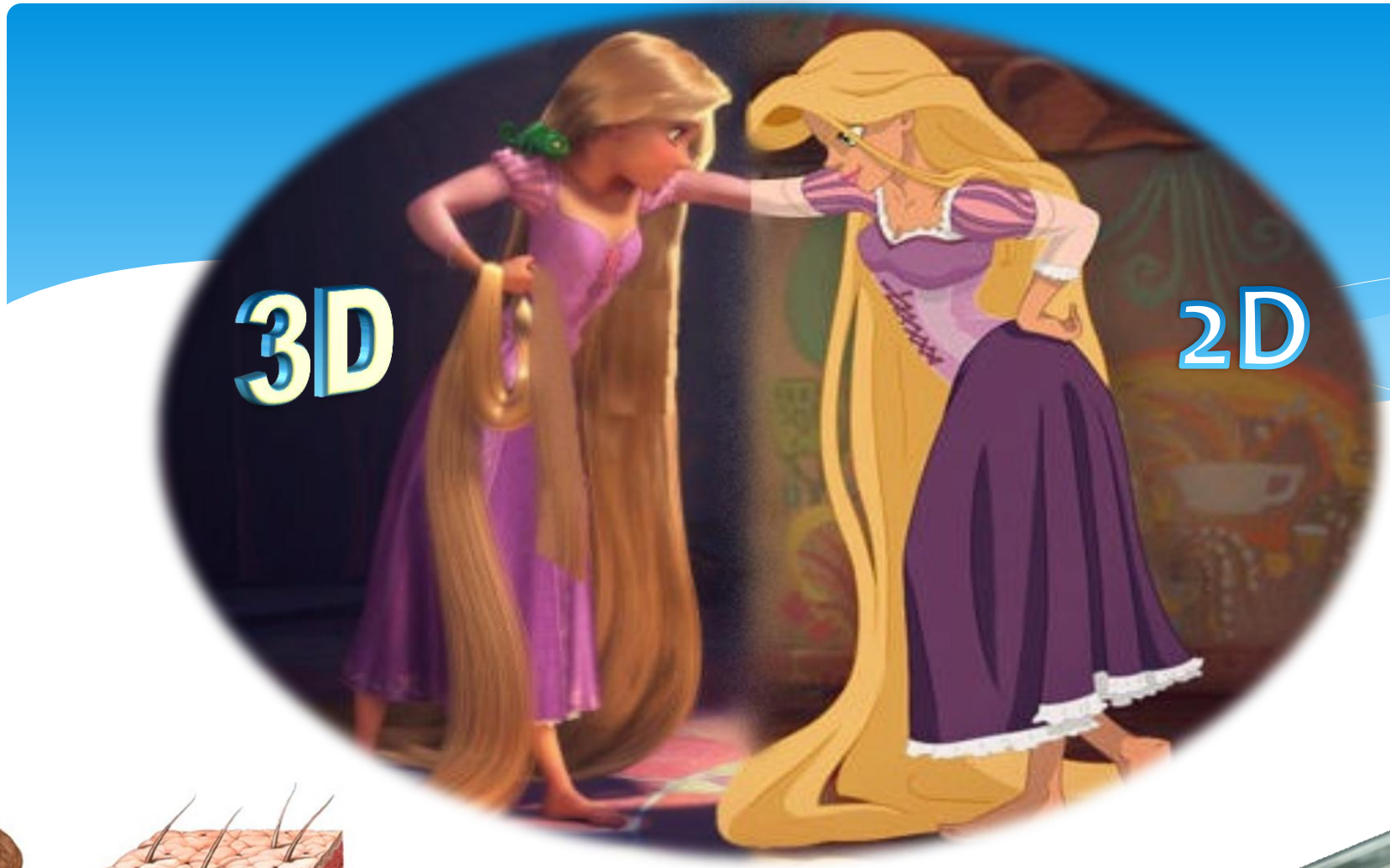


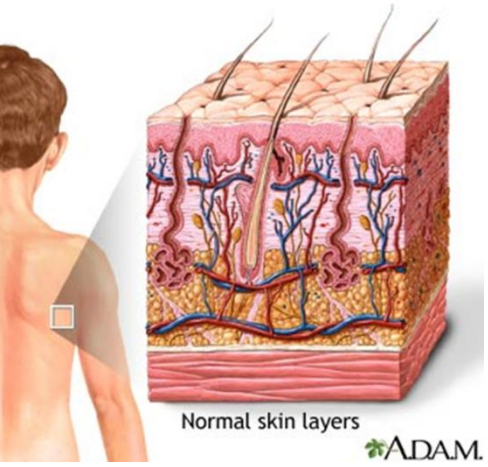
www.szhifu.com/eng/page/chan_shi.htm

Bone cyst



http://www.wheelessonline.com/ortho/simple_bone_cyst_unicameral

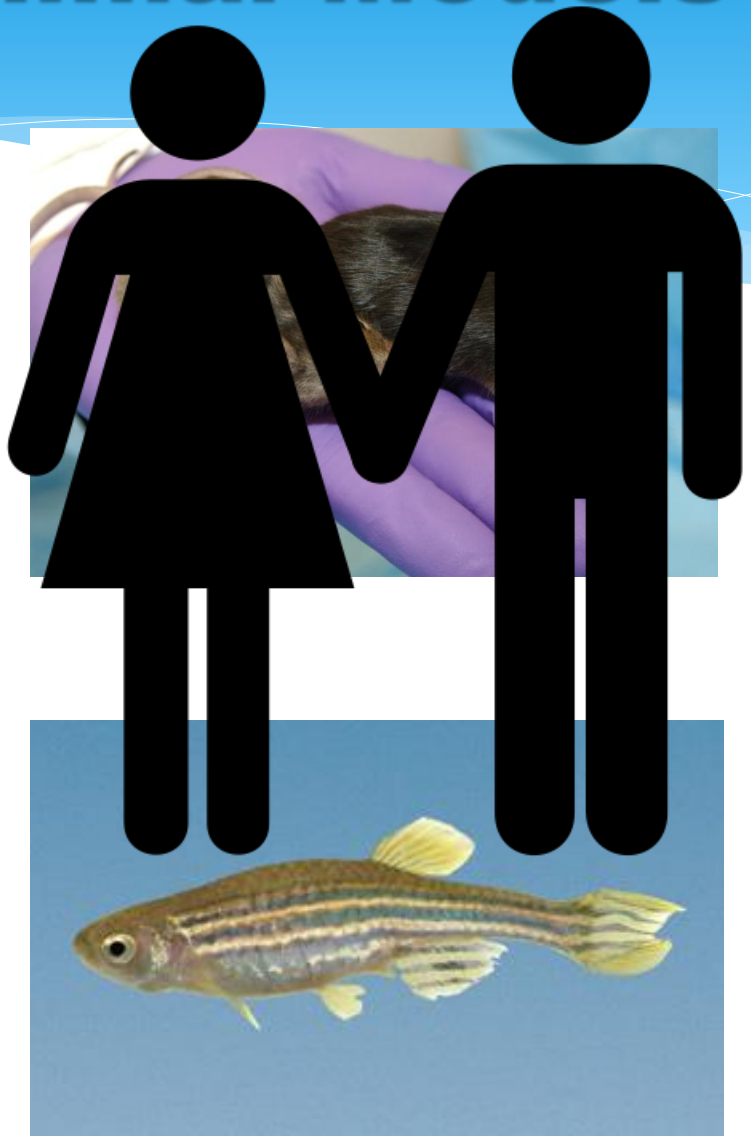

3D
2D

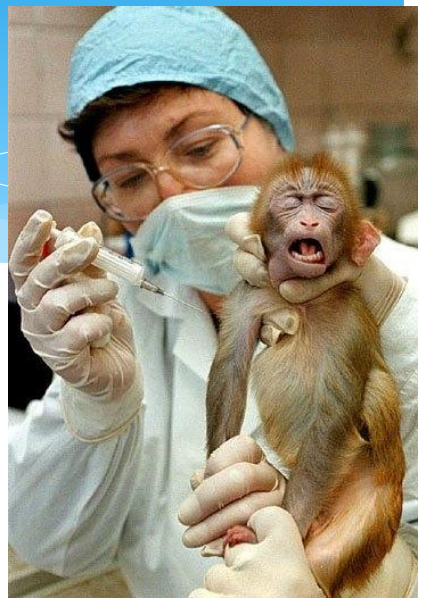

Normal skin layers
A.D.A.M.

