

OPEN DOORS FELLOWSHIP INTERNATIONAL TRAINING PROGRAM

MODALITY A: APPLICATION TEMPLATE FROM FLEMISH RESEARCH GROUPS.

This modality has been conceived for research institutions in Flanders that are looking for new scientific partners in Africa and are willing to explore new joint research streams with their African counterparts.

The slots open slots offered by the Flemish research laboratories shall be published on the ODFP web page <https://ipbo.vib-ugent.be/en/belgian-research-groups-portal>

Information from the hosting institutions in Flanders

Contact details of a focal point	✉: tobee@psb.ugent.be ☎: +32(0)9 331 38 30
Name of the research or academic institution and acronym	VIB/UGent Center of Plant Systems Biology (PSB)
Name of the research group	Root development group
Name and position of the focal point supporting the fellow	Prof Dr Tom Beeckman
Website of institution /research group	https://www.psb.ugent.be/groups/root_development

Present the group's research line(s) and activities, including a list of current projects coordinated by the Flemish laboratory

The root system of *Arabidopsis thaliana* is an excellent model for studying the relationship between cell cycle regulation and growth and development. Understanding this offers great potential for altering root architecture and nutrient uptake, allowing to design plants to survive under dryer conditions. The research of this group focuses on the formation of lateral root primordia in the pericycle to investigate how cell cycle regulation is involved in the initiation of new organs. Plant roots serve a multitude of functions. They anchor plants and supply them with water and nutrients and exchange various growth substances with the shoots. At the root-soil interface, numerous interactions between plants and their environment take place.

The diversity of functions and a broad range of interactions with the environment render the biology of roots complicated. During the last ten years, *Arabidopsis thaliana* has been proven to be an efficient model plant to study root development and time has come to extrapolate the obtained insights to crop species such as maize, a species that is currently also under investigation. Besides the various advantages this plant offers in genetic and molecular studies, the *Arabidopsis* root boasts quite predictable ontogeny, very simple anatomy and a high level of transparency, making it very suitable for morphogenetic and cell biology studies. Understanding how root systems develop is crucial for maximizing crop production in a world in which the population is increasing, and the amount of arable land is decreasing. Lateral root formation or root branching is one of the major regulators of root system architecture.

Owing the importance of the root system for nutrient uptake, one of the research lines of the Root Development group aims to identify treatments contributing to an increased nutrient use efficiency and understand the mode of action of them. For example, seaweed extract is a biological known to increase nutrient use efficiency, but the mechanism behind this induction is unknown. One of the current projects aims at revealing the molecular plant response towards seaweed extract in the context of nutrient (nitrogen) deficiency conditions.

For a full overview, see Tom Beeckman's Lab website: <https://beeckmanlab.sites.vib.be/en/#/>

Summarise (600 - 800 words approx.) the research project(s) to which the ODFP fellow would contribute during the short research stage in Flanders.

The fellow would contribute to a project in which the response of seaweed extract is characterized. More specifically, the fellow will assist in developing a robust assay using a small scale *Arabidopsis* hydroponic system in which responses towards the extract can be easily monitored. Next, multiple experiments in different N-deficiency conditions while applying the seaweed extract in different doses to the root or to the leaves will be performed and multiple phenotypic parameters, related to growth, chlorophyll content and nutrient uptake, will be recorded. Additionally, time-course experiments will be performed to sample root and shoot tissue and assess gene expression of a set of nutrient response genes via RT-qPCR and/or via marker lines. For functional characterization, a number of *Arabidopsis* mutants will be used to assess the requirement of different pathways for the action of the seaweed extract.

Depending on the fellow's interest, parallel experiments may be conducted using seaweed extract treatment on African-relevant crops for food security, preferably rice, maize, soybean, cowpea or grass pea.

Describe the primary hard and soft skills desirable from the awarded ODFP fellow to deliver the task at hand in the Flemish research group (i.e. *bioinformatics, genetic engineering, chromatography, sequencing, metabolomics, metagenomics*).

General molecular lab work skills:

The expected candidate should be acquainted with general molecular skills (e.g. primers development, PCR, DNA purification, electrophoresis, sequencing analyses, RNA extraction, and essential bioinformatics); basic knowledge of qPCR is desired. The current project uses *Arabidopsis thaliana* as a model organism for research. Hence experience in working/growing this species will be considered a plus.

Related to soft **skills & competencies**, the fellow should have excellent communication (verbal and written) in English, interpersonal communication, self-management, teamwork, and problem-solving.

Indicate the short and long-term outputs that the Flemish research group would like to see arising from this collaboration.

Expected Short-term outputs (1-2 years)	Expected Long-term outputs (after two years)
• Contribution to results of running project. • Exchange of staff and students (short research stages/ short courses). • Organization of one study tour to Africa to assess the potential of future research collaborations.	• Publication of a joint research paper. • Development of a research proposal related to crops relevant to Africa (MSc/ PhD).

Please list any other relevant resources (e.g. articles, videos, project documents and summaries, repositories) related to the targeted projects and the short research stay that would help applicants build up their project proposal for your group.

De Saeger, J., Van Praet, S., Vereecke, D., Park, J., Jacques, S., Han, T., & Depuydt, S. (2020). Toward the molecular understanding of the action mechanism of *Ascochylla nodosum* extracts on plants. *Journal of Applied Phycology*, 32(1), 573-597.

Łangowski, Ł., Goñi, O., Ikuyinminu, E., Feeney, E., & O'Connell, S. (2022). Investigation of the direct effect of a precision *Ascophyllum nodosum* biostimulant on nitrogen use efficiency in wheat seedlings. *Plant Physiology and Biochemistry*, 179, 44-57.

Rayorath, P., Jithesh, M. N., Farid, A., Khan, W., Palanisamy, R., Hankins, S. D., ... & Prithiviraj, B. (2008). Rapid bioassays to evaluate the plant growth promoting activity of *Ascophyllum nodosum* (L.) Le Jol. using a model plant, *Arabidopsis thaliana* (L.) Heynh. *Journal of applied phycology*, 20, 423-429.

To complete this application, we need **an official letter from the Principal Investigator of the Flemish receiving group confirming the collaboration with the ODFP**. Please, send the application form and supporting letter as a separate **PDF file**.

Applications must be submitted electronically to IPBO@vib-ugent.be. The application form must be named as follows: "**ODFP_ModalityA_name of short research stay**".
