Title	**Design of Novel Fluorescent Gold Nanoparticle Sensors for Multi-metabolite Monitoring in Diabetes**
Background	Diabetes is a rapidly growing global health challenge. In 2021, the International Diabetes Federation estimated that 537 million adults aged 20–79 years were living with the disease, a number projected to reach 783 million by 2045, underscoring the urgent need for effective monitoring and management. Leading healthcare companies are dedicating significant resources to developing advanced diagnostic tools, continuous glucose monitoring technologies, and innovative therapies to help manage the growing impact of diabetes on patients' lives. Boronic acid-based sensors offer a promising approach for selectively detecting sugars and other metabolites due to their adaptable chemistry and strong binding capabilities, making them ideal for next-generation diagnostic tools. In this project, these sensors will be anchored onto gold nanoparticles (AuNPs). AuNPs are capable of concentrating and amplifying light through localized surface plasmon resonance (LSPR). When combined with fluorescent materials, they exhibit metal-enhanced fluorescence, resulting in a significant increase in signal intensity.
Aim	This master's thesis aims to synthesize and characterize organic probes that will be functionalized onto AuNPs, developing a novel optical platform for continuous multi-metabolite monitoring.
Research work, methods	**Literature Review:** Conduct a thorough review of current research on multi-metabolite monitoring, and the functionalization of AuNPs for sensing applications. **Design and Synthesis:** Design boronic acid-based sensors and optimize their structure for effective multi-metabolite monitoring. Functionalize these sensors onto AuNPs. **Characterization:** Confirm the structures of the synthesized compounds using analytical tools such as NMR, HRMS, and IR. Characterize the functionalized AuNPs using spectroscopic techniques (e.g., UV-Vis, fluorescence spectroscopy, and electron microscopy) and assess their sensing capabilities in controlled laboratory conditions to evaluate their potential for detecting analytes. **Learning Outcomes:** 1) develop advanced skills in synthetic organic chemistry; 2) gain hands-on experience with techniques such as NMR, HRMS, IR, UV-Vis, fluorescence spectroscopy, cell culture; 3) work in a highly interdisciplinary research environment, gaining exposure to multiple scientific fields.
Potential Relevance	This project will advance new glucose sensing technology by increasing their sensitivity and specificity.
References	*Diabetes Res Clin Pract.* ***2018***, *138,* 271–281, https://doi.org/10.1016/j.diabres.2018.02.023. *ACS Omega* **2025**, *10, 11*, 10812–10825, https://doi.org/10.1021/acsomega.4c06237. *J. Am. Chem. Soc.* **2023**, *145*, 8408−8416, https://doi.org/10.1021/jacs.2c13694.
Requirements	Strong background in chemistry, excellent organizational skills, strong problem-solving skills, and attention to detail.
Preferred start date	*January 2025*
Contact details of supervisors	Prof. Dr. Lilian Witthauer Freiburgstrasse 3 3010 Bern +41 31 664 22 77 lilian.witthauer@unibe.ch https://samlab.org/ Prof. Dr. Matthias Arenz Freiestrasse 3 3012 Bern +41 31 684 53 84 matthias.arenz@unibe.ch arenz.dcbp.unibe.ch Dr. Saiyyna Stepanova Freiestrasse 3 3012 Bern +41 78 302 52 01 saiyyna.stepanova@unibe.ch

Please submit to verena.schroeder@unibe.ch