

MERIT Newsletter



06 - 2013

Dear all,

A few months ago we were quite busy with our 1. Periodic Report, which was THE report for the next interim payment. We are happy to announce that this has been finished successfully: the report has been accepted as it is, with only some small corrections of the financial part, and the next tranche is already distributed. Thanks to all of you for all your contributions and efforts! The report is available at our website (protected area):

<https://theory.bio.uu.nl/MERIT/internal/meritreportfirstperiodicsubmitted.pdf>

Content

Welcome

Project timeline

Calendar 2013 / 2014

ST3 – review

ST3 evaluation

MERIT cuts the edge – Mega Experiment Vienna

Würzburg – nice to meet you!

ST4 outlook

MERIT – Publications so far

Suggestions for the next issue are highly welcome!

And the next one will come ;) ... But first we will have our 3. Annual Meeting in Würzburg, a beautiful city with one of the oldest universities of Germany. I'm looking forward seeing you there!

Until then, best wishes and sunny holidays,
Sylvia

PS As usual: for more information please visit our website

<http://theory.bio.uu.nl/MERIT/html/index.html>

Project timeline

- 01/11 start of the project
- 03/11 kick off meeting in Utrecht
- 09/11 website online
- 10/11 almost all fellows selected
- 11/11 1.annual meeting in Madrid
- 01/12 1.Annual Report submitted
- 02/12 ST1 successfully finished
- 03/12 Umeå new MERIT partner
- 05/12 1.Annual Report accepted
- 06/12 MERIT team complete
- 07/12 ST2 successfully finished
- 08/12 Midterm Report submitted
- 10/12 CST 2 and M³ – MERIT Mid-term Meeting in Lisbon
- 02/13 1.Periodic Report submitted
- 03/13 ST3 successfully finished
- 09/13 MERIT 3.Annual Meeting in Würzburg

2.Progress Report is coming soon!
Deadline 06.12.1013

ST3

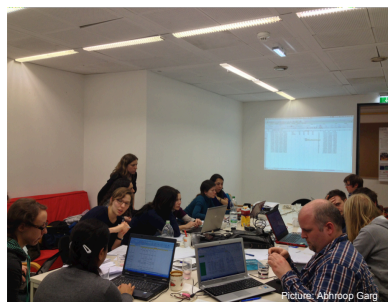
Metabolomics

– Measuring metabolic adaptation –

11 – 16 March 2013, Vienna

The MERIT Skill Training Course 3 on Metabolomics took place from 11. – 16. March 2013 at the Department of Molecular Systems Biology, University of Vienna. After all MERIT Fellows and four associate researchers had arrived and acclimated to the snowy winter atmosphere in Vienna, the course started on Monday, 11th of March, with a welcome and brief introduction to the program.

Following a short coffee break, the experimental part directly began with the extraction of polar and unipolar metabolites from leaf samples of the bzip63



knock down mutant of Arabidopsis. Motivated by the question how the bZip/SnRK network is related to the low energy syndrome and how it affects the metabolome, metabolite profiles of samples were analyzed from three conditions: day, night and extended night.

At this point, I would like to mention and thank the staff of Johannes

Hanson's Lab in the name of the whole MERIT network for growing, harvesting and grinding leaf samples of over 20 different lines for all of the three conditions!

In addition to a comparison of relative metabolite abundances between different conditions, the course also aimed at absolute quantification of metabolite levels. For this, calibration curves of 40 metabolites were generated and applied to quantify metabolite contents of leaf samples. Prior to the experi-

mental procedure of metabolic profiling, a theoretical introduction was given about Metabolomics science and its central position in systems biology research. Basic principles of gas chromatography and mass spectrometry were explained and discussed. A theoretical introduction provided information about the prominent systems of mass spectrometry, which are the triple quadrupole and the time-of-flight (TOF) system.

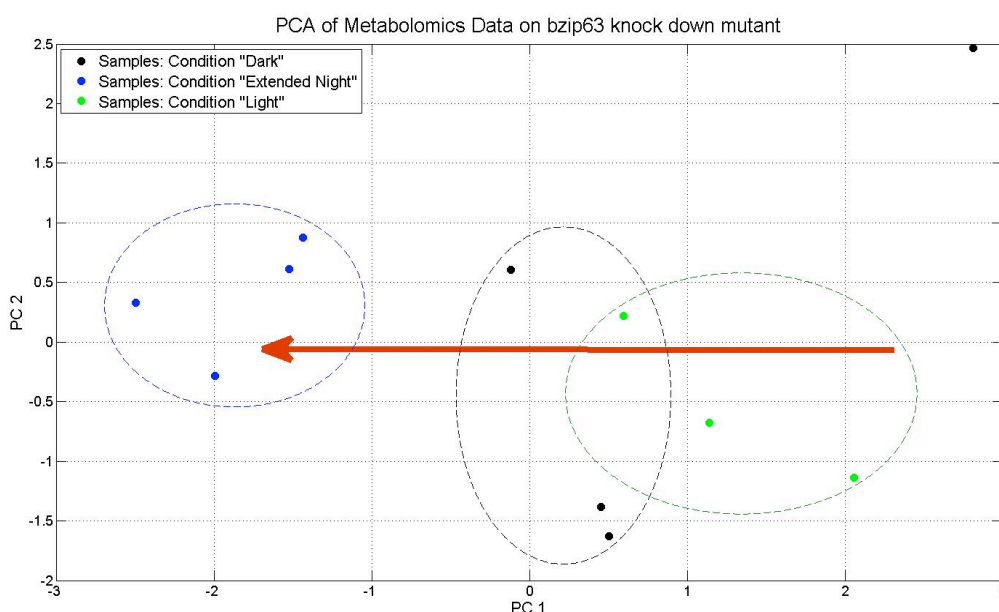


Figure 1: PCA of metabolomics data

ST3 – Metabolomics continued

The latter one was then used for measurements of the samples followed by the evaluation of chromatograms and metabolite spectra.

Working together in small groups, the fellows analyzed and determined key parameters like retention time, retention index, mass-to-charge ratios and ion traces for the whole batch of measured samples. This ended up in a comprehensive dataset for statistical analysis. Following a brief introduction to statistical methods and techniques of metabolic modeling, principal component analysis (PCA) was applied to the experimental data set. Results from the PCA (see Fig. 1) allowed for a separation of metabolite profiles from light, night and extended night conditions providing evidence for a severe impact of low energy stress on the leaf metabolism of bz1p63 knock down mutants. Of course, several more measurements are needed to provide a detailed information about strategies of metabolic reprogramming under low energy syndrome – however, initial tendencies have been provided by the course participants: Congratulations!

Beside the theoretical and practical issues on metabolomics there was still enough time for social events like ice-skating around the town hall, a guided city tour or a dinner in one of the famous Viennese Heurigen. It was a nice opportunity to discuss topics beyond science and spending a nice time together. To summarize the course, it was great to have the group here in Vienna and I am looking forward to see you all again during one of meetings!



Picture: Jochen Eisele

Thomas Nägele, in the name of the whole Weckwerth Group, University of Vienna

Calendar 2013 / 2014

SEB Annual Main Meeting
3 – 6 July 2013
Valencia, Spain

Plant Metabolic Engineering
Gordon Conference
7 – 12 July 2013
Waterville Valley Resort

ASPB Plant Biology
20 – 24 July 2013
Providence, Rhode Island, US

Plant Vascular Biology
26 – 30 July 2013
Helsinki, Finland

Plant Genome Evolution
8 – 10 September 2013
Amsterdam, The Netherlands

CST 3 + CST 4 Scientific writing
12 – 13 September 2013
Würzburg, Germany

MERIT 3. Annual Meeting
16 – 18 September 2013
Würzburg, Germany

ST4 – Industrial relevant skills
February 2014, Gent, Belgium

ASPB Plant Biology
12 – 16 July 2014
Portland, OR, USA

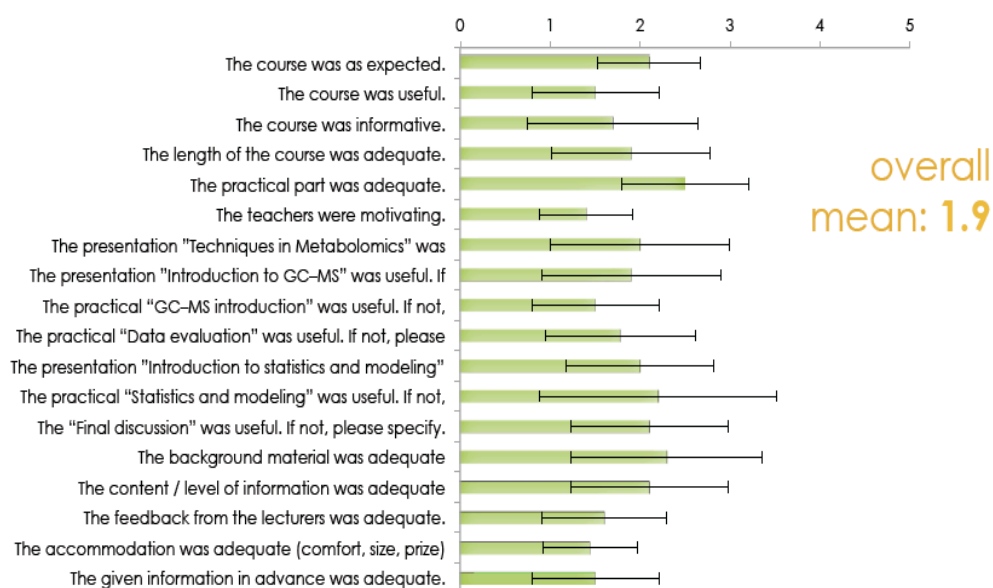
25th ICAR - International Conference
on Arabidopsis Research
28 July – 1 August 2014
Vancouver, Canada

ST3 – Evaluation

Aim of this course was to learn how to systematically describe living systems by using metabolomic techniques with its broad application range such as GC–MS, and to improve complementary skills in computational analysis, data mining, result presentation and scientific communication. In the end the course was evaluated by 10 participants, with a mean score of 1.9 (see also the MERIT website). This value is in line with the evaluation results of the previous given courses within the project. Following the participants the course was very intensive and could have been longer.

However, some wished to have the practical and technical parts extended, whereas the data evaluation could have been a bit shorter, also regarding to the statistics course in Utrecht. A complete data set as a backup for demonstration would have been good. For the information level of the experiment it would have been an advantage to include wild type lines also and having less treatment samples. The accommodation was perfect and the participants enjoyed their stay in Austria.

Figure 2: Evaluation of ST3



MERIT cuts the edge

A collaborative metabolite profiling study to unravel the low energy syndrome



Fig. 3: cultivation of different Arabidopsis lines

The signaling network raised by bZIPs and SnRKs shows a high level of interconnection and significantly affects primary plant metabolism. Besides known target genes like ASPARAGINE SYNTHETASE 1 or PROLINE DEHYDROGENASE 1/2 it may be speculated that there exist numerous further molecular targets connected to this signaling network. To comprehensively unravel such targets being involved in low energy-induced metabolic reprogramming, a collaborative metabolite profiling study was set up within the MERIT network. Supervised and organized by the staff of Johannes Hanson's lab, Utrecht University leaf material from more than 20 different Arabidopsis lines was cultivated and harvested under uniform growth conditions (Fig. 3). Seed material was provided by the laboratories of the MERIT network, comprising single, double, triple and quadruple mutants affected in bZIP/SnRK gene expression. The sampling strategy included time points of light, dark and extended

darkness to track changes in metabolism induced by conditions of energy deprivation. Profiling studies are performed on a GC- and LC-MS platform in the Weckwerth lab, University of Vienna. First results have already proven the ability to comprehensively detect low energy-induced shifts in primary metabolism due to a single mutation the bZIP interaction network (for details see report on the metabolomics course). Metabolite profiling of the remaining mutant lines is still in progress. Yet, the promising output of first results point to a significant improvement of current knowledge about the low energy syndrome and regulatory instances being involved in metabolic reprogramming. This is a significant advance in the characterization of plant-environment interactions, demonstrating once more the high potential of the collaborative and multinational MERIT project.

Thomas Nägele
Dept. of Molecular Systems Biology
University of Vienna

Würzburg

CST 3/4 and the 3. Annual Meeting

Nice to meet
you!

to meet
you!

meet
you!

you!



Our MERIT 3. Annual Meeting will take place 16. – 18.09.2013 in Würzburg, Germany, organized by Wolfgang Dröge-Laser.

We will have a full program: The first day of the meeting is reserved for the fellows to present his/her work and the progress over the last months to the other network participants. During the second day the PI's give a short overview about their groups. Besides the scientific presentations the Career Development Plans (CDP's) will be updated. The administrative issues are scheduled for the morning of the third day. It is a pleasure to welcome Christine Foyer as member of the scientific advisory board and invited speaker, as well as Britta Mägde and Marcy Scholz as lecturers for our complementary skill training, associated to our meeting.

Associated to the meeting the students will follow the combined network course CST3/4 about "Optimizing writing strategies for publishing in English". The course combines theory and practical exercises for publishing data and writing proposals, both indispensable for surviving in science.

For more details about the program please visit: <http://theory.bio.uu.nl/MERIT/html/meritmeetingthirdannual.html>



More information about Würzburg can be found at (e.g.): <http://en.wikipedia.org/wiki/Würzburg>, <http://www.wuerzburg.de/en/index.html>, or http://www.tripadvisor.com/Tourism-g187321-Wurzburg_Bavaria-Vacations.html.



Outlook ST4

Industry relevant skills from the laboratory to the field

??????????

Skills? Relevant? More?

What skills are needed for a career? And are there differences inside and outside science? Not for all students is staying in science a possibility or an option.

But how to step over? How is research outside science organized?

This workshop, organized by Matthew Hannah (Bayer, Belgium) and Wim Vriezen (Nunhems, The Netherlands) will introduce the MERIT employees to the complexity of the R&D process within a modern agro-biotech company, including IP and legal protection, licensing and stewardship, to allow successful product commercialization.

This exposure to industry-relevant research and to the various departments and functions will also provide insights into the diverse career opportunities in non-laboratory functions. The schedule of this workshop is outlined below and will include the following components:

(i) A general overview of the current agro-biotech landscape, complemented with a specific example by describing the industry activities and organization of the industrial partner Bayer BioScience

(ii) The background and laws governing Intellectual property and their implications for the Ag-Biotech industry will be discussed with specific and relevant examples. This will be complemented by a hands-on IP activity.

(iii) A discussion of the importance of Public-private partnerships will illustrate the benefits of academia-industry interactions. This will be followed by an introduction of the activities of Technology Licensing and their role in supporting the R&D process. An interactive activity focusing on contract negotiations will complete this section of the training.

(iv) The third day will be mostly devoted to training in Plant Breeding and its role in a modern agro-biotech company. Background and general introduction of plant breeding and its role will be complemented by a specific case-study of Plant Breeding at Nunhems.

(v) The day will be completed by bringing all of these aspects into context by a R&D pipeline activity which will be fun, practical activity and quiz where the attendees will participate in building their own R&D pipeline and cooperating with other team members to successfully complete their "product", and learning the R&D phases in the process.

(vi) The final day will focus on downstream effects and consequences, illustrating the potential for modern plant breeding with the example of submergence tolerant rice (Prof. J. Bailey Serres). This will be followed by an overview of the laws, processes and socio-economic implications of the Product Deregulation and Stewardship process.

Last but not least ... MERIT publications so far:

- Bedhomme, M., **Adamo, M.**, Marchand, C.H., Couturier, J., Rouhier, N., Lemaire, S.D., Zaffagnini, M., and Trost, P. (2012): "Glutathionylation of cytosolic glyceraldehyde-3-phosphate dehydrogenase from the model plant *Arabidopsis thaliana* is reversed by both glutaredoxins and thioredoxins in vitro", *Biochem J.*, 445(3), 337-47; [doi: 10.1042/BJ20120505](https://doi.org/10.1042/BJ20120505)
- **Nägele, T.** and **Weckwerth W.** (2012): "Mathematical Modeling of Plant Metabolism — From Reconstruction to Prediction", *Metabolites* 2012, 2(3), 553-566; [doi:10.3390/metabo2030553](https://doi.org/10.3390/metabo2030553)
- Doerfler, H., Lyon, D., **Nägele, T.**, Sun, X., Fragner, L., Hadacek, F., Egelhofer, V., **Weckwerth, W.** (2012): "Granger causality in integrated GC-MS and LC-MS metabolomics data reveals the interface of primary and secondary metabolism", *Metabolomics* 2012, [doi: 10.1007/s11306-012-0470-0](https://doi.org/10.1007/s11306-012-0470-0).
- Hoehenwarter, W., Thomas, M., **Nukarinen, E.**, Röhrig, H., **Weckwerth, W.**, Conrath, U., Beckers, G.J.M., "Tandem MOAC identifies novel in vivo MAP kinase substrates in *Arabidopsis thaliana*", *Molecular and Cellular Proteomics*, article in press, [doi:10.1074/mcp.M112.020560](https://doi.org/10.1074/mcp.M112.020560).
- Wind, J.J., **Peviani, A.**, **Snel, B.**, **Hanson, S.J.**, Smeekens, S.C. (2012): "ABI4: versatile activator and repressor", *Trends in Plant Science* 2012, doi.org/10.1016/j.tplants.2012.10.004
- Seidl, M.F., Wang R.P., van den Ackerveken, G., Govers, F., **Snel, B.**: "Bioinformatic inference of specific and general transcription factor binding sites in the plant pathogen *Phytophthora infestans*", *PLoS One*, 2012, 7(12), e51295, [doi:10.1371/journal.pone.0051295](https://doi.org/10.1371/journal.pone.0051295).
- Mihoe, S.C., Boersema, P.J., Berke, L., **Snel, B.**, Heck, A.J., Menke, F.L.: "Targeted quantitative phosphoproteomic approach for the detection of phospho-tyrosine signaling in plants", *J. Proteome Res.*, 2012, 11(1), 438-448, [doi:10.1021/pr200893k](https://doi.org/10.1021/pr200893k).
- Berke, L., Sanchez-Perez, G.F., **Snel, B.**: "Contribution of the epigenetic mark H3K27me3 to functional divergence after whole genome duplication in *Arabidopsis*", *Genome Biol.*, 2012, 13(10), R94, [doi:10.1186/gb-2012-13-10-r94](https://doi.org/10.1186/gb-2012-13-10-r94).
- Bieker, S., Riester, L., Stahl, M., Franzaring, J., **Zentgraf, U.**: "Senescence-specific alteration of hydrogen peroxide levels in *Arabidopsis thaliana* and oil seed rape summer variety *Brassica napus* cv. Mozart", *Journal of Integrative Plant Biology* 2012, 54 (8), 540-554, [doi:10.1111/j.1744-7909.2012.01147.x](https://doi.org/10.1111/j.1744-7909.2012.01147.x).
- **Zentgraf, U.**, Smykowski, A., Zimmermann, P.: "Role of intracellular hydrogen peroxide as signaling molecule for plant senescence", *Senescence*, Edited by Tetsuji Nagata, ISBN 978-953-51-0144-4, Hard cover, 850 pages, Publisher: InTech, Published: February 29, 2012 under CC BY 3.0 license, [doi: 10.5772/1905](https://doi.org/10.5772/1905).