

# Celtec introduces the ultimate research tool, U-CUP perfusion bioreactor to address the need of :

## 3D cell cultures

Adding the third dimension to a cell's environment creates significant differences in cellular characteristics and behaviour

## Advanced in vitro models

Multi-cellular models to resemble biochemical and biomechanical cues while recreating cellular environment (cell niche)

## Reduce animal use (3R's principle)

- Replacement
- Refinement
- Reduction

## Materials and methods

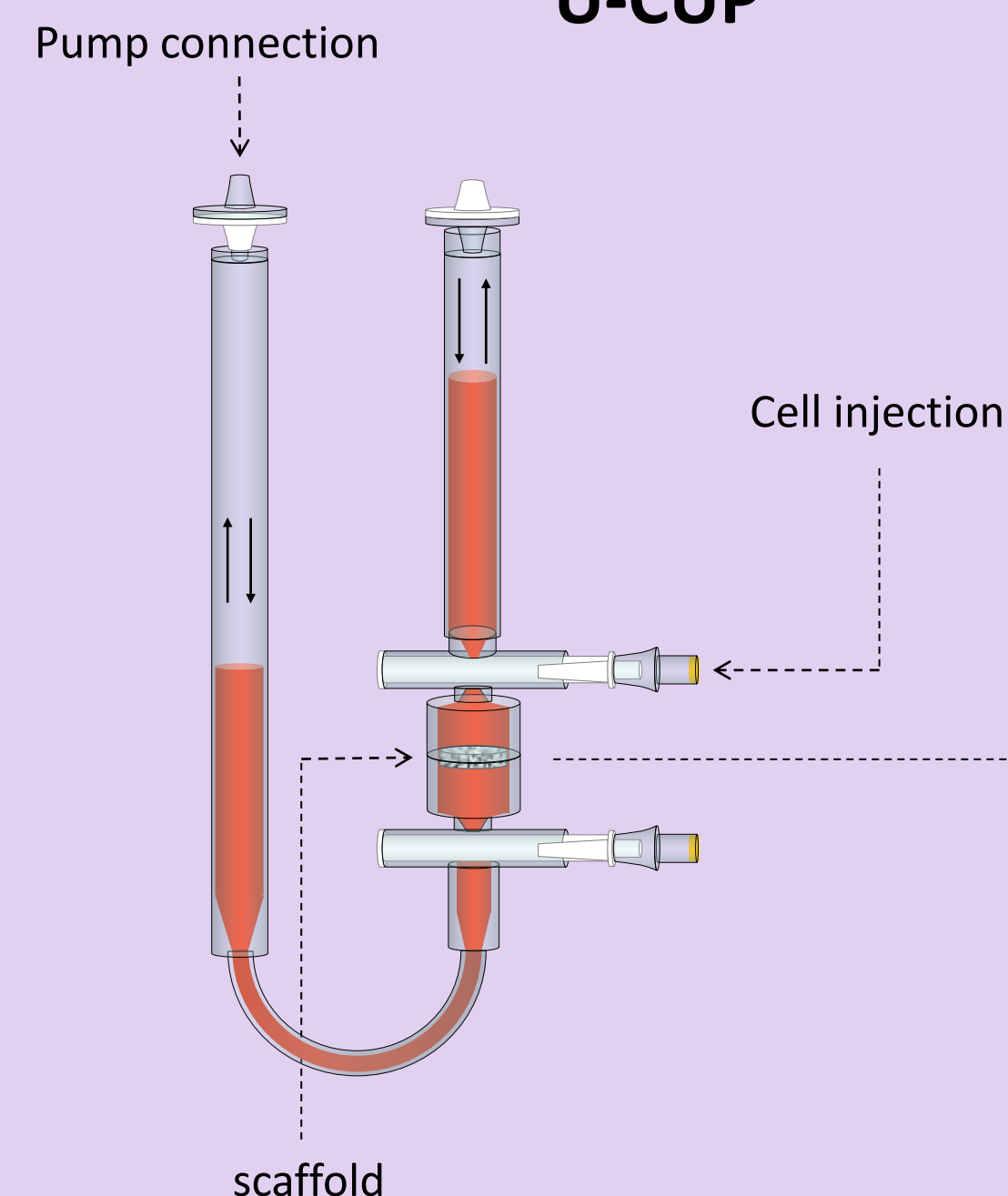
### Cells

- freshly isolated
- expanded cells
- cell lines

### Scaffold

- porous biocompatible substrate
- provides support to the cells
- offers 3D architecture

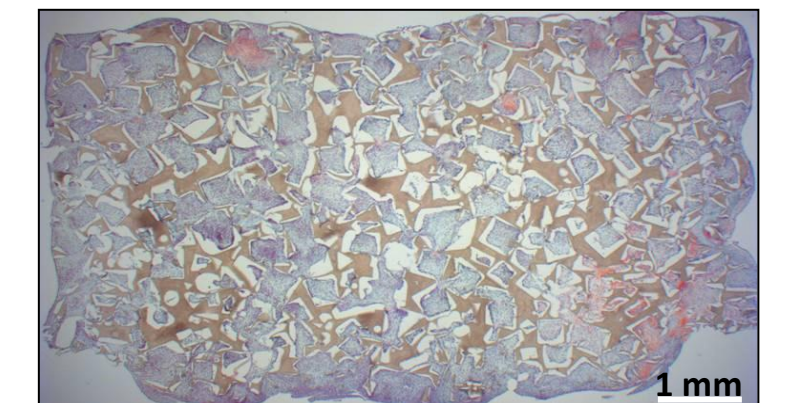
### Perfusion bioreactor device U-CUP



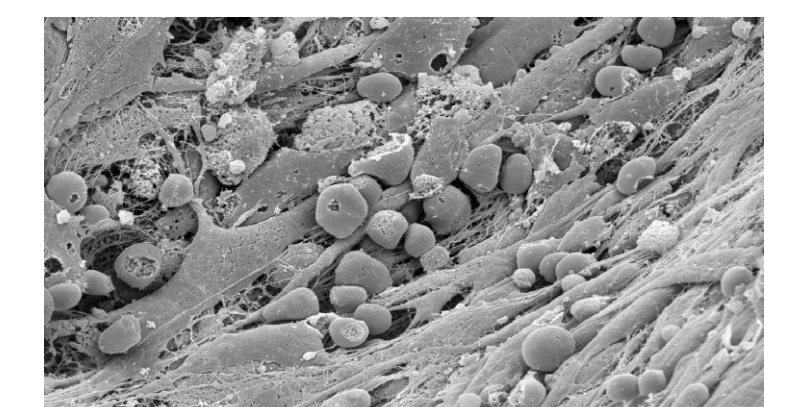
Cells and medium direct perfusion through the pores of 3D scaffold in alternate directions



