

# CROPSTRENGTHEN - EUROPEAN INDUSTRIAL DOCTORATE



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Marie Skłodowska-Curie ITN

The project provides advanced systems biology training for 5 young researchers who will develop novel methods for increasing crop strength and resistance to stress by alternative genetic and genomic, non-GMO technologies. Young researchers will receive significant training in the partner companies.

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# CropStrengthen - European Industrial Doctorate

MARIE SKŁODOWSKA-CURIE ITN

## THE PROJECT

Early Stage Researchers (ESR) have been appointed in the EU Project CropStrengthen. CropStrengthen is a Marie Skłodowska-Curie Action in Horizon 2020. The type of action is a European Industrial Doctorate (EID).

The dual approach of the project will meet the growing EU push towards secure, sustainable and safe means of food production (Dir.2009/128/EC & EU Reg. EC/178/2002):

- (1) Selecting allelic variants of a novel gene identified by members of the consortium which regulates oxidative and abiotic stress tolerance and
- (2) Molecular priming by biostimulants or low doses of H<sub>2</sub>O<sub>2</sub> to induce stress-protective mechanisms in crops.

The genetic approaches are combined with high-throughput technologies for transcriptome, metabolome, and phenotype analyses, combined with advanced bioinformatics. Equipping the young researchers with these skills will enable them to develop their research career in academia or industry.

The expected results will increase our understanding of the molecular basis of stress tolerance and provide two alternative strategies for crop improvement and increasing food production. Partner companies will ensure rapid dissemination of applied research to end users.

- [CropStrengthen public webpage](#)

## THE CONSORTIUM

### University of Potsdam, Department of Molecular Biology

Since its foundation 24 years ago the University of Potsdam has excelled in research and teaching and is well positioned both at national and international scales. The Department of Molecular Biology (UP) focuses on the functional analysis of plant transcription factors and the gene regulatory networks they control, employing a combination of molecular, genomics and systems biology approaches. The focus is on regulators that control leaf growth and senescence, and

the response to abiotic stress. The group also uses synthetic biology approaches to construct artificial regulatory networks with the aim of building synthetic bio-systems.



### Enza Zaden Research & Development B.V.

Enza Zaden (EZ) is an international breeding company that develops innovative vegetable varieties. We grow and sell the seeds of those varieties worldwide. Our breeding efforts focus on more than twenty vegetable varieties, the most important of which are tomato, sweet pepper, lettuce, cucumber, onion and melon. Our vegetables are bought and consumed all over the world. And they are greatly appreciated by growers, traders and consumers alike. We are an independent family company. As an independent company we focus on continuity in the long term and healthy

growth. Those two factors are essential for enabling us to focus on our greatest strengths: developing and supplying high-quality vegetable varieties and vegetable seeds. Many years of experience and of investments in people, breeding and innovation have laid the basis for a strong, healthy company.



## BioAtlantis Ltd.

**BioAtlantis Ltd.** (BA) is a biotechnology company, specialising in the **development and production of bioactives** for the plant, animal, and human markets.

At the forefront of the company's growth and rapid expansion into worldwide markets, is the pursuit of scientific excellence. As such, we work with several of the leading universities across the world isolating key functional molecules from natural resources and validating their functionality and effectiveness for use in

solving problems facing modern agriculture.

As part of CropStrengthen, BioAtlantis Ltd. will develop biostimulant-based technologies to enhance crop growth and stress tolerance.



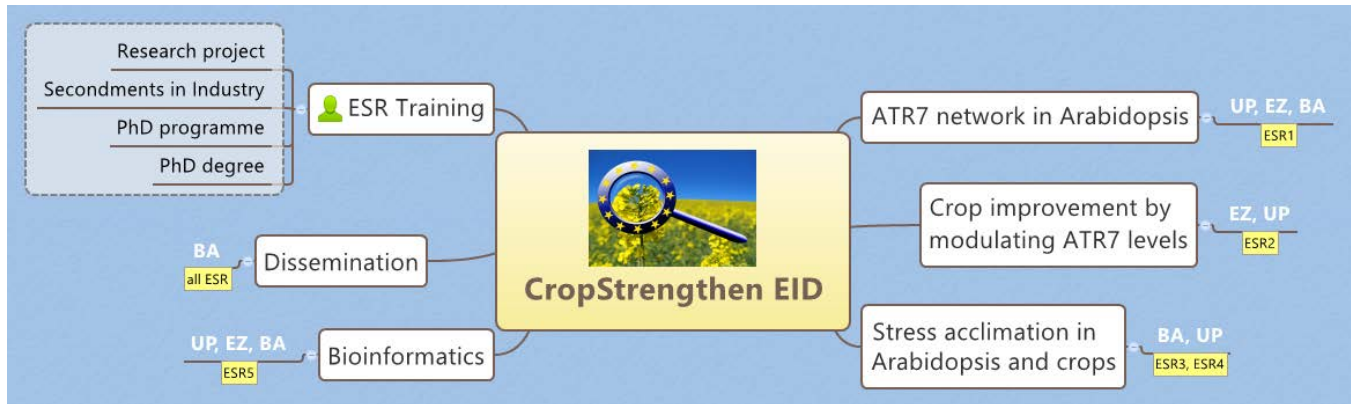
## For Funding: The European Commission



CropStrengthen is a [Marie Skłodowska-Curie Action](#) funded in [Horizon 2020](#) (Grant Agreement No 642901).

## RESEARCH

The research of the project is organised in distinct scientific work packages (WP) which will be implemented jointly by industrial and academic partners. Essential elements in the work programme are the ESR training and the dissemination of results and outcomes.



### ATR7 network in Arabidopsis

**Objectives:** To decipher the signalling network of **ATR7** in *Arabidopsis thaliana*, which can serve as a fundamental basis for further molecular improvement of crops via transcriptome and metabolome analysis and the identification of genes and proteins which interact with the ATR7 stress network in *A. thaliana*.

### Crop improvement by modulating ATR7 levels

**Objectives:** To enhance the tolerance to abiotic stress of important vegetable crops through modulation of ATR7 levels.

### Stress acclimation in Arabidopsis and crops

**Objectives:** To develop a system for enhancing the tolerance of vegetable crops to abiotic and oxidative stress through molecular priming (acclimation). The WP will lead to induced stress tolerance in *A. thaliana* and crop species.

### Bioinformatics

**Objectives:** To train the ESRs in advanced bioinformatics and statistics. The WP will lead to identification of ATR7 homologues and co-expressed genes in other species; identification of stress-related genes commonly regulated in different crop species; identification of metabolic stress signatures and specific metabolites altered in abundance during different stresses.

## TRAINING

Training will be conducted at the University of Potsdam (UP), Germany, and two companies: BioAtlantis (BA), Ireland, and Enza Zaden (EZ), The Netherlands. Offered training packages (TP) are:

### TP1: Training by research.

CropStrengthen young researchers will perform their individual **research projects** in the academic and the industrial sectors. The ESRs will spend at least 50% of their time in industry. They will be supervised by PIs and experienced researchers from different partner institutions.



### TP2: Attending lectures and seminars.

A series of lectures for all ESRs is designed and will be delivered at UP with topics in plant genetics, development, and evolution.

### TP3: Attending courses, workshops, and conferences.

CropStrengthen young researchers will have the opportunity to attend a number of courses delivered at UP, BA and EZ.

In addition, it is policy of UP to urge its PhD students to attend international conferences, especially in the final year of their study. In the last year of the project, a conference on oxidative and abiotic

stress in plants will be organized. Leading scientists from consortium partners worldwide will be invited as speakers. The conference will be open to the general public.



## TP4: Hands-on training on genomics and metabolomics instruments.

More specifically, the ESRs will be trained with the in-house instruments for genome and metabolome analyses, quantitative multi-parallel real-time PCR, gas and liquid chromatography coupled with sensitive mass spectrometers.



- ❖ **Workshop on transcriptomics and proteomics**
- ❖ **Course on plant metabolomics**

## TP5: Bioinformatics.

Such skills are needed to prepare ESRs for tasks such as comparative genomics, analysis of large transcriptome and metabolome datasets, integration of complex data into systems biology models.

Topics will include:

Introduction to bioinformatics and sequence analysis: Provides basic insight into how sequences are obtained and how to analyse them (BLAST, HMMer, Aligment). Gives an overview of what a genome is, how it is structured and what it contains. Gene annotation.

Linux for bioinformatics. What is the command line, how to use it and why? Useful command line tools (grep, sed, awk and others). Basic scripting (Bash & Perl). Using a computer cluster.

Comparative & evolutionary genomics: Clustering genes into gene families. Phylogenetics. Genome evolution.

Using R and Bioconductor: Why R and Introduction to R syntax. How to use Bioconductor.

NGS expression analysis: Overview of NGS methods. Tools to measure expression (Bowtie, Cufflinks, CummeRbund, DESeq, EdgeR).

- ❖ **Workshops on bioinformatics and statistics**





### TP6: Abiotic stress phenotyping and analysis.

This training package will bridge fundamental science with applied, market-oriented science. The TP includes hands-on training on methods for plant phenotype analysis and evaluation of crop parameters such as yield, seed and pollen viability, and stress tolerance, using classical as well as advanced technologies (such as the LemnaTec machine for high-throughput phenotype analysis or the

Amphasys' patented "lab-on-a-chip" technology, available at EZ).

- ❖ **Course on abiotic stress phenotyping**



### TP7: Active participation in designing research and writing projects.

This is an important part for the development of ESRs careers. The package will be jointly delivered by UP and BA.

- ❖ **Workshop Project planning, implementation and coordination**

### Enrolment as PhD student at University of Potsdam

Young researchers will be enrolled as PhD students and will defend their PhD thesis at UP.



## ESR PROJECTS

### Supervisors

Based on the CropStrengthen project plan and UP PhD regulations all ESRs will have two supervisors and one mentor as below:

#### Primary supervisor

A primary supervisor is appointed by the Doctoral Committee and should have the Professor degree and work at Faculty of Science of UP.

The primary supervisor is responsible for continuous monitoring the doctoral candidate's progress. The doctoral candidate presents a progress report on dissertation plans at least once a year.

#### Secondary supervisor

Secondary supervisor assumes a supervisory and consultative function. Professors and university lecturers with post-doctoral qualifications can serve as secondary supervisors. Together with the primary supervisor, they take part at least once a year in progress report meetings. Furthermore, they should be available as discussion partners if problems arise in the relationship between the supervisor and the doctoral candidate.

#### Mentor

Mentor assumes a consultative function. The PIs of our partner companies will take this important task as Mentors.

### Secondments

As general rule each ESR should work at least half of the appointment (18 months) in the partner companies. The periods of secondments are arranged for each ESR individually. During the secondment the salary is paid through the appointing partner but the research costs will be covered by the hosting partner.

For the secondment, it will be necessary to arrange the resident permit, living place and also the health insurance for the ESRs in the new country. Arrangements are supported by the supervisor, mentor and also the hosting institute.

## SUPERVISION AND REPORTING

Together with supervisors and mentors ESRs will regularly discuss the research and training projects. Supervision can be structured with the help of the Personal Career Development Plan, reports and meetings.

## ATTACHMENTS

### Useful EU websites

- [NCPs MSCA Germany, Ireland, Netherlands](#)
- [Euraxess](#) – Researchers in Motion
- [Marie Skłodowska-Curie Actions](#)
- [Marie Curie Fellowship Association](#)
- [The European Plant Science Organisation](#)



### Closing and acknowledgement

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#### **Contact:**

University of Potsdam  
CropStrengthen  
IBB - Molecular Biology

Karl-Liebnecht -Str. 24/25, Haus 20  
14476 Potsdam

Tel.: +49 331 977-2807

Fax: +49 331 977-2512

E-Mail: [cropstrengthen@uni-potsdam.de](mailto:cropstrengthen@uni-potsdam.de)