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Océane Messaoudi, Christel Henrionnet, Laurent Grossin, Pierre Gillet, Didier Mainard, Laurent Galois, Damien Loeuille, Christophe Marquette, Astrid Pinzano

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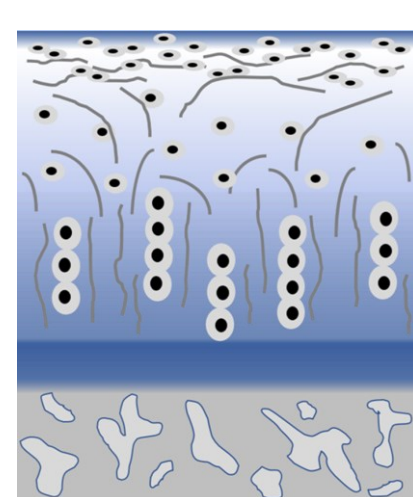
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Interest of type I collagen as an additive in an alginate-based bioink for the production of cartilaginous substitutes by 3D printing

Océane MESSAOUDI*, Christel HENRIONNET, Laurent GROSSIN, Pierre GILLET, Didier MAINARD, Laurent GALOIS, Damien LOEUILLÉ, Christophe MARQUETTE and Astrid PINZANO

Introduction

Hyaline cartilage



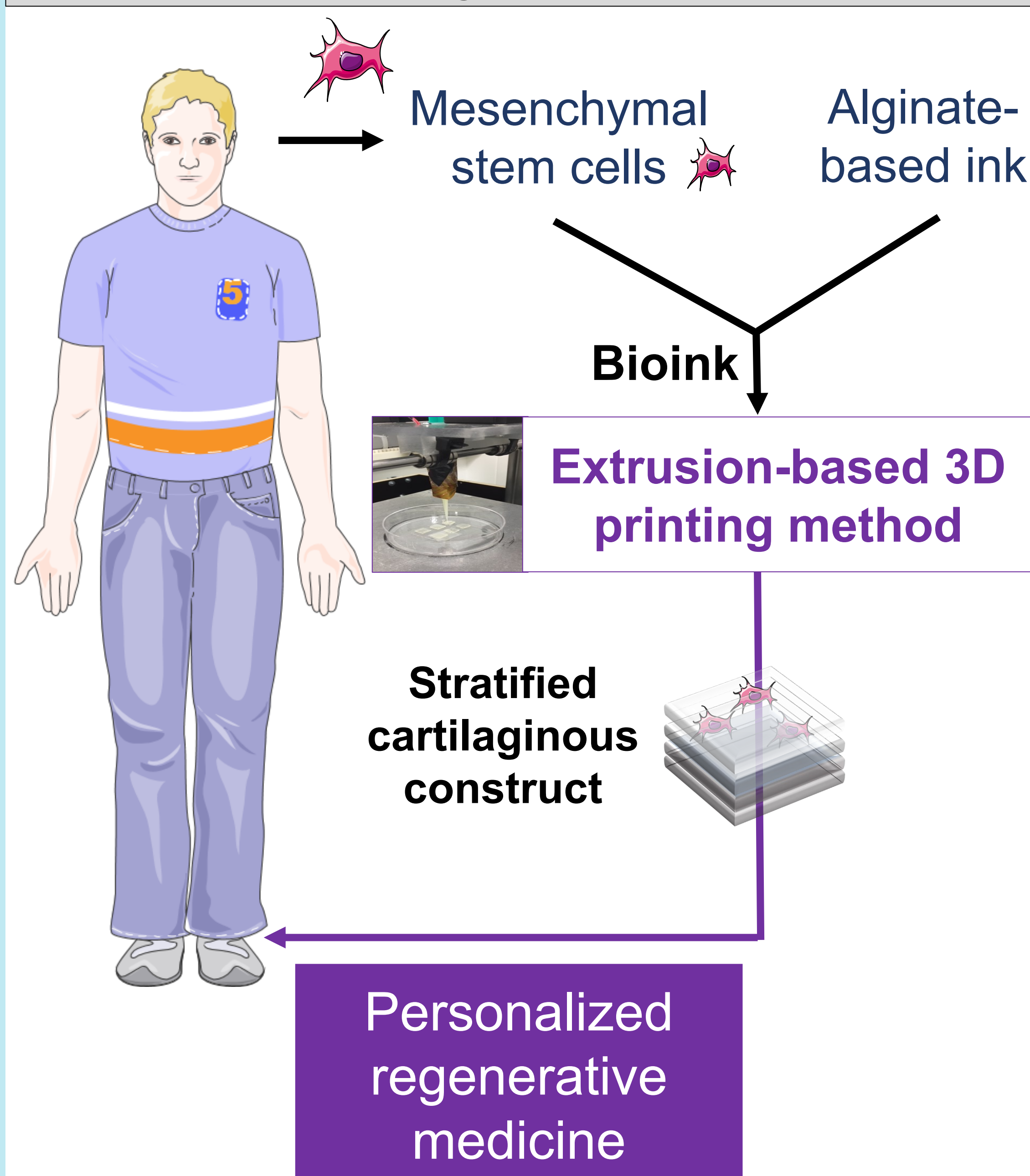
Stratified
Non vascularized
Non innervated
→ **Limited self-repair properties**

Trauma or Overload



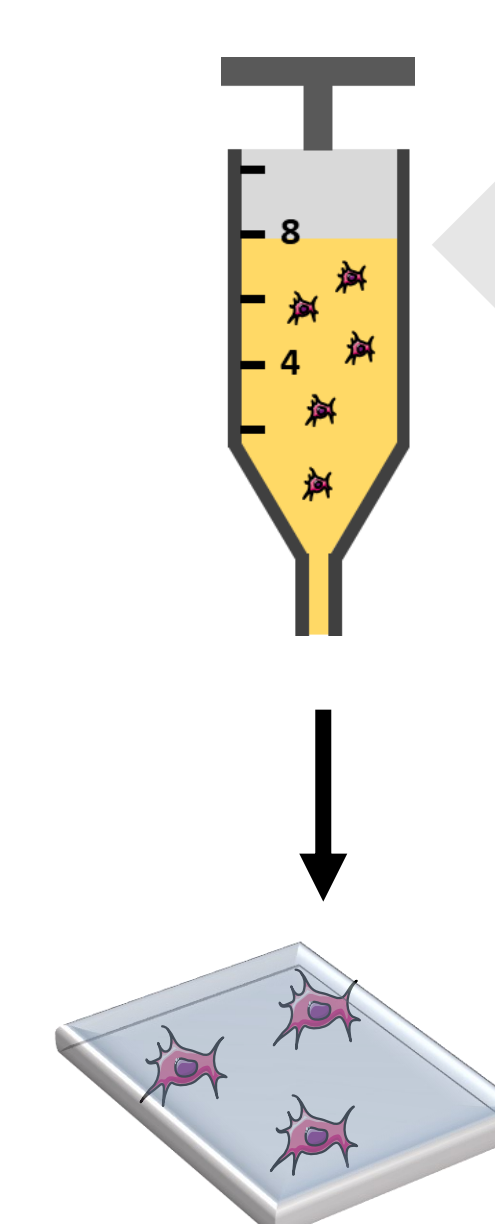
Focal lesions :
Chondral
Osteochondral

Objectives



Methods

Cellularized bioink



Addition

Type I collagen

0, 0.5, 1 or 5 mg

Maturation : 28 or 56 days

Conditions :

ITS 1%: Control

TGF-β1: Chondro-inductor

Analyses :