Uniform cell seeding



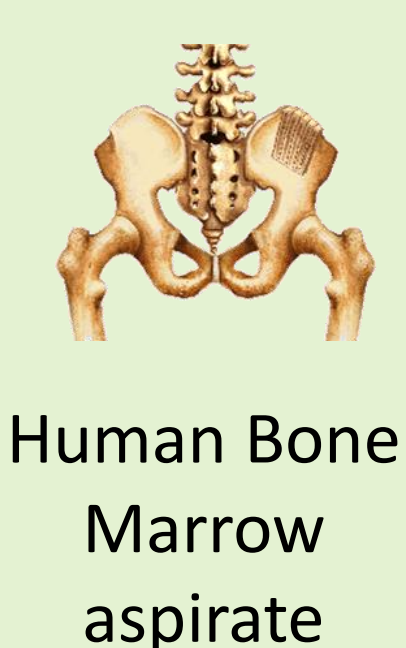
Uniform tissue formation



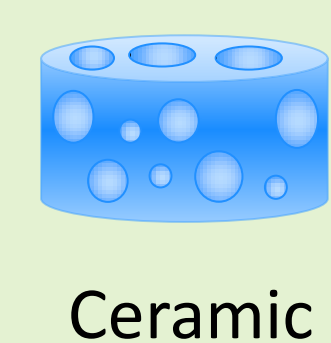
3D tissue formation

## Examples

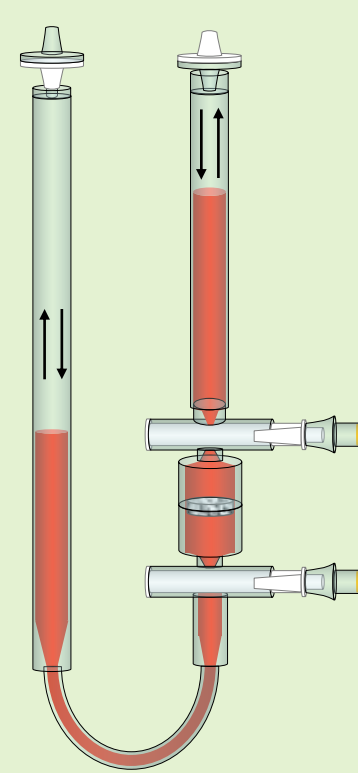
### Cells



### Scaffold

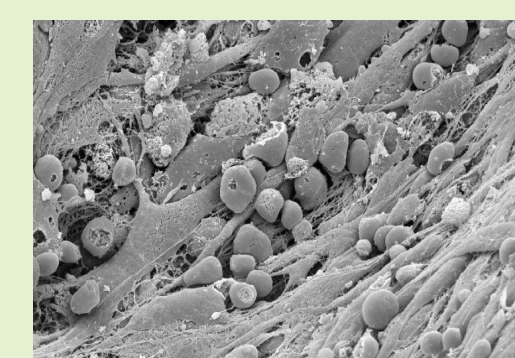


### U-CUP

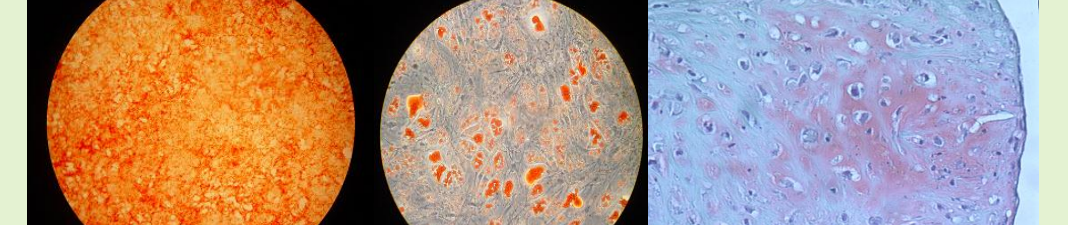
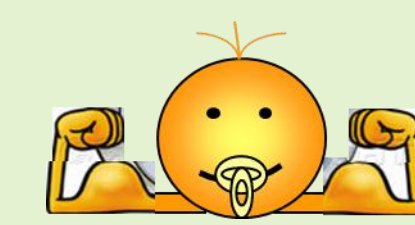
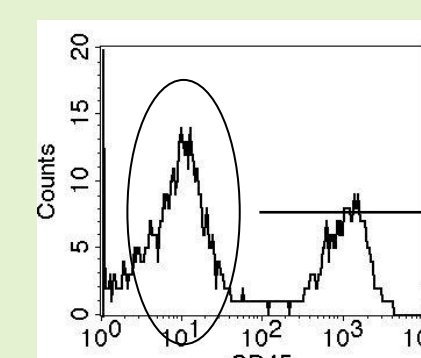


- ✓ 3D cell expansion
- ✓ Multicell Co-culture
- ✓ Stromal tissue
- ✓ Osteogenic grafts

