Mouse in vitro follicle culture bioassay for fundamental and translational research on oocyte developmental capacity

Created on: 03-10-2019 - Last modified on: 08-11-2019

SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo
This method makes use of	Animal derived cells / tissues / organs
Species from which cells/tissues/organs are derived	mouse
Type of cells/tissues/organs	ovarian follicles

DESCRIPTION

Method keywords

in vitro
oogenesis
folliculogenesis
oocyte maturation

Scientific area keywords

follicle culture
fertility preservation
in vitro oocyte maturation
assisted reproductive technology
oocyte quality

Method description

Follicle Biology Laboratory has developed a well characterized and standardized MOUSE *in vitro* follicle culture (IFC) system. In this system, early stage ovarian follicles are cultured *in vitro* under physiological hormone concentrations up to fertilizable and developmentally competent mature oocytes. The follicle culture bioassay provides unique opportunities to study ovarian physiology and to assess the effects of adverse metabolic, nutritional, toxicological or environmental exposure on epigenetic reprogramming, folliculogenesis and oocyte quality. The IFC system allows identifying molecules and pathways that affect oocyte quality. Furthermore, *in vitro* systems for oocyte maturation (IVM) allow determining windows of sensitivity. Finally, the mouse IFC and IVM systems are a model for translational research in the context of human fertility preservation strategies and optimized IVM protocols in infertile patients.

Lab equipment

- Cabinet laminar flow with: hot plate and stereomicroscope equipped with a hot plate ;

- Inverted microscope with 40x objective and ocular scale for measurement ;
- Incubators (5%CO2, normal oxygen).

Method status

History of use
Internally validated
Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- *In vitro* development allows the standardized growth and maturation of high numbers of ovarian follicles at the same developmental stage. This is not achievable *in vivo* in an efficient way.
- The system has already been extensively characterized (published in peer reviewed journals).
- The system has great potential as a bioassay for testing exposure to adverse conditions.

Challenges

Developmental capacity of the cultured oocytes is still inferior compared to *in vivo* developed counterparts. The system would benefit from further optimization.

Modifications

We plan a project on the optimization of the IFC system.
Strategy:
- 3D culture system
- Incorporation of extracellular matrix components

- Addition of specific hormones and growth factors that might enhance developmental capacity
- Addition of somatic feeder cells

Future & Other applications

After optimization the IFC system will result in a bioassay with targeted endpoints for testing of culture media, pharmacological and toxicological compounds and metabolic and nutritional challenges with potential for valorization.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

In vitro follicle culture in the context of IVF. Herta AC, Lolicato F, Smitz JEJ. Reproduction. 2018
Immature Oocytes from Unprimed Juvenile Mice Become a Valuable Source for Embryo Production When Using C-Type Natriuretic Peptide as Essential Component of Culture Medium. Romero S, Sánchez F, Lolicato F, Van Ranst H, Smitz J. Biol Reprod. 2016.
Culture of oocytes and risk of imprinting defects. Anckaert E, De Rycke M, Smitz J. Hum Reprod Update. 2013
Oocyte and cumulus cell transcripts from cultured mouse follicles are induced to deviate from normal *in vivo* conditions by combinations of insulin, follicle-stimulating hormone, and human chorionic gonadotropin. Sánchez F, Romero S, Smitz J. Biol Reprod. 2011
Mouse cumulus-oocyte complexes from *in vitro*-cultured preantral follicles suggest an anti-luteinizing role for the EGF cascade in the cumulus cells. Romero S, Sánchez F, Adriaenssens T, Smitz J. Biol Reprod. 2011

Associated documents

PARTNERS AND COLLABORATIONS

Organisation

Name of the organisation Vrije Universiteit Brussel

Department Follicle Biology Laboratory

Country Belgium

Geographical Area Brussels Region

Coordinated by

Financed by