

Master of Science – Biomedical Engineering
Thesis Proposal

Master's Thesis: Development of an Automated Interchangeable Pipetting-Head for Collaborative Robots

Context: In modern pharmaceutical and tissue engineering laboratories, flexibility and space are the bottlenecks. Collaborative robots (cobots), such as the PreciseFlex 400, offer a flexible alternative that can work safely alongside humans. However, current cobot end-effectors are limited to fixed grippers to handle microplates. To make cobots true assistants, save space, and enable workflow automation, they require the ability to handle micropipettes. Current attempts include a supplementary actuator for micropipette actuation, which requires modification of the robot itself (1).

The research question is whether the robot can autonomously dock and undock different pipetting heads and the micropipette, and actuate the micropipette using only the robot's mechanical finger motion.

Task description: Your mission is to prototype the first functional, automatically interchangeable "Pipetting-Head" for our robot. You will design the mechanical coupling that allows the robot to dock and undock different pipetting heads and the micropipette autonomously, and actuate the micropipette using only the robot finger mechanical motion.

Nature of the Thesis

Experimental: 60%

Programming: 20%

Documentation: 20%

Specific Requirements

Passion for microfluidics or for CAD or robotics

Ideally, hands-on experiment building mechanic or mechatronic devices

Group Leader

Prof. Dr. Georg Rauter

BIROMED-Lab

<https://biomed.dbe.unibas.ch>

Supervisor

Dr. Cédric Schicklin

Contact

Cedric.schicklin@unibas.ch

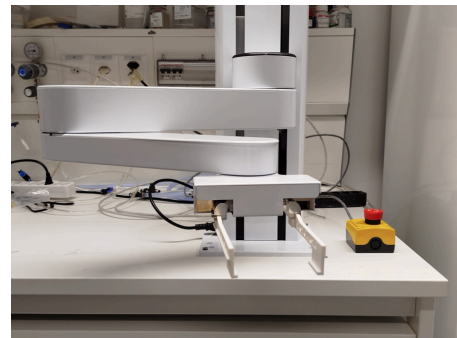
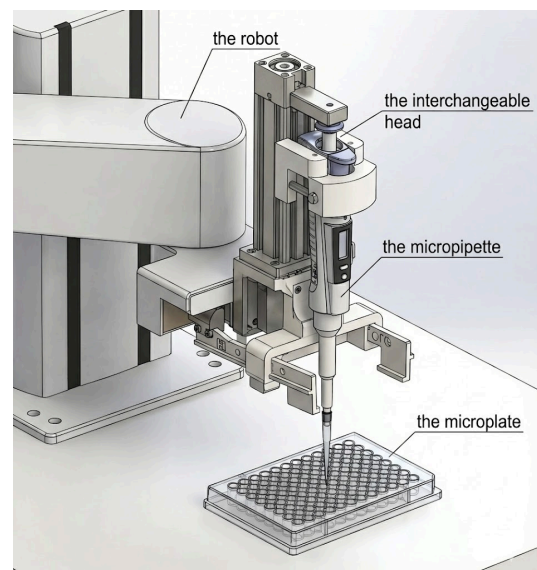


Figure 1: Photo of a cobot in our tissue engineering laboratory.

Figure 2: Artistic view of an automatically interchangeable pipetting head. Source: AI image generation



1 Ciupe, V., Lovasz, E.-C., Kristof, R., Sandu, M.-O., & Sticlaru, C. (2025). Design, Simulation and Experimental Validation of a Pneumatic Actuation Method for Automating Manual Pipetting Devices. *Machines*, 13(5), 389. <https://doi.org/10.3390/machines13050389>