



# species and tissue Specific extracellular Matrix produced by mesenchymal stem cells for Representative in vitro models and Tissue Engineering

*Commonly used acronym: SMarTEr*

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## Organisation

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**Country** Belgium

**Geographical Area** Flemish Region

**Name of the organisation** Ghent University (UGent)

Polymer Chemistry & Biomaterials Group, Department of Organic and

**Department** Macromolecular Chemistry

**Country** Belgium

**Geographical Area** Flemish Region

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Animal health, Human health
<b>The Method is situated in</b>	Basic Research

<b>Type of method</b>	In vitro - Ex vivo
<b>Species from which cells/tissues/organs are derived</b>	human, horse, dog, cattle, pig
<b>Type of cells/tissues/organs</b>	fat tissue, skin tissue, intestinal tissue

## DESCRIPTION

### Method keywords

biomaterials  
 skin  
 intestine  
 adipose tissue  
 extracellular matrix

### Scientific area keywords

Tissue engineering  
 3D in vitro models  
 mesenchymal stromal cells  
 Organoids

### Method description

The extracellular matrix (ECM) is a highly organized tissue-specific network, which is secreted by tissue-resident cells and significantly influences cell phenotype, behaviour and function. The 3R principle calls for the replacement of animal models in areas like drug screening, and consequently, numerous 3D *in vitro* models are being developed. A key element, however, is providing an adequate, controlled environment for cell expansion and differentiation by dynamically displaying appropriate mechanical properties and the correct biochemical and biophysical cues, similar to the ECM *in vivo*. Additionally, in regenerative medicine, tissue engineering (TE) strategies are used to restore the physiological architecture and biomechanical function after injury. In this project, cell-derived ECM is being used as an alternative to the commonly used, but badly defined, murine tumor-derived

matrices, such as Matrigel and Geltrex. Mesenchymal stromal cells (MSCs) are multipotent adult stem cells that reside in nearly all tissues and organs and play an important role in tissue homeostasis. After isolating MSCs from various tissues, a species- and tissue-specific matrix can be harvested to represent the (patho-) physiological microenvironment. Using chemical modification, the mechanical properties of the ECM-based biomaterial can be tuned towards various applications, ranging from adipose and skin TE to intestinal organoid models. Additionally, the biomaterial will be processable using various additive manufacturing techniques, such as 3D extrusion printing, light-based printing (DLP, SLA) and volumetric printing to further improve biomimicry of the models. The development of these species- and tissue-specific biomaterials will further enhance the design of reliable *in vitro* models and improve the outcomes of regenerative medicine.

### **Lab equipment**

- Laminar air flow,
  - Centrifuge,
  - Incubator,
  - Freeze-dryer,
  - UVA-light source,
  - Spectrophotometer for biomaterial evaluation,
  - Rheometer for biomaterial evaluation,
  - 3D bioprinter,
  - electrospinning set-up,
  - volumetric printer, ...
- depending on application.

### **Method status**

Still in development

## **PROS, CONS & FUTURE POTENTIAL**

### **Advantages**

- Mimicking the natural composition of extracellular matrix,
- Chemically defined material,
- Easy-to-use Tuneability (e.g. chemical composition and mechanical properties),

- Compatible with multiple biofabrication methods.

## Challenges

- Low throughput at this moment,
- Still in optimization process.

## Modifications

Further optimization is currently under investigation in order to make the matrices tuneable for printing and/or modelling purposes.

## Future & Other applications

Currently, cell-derived ECM was generated from equine, bovine, porcine and human MSCs, isolated from skin, adipose or small intestinal tissue. The method, however, can be easily translated to other MSCs and the biomaterial can be used for various organoids and cell cultures in general although optimization per application will be required.

## REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

### Links

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