



EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN



CSC-Tübingen PhD Scholarship Program

2026/2027 application round: prospective PhD positions at the University of Tübingen

Faculty: Faculty of Science

Institute / Section / Subject: Center for Plant Molecular Biology (ZMBP), Plant Physiology

Supervising Professor: Prof. Dr. Sebastian Wolf

About the Supervisor : The Wolf group studies how plant cells sense the state of their own cell wall, and how they use that information to decide how much to grow and what kind of cell to become. We work with the model plant *Arabidopsis thaliana* and combine molecular genetics, quantitative live-cell imaging and, increasingly, biophysical measurement. The group is part of the ZMBP, ranked by the DFG as the leading university-based plant research institution in Germany, housed in a modern, fully equipped building on the Tübingen science campus. Doctoral researchers have direct access on site to confocal and super-resolution microscopy, electron microscopy, proteomics and extensive plant growth facilities. The working language of the group and of the graduate programme is English, and the team is international.

Specification/Project title: **What keeps a stem cell a stem cell? Cell wall properties and mechanics in the plant shoot apical meristem**

Topic Description: Almost all above-ground organs in plants, i.e. every leaf, every flