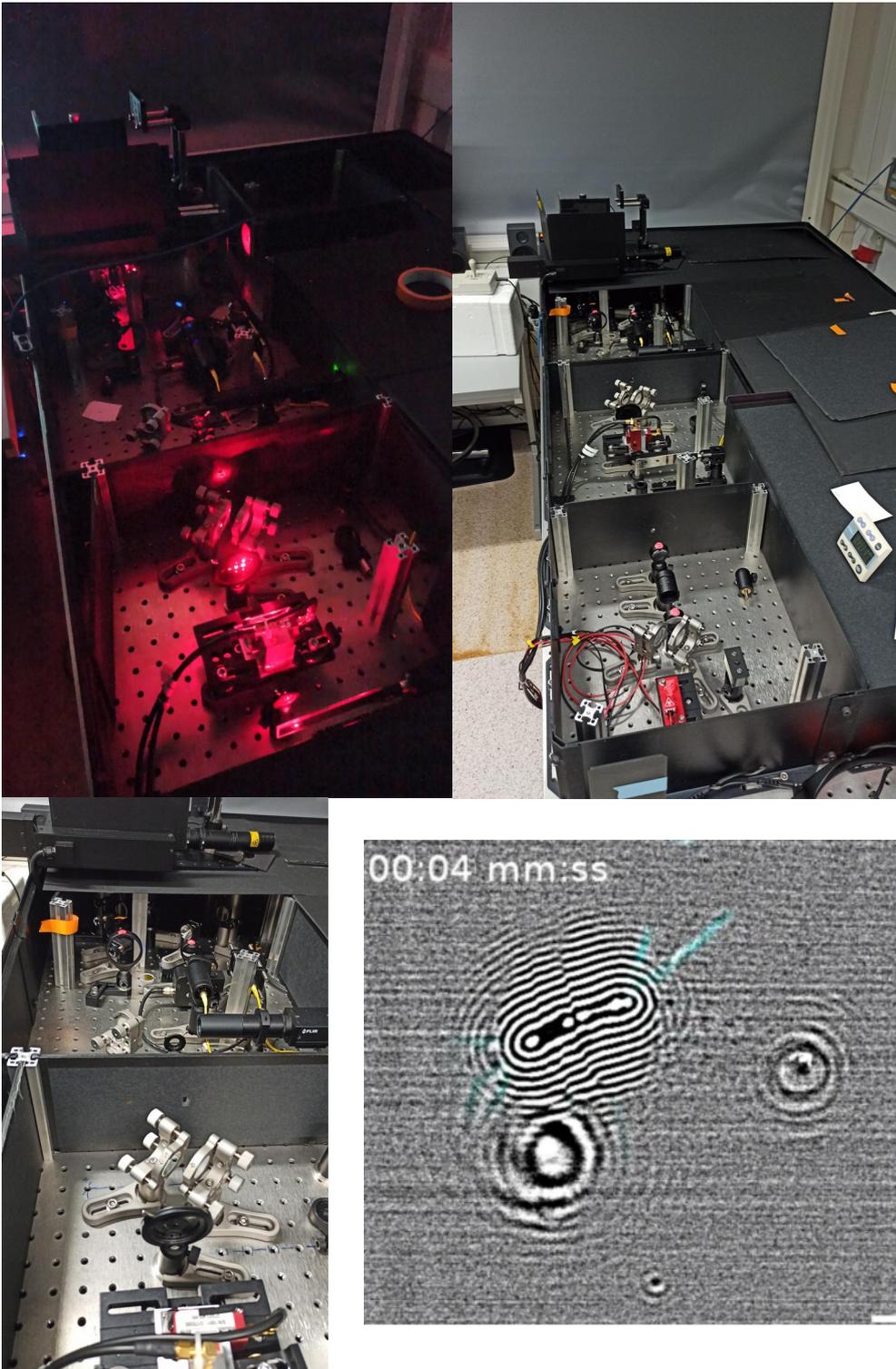


Dear Sir or Madame,

here, I present a little summary of projects, on which I worked in the past

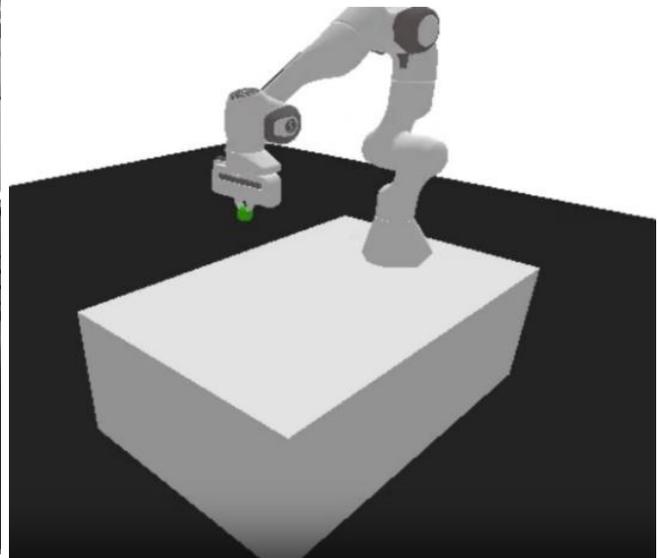
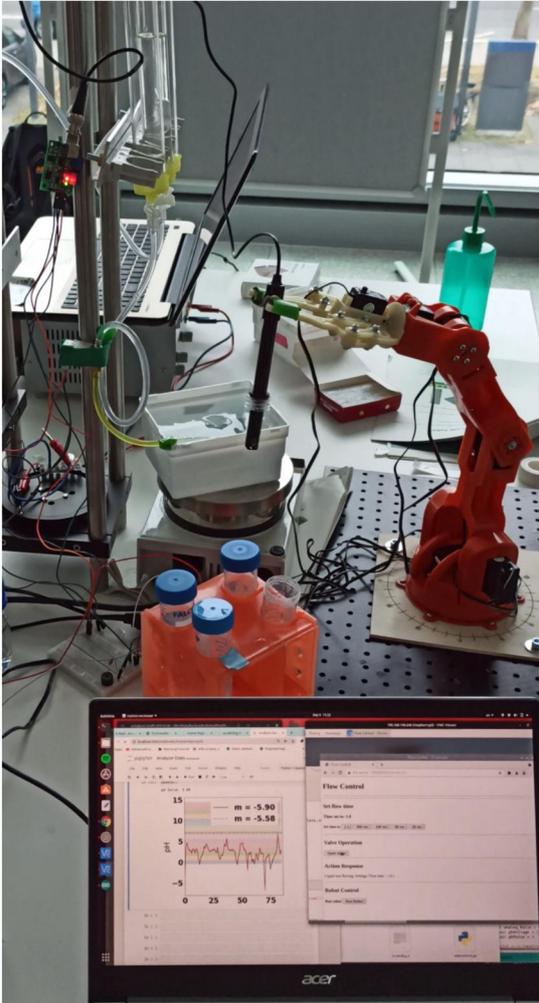
PhD, Advanced Microscopy

- Setup of the microscope
- AI based segmentation and tracking of bacteriophages and “Type IV Pili” during bacteria locomotion



