Max Planck Institute
of Molecular Plant Physiology

Report on a Student Internship

at

Max Planck Institute of Molecular Plant Physiology

Workgroup Dr. Yariv Brotman

Tutor: Ke Xu

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Content

1 About myself

Figure 1 - Me working in the lab

I am currently 12th-grader at Edith-Stein-Schule in Erfurt. In summer 2016 I am going to graduate. I discovered my interest in biology by reading books and magazines about biological topics. I have already attended the selection contest for the International Biology Olympiad twice. Thanks to the Förderverein der Internationalen Biologie-olympiade e.V. I had the opportunity to do an internship at the Max Planck Institute of Molecular Plant Physiology in Golm. I was interested in plants before, but never thought about the deeper molecular backgrounds of their existence in a way, as I learnt in my internship. Besides I had only very little experience in working in a molecular biological lab.

2 My Working Group

The Max Planck Institute of Molecular Plant Physiology is divided into three departments. I worked in the department of molecular physiology under the direction of Lothar Willmitzer. Its main topic is the research and description of primary metabolism processes. The group I joined is dealing with the genetics of metabolic traits. Genes that play a role in plant metabolism shall be identified. Various molecular biology techniques are used for their further characterization.

One key aspect is the functional characterization of MYB transcription factors. “In plants, MYB transcription factors (TF) play a key role in different aspects of plant development, secondary metabolism, hormone signal transduction, disease resistance and abiotic stress tolerance” [1]. Different transgenic plants are used for the further characterization of selected transcription factors.

3 My Project

My tutor Ke Xu researches issues of plant physiology and genetics, amongst other things whether MYB95 is target gene of the transcription factor MYC2 in *Arabidopsis thaliana*. Therefore three lines of *Arabidopsis thaliana* plants with two, one or no MYC2-binding site within the MYB95 promoter are constructed.

One method to visualize in which tissues a gene is expressed is the GUS reporter system. During my internship I designed a plasmid, that combined a fragment of the MYB95 promoter without MYC2-binding site with the *gus* gene. Using this plasmid I ran transformation of *Agrobacterium tumefaciens*. After the end of my internship, *Arabidopsis thaliana* plants were transfected with these bacteria. They shall provide seeds for plants without MYC2 binding site within the MYB95 promoter for further experiments.

Besides I ran GUS-staining with two week old *Arabidopsis thaliana* seedlings with MYB47-promoters of different promoter length. This was done to find out which promoter region is the binding site of the transcription factor.

4 Background Information

4.1 Arabidopsis thaliana

Arabidopsis thaliana is a small flowering plant that belongs to the *Brassicaceae* family. It is a widespread model organism in plant biology. A small and well researched genome, a rapid life cycle, easy cultivation and reproduction in limited space and efficient transformation by means of *Agrobacterium tumefaciens* are counted among its advantages. Although *Arabidopsis thaliana* itself has no meaning in agriculture, it is a good representative of physiology of higher plants (cf. [2]). Therefore it can give important information regarding the cultivation of plants of agricultural importance.

Figure 4.1 - *Arabidopsis thaliana*
from:
https://www.arabidopsis.org/images/arabi_bw1tr.gif (23.10.2015)

4.2 Transcription Factors

Transcription factors are DNA-binding proteins, which influence a gene´s transcription rate. They can either act as an activator or as a repressor for the activity of RNA polymerase. As other proteins, transcription factors are synthesized in protein biosynthesis. Transcription factors contain at least one DNA-binding domain. They attach to certain binding sites upstream of the regulated gene within or close to the promoter region or sometimes to enhancer or silencer regions further upstream (cf. [3]).

“The MYB gene family is one of the largest families encoding for transcription factors in *Arabidopsis thaliana*.” [4]

4.3 The GUS reporter system

The *gus* gene encodes the enzyme β-glucoronidase. β-glucoronidase hydrolyzes X-Gluc. The reaction product is a colorant, which causes a blue color signal.

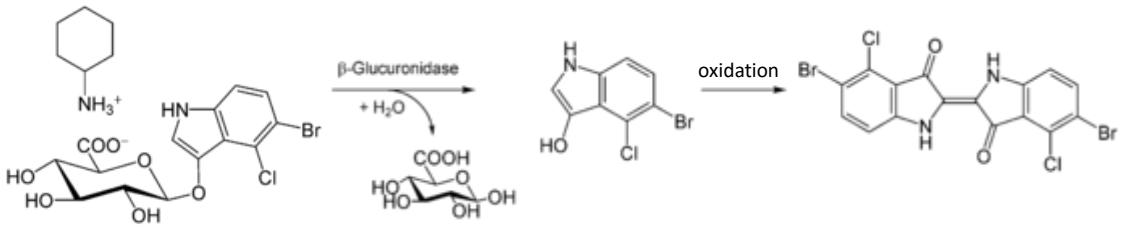

Figure 2.2 - Synthesis of the blue colorant.
Adapted from: https://de.wikipedia.org/wiki/X-Gluc (23.10.2015)

gus is a widespread reporter gene in plant physiology, because there is no distracting natural β-glucoronidase activity within plants. The *gus* gene is linked to the promoter of the gene of interest and plants are transfected with this construct. For GUS-staining plants of the first filial generation are used. After a treatment with X-Gluc blue stains are visible in tissues, where the gene of interest is expressed in wild type plants.

5 Conclusion

My idea of what I wanted to be when I am grown up ranged from architect to artist when I was younger. But becoming a scientist was definitely up for discussion as well. Now, as a 12th-grader I have to make up my mind. In this context my internship was really helpful, because it showed me, that science could be a good field of work for me. I enjoyed the large variety of work steps. After pipetting small volumina for hours it was always a good alternation to work in green house. But I also experienced that you have to be patient, because few things work perfectly the first time. The Max-Planck-Institute is a really good place for scientific exchange. I learnt a lot attending the weekly progress seminars, where Master or PhD students present their projects. Even though I understood only the basics. After a few days I felt really part of my Chinese-Polish-Israeli workgroup. A positive side effect of working with people of many nationalities was that I improved my English and learned plenty of new phrases.

6 Acknowledgements

I am really grateful that I had the opportunity to look into research this way. I´d like to thank the Förderverein der Internationalen Biologieolympiade e.V., which made this possible. Many thanks to my tutor Ke Xu as well. I learned a lot about molecular biology from her. The same applies for my group leader Yariv Brotman, who gave good advices for the evaluation of the experimental results. And last but not least I want to say thank you to everybody, who has supported me.

7 References

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