Ph.D. position in microbiology and 3D printing of biofilms

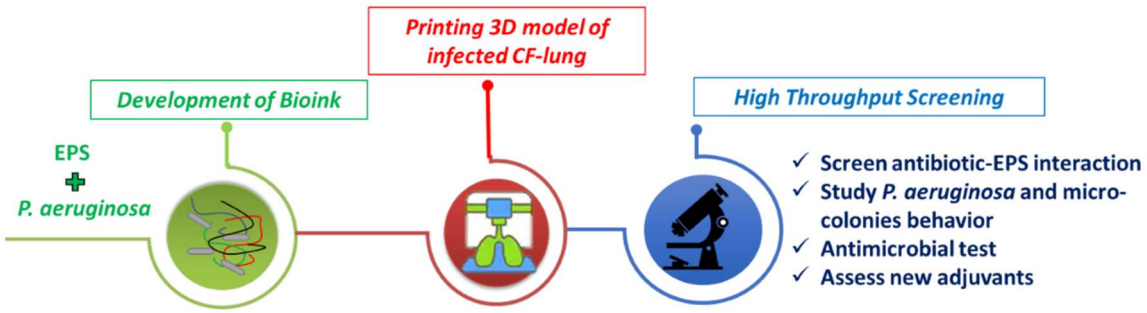
The project

Bacteria within a biofilm are up to 1,000-fold more resistant to antibiotics and are inherently insensitive to the host immune response. This is particularly relevant for patients affected by Cystic Fibrosis (CF), also called mucoviscidosis. Indeed, once *Pseudomonas aeruginosa* colonizes the lungs, it can acquire a mucoid phenotype, which renders infections insensitive to antibiotics.

Our preliminary data show that antibiotherapy directly impacts the properties of the extracellular matrix surrounding bacteria in a biofilm [1]. We hypothesize that these changes increase the protection of bacteria in the biofilm, rendering them even less permissive to antibiotherapy.

Our goal

We want to establish a standardized and clinically relevant 3D *in vitro* model of CF-biofilm to screen environment-specific stresses and directly measure its influence on *P. aeruginosa* biofilms.



The main aims of the 3.5 years Ph.D. position are (1) to establish a relevant *in vitro* model of CF-biofilm, (2) to study the interactions between exopolysaccharides (EPS), antibiotics and *P. aeruginosa* and (3) to test adjuvants able to restore the efficacy of the antibiotics using high-throughput screening.

Very few studies report on the physicochemical characteristics of EPS and how the micro-environment can be modulated by external compounds, such as antibiotics or other adjuvants. Finding adjuvants that prevent EPS from neutralizing antibiotics administered to biofilms could revolutionize how we tackle antimicrobial resistance.

Your job

- ➔ Isolate, purify, and characterize important exopolysaccharides of Cystic Fibrosis biofilms.
- ➔ Develop bioinks for 3D printing, including *P. aeruginosa.*
- ➔ Characterize the structure and changes to native and printed *P. aeruginosa* biofilms due to environmental factors, including antibiotherapies.
- ➔ Elucidate the interplay between EPS remodeling and bacteria behavior.

Your profile

Applicants should have a Master's degree in microbiology and biotechnology or a related degree of interest with very good to excellent grades, i.e., capable of growing and characterizing bacteria and testing antibiotic efficacy. Experience with microscopy, bioreactors, and 3D bioprinting is preferred but not mandatory.

What we offer

The project is interdisciplinary with strong collaborations across scientific disciplines.

The coordinator of this project is Dr. Olivier Guillaume (TU Wien). You will mainly work at the Institute for Biologically Inspired Materials (BIMat), University of Natural Resources and Life Sciences, Vienna. Prof. Erik Reimhult (BIMat) will co-supervise this Ph.D. program. Nevertheless, around 30% of the project will be done at the TU Wien, in the 3D Printing and Biofabrication Group of the Institute of Materials Science and Technology, Vienna (Head, Prof. Aleksander Ovsianikov).

The Reimhult group offers the complete infrastructure, including microbiology laboratories (including bioreactor, HPLC, FPLC, columns for EPS purification, RNA isolation and PCR for gene expression), wide-field and electron microscopes (holographic microscope, SEM, TEM and recently developed DDM to measure locally mechanical properties of hydrogel) and biopolymer characterization equipment (including ^{1}H-NMR, FT-IR, GPC, DSC, and TGA). ITC, DSC, FT-IR, and confocal microscopy are available at the core facilities "Biomolecular & Cellular Analysis", "Extremophile Center" and "VIBT Imaging Center".

The Ovsianikov group has full access to various printing/bioprinting equipment (bioprinter Cell link BioX and 2-photon polymerization apparatus) to conduct ink/hydrogel characterization (rheometer, AFM, ^{1}H-NMR, FT-IR, DSC and TGA if required) and microscopic analyses (confocal LSM700 and LSM800).

The Ph.D. candidate will be registered at the BOKU, 30 h/week with a gross salary of € 2.196,80 14 times per year (following the terms of the collective agreement for university staff, B1), with 10 h/week studies. The candidate will be enrolled in the BioMatInt doctoral school.

We especially encourage female applicants, applicants from minority groups, and applicants with disabilities.

For further information, you are welcome to contact Dr. Olivier Guillaume
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To apply, please send your CV, motivation letter, grade excerpt, diploma for the highest finished degree (or expected date of graduation), and referee contacts to Ms. Tiziana Fresu (E-mail: tiziana.fresu@boku.ac.at). Mark your application "BREATH".

We will invite shortlisted candidates to interviews after the **28th of February 2021**. The position is expected to be filled and to start in March 2021.

Literature: [1]: Heriot M. et al, Interaction of Gentamicin Sulfate With Alginate and Consequences on the Physico-Chemical Properties of Alginate-Containing Biofilms (2019) Int J Biol Macromol.