*in vitro*

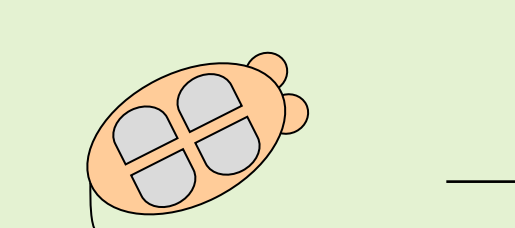


Formation of 3D stromal-like tissue and co-culture of mesenchymal stromal (CD45-) and hematopoietic cells (CD45+) within the pores of the scaffolds

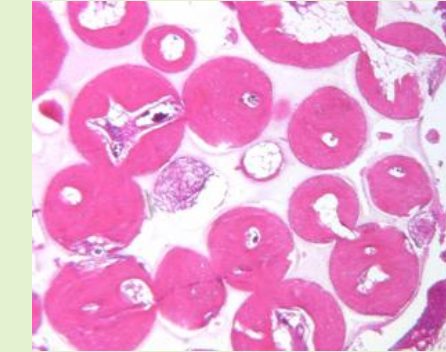


Efficient 3D expansion of mesenchymal stromal cells with maintenance of "early" progenitor functions

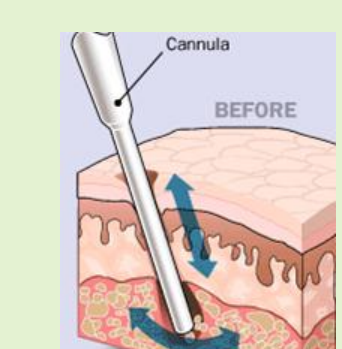
*in vivo*



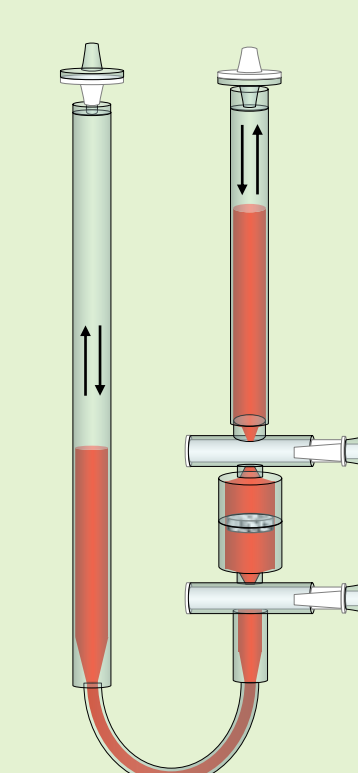
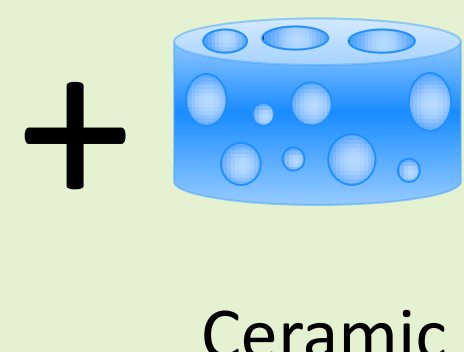
Ectopic implantation of cell-scaffold samples in nude mouse



