



OPEN DOORS FELLOWSHIP PROGRAM- APPLICATION TEMPLATE FOR RECEIVING LABORATORIES IN FLANDERS

APPLICATION MODALITY A: This modality has been conceived for research institutions in Flanders' higher education institutions or research centres looking for new scientific partners in Africa and willing to explore new joint research streams with their counterparts.

Objective: The application presented by the candidate ODFP fellow shall align with the scope and the requirements of open slots offered by the Flemish research laboratories and published on the ODFP web page.

Examples of the testimonies and open slots offered by the Belgian research laboratories are published [on the ODFP web page](#).

Information from the hosting institutions in Belgium

Contact details of a focal point	✉: thomas.jacobs@psb.ugent.be ☎: +32(0)9 331 38 60
Name of the research or academic institution	VIB-UGent Center for Plant Systems Biology
Name of the research group	Plant Genome Editing
Website of institution /research group	https://jacobslab.sites.vib.be/

Present the group's research line(s) and activities, including a list of commonly used technologies (e.g. *bioinformatics, genetic engineering, chromatography, sequencing, metabolomics, metagenomics*).

The Plant Genome Editing group focuses on the use of CRISPR/Cas technologies to edit plant genomes for the study and improvement of plant systems. To enable the use of this technologies within the VIB and beyond, the group is pursuing two lines of research:

1. The curation of a collection of CRISPR reagents and protocols.
2. The systematic optimisation of plant genome editing techniques.

To increase the frequency of gene editing and improve the recovery of useful edited plants, the focus is on the entire gene editing workflow, from optimisation of protocols and vector components to downstream analysis and isolation of mutants of interest.



The group is also investing in the development of a range of protocols and technologies to enable CRISPR screens in plants. In recent years, the research group has been working on the OMEGA project to develop a new plant biotechnology synthetic biology platform for large-scale genetic engineering in the model bryophyte *Physcomitrium patens*.

Commonly used technologies include:

- Genetic engineering
- Cloning
- PCR
- Sequencing (Sanger, NGS)
- Bioinformatics

Describe the primary hard and soft skills desirable from the awarded ODFP fellow to deliver the task at hand.

- Proficient in these hard and soft skills:
Hard skills: Basic molecular biology techniques (e.g. sterile techniques; media preparation; cloning; growth of bacteria cultures; *E. coli* transformation, PCR, purification of genomic and plasmid DNA; agarose gel electrophoresis; Sequencing preparation and analysis)
Soft skills: Clear and respectful communication with other lab members, ability to plan work for day and week, ability to ask for help when unsure of task or result, maintain a clear and safe work environment.
- Somewhat conversant in these hard and soft skills:
Plant biology
- Basic or minimal knowledge in these hard and soft skills:
Basic knowledge of the CRISPR technology
- Language preferences:
English
- Interpersonal skills:
communication, self-managing, teamworking, adaptability.

Indicate the short and long-term outputs and synergies the PI in Belgium would like to see arising from this collaboration.



Expected Short-term synergies	Expected Long-term synergies
This project may contribute data/results to a scientific publication.	Opportunity for long-term cooperation in Genome editing research, for example through MSc students or PhD thesis projects and research projects.

Summarise (between 400 - 800 words approx.) the research project(s) or activities where the ODFP fellow would contribute to her/their research.

Genomics research, combined with revolutionary genome editing tools, has created new opportunities to explore fundamental aspects of biology and to develop novel (bio)technologies for medicine, agriculture and industry. The OMEGA project aims to build on these developments by enabling large-scale engineering of plant genomes. The research carried out by the ODFP fellow would contribute to the activities of this project.

Experimentally determined lists of essential genes have been crucial to such large-scale projects in other species, but are not currently available for plants. The OMEGA project therefore needs to identify which plant genes are essential for growth and development. However, the standard technologies used to identify essential genes are limited by genetic interactions (e.g. redundancy, synthetic lethality). To overcome these limitations, the Plant Genome Editing group is developing multiplex CRISPR screens in plants. This will allow genetic interactions to be identified by targeting specific sets of closely related or functionally overlapping genes, and not only link individual genes to basic phenotypes such as development and essentiality under different environmental conditions, but also combinations of genes (e.g. synthetic lethal) that cannot be evaluated in standard mutagenesis screens.

The OMEGA project will identify essential genes and genetic interactions on a genome-wide scale in the moss *Physcomitrium patens*. This model organism offers a number of advantageous characteristics, ranging from simple culture requirements and a relatively fast life cycle to the most efficient homology-directed recombination (HDR) rates known in plants (equivalent to yeast). In addition, as a bryophyte, the dominant life stage is the haploid gametophyte, making the production of knockouts straightforward as individuals are immediately homozygous.

The list of essential genes revealed by generating a knockout mutant collection in *P. patens* will be an invaluable resource for designing future genome engineering projects, as essential genes limit large-scale manipulations. Essential genes and genetic interactions are conserved between closely related organisms, suggesting that these results will be useful in other plant systems and will be a useful resource for comparison with essential genes in other species. The mutant collection will also be useful to the research community by providing a comprehensive collection of higher order mutants not currently available in any plant system.



Are there additional resources relevant to the work/project related to the short research stay (e.g. articles, videos, project documents and summaries, repositories) that would help the fellow have a broader background of the intended project? If so, please list them below.

Some interesting papers:

doi: 10.1093/plcell/koab099

<https://doi.org/10.1186/s13059-022-02836-2>

<https://doi.org/10.1105/tpc.19.00828>

<https://doi.org/10.1093/nar/gkado36>

<https://doi.org/10.1016/j.tplants.2020.10.004>

An official letter from the Principal Investigator of the Belgian receiving group confirming the collaboration with the ODFP should be sent together with this form duly filled.

Applications can be submitted electronically to IPBO@vib-ugent.be (The application form must be named as follows: "ODFP_ModalityA_name of research group". Please send the application form and supporting letter as a **single PDF file**).

