ETH zürich

Department of Biosystems Science and Engineering

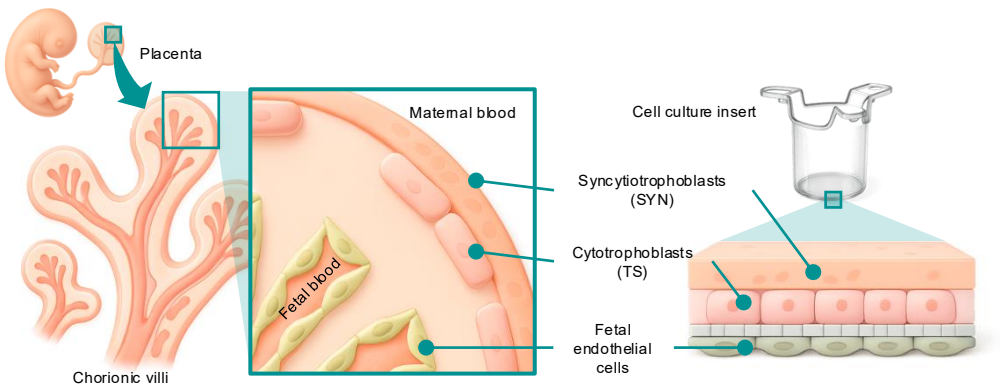
Microfluidic *in-vitro* model of human brucellosis at the maternal-fetal axis to study infection dynamics and antibiotic treatment during pregnancy

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1 Brucellosis: an understudied infection with critical obstetric complications

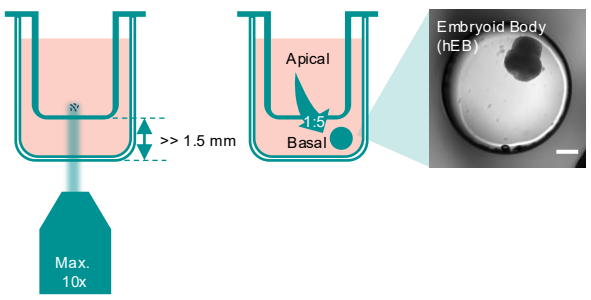
- ***Brucella melitensis* (BSL-3)** is the main strain, linked to sheep and goats, but can infect humans too[1]
- Targets the **placenta**; replicates in **trophoblasts**, disrupting the anti-inflammatory environment required for uncomplicated gestation[1]
- Obstetric risks include **miscarriage and stillbirth** (up to 25%), **preterm birth** (20%), **postpartum endometritis**, and **low birth weight**[2]
- WHO offers **no treatment** due to antibiotic-related developmental risks (i.e. ototoxicity from tetracyclines)[3,4]
- Animal models are **non-translatable**; cell models are either **too precious** (primary tissue) or **oversimplistic** (immortalised lines)[4]

2 Methods



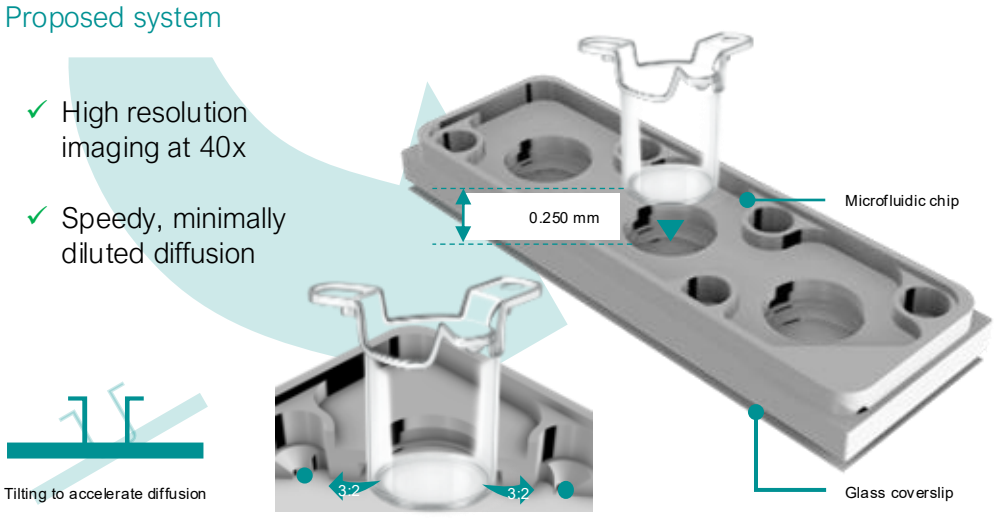
Challenges of conventional culture

- X Distance too large to image single bacteria
- X Slow, overdiluted diffusion of apical secretions to the basal (hEB) compartment



