

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	✉: stefaan.werbrouck@ugent.be ☎: +32499400046
Name of the research or academic institution and acronym	Ghent University
Name of the research group	Laboratory of Applied In Vitro Plant Biotechnology
Name and position of the focal point supporting the fellow	Prof Dr Stefaan Werbrouck
Website of institution /research group	http://www.invitro-ugent.be

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

Prof. Stefaan Werbrouck heads the Laboratory for Applied In Vitro Plant Biotechnology at UGent. He has nearly 30 years of experience in plant tissue culture and has a strong track record in service projects exploring many aspects of the major sub-domains of this technology. His team consists of 15 PhD students. Their central motivation is to provide innovative solutions for the cloning of superior herbaceous and mainly woody plants for food, feed, fibre, pleasure and pharma. A good scientific network and own research results ensure a continuous inflow of new research resources. In a well equipped lab we develop new in vitro strategies and strive to discover the unexpected. We all work on topics related to micropropagation, regeneration and genetic modification of plants in a wide variety of species. We collaborate with companies and research groups around the world that are

familiar with local plant species and growing conditions, and we would like to expand our network in sub-Saharan Africa.

As part of our core research activities, we explore the use of new tools such as new cytokine- and auxin-related compounds, LEDs for phytochrome and cryptochrome manipulation and transgenic reporter plants. On the other hand, these tools are applied to achieve breakthroughs in recalcitrant economically important crop species.

Therefore during the SRS in the in vitro plant and biotechnology lab, **the fellow will enhance their** skills in in vitro tissue cultivation, production of media cultures, propagation of clean planting material from tissue culture and seeds, and some basic molecular techniques (DNA extraction, conventional PCR). In addition, as part of her daily tasks, the fellow will also become acquainted with good laboratory management practices and safety in the lab. The intended candidate **should have demonstrated experience** in the field of in vitro or microbiological techniques.

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*).

The fellows visiting our lab during the short research stay should have demonstrated basic background on plant tissue culture, plant physiology and basics on biochemistry. In addition, we would like to collaborate with someone who has the following **soft skills & competencies**: interpersonal communication, teamwork, decision-making, problem solving, critical thinking, adaptability and scientific integrity. Ability to communicate fluently in English or in French is required.

The ODFP fellows help other PhD students conduct their research for a few weeks and in return the ODFP learns a lot of new in vitro techniques. The fellow will see from close by how a problem is discussed and approached and how experiments are set up. The evaluation and documentation of the experiments (microscopy and photography) is also interesting. We find it interesting to discuss the approach and the results of the experiments with the ODFP and her fresh view will always be enriching for all of us.

Through this experience in our laboratory, the fellows will improve their soft and hard skills. Thus, we expect this to increase their chances of co-creating new projects with our lab to guarantee a long-term collaboration. With the associated better research resources, the fellow should increase her publication success, gladly together with our research group.

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)
- At least, one joint publication in a peer-reviewed journal. - Presentation of the results achieved in the lab in an international conference/symposium. - Support to increase the external visibility of our research group in sub-Saharan Africa among local stakeholders, including private companies.	- Submission of, at least, one joint proposal for funding research. - North-South exchange of students (MSc or PhD) and staff. - North-South teaching collaborations formalized and implemented (e.g. trainings and workshops in UGent and in SSA implemented).

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

Plant tissue culture is the basis of an international billion-dollar industry that supplies growers with enormous quantities of young plants. A large number of agricultural and horticultural crops undergo such an 'in vitro' phase during vegetative propagation and breeding. Also for genetically modification and random or directed mutation of a crop, knowledge about its in vitro culture is essential. Other applications include: mass cleaning of viruses from propagation material, cryopreservation and much more. The ODFP fellow will collaborate also in the ongoing research of the PhD students. A number of them are currently working on the in vitro propagation, rooting or regeneration of plants that are specially difficult to propagate. Problems such as recalcitrance, excessive callus formation, hyperhydricity and phenolic oxidation are tackled with novel cytokinins and auxins, specific metabolically active compounds, blue, red or far-red LEDs, temporary immersion bioreactors, bottom cooling, etc. The approach to remove endogenous bacteria is preceded by identification via 16SRNA-DNA sequencing. Members of our lab also work with model crops, whether genetically modified or not, to develop tactics and tools to solve in vitro problems. This includes trialling new disinfectants to improve initiation, testing molecules that intervene in the metabolism of cytokinins and auxins for shoot and root regeneration.

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.

Website of our research group: <https://invitro.ugent.be/contact.htm>

The candidate receives a safety and instruction booklet in advance to prepare for the stay in the laboratory. Some recent relevant publications of the lab are listed below:

Murvanidze, N., Doležal, K., & Werbrouck, S. (2019). Fluorine containing topolin cytokinins for *Phalaenopsis amabilis* (L.) Blume micropropagation. *Propagation of Ornamental Plants*, 19(2), 48-51.

Lotfi, M., Mars, M., & Werbrouck, S. (2019). Optimizing pear micropropagation and rooting with light emitting diodes and trans-cinnamic acid. *Plant Growth Regulation*, 88(2), 173-180.

Nisler, J., Kopečný, D., Pěkná, Z., Končítíková, R., Koprna, R., Murvanidze, N., Werbrouck S, ... & Strnad, M. (2020). Diphenylurea-derived cytokinin oxidase/dehydrogenase inhibitors for biotechnology and agriculture. *Journal of experimental botany*, 72(2), 355-370

Lotfi, M., Bayoudh, C., Werbrouck, S., & Mars, M. (2020). Effects of meta-topolin derivatives and temporary immersion on hyperhydricity and in vitro shoot proliferation in *Pyrus communis*. *Plant Cell, Tissue and Organ Culture (PCTOC)*, 143(3), 499-505.

Murvanidze, N., Nisler, J., Leroux, O., & Werbrouck, S. P. (2021). Cytokinin oxidase/dehydrogenase inhibitors stimulate 2iP to induce direct somatic embryogenesis in *Coffea arabica*. *Plant Growth Regulation*, 94(2), 195-200.

Werbrouck, S.P.O. (2021). Meta-topolin and Related Cytokinins as a Solution to Some In Vitro Problems. In: *Meta-topolin: A Growth Regulator for Plant Biotechnology and Agriculture*, 85-91. Springer, 339 pp

Murvanidze, N., Ameye, M., Geelen, D., & Werbrouck, S. P. (2021). A calmodulin antagonist protects in vitro raspberries against disturbed photosynthesis caused by constant light and cytokinin. *Plant Cell, Tissue and Organ Culture (PCTOC)*, 1-8

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**".