Reproducibly high amounts of uniform bone formation

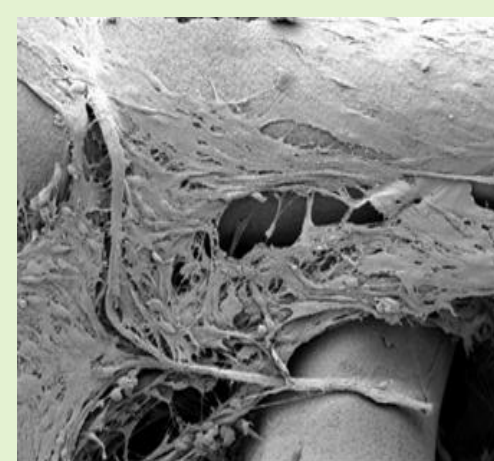


Human Lipoaspirate



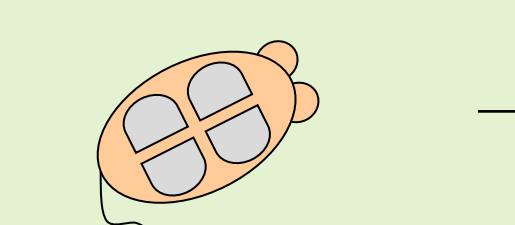
- ✓ 3D cell expansion
- ✓ Multicell Co-culture
- ✓ Stromal endothelialisation
- ✓ Osteogenic grafts
- ✓ Vasculogenic grafts

*in vitro*

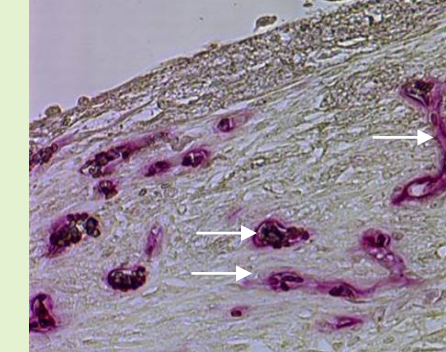


Formation of tubular structures expressing endothelial markers

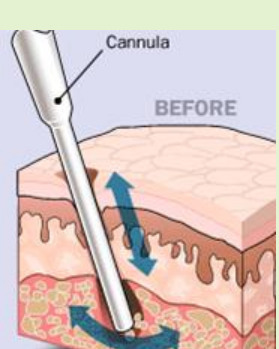
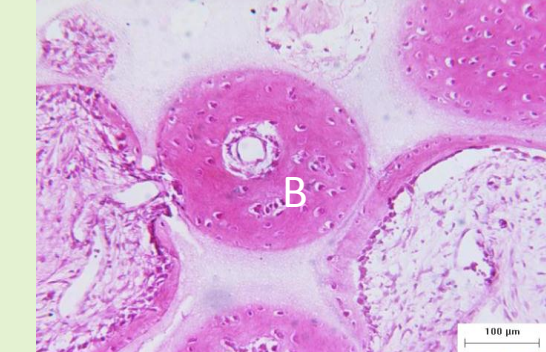
*in vivo*



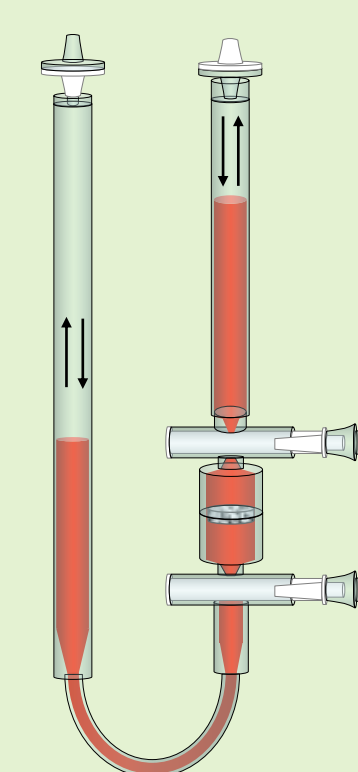
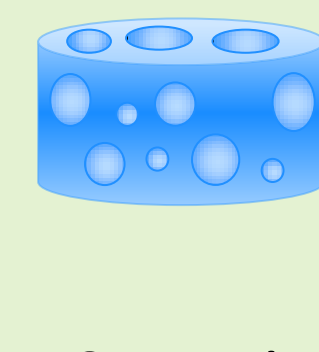
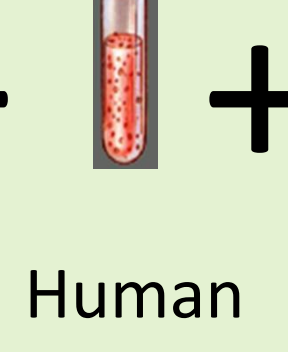
Ectopic implantation of cell-scaffold samples in nude rats