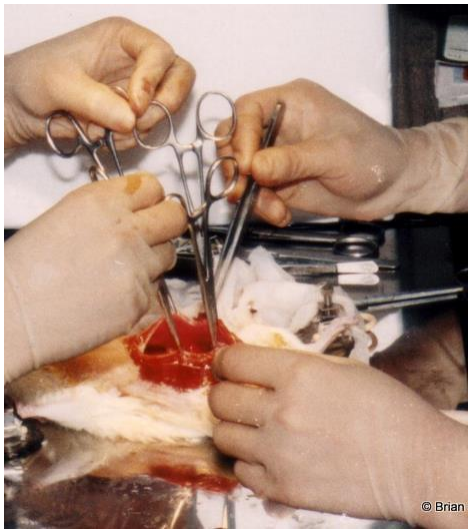


Animal Models



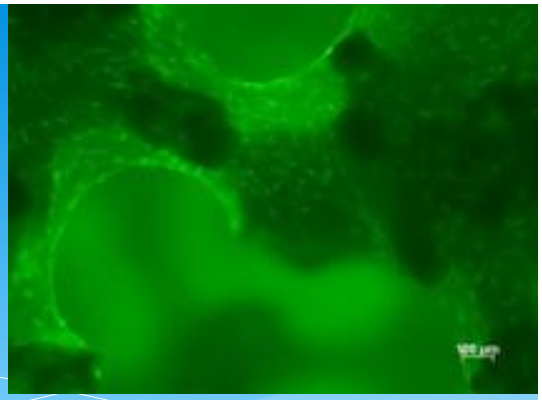


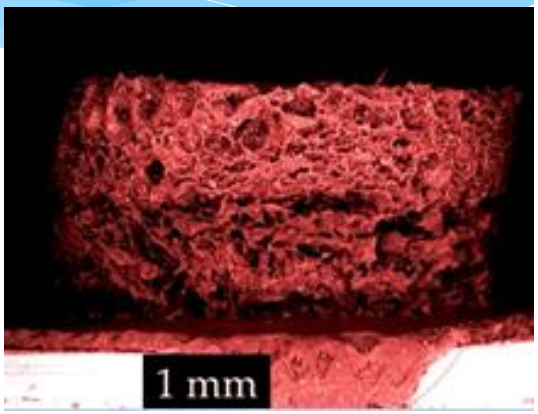




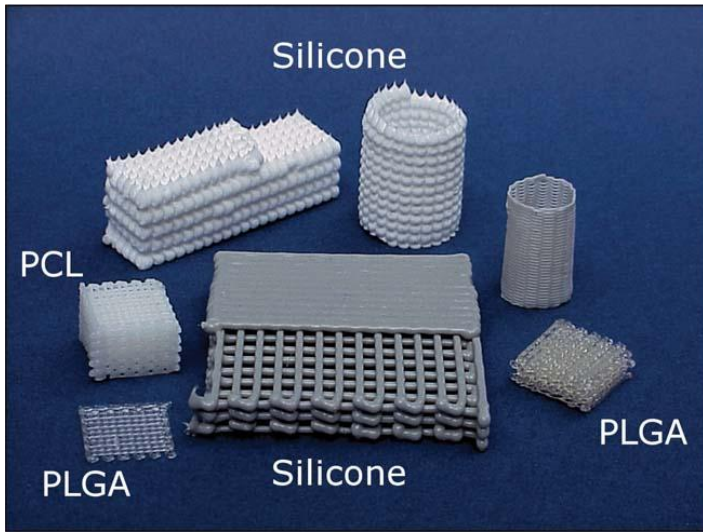


Scaffolds



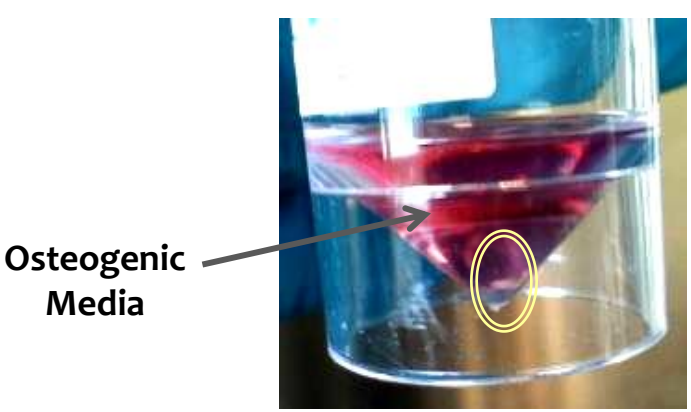


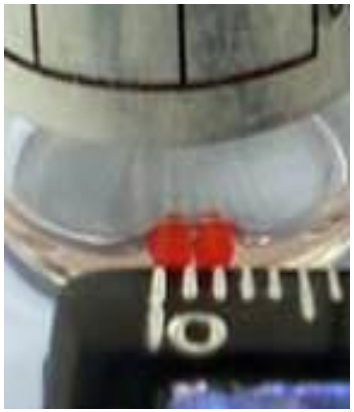
- toxic products of degradation
