Dual and Triple Epithelial Co-culture Model Systems with Donor-Derived Microbiota and THP-1 Macrophages To Mimic Host-Microbe Interactions in the Human Sinonasal Cavities

Created on: 20-02-2020 - Last modified on: 28-02-2020

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Organisation

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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Translational - Applied Research
Type of method	In vitro - Ex vivo

DESCRIPTION

Method keywords

upper respiratory tract

host-microbe interaction

air-liquid interface

sinonasal cavities

chronic rhinosinusitis

epithelial barrier function

macrophages

Scientific area keywords

host-microbiome interaction
biotechnology
microbiology
immunomodulation

Method description

This is a method to study host-microbe interaction in the upper respiratory tract. A physiologically representative epithelial structure, with mucin producing and ciliated cells, is obtained by culturing respiratory epithelial cells at air-liquid interface in Transwell inserts. Optionally, macrophage-like cells, derived from monocytes, can be included to examine immunomodulation. This co-culture system can be apically inoculated with pure strains, a defined mixture of bacteria, or donor-derived nasal microbiota. During host-microbe co-culture, typically 72 h, bacterial adhesion, growth and community composition can be measured, as well as host responses such as cytokine release and epithelial barrier functionality.

Lab equipment

Biosafety cabinet ;
Incubator ;
Flow cytometer ;
Plate-reader ;
Electrode to measure transepithelial electrical resistance ;
Micropipettes.

Method status

Still in development
History of use
Internally validated
Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- Low-tech ;
- High throughput ;
- Commercially available culture system (Transwell) ;
- Easy sampling ;
- Variety of samples ;
- Versatility of host and microbial materials that can be used ;
- Robust co-culture preserving viability of host cells and bacteria over multiple days.

Challenges

- Labour intensive ;
- Static co-culture (accumulation of metabolites, medium acidification) ;
- Several weeks required for differentiation ;
- Low biomass samples of microbial community.

Modifications

- Inclusion of more/other host cell types ;
- Downscaling ;
- Increasing throughput ;
- Standardized inoculum.

Future & Other applications

- Testing of environmental contaminants (cigarette smoke) ;
- Antibiotics ;
- Live biotherapeutic products ;
- Topical treatments for upper respiratory tract diseases

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

De Rudder C, Calatayud Arroyo M, Lebeer S, Van de Wiele T. 2020. Dual and triple epithelial coculture model systems with donorderived microbiota and THP-1 macrophages to mimic host-microbe interactions in the human sinonasal cavities.

mSphere 5:e00916-19. https://doi.org/10.1128/mSphere.00916-19.

Associated documents

DeRudder2020_mSphere_DualTripleModelSystems_HMI_URT.pdf

Links

Dual and triple epithelial coculture model systems with donorderived microbiota...

Other remarks

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Coordinated by

sciensano VUB

Financed by

Vlaanderen verbeelding werkt

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