2019 Helmholtz – OCPC – Program
for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project: Interaction of epigenetic changes and metabolism during climatic plant stress

Helmholtz Centre and institute: Helmholtz Zentrum Muenchen, Institute of Biochemical Plabt Pathology

Project leader: Prof. Dr. Joerg Durner, Dr. Martin Groth (co-supervisor)

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Description of the project (max. 1 page)**:**

Drought, heat, and other environmental stresses associated with climate change are major limiting factors for plant productivity. To ensure global food security, new strategies for the generation of stress resistant crops are required. Plant acclimation to recurring stress involves epigenetic changes mediated by methylation of DNA and histones, which are the main constituents of chromatin. It is known that environmental stress causes changes in DNA and histone methylation but the underlying mechanisms and biological functions are still poorly understood. The aim of this project is to gain new insights into the regulation of chromatin methylation by diurnal, developmental, and stress-related metabolic changes that will be highly relevant to the productivity of crops under challenging environmental conditions.

DNA and histone methylation are catalyzed by distinct methyltransferases, which require the cofactor S-adenosylmethionine (SAM) as methyl donor. During methylation SAM is converted to S-adenosylhomocysteine (SAH), which in turn is a competitive inhibitor of SAM-dependent methyltransferases. SAM production and SAH degradation are controlled by folate-mediated one-carbon metabolism. Accordingly, changes in one-carbon metabolism are linked to altered DNA and histone methylation patterns and have major implications in disease and development (Groth et al., 2016, Nat Commun 7:11640). To understand the causalities, the project will address the following questions:

- What are the mechanisms that control SAM supply towards distinct DNA and histone methylation pathways?
- How is SAH removed from the chromatin environment?
- Which genomic regions and chromatin patterns are sensitive to changes in SAM and SAH metabolism?

Therefore, the project aims include determination of subcellular localization dynamics of candidate proteins involved in one-carbon metabolism, protein-protein interactions of nuclear candidate proteins (e.g. by immunoprecipitation and mass spectrometry as well as *in situ* Proximity Ligation Assay), and chromatin interaction dynamics by ChIP-seq. Stress responses of relevant *Arabidopsis* genotypes will be characterized at chromatin, transcriptome, metabolome, and phenotype levels using state-of-the-art facilities (e.g. for environmental simulation and automated phenotyping).

The Helmholtz Zentrum München is Europe's leading research center focused on environmental health. Comprising 40 research units, unique experimental platforms, and expert scientists from 50 different nationalities, it offers a dynamic environment for groundbreaking research.

Description of existing or sought Chinese collaboration partner institute (max. half page)**:**

Existing collaboration: Since its establishment at the Southern University of Science and Technology (SUSTech) in 2012, the Department of Biology has attracted internationally renowned professors to join as leaders and young scientists to start their independent academic career in pursuit of excellence in research and teaching. The research interests of the faculty members include diverse topics such as cell biology, development & regeneration biology, neuro biology, plant biology & food safety, bioinformatics, systems biology, structural biology and biophysics. The primary goals of the faculty are to address the most significant fundamental biological questions and to develop new strategies to treat various complex diseases. Such efforts will benefit from the shared inter-disciplinary collaborative spirit deeply rooted in the minds of all the faculty members working in different departments at SUSTech.

We are looking forward to receiving applications from highly motivated scientists at SUSTech or other Chinese institutions, who are interested in working on the described research project. Postdocs from other (non-partner) institutions meeting the above described criteria, who are interested in establishing an active and long-lasting collaboration, are encouraged to apply.

Required qualification of the post-doc:

- PhD in (plant) biology, biochemistry, or agricultural sciences and engineering
- Background in chromatin biology and/or (plant) metabolism
- Experience with molecular lab work
- Excellent academic track record, including peer-reviewed publications in internationally renowned journals