

PhD Candidate in Sustainable and Green Electronics for Biotechnology Instrumentation

Summary

The PhD project aims to develop energy-efficient droplet biotechnology instrumentation for research and development. The project focuses on flow and thermal regulation, light intensity measurement, system integration, and edgeAI control, with a focus on sustainability and green electronics.

Research field:	Information and communication technology
Supervisors:	Dr. Tamas Pardy Rauno Jõemaa
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

We are looking for a highly motivated and ambitious PhD candidate with experience in either biomedical engineering, mechanical/mechatronics engineering, electrical engineering, technical physics, system integration and/or similar fields, to join our Lab-on-a-chip & Microfluidics team (Website | Facebook) at Tallinn University of Technology (TalTech).

Droplet biotechnology instrumentation is a type of laboratory/liquid handling automation, which helps automate droplet-based biotechnology workflows, be it for analysis or manufacturing. In research, bioanalytical instrumentation is typically a combination of commercial off-the-shelf (COTS) sensors (cameras, photomultiplier tubes etc.) and actuators (pumps, valves, heaters/coolers etc.), integrated for a specific workflow by a highly skilled expert. If the workflow changes, so does the setup. This takes away valuable time and resources from scientifically relevant research. Additionally, a combination of high-end COTS instruments is neither power-efficient, nor compact enough to fit limited lab spaces research teams so often face.

Therefore, the goal of this PhD project is to support research and development efforts in areas such as:

1. energy-efficient flow and thermal regulation
2. light intensity measurement and imaging on low-end hardware
3. system integration and edgeAI control
4. translation to bioanalytical/biomanufacturing applications (e.g. cell/enzyme library preparation)

All the while considering questions related to sustainability of the setup and its outputs, as well as the use of green electronics, i.e. implementation of ecodesign, lifecycle assessment and inventory (LCA/LCI) principles and reusability.

The project is related to Horizon Europe projects #101099125 "3D-BRICKS" and #101046961 "Chiralforce", as well as national research grants and collaboration projects with Estonian industrial and academic partners.

Possible research questions:

- What is the minimum viable hardware/software configuration for microfluidic droplet sorting?
- What is the most efficient, most scalable and flexible combination of edgeAI algorithms and hardware for bioanalytical instrumentation control?
- What are the possible root causes for droplet instability and variable encapsulation rates in continuous flow microfluidics and how can they be mitigated?
- How and to what extent can ecodesign, LCA/LCI principles be implemented in bioanalytical/biomanufacturing instrumentation?

Applicants should fulfil the following requirements:

- MSc either in biomedical, mechanical/mechatronics, electronics and electrical engineering, technical physics, system integration or related fields
- Have a clear interest in the topic of the position
- Excellent command of English
- Good candidate should like to play for a dynamic, interdisciplinary, and international team
- Successful candidate should have prior experience in at least one of those areas: system integration, hardware-software co-development, laboratory automation, measurement instrumentation

(The following experience is beneficial, but not required):

- Experience with bioanalytical/biomanufacturing workflows

We offer:

- 4-years PhD programme at TalTech Estonia (in the top 2% of global university rankings in related field)
- PhD/early-stage researcher position at TalTech
- Opportunities for conference visits, research stays and interdisciplinary networking with partners both locally and internationally
- Specific trainings taking into account the core skills of the candidate
- Starting salary of 2300 €/month gross, with a possibility to increase
- Position comes with full social and medical benefits in Estonia

In addition to submitting your application before the application deadline on Glowbase, you must fill a pre-application via the following Microsoft Forms: <https://forms.microsoft.com/e/j1EAiEfc9r>. Top candidates will enter the second round of recruitment and will be notified.

For further information, please contact Dr. Tamas Pardy (tamas.pardy@taltech.ee) and Dr. Rauno Jõemaa (rauno.joemaa@taltech.ee) with "CogniFlow-PhD" in the e-mail title.

About the department

The Thomas Johann Seebeck Department of Electronics at Tallinn University of Technology offers a dynamic and innovative environment for PhD students interested in electronics and communication technologies.

- **Research Focus:** The department specializes in Cognitive Electronics and Communication Technologies, aligning its research with industry interests and future development trends.
- **Laboratory Facilities:** Students have access to a robust laboratory infrastructure, providing practical skills essential for professional careers.
- **Historical Significance:** Named after the renowned physicist Thomas Johann Seebeck, the inventor of the thermoelectric effect, the department carries a legacy of pioneering research in thermoelectricity, magnetism, and optics.
- **Curriculum:** The department is involved in the Communicative Electronics Master's program, which feeds into the PhD studies, ensuring a comprehensive educational pathway from undergraduate to doctoral levels.
- **Industry Collaboration:** There is a strong emphasis on cooperation with both local and international companies, government bodies, and organizations, enhancing the practical impact and relevance of research.

For detailed information on the PhD program, including specific research projects and opportunities for collaboration, prospective students can visit the department's official website.



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