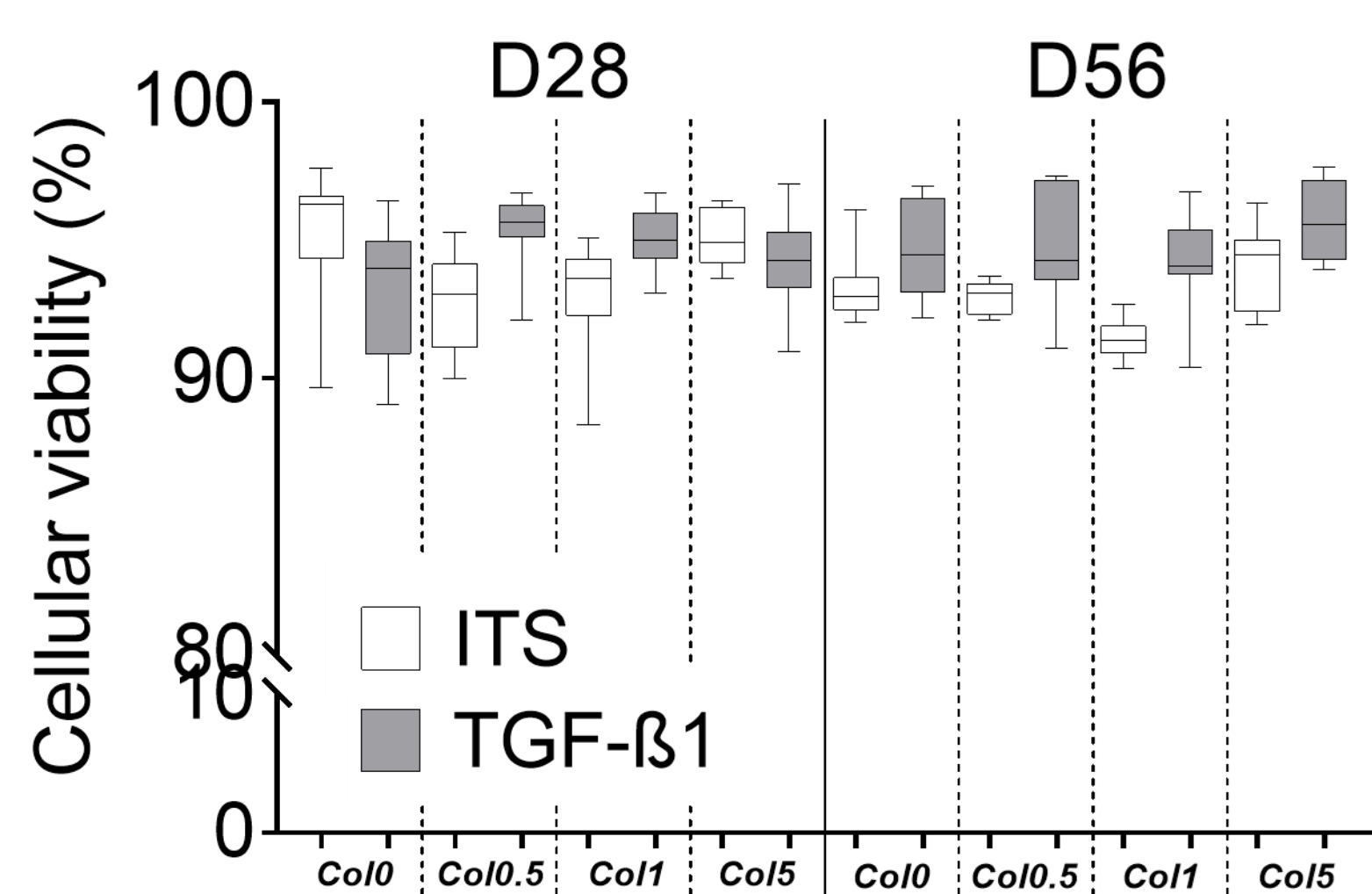
Cellular viability : LDH assay

Genes expressions : RT-qPCR

Matrix synthesis : Histological stainings

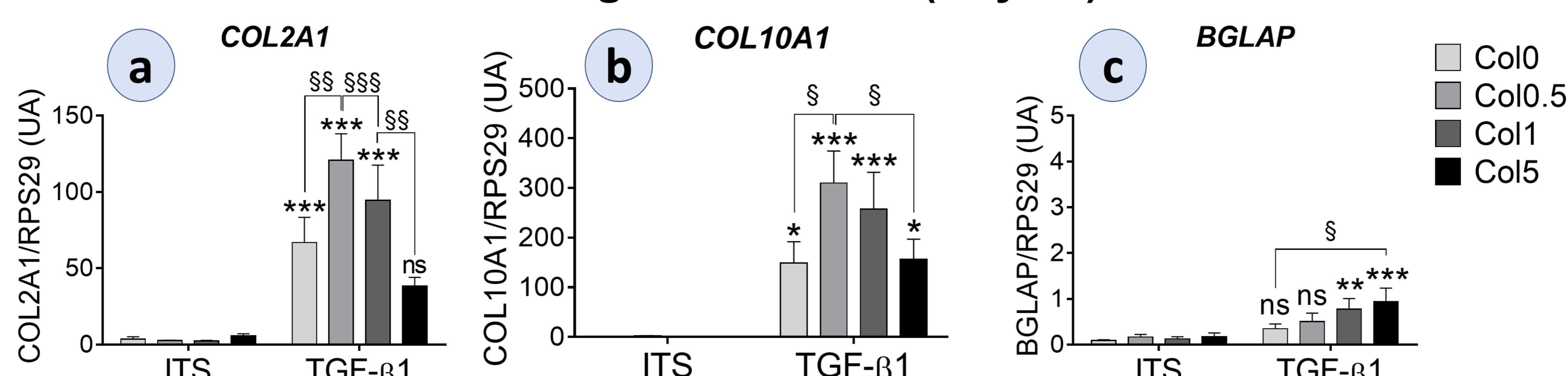
Results

1. Viability assay (LDH)

