3D skeletal muscle model

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Organisation

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Specific Research Group or Service Research group muscles and movement
Country Belgium
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SCOPE OF THE METHOD

<table>
<thead>
<tr>
<th>The Method relates to</th>
<th>Animal health, Human health</th>
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</thead>
<tbody>
<tr>
<td>The Method is situated in</td>
<td>Basic Research, Translational - Applied Research</td>
</tr>
<tr>
<td>Type of method</td>
<td>In vitro - Ex vivo</td>
</tr>
<tr>
<td>Specify the type of cells/tissues/organs</td>
<td>myoblasts, fibroblasts, endothelial cells derived from human muscle tissue</td>
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</tbody>
</table>

DESCRIPTION

Method keywords

Coculture
Myoblasts
endothelial cells
Bio-artificial muscle
Intramuscular injection
Compound testing

**Scientific area keywords**
tissue engineering
Muscle model
Skeletal muscle
Atrophy
Sarcopenia
Cachexia
Hypertrophy
Tissue development
mechanobiology

**Method description**
We tissue-engineer *in vitro*, skeletal muscle consisting of aligned myofibers. To create the so-called bio-artificial muscle (BAM), human muscle progenitor cells are expanded, and a 3D construct is created by mixing the cells with a hydrogel. The cell-gel mix is cast into custom-made silicone molds with end attachment sites and then differentiated for 1 week. The passive forces generated in the contracted hydrogel align the myogenic cells parallel to the long axis of the contracted gel such that they fuse into aligned multinucleated myofibers. This results in the formation of a 2 cm long and ~1.5 mm thick human BAM construct with endothelial networks. In addition, by co-culture with endothelial cells, interspersed endothelial networks can be created.

**Lab equipment**
- Incubator,
- Biology safety cabinet,
- Custom molds,
- Fluorescence microscope.

**Method status**
Published in peer reviewed journal
PROS, CONS & FUTURE POTENTIAL

Advantages

The model system allows for extensive biochemical, physical, cellular and electrical characterization of the effect of adding compounds, different extracellular matrix components or different cell types to investigate the effects on muscle development, morphology and function. It thus bridges the gap between 2D culture systems and *in vivo* experiments related to muscle tissue.

Challenges

- Limited size of the constructs imposed by the limit of passive diffusion of nutrients and gases.
- Developmental stage of the muscle is comparable to foetal tissue, but can be stimulated to induce maturation (involves longer culture time).

Modifications

- Integration with flow system, stimulation methods are under development.
- Cells derived from mouse, pig, rabbit, and cow muscles can also be used.

Future & Other applications

Besides further development toward regenerative medicine, such a muscle model can also be used to study mechanisms underlying myogenesis, vasculogenesis, and drug effects, administered either to the medium surrounding the muscle either by injection in the muscle.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References


Gholobova D., Gerard M., Terrie L., Desender L., Shansky J., Vandenuburgh H., Thorrez L. Coculture Method to Obtain Endothelial Networks Within Human Tissue-


Links

Research group muscles and movement