Functionally connected human vessels (arrows) with mouse vasculature and subsequent bone (B) formation

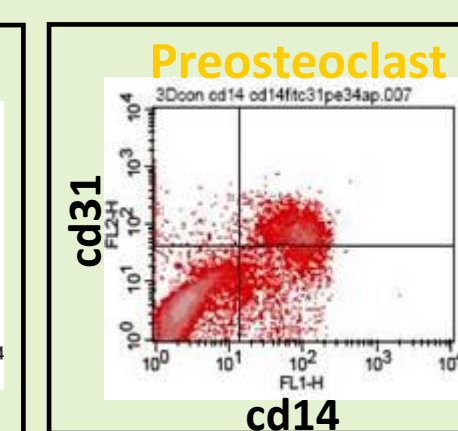
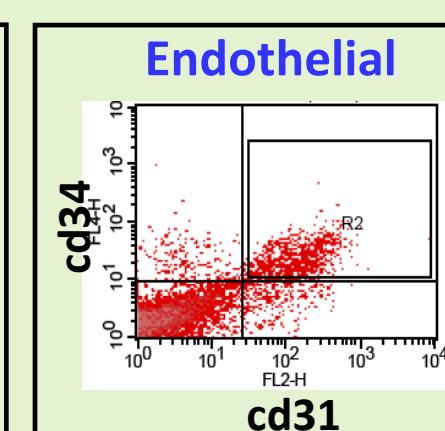
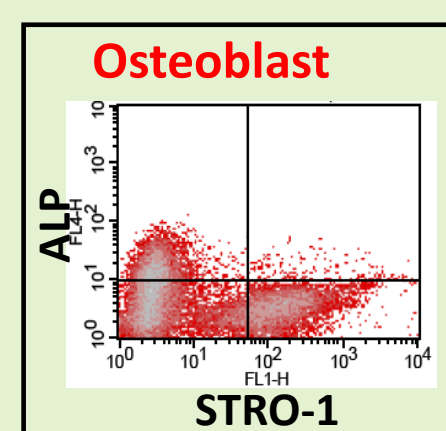


Human Lipo-aspirate

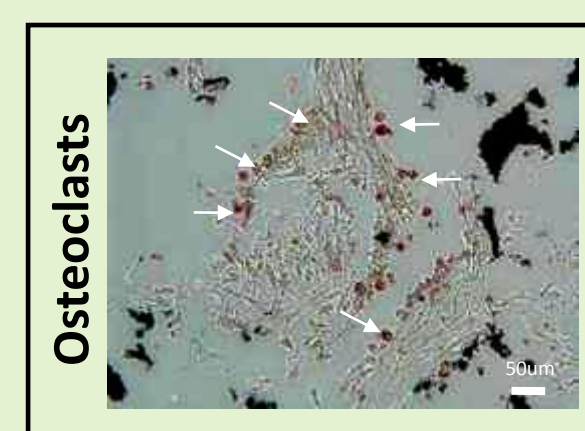


- ✓ 3D cell expansion
- ✓ Multicell Co-culture
- ✓ Stromal endothelialisation
- ✓ Bone organ model
- ✓ Advanced multifunctional grafts