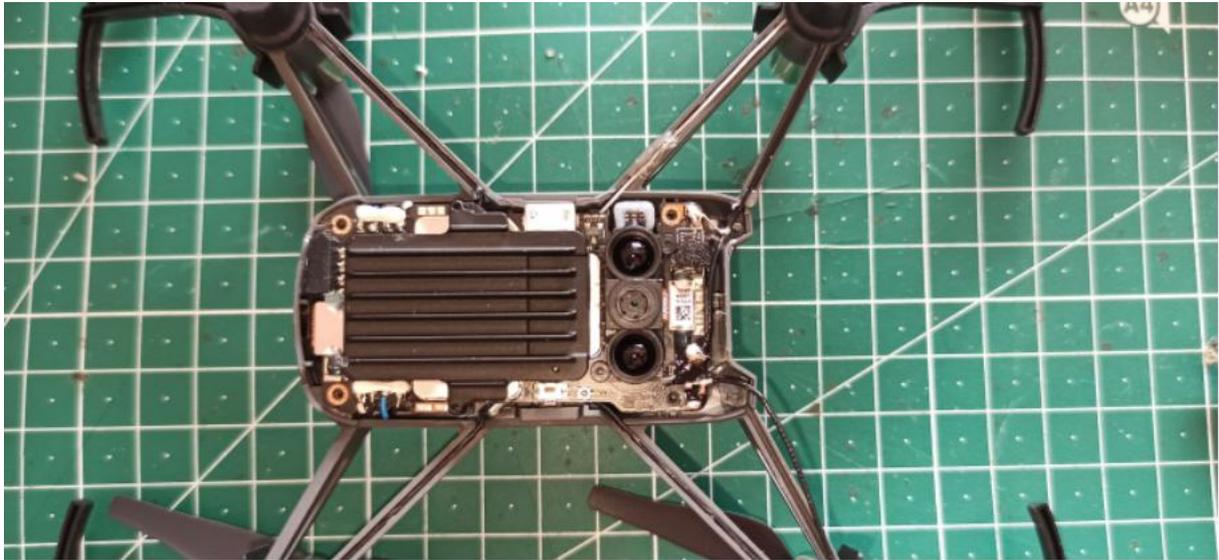
Web controlled robot arm for lab support

- UI development
- Robot interaction
- Database interaction
- web control
- Reinforcement Learning



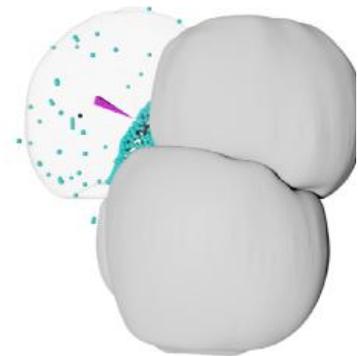
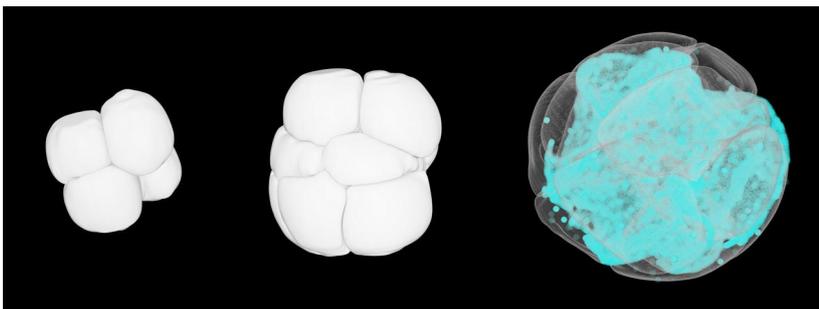
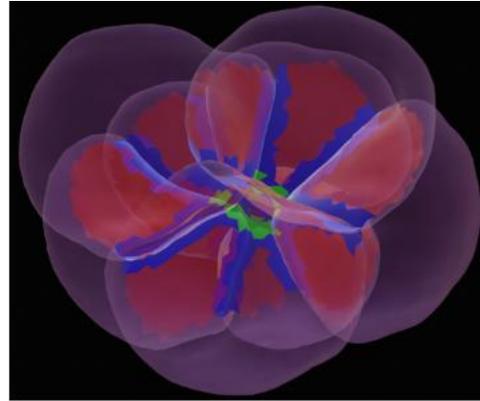
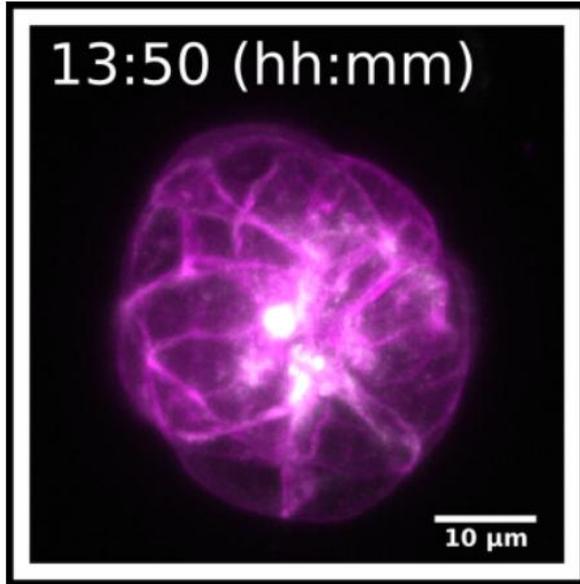
Drone – instance recognition and tracking

- programming of a drone to recognize (AI) and follow objects
- depth estimation based on AI



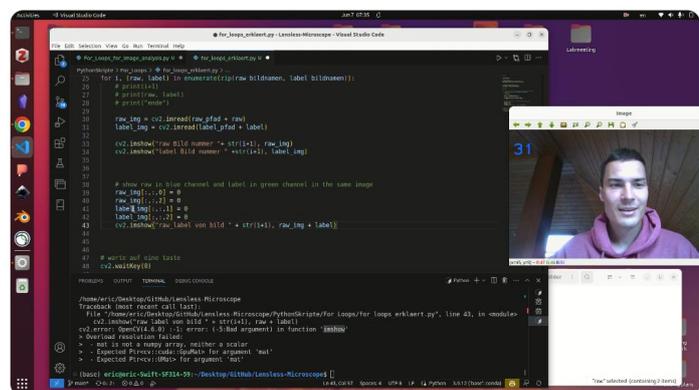
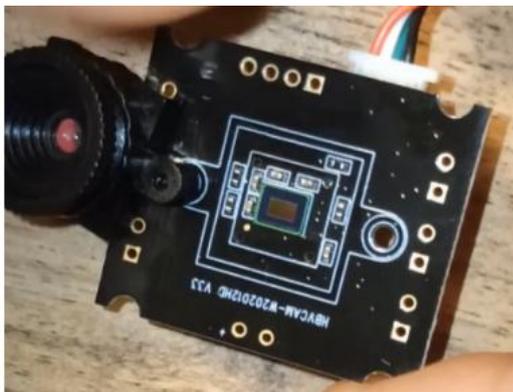
Master Thesis, 3D Fluorescence microscopy

- AI based 3D Instance Segmentation and object tracking
- Pointcloud and Mesh Reconstruction
- Data Quantification



Lensless Microscope project

- building a lensless microscope for 3 euros and imaging objects of single micrometer size
- started to record videos for youtube to teach children about it



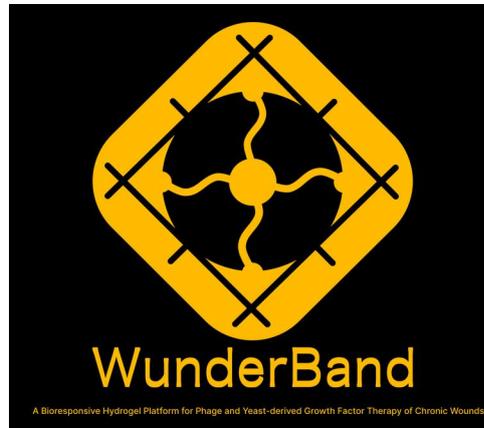
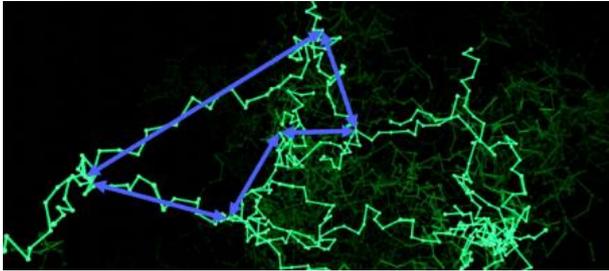
For Loops zur automatisierten Verarbeitung von Bildern



international Genetically Engineered Machines (iGEM) competition

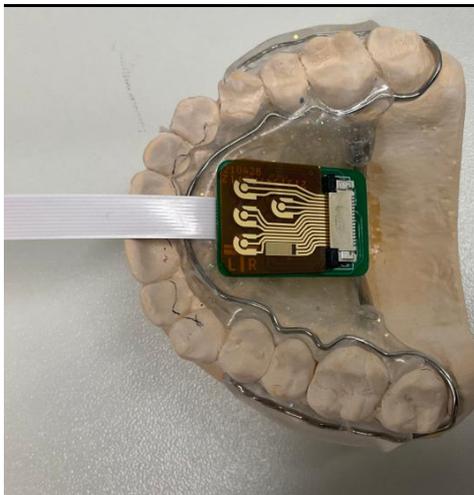
- Development of a hydrogel based wound dressing
- synthetic biology
- computational biology

<https://2022.igem.wiki/tu-dresden/>



Biosensor development for Diabetes detection

- Arduino and enzyme based biosensor for the detection of sugar
- used in the human saliva, it is supposed to help dentists to detect diabetes



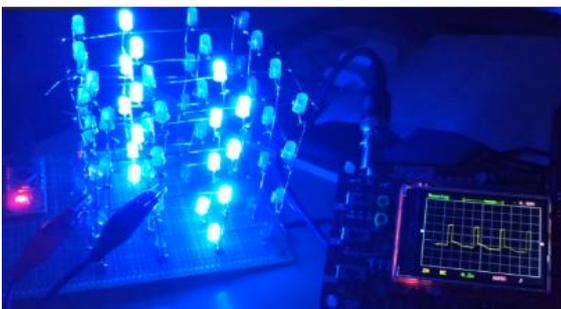
YouTube Channel for Deep Reinforcement Learning

- Unity Scene Creation
- Agent Training and Description of the processes



More Projects

- DIY projects (building oscilloscope and arduino driven projects)
- Experience with soldering irons and laser cutters



Co-Author Nature Microbiology

- writing the image analysis software for the publication

<https://www.nature.com/articles/s41564-024-01842-3>

- the software is accessible on GitHub <https://github.com/Nablaaa/CompetitionAssay>

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***Pseudomonas aeruginosa* faces a fitness trade-off between mucosal colonization and antibiotic tolerance during airway infection**

[Lucas A. Meirelles](#), [Evangelia Vayena](#), [Auriane Debache](#), [Eric Schmidt](#), [Tamara Rossy](#), [Tania Distler](#), [Vassily Hatzimanikatis](#) & [Alexandre Persat](#) ✉

Nature Microbiology 9, 3284–3303 (2024) | [Cite this article](#)

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Abstract

Pseudomonas aeruginosa frequently causes antibiotic-recalcitrant pneumonia, but the mechanisms driving its adaptation during human infections remain unclear. To reveal the selective pressures and adaptation strategies at the mucosal surface, here we investigated *P. aeruginosa* growth and antibiotic tolerance in tissue-engineered airways by transposon insertion sequencing (Tn-seq). Metabolic modelling based on Tn-seq data revealed the nutritional requirements for *P. aeruginosa* growth, highlighting reliance on glucose and lactate and varying requirements for amino acid biosynthesis. Tn-seq also revealed selection against biofilm formation during mucosal growth in the absence of antibiotics. Live imaging in engineered organoids showed that biofilm-dwelling cells remained sessile while colonizing the mucosal surface, limiting nutrient foraging and reduced growth. Conversely, biofilm formation increased antibiotic tolerance at the mucosal surface. Moreover, mutants with exacerbated biofilm phenotypes protected less tolerant but more cytotoxic strains, contributing to phenotypic heterogeneity. *P. aeruginosa* must therefore navigate conflicting physical and biological selective pressures to establish chronic infections.