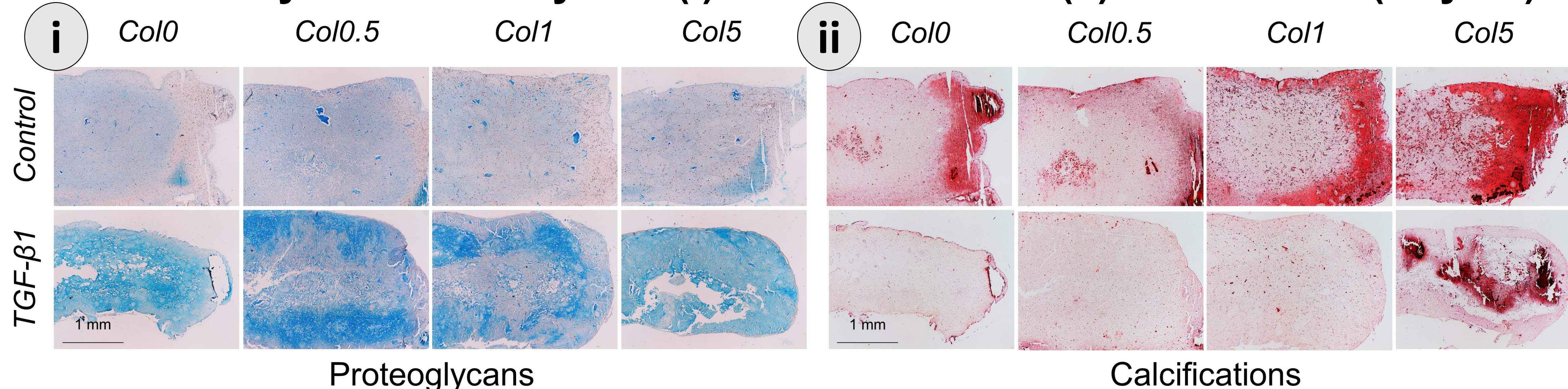


Mean ± SEM. Effect of TGF-β1: * p < 0.05, ** p < 0.01, and *** p < 0.001. Effect of the bioink composition: § p < 0.05, §§ p < 0.01, and §§§ p < 0.001. ; ns: not significant.