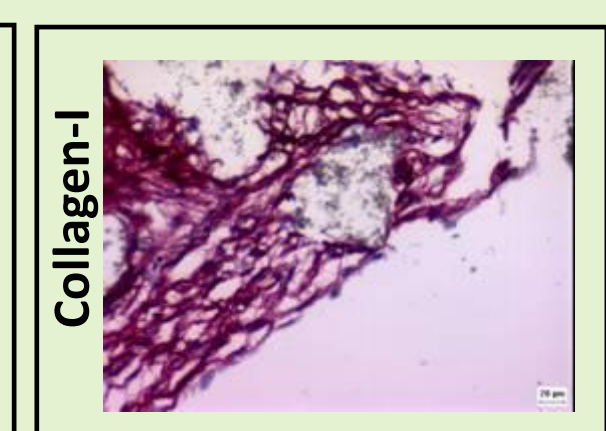
*in vitro*



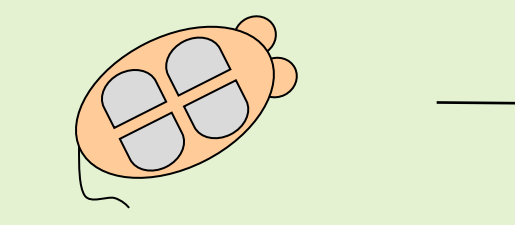
Cell phenotype by cytofluorimetry



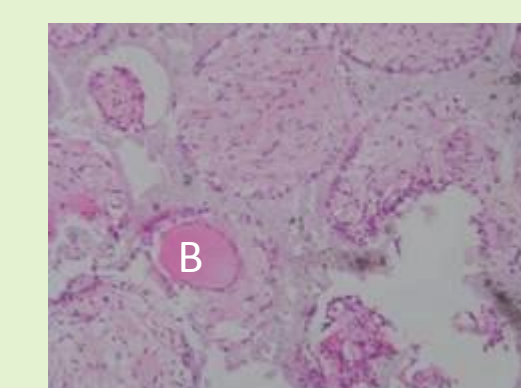
Osteoblast / Osteoclast (arrow) mediated remodelling of cell-laid extracellular matrix



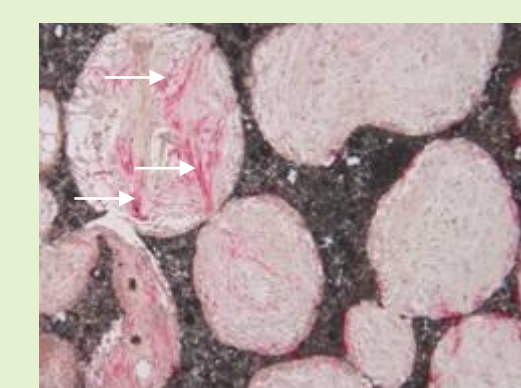
*in vivo*



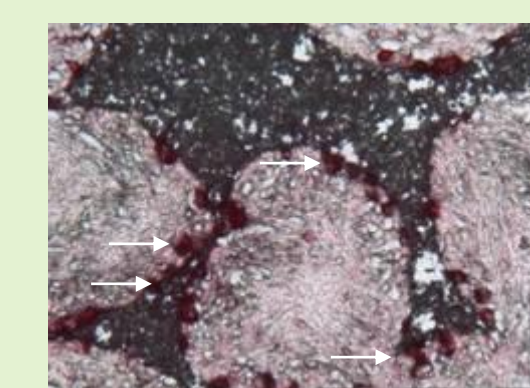
Ectopic implantation of cell-scaffold samples in nude mice



Bone (B)



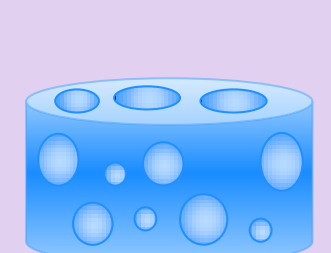
Human Vessels (arrows)



Osteoclasts (arrows)

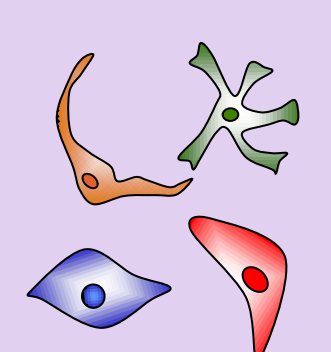
## Parameters modulation

### 3D SCAFFOLD PROPERTIES



- Architecture, Composition, Stiffness
- Molecular Functionalization
- Cell-Matrix and Cell-Scaffold Interactions

