

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

**Commonly used acronym:** SynCom

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## Organisation

**Name of the organisation** University of Antwerp (UAntwerpen)

**Department** Bioscience Engineering

**Specific Research Group or Service** Lab of Applied Microbiology and Biotechnology

**Country** Belgium

**Geographical Area** Flemish Region

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Human health
<b>The Method is situated in</b>	Translational - Applied Research
<b>Type of method</b>	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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