Mucosal Simulator of the Human Intestinal Microbial Ecosystem

Commonly used acronym: *M-SHIME*

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Organisation

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SCOPE OF THE METHOD

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

DESCRIPTION

Method keywords

dynamic gut simulator
mucus covered microcosms
mucosal microenvironment
mucosal microbiome
fecal microbiota

Scientific area keywords

host-microbiome interaction
human health
human diseases
inflammatory bowel disease

Method description

The M-SHIME is a dynamic model for the human digestive tract that mimics the different compartments - stomach, small intestine and colon - while also incorporating a cross-sectional simulation mimicking both the luminal as the mucosal microenvironment of the human gut. The mucosal environment in particular is simulated with mucus-coated microcosms (carriers with high specific surface area) to facilitate colonisation of the mucosal microbiota. Compared to regular SHIME systems, the M-SHIME model allows to

accurately study the colonisation of the endogenous mucosal microbiome, study different colonisation behaviour according to health status, and assess the engraftment potential of probiotic strains or live biotherapeutics. The M-SHIME is inoculated with fecal microbiota from an individual human donor. Mimicking the mucosal conditions enables adaptation of the microbiota to the mucosal environment thus yielding a microbial community that reflects the *in vivo* situation in terms of composition and functionality. Pooling of fecal microbiota samples is strongly disadvised. The method is a 1 donor per experiment setup. This also allows maintaining the unique features of an individual's microbiome in order to study interindividual differences in mucosal colonisation and microbial behaviour.

Lab equipment

BSL2 lab required as M-SHIME inoculum is derived from human fecal slurry.

Method status

History of use
Internally validated
Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- Specific study of gut mucosa-associated microbiota that are difficult to access through invasive *in vivo* sampling procedures (tissue brushes, biopsies...),
- Multi-parametric model,
- Longitudinal model that allows time-resolved analyses,
- Responsive model that allows treatments that are impossible to carry out *in vivo*,
- Absence of host tissue allows to solely address responsiveness of the mucosal microbiota to determinants/stressors of interest (e.g. antibiotics, drugs...).

Challenges

Absence of host tissue means absence of epithelial barrier or immune response.

Modifications

- Incorporation of different mucin types for more delicate enteropathogen studies,
- Incorporation of more immune related components (Ig, AMP...).

Future & Other applications

Enteropathogen studies, Human nutrition, Chronic gut inflammation, Pharmacokinetics, Toxicokinetics...

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