- loss of phenotype associated with solid scaffolds
- inhibition of cell migration and cell-to-cell communication
- obstruction of cell growth
- stress shield of cells from mechano-transduction

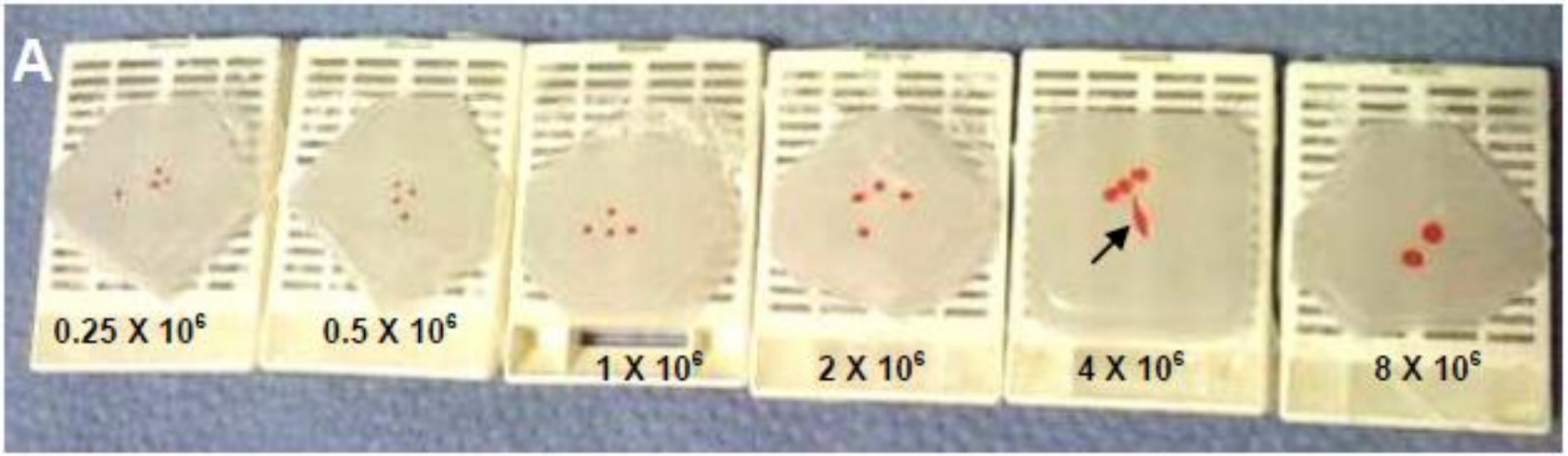


Scaffold-FREE

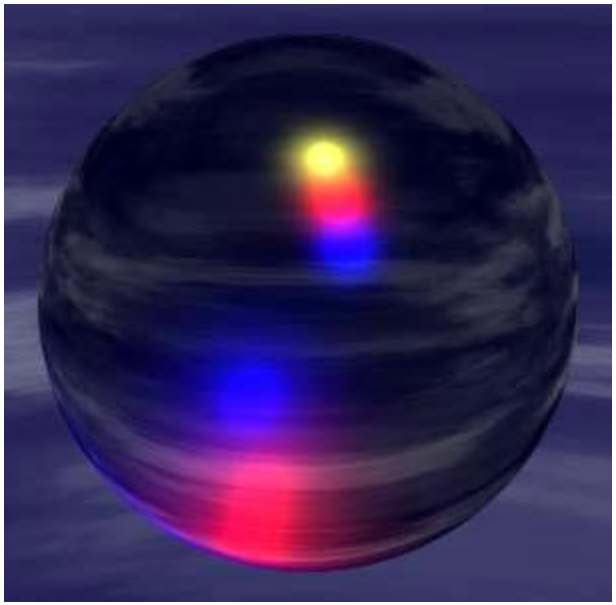
* Pellet culture
* Spheroidal culture
* Organoid culture





