MSCA COFUND Doctoral Fellowships “Gene Editing in Solanaceous Crops for Resistance Against Potyviruses”

Summary

This PhD topic is part of the INNOCHEMBIO Doctoral Programme, which is funded through the Marie Skłodowska-Curie Actions (MSCA) COFUND action. The main objective of INNOCHEMBIO is to train future experts of sustainable chemistry and biotechnology, helping Europe to take the next steps in the green transition. This project aims to develop PVY-resistant Estonian tomato cultivars using CRISPR/Cas gene editing, while preserving the key agronomic traits of the original varieties. Additionally, advance the understanding of the molecular mechanisms underlying PVY infection in tomato. This PhD position will be hosted at TalTech with main supervisor Dr. Cecilia Sarmiento and will contain a secondment to co-supervisor Dr. Jean-Luc Gallois at Institut National de Recherche pour l’agriculture, l’alimentation et l’environnement (FR).

Research field:	Chemistry and biotechnology
Supervisor:	Dr. Maria Cecilia Sarmiento Guerin
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between July 01, 2025 00:00 and August 31, 2025 23:59 (Europe/Zurich)

Description

1. General description of programme and host

The PhD fellowship is part of the Marie Skłodowska-Curie Actions (MSCA) COFUND doctoral programme INNOCHEMBIO (https://taltech.ee/en/innochembio), which is co-funded by the European Union (Grant agreement 101217295). The main objective of INNOCHEMBIO is to train future experts to help Europe take the next steps in the green transition. The solutions and trained experts can reduce the environmental impact of the chemical and agricultural industries, offer eco-friendly analytical techniques, and assess the safety of new materials. INNOCHEMBIO funding will co-finance **15 PhD positions**, for which the application process in the first call will start on the **1st of July in 2025**.

For 12 PhD positions the hosting institution will be Department of Chemistry and Biotechnology (DCB) at Tallinn University of Technology (TalTech) which combines three divisions – Chemistry, Gene Technology and Biomedicine, and Food and Biotechnology. DCB is developing solutions to the great challenges of the 21st century – climate change, environmental protection, carbon neutrality, renewable energy, and biodiversity conservation. DCB hosts the second biggest PhD programme in TalTech with nearly a hundred enrolled students.

For 3 PhD positions the hosting institution will be the implementing partner – National Institute of Chemical Physics and Biophysics (NICPB). NICPB is a public research institution that conducts both fundamental and applied research, developing novel directions in fields ranging from material sciences to informatics. NICPB houses the Laboratory of Environmental Toxicology and several laboratories focused on fundamental research in NMR technologies with expertise dating back decades. The PhD training activities conducted by NICPB are funded through TalTech.

Importantly, each PhD project has one co-supervisor from another European country, which is detailed under the specific offer (see under supervisors' section). In total, INNOCHEMBIO has **19 associate partners from 11 European countries**.

2. Description of specific PhD project

Background

The current geopolitical landscape and the impact of climate change underscore the need for innovative solutions in food security and sustainable agriculture. New Genomic Techniques (NGTs), particularly CRISPR-Cas technology, have emerged as powerful tools to address these challenges.

Tomatoes are the most widely produced vegetable crop in the European Union by volume, with major production in countries such as Italy, Spain, and France. Although tomato production in Estonia is limited, the crop holds significant cultural and practical value in home gardening. Notably, tomato seeds are often imported from non-EU countries, which poses a potential phytosanitary risk due to the introduction of plant diseases—also viral infections.

Potato virus Y (PVY) is the most prevalent potyvirus naturally infecting tomato plants. The molecular mechanisms of PVY infection in solanaceous crops have been extensively studied. A key factor in PVY pathogenicity is the interaction between the viral protein genome-linked (VPg) and the host plant's eukaryotic translation initiation factor 4E (eIF4E). Disrupting this interaction is essential for developing PVY-resistant plants. In tomato, the eIF4E gene family consists of four members: eIF4E1, eIF4E2, eIF(iso)4E, and nCBP. Additionally, multiple PVY isolates exist, further complicating resistance strategies.

Some plant species possess natural resistance to potyviruses due to mutations in eIF4E genes. Where such natural mutations are absent, gene editing technologies can be employed to mimic them. Further research is required to develop targeted editing strategies that account for the diversity of eIF4E genes in different plant species.

CRISPR/Cas technology is currently the most straightforward method for inducing mutations in eIF4E genes that prevent VPg binding, thereby conferring resistance to PVY.

Main Goals

- Develop PVY-resistant Estonian tomato cultivars using CRISPR/Cas gene editing, while preserving the key agronomic traits of the original varieties.
- Advance the understanding of the molecular mechanisms underlying PVY infection in tomato.

These goals are interconnected and mutually reinforcing, providing the PhD candidate with a comprehensive foundation in applied plant biotechnology grounded in fundamental molecular research.

Key Methods

- Application of various CRISPR-Cas systems—including Base Editing and Prime Editing—on different Estonian tomato cultivars.
- Testing of guide RNAs (gRNAs) via transient expression systems, such as Nicotiana benthamiana and tomato protoplasts.
- Generation of edited plants through Agrobacterium-mediated transformation of explants or delivery of RNP complexes into protoplasts.

Perspective

The PhD candidate will be embedded within active research consortia in Estonia and France, linked to the expertise and collaborations of their supervisors. The Centre of Estonian Rural Research and Knowledge—Dr. Sarmiento's partner—will provide Estonian tomato cultivars of regional importance. International mobility, including research stays and joint experiments with Dr. Gallois in France, will broaden the candidate's perspective.

