Mouse in-vitro spermatogenesis on alginate-based 3D bioprinted constructs

Commonly used acronym: *IVS*

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Organisation

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SCOPE OF THE METHOD

The Method relates to	Animal health, Human health
The Method is situated in	Basic Research
Type of method	In chemico
Species from which cells/tissues/organs are derived	Mouse
Type of cells/tissues/organs	Testis

DESCRIPTION

Method keywords

3D in vitro model

3D bioprinting

organoid culture

microscaffolds

extrusion-based 3D printing

Scientific area keywords

fertility preservation

reprotoxicity

preclinical

Drug discovery

drug development

testicular physiology

Method description

Studying spermatogenesis *in situ* has led to the understanding that the 3D reorganization of testicular cells into an interstitial and tubular compartment is of enormous importance for germ cell differentiation. We will rely on 3D bioprinting technology which gives control over cell deposition and scaffold design, to recreate the compartmentalization of the testis *in vitro*. Testicular constructs will be produced by culturing epithelial testicular cell fractions in the macropores of bioprinted interstitial cell-laden scaffolds. We expect these biomimetic scaffolds will also support differentiation of human germ cells.

Lab equipment

Extrusion-based 3D printer;

Air compressor;

Hydrogel;

Fluorescence activated cell sorter or magnetic activated cell sorter;

Fluorescence microscope.

Method status

Still in development

Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

Allows manipulation of cell suspensions before culture to help understand the many mechanisms controlling testicular physiology and spermatogenesis, but also to discover new clinical targets.

Challenges

Requires high cell concentrations ;

Lack of bioactivity or biocompatibility of the hydrogel ;

Uncertainty related to the medium ingredients that drive testicular morphogenesis and spermatogenesis.

Modifications

Use of higher cell concentrations ;

Use of alternative hydrogels ;

Optimisation culture medium.

Future & Other applications

Tool to study testicular physiology through cell manipulation or gene editing ;

In vitro derived sperm of prepubertal cancer patients and adult non-obstructive patients can be used to generate offspring through assisted reproduction ;

Cell therapy ;

Following the incorporation into multi-organs microfluidic devices, the constructs can serve as a high-throughput screening assay in preclinical tests.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Baert, Y., Dvorakova-Hortova, K., Margaryan, H. & Goossens, E. (2019) Mouse *in vitro* spermatogenesis on alginate-based bioprinted scaffolds. Biofabrication 11, 035011

Richer, G., Hobbs, R., Loveland, Kate., Goossens, E., Baert, Y. (2021) Long-term maintenance and meiotic entry of early germ cells in murine testicular organoids functionalized by 3D printed scaffolds at the air-medium interface cultivation. Frontiers in Physiology 12, 757565

Associated documents

Baert_2019_Biofabrication.pdf

Richer et al. 2021.pdf

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