### CO-CULTURE OF DIFFERENT CELL TYPES

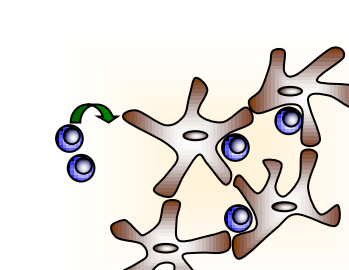


- Structural Organization
- Cell-Cell Interaction
- Cytokines Secretion
- Auto-regulation (niche establishment)

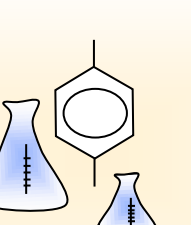
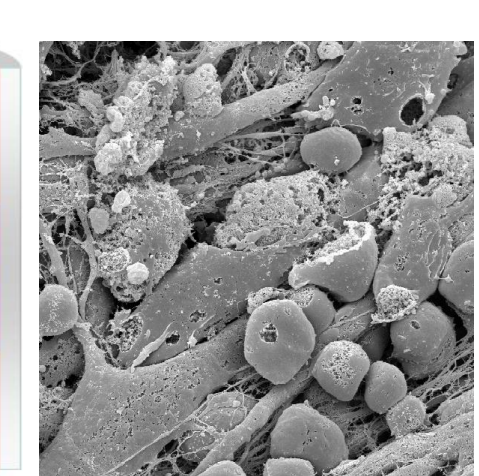
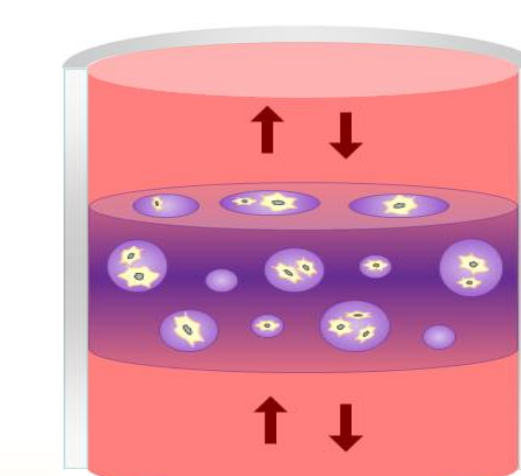
### CULTURE CONDITIONS

- Exogenous Cytokines
- Dissolved Oxygen Concentration, pH
- Shear Stress
- Feeding Mode

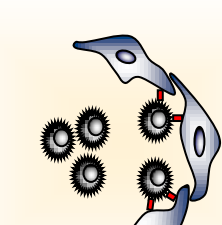
## Applications



Advanced biological studies under physiologic conditions (e.g. investigate signals controlling HSC function)

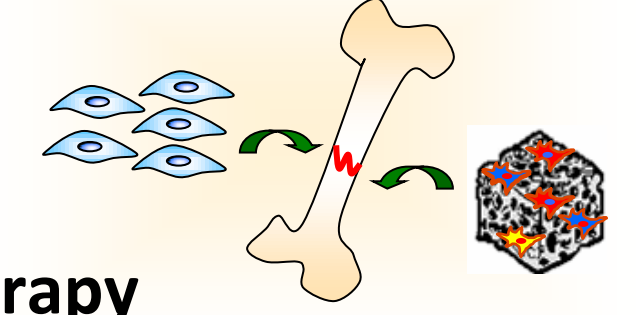


Platform for drug screening (e.g. drugs that regulate bone homeostasis)



Advanced biological studies under pathologic conditions (e.g. osteoporosis, bone-tumour interaction and metastasis)

Cell therapy



Graft generation