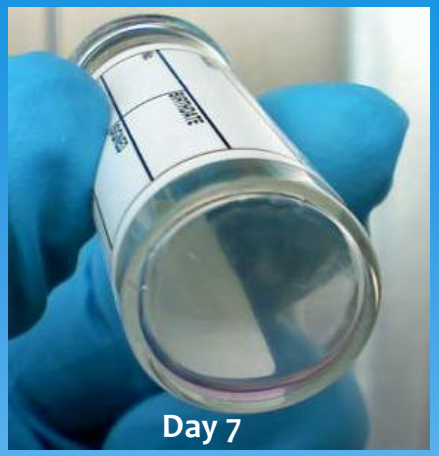

A
0.25 X 10⁶
0.5 X 10⁶
1 X 10⁶
2 X 10⁶
4 X 10⁶
8 X 10⁶

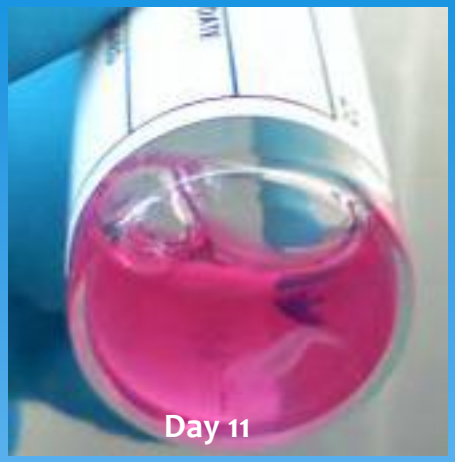




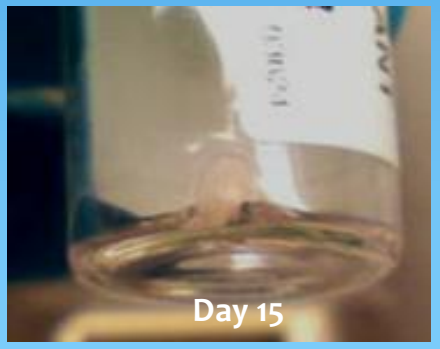
Cells on Glass

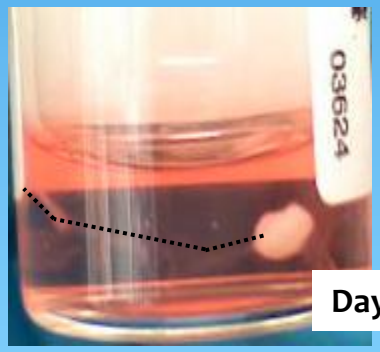




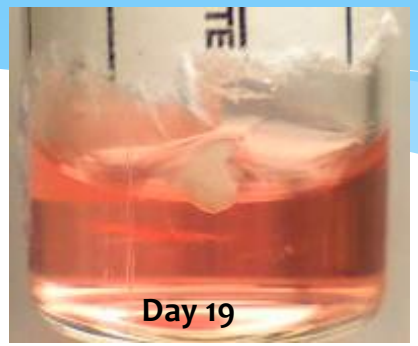


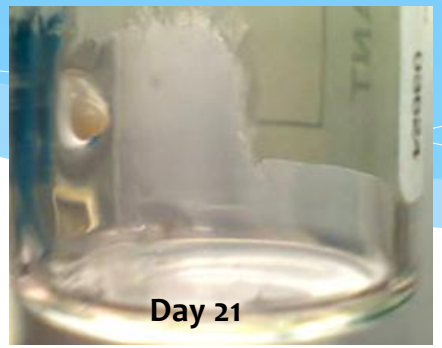






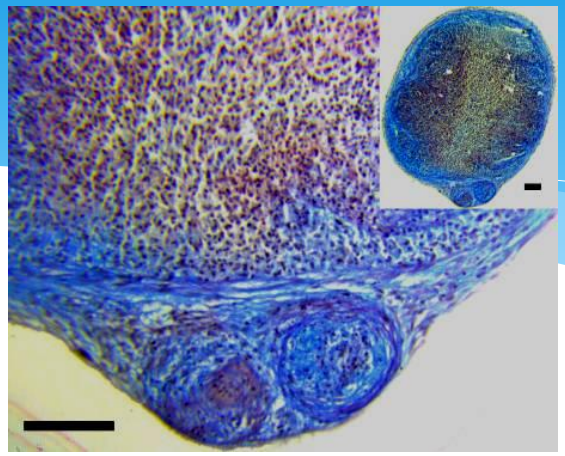






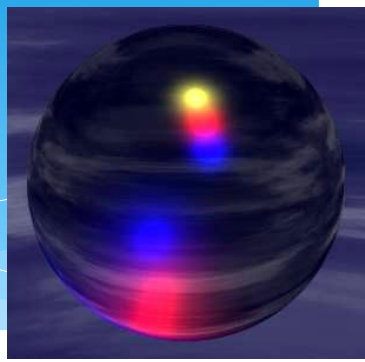
Pellet Size A/S stain DNA/ RNA content Configuration