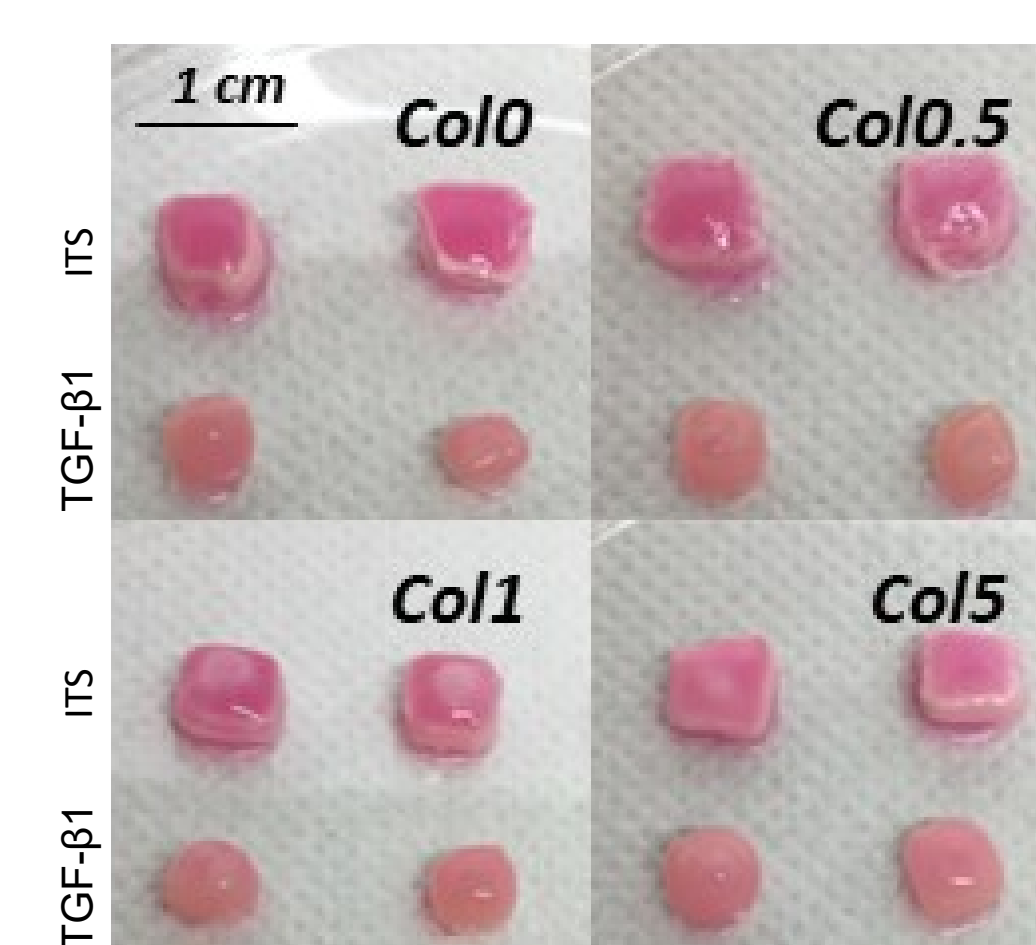
2. Gene expressions of (a) chondrogenic, (b) hypertrophic and (c) osteogenic markers (Day 28)



3. Matrix synthesis analyses: (i) Alcian blue and (ii) Alizarin red (Day 56)



Macroscopic view

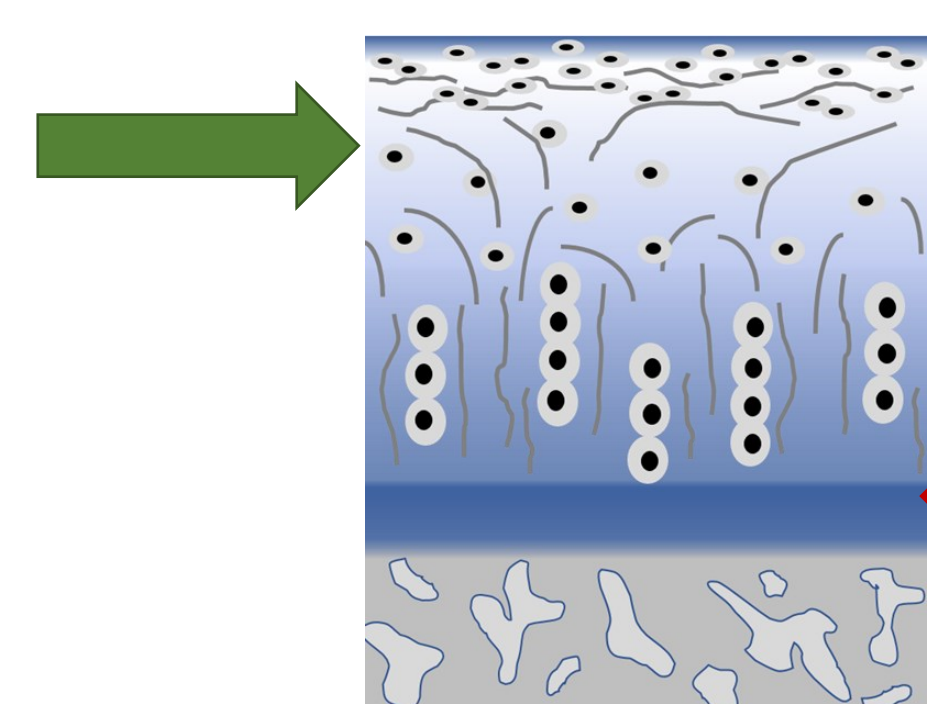


Conclusions

Low type I collagen addition (0.5mg) :

- Proteoglycans
- Type II collagen
- Calcifications

➔ **Rich matrix adapted to recreate the superficial layers of the cartilage**

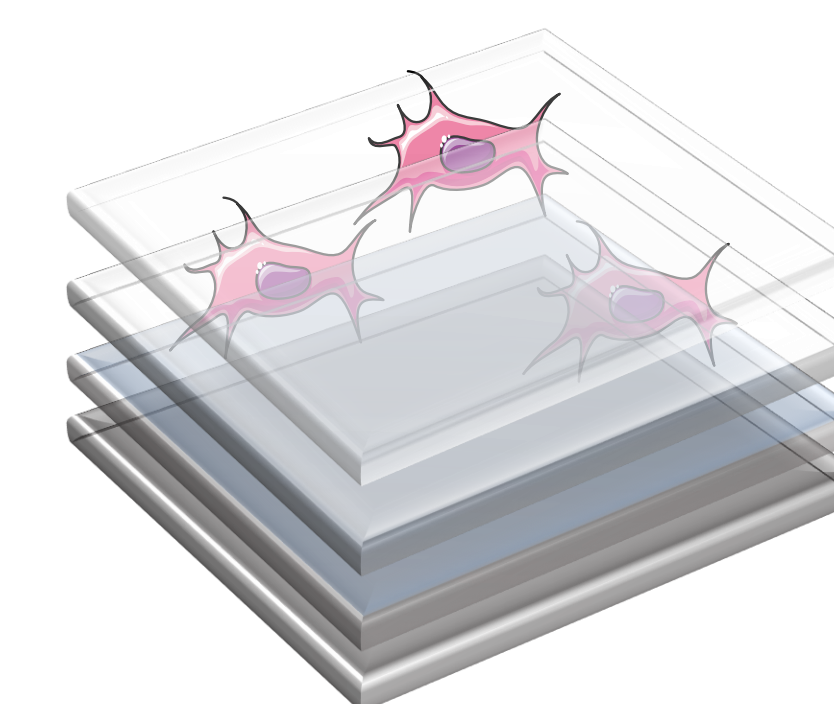


High type I collagen addition (5mg) :

- Proteoglycans
- Type II collagen
- Calcifications

➔ **Calcified matrix mimicking the calcified layer of the cartilage**

Perspectives



Producing a stratified cartilaginous construct