Soft Matrix for Tissue engineeRing and in vitro modelling

Commonly used acronym: *SMarTer*

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Organisation

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Department

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Specific Research Group or Service Veterinary Stem Cell Research Unit

Country Belgium

Name of the organisation Ghent University (UGent)

Department

Polymer Chemistry & Biomaterials Group, Department of Organic and Macromolecular Chemistry

Country Belgium

SCOPE OF THE METHOD

The Method relates to	Animal health, Human health

The Method is situated in	Basic Research
Type of method	In vitro - Ex vivo
Species from which cells/tissues/organs are derived	human, horse, dog, cattle, pig
Type of cells/tissues/organs	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 form 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

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