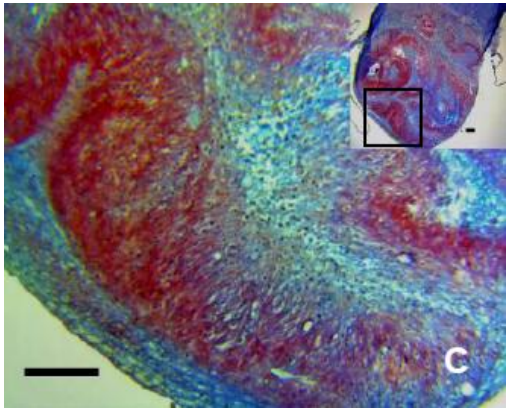


97.3 ng/ul /

10.5 ng/ul

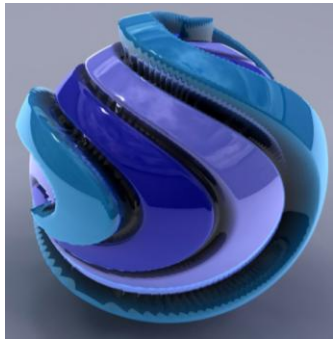


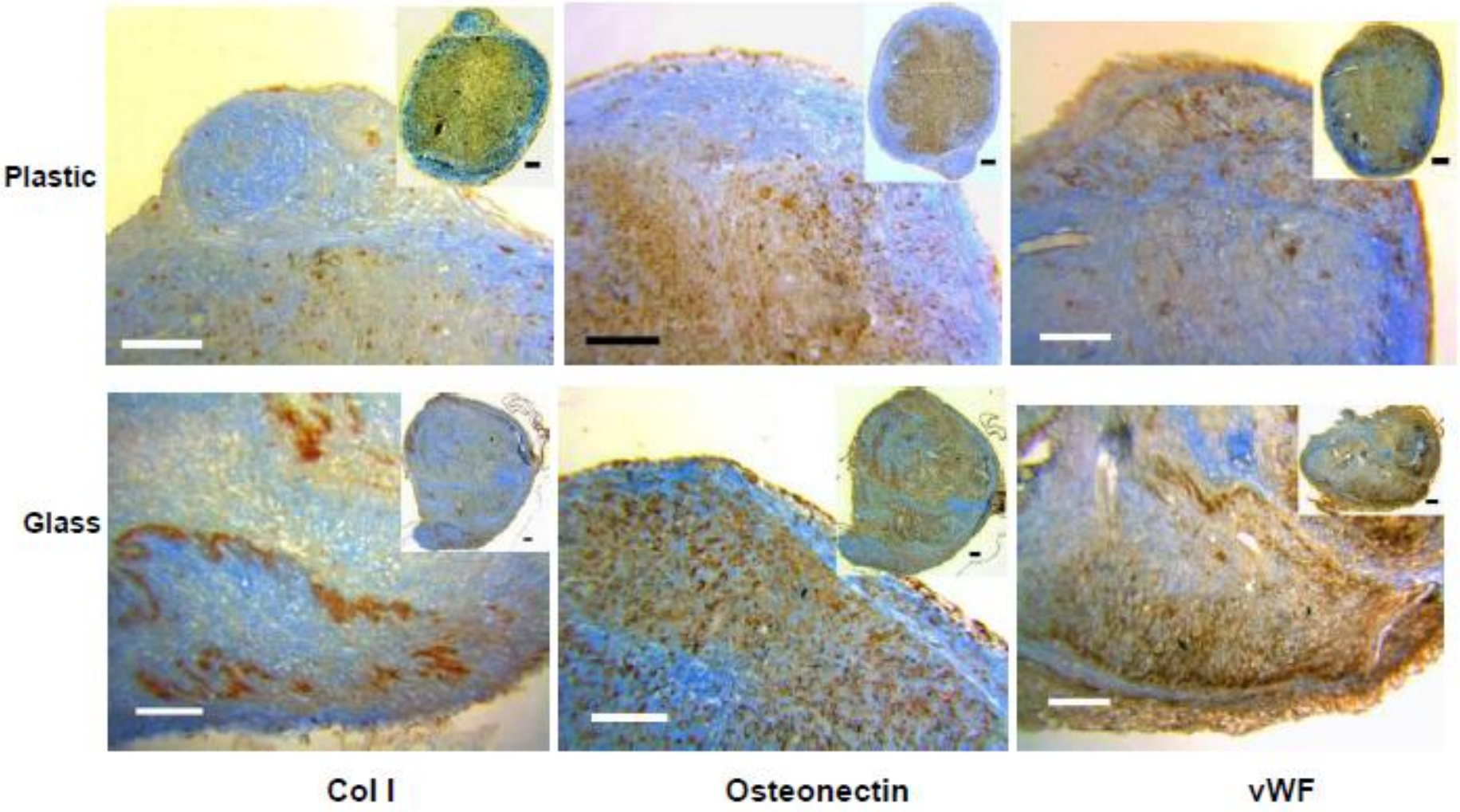


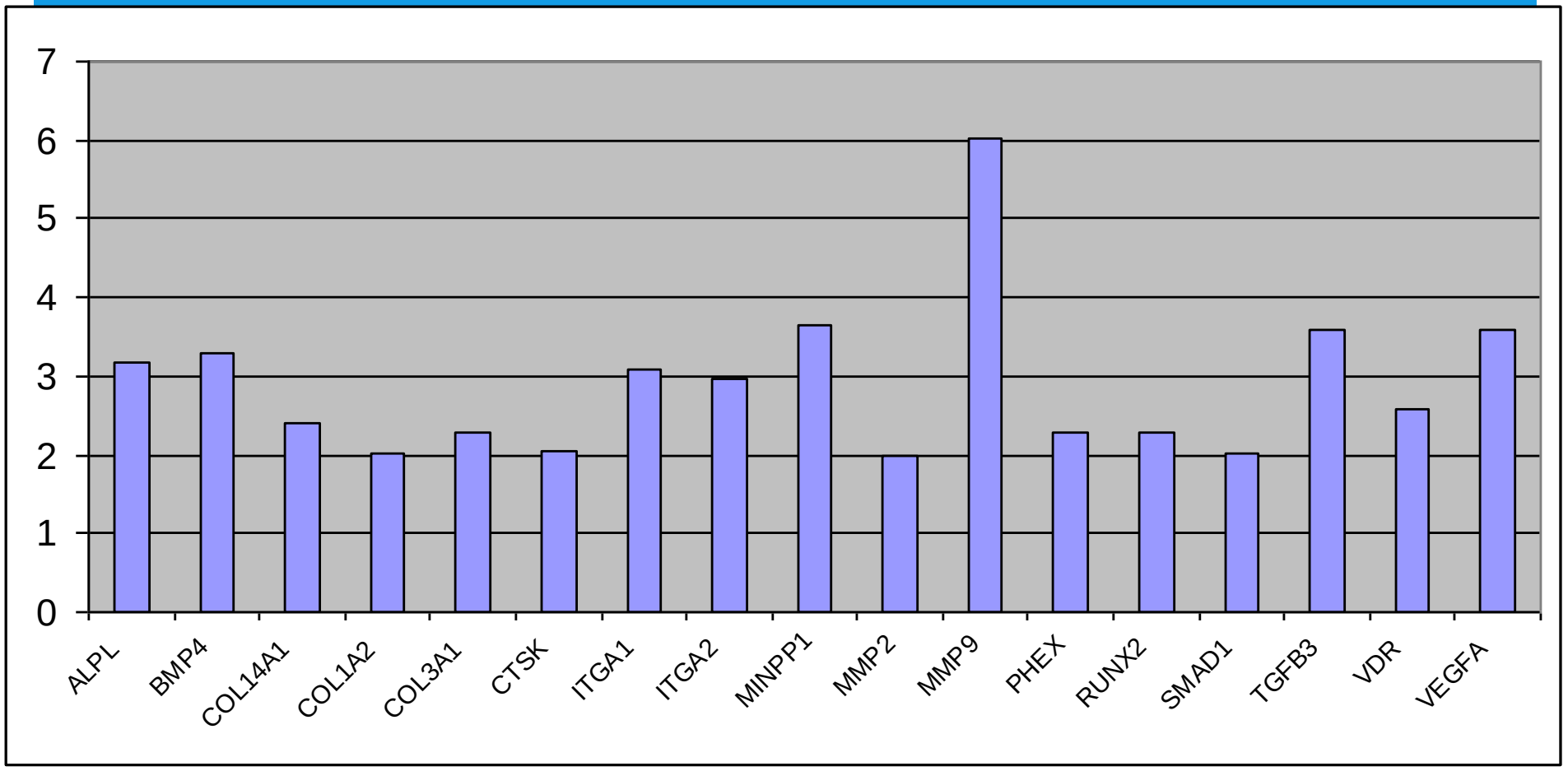


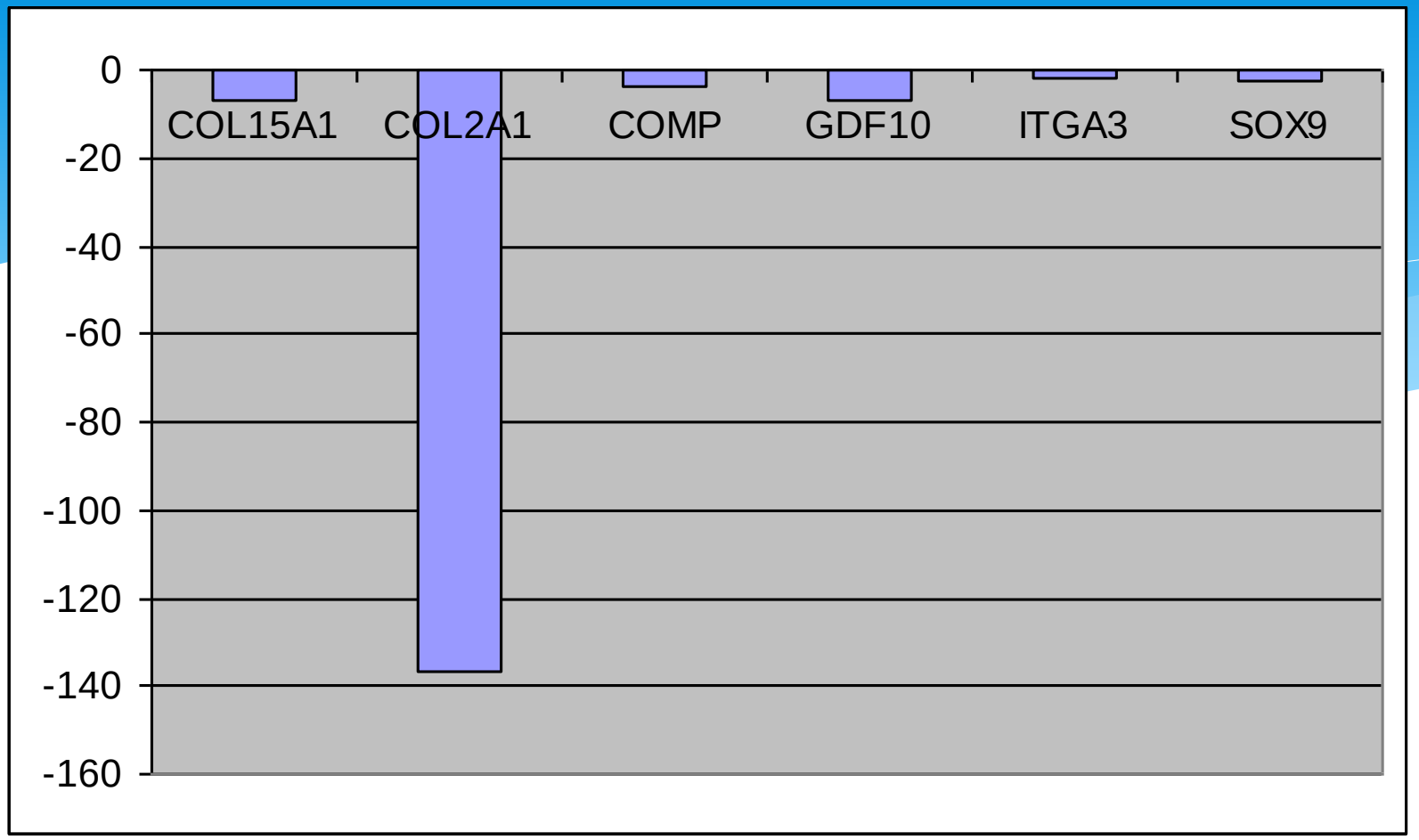
178.9 ng/ul /

240 ng/ul




Plastic
Glass
Col I
Osteonectin
vWF

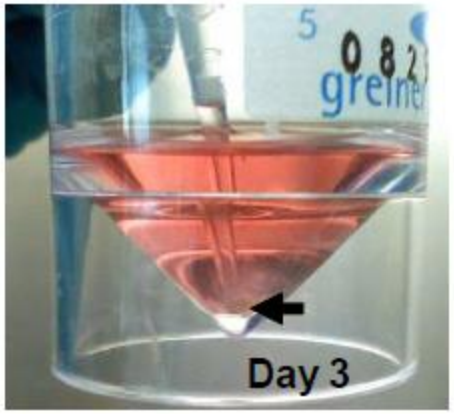

7
6
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4
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2
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ALPL
BMP4
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COL3A1
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TGFB3
VDR
VEGFA

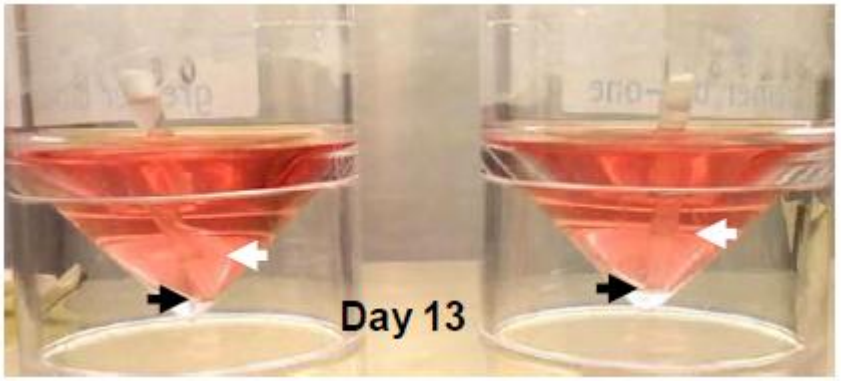


This model may have clinical application but still needs further characterization

Material effect or surface area effect?



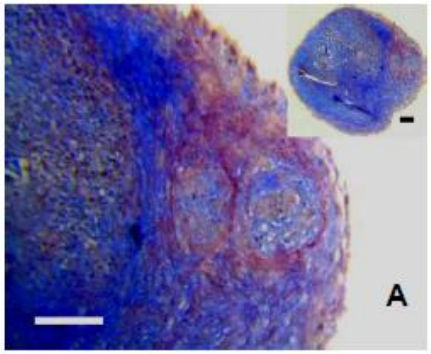


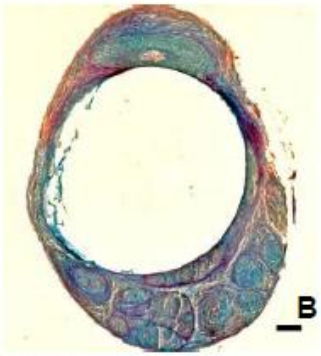


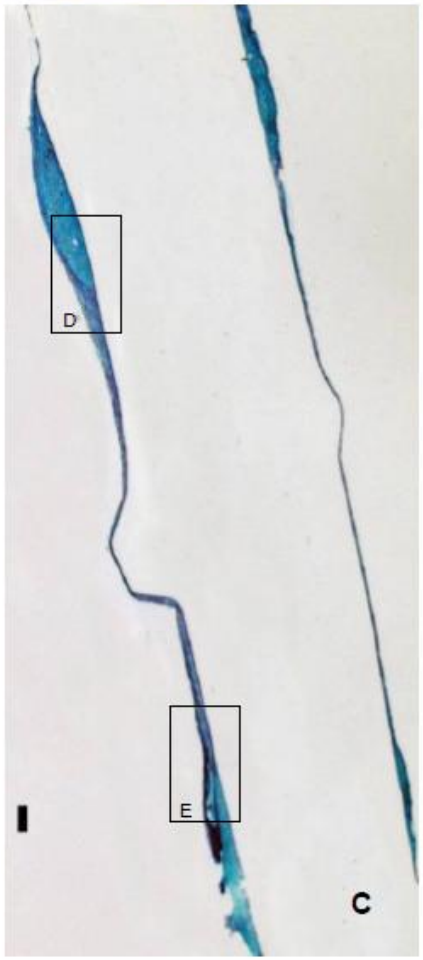


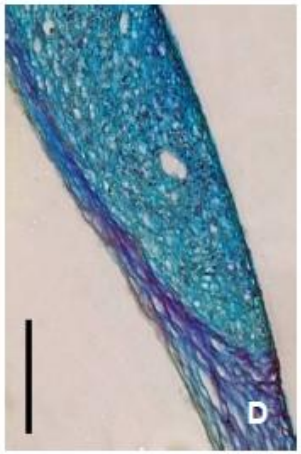


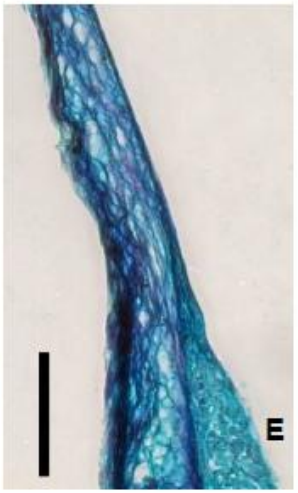




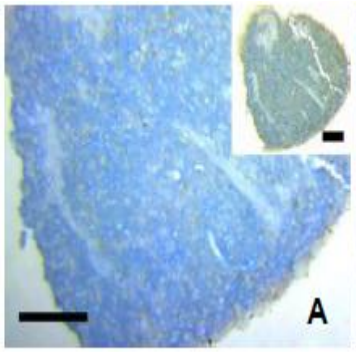


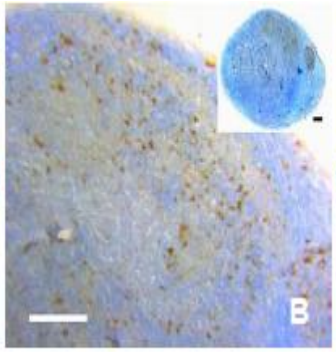


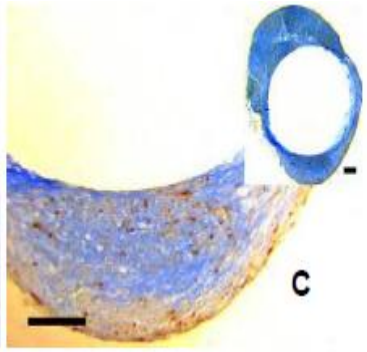




A/S staining

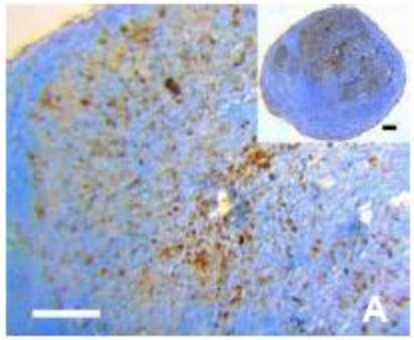


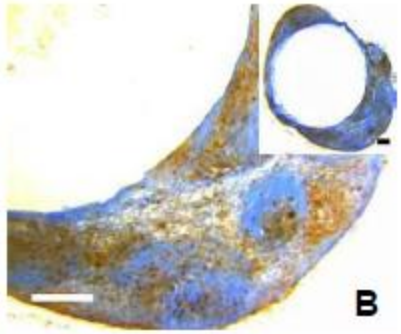


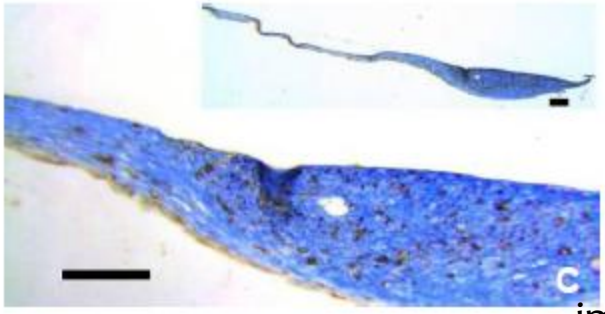




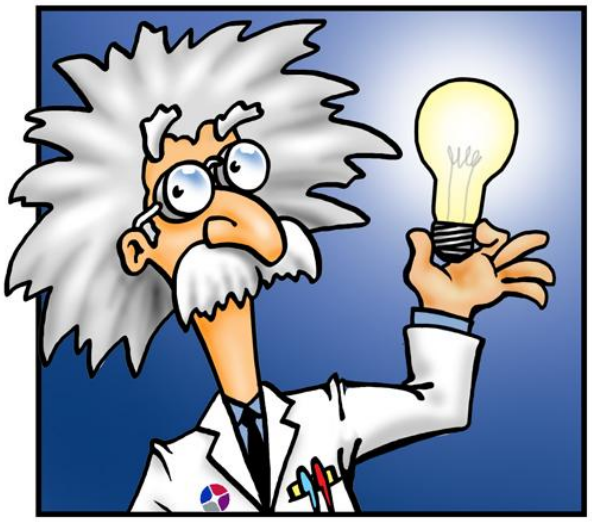
Collagen I immunostaining







Osteonectin immunostaining



Conclusion

* Three dimensional scaffold-free constructs are models for tissue culture that can resemble the physiological conditions.
* Glass based model may have a potential in bone regeneration.
* Further developments and characterization in different culture conditions may lead to new discoveries in the field of regenerative medicine.

Acknowledgement

* Prof. Richard Oreffo
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