



Exploration of synthetic communities as a tool to modulate the vaginal microbiome

Commonly used acronym: SynCom

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Organisation

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Country Belgium

Geographical Area Flemish Region

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

vaginal microbiome
synthetic communities
live biotherapeutic products
consortia
lactobacilli
vaginal infections
probiotics

Scientific area keywords

vaginal health
microbiology
bioreactor technology
female health
Biopharmaceuticals
biotechnology

Method description

This method/PhD project explores an innovative approach using synthetic communities (SynComs) to develop vaginal therapeutics. First, a top-down approach will be used to screen and select consortia of vaginal microbiota, emphasizing synergistic interactions and eliminating antagonistic effects. A bottom-up approach will validate the top-down findings, providing defined communities suitable for automation and scaling up. Simultaneously, these defined SynComs will undergo testing for their probiotic potential, comparing them with single strains through *in vitro* anti-pathobiont assays, community fitness analyses, and implementation into cutting-edge vaginal cell models. This research project will offer ground-breaking insights into a novel approach to establishing robust, safe, and effective microbiome-targeted therapies.

Lab equipment

BSL2 lab, hypoxic chamber, biosafety cabinet, bioreactor equipment (pumps, tubing, magnetic stirring plates), qPCR, sequencing techniques (e.g., ONT minION), cell culture room, vaginal cells, etc.

Method status

Still in development

PROS, CONS & FUTURE POTENTIAL

Advantages

- Allows high-throughput screening in mini bioreactors,
- Scale-up possible up till larger volumes (5L and 7L),
- Consortia of synergistic bacteria compared to individual strains may offer more benefits in application as LBP, such as easier niche engraftment and long-term effects due to robustness,
- Easier implemented than vaginal microbiome transplants (safety, cost, regulation-wise).

Challenges

- Still in optimization stage,
- Culture bias may not always lead to target lactobacilli,
- Whole genomes required for safety testing and unveiling modes of action.

Modifications

Additional metabolic modeling to screen for consortia of genome-complementary lactobacilli strains (e.g., screen for potential of cross-feeding) in strain selection of defined bottom-up SynComs and *in vitro* testing

Future & Other applications

This can be applied to gut microbiome research for the same purpose, namely modulating the gut microbiome in a positive way. Additionally, this can be used in environmental research, modulating the microbiome of plants, crops, other ecosystems to enhance resistance and resilience against different types of disease.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Manuscript preprint on the use of SynComs: Vander Donck, Leonore and Victor, Maline and Van Beeck, Wannes and Van Rillaer, Tim and Dillen, Jelle and Ahannach, Sarah and Wittouck, Stijn and Allonsius, Camille Nina and Lebeer, Sarah and Administrator, Sneak Peek, Host-Independent Synergism between *Lactobacillus crispatus* and Other Vaginal Lactobacilli. Available at SSRN: <https://ssrn.com/abstract=5243601> or

<http://dx.doi.org/10.2139/ssrn.5243601>

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