The position offers a unique opportunity to contribute to real-world agricultural challenges while developing advanced skills in molecular biology, plant biotechnology, and applied genome editing—positioning the candidate for a career at the intersection of basic research and practical innovation.

Link to the project: https://taltech.ee/en/innochembio/sarmiento

3. Supervisory team

- Tallinn University of Technology (main supervisor): Dr. Cecilia Sarmiento
- Institut National de Recherche pour l'agriculture, l'alimentation et l'environnement (France): Dr. Jean-Luc Gallois (The PhD student will stay 6-12 months at the co-supervisor's lab as mutually agreed upon).
- Tallinn University of Technology: Dr. Triin Vahisalu

4. Requirements

- Excellent command of written and spoken English.
- MSc degree or equivalent in chemistry or biotechnology, or equivalent.
- Compliance with the rules of INNOCHEMBIO (e.g. eligibility, adhering to MSCA mobility rules, etc.).
- The primary workplace will be in Estonia. Therefore, candidates from outside the EU must be eligible to obtain a visa. The position is expected to start in the first half of 2026.

- The candidate should possess a strong background in molecular biology, along with basic knowledge of plant biology and virology.
- Prior experience with CRISPR/Cas9 systems and plant tissue culture techniques will be considered an advantage.
- Proficiency in standard molecular biology techniques—such as cloning, DNA/RNA isolation, PCR, and genomic sequence analysis—is essential, as is proven hands-on laboratory experience.
- While prior work with plants is beneficial, it is not mandatory; however, experience working under sterile conditions is required.
- The candidate is expected to demonstrate a willingness to learn and apply advanced techniques, as well as the ability to critically read and analyse scientific literature in the field.
- Independent and innovative thinking, combined with strong analytical and problem-solving abilities, are crucial.
- Effective communication skills, both oral and written, are also essential.
- A collaborative mindset and readiness to work as part of a team, both in Estonia and in France, are expected.

5. Duties and Responsibilities

- Undertake postgraduate research for specific doctoral research project at TalTech or NICPB, respectively.
- Present and publish research in both academic and non-academic audiences. Attend and participate in academic and non-academic conferences, events and seminars.
- Attend and participate in all training events and supervisory meetings.
- Be seconded to the associated partner as necessary to fulfil the grant obligations.
- Prepare progress reports and similar documents on research for funding bodies, as required.
- Actively contribute to the public engagement and outreach activities of the project.
- The above job descriptions are not exhaustive, the PhD candidate may be required to undertake other tasks, which are broadly in line with the above duties and responsibilities.
- Full-time employment (40 hours per week), temporary contract for 4 years.

6. Eligibility requirements

- The applicant must be a doctoral candidate (i.e. not already in possession of a doctoral degree at the date of the recruitment).
- At the time of recruitment, the researcher must not have resided or carried out their main activity (work, studies, etc.) in Estonia for more than 12 months in the three years immediately prior to the recruitment date. Compulsory national service and/or short stays such as holidays are not taken into account.

7. Benefits

- Competitive funding scheme, with a minimum gross monthly salary of EUR 2500. Topped by additional mobility allowances as well as optional family allowances (if applicable).
- Covered tuition costs, research costs and funding for short term mobility (i.e. conference attendance).
- Interdisciplinary and international research projects.
- Early-stage researcher position, with corresponding social and medical benefits in Estonia.
- Becoming a Marie Skłodowska-Curie PhD fellow.

8. How to Apply

All applications must be sent through TalTech's official application platform Glowbase and only applications submitted here will be considered for the programme. We ask the candidates not to contact the supervisors directly, in case of questions please write at innochembio@taltech.ee. Each application must include the following material: CV, 1-page motivation letter, copies of BSc and MSc study records and diplomas, scanned copy of valid photo ID, 2 reference letters, eligibility statement.

NB! The INNOCHEMBIO programme has additional requirements compared to the standard TalTech application process. Details on the exact nature of these documents and how to insert them in Glowbase can be found at our official INNOCHEMBIO website: https://taltech.ee/en/innochembio/application-process. **If any of the required documents are missing, the candidate will not be eligible to proceed to the selection stage.**

9. Selection Process

The selection and recruitment process will be in accordance with the European Charter and Code of Conduct for the Recruitment of Researchers. The recruitment process will be open, transparent, impartial, equitable, and merit-based. There will be no overt/covert discrimination based on race, gender, sexual orientation, religion or belief, disability or age. To this end, the following selection criteria will be considered.

The application deadline is 31 August 2025. The application process will be carried out in 3 steps. In short, first an eligibility check is performed. All eligible candidates will proceed to stage 1, where they will be evaluated by independent evaluators based on the application documents. Lastly, shortlisted candidates from stage 1 will proceed to stage 2, where they will be interviewed via teleconference, which will be used to determine a candidate to whom an offer will be made. All candidates will be informed about the progress in due course after each step of the process. The selection process is described on the guide for applicants available here: https://taltech.ee/en/innochembio/application-process.

10. Disclaimer

By applying for this position, the applicants

1. give their consent to circulate their application and personal data within the INNOCHEMBIO consortium and with the evaluators;
2. confirm that the data provided is valid and accurate;
3. confirm compliance with the eligibility requirements;
4. commit to undertaking the planned secondment at the co-supervisor's institution.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1016 or scan the the code on the left with your smartphone.