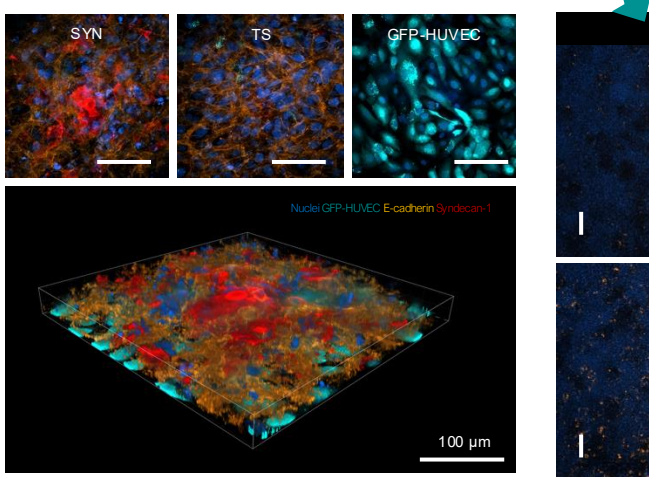
Proposed system

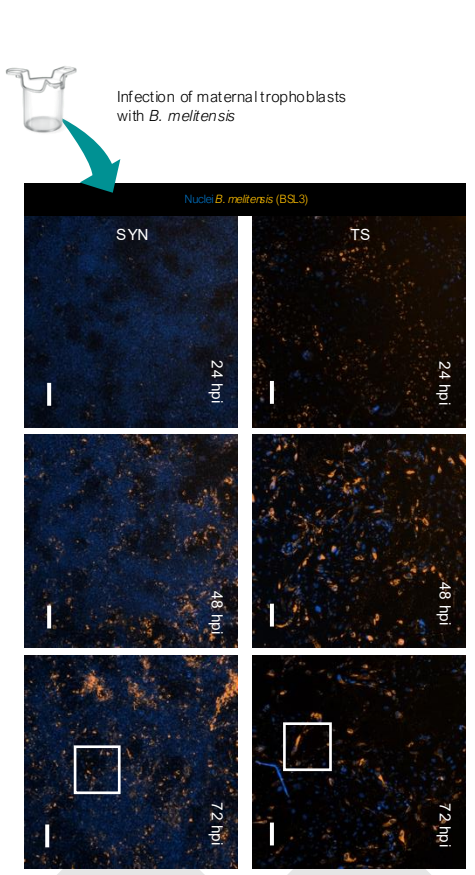
- ✓ High resolution imaging at 40x
- ✓ Speedy, minimally diluted diffusion



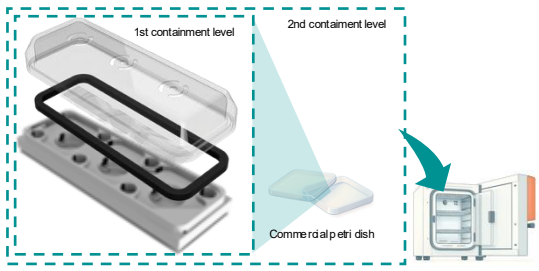
4 Results

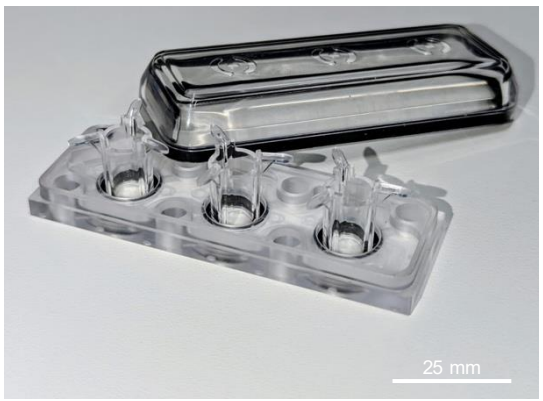
Insert-based barrier model of the human placenta

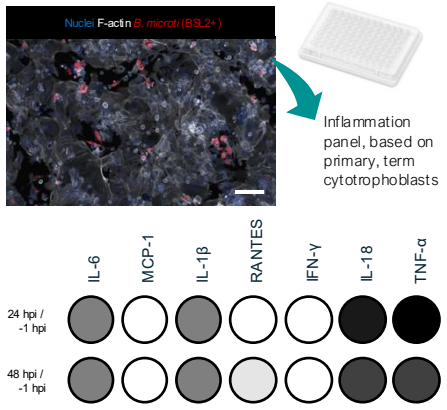




Chip double-containment system for BSL3 integration







5 Conclusion

- A high-containment microfluidic co-culture platform to study human brucellosis at the maternal-fetal interface

References

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3. World Health Organization. (2020, July 29). Brucellosis. https://www.who.int/news-room/fact-sheets/detail/brucellosis
4. Delorme-Axford, E., et al. (2022). Modeling the human placenta to investigate infections during pregnancy. Frontiers in Virology, 2, 831754. https://doi.org/10.3389/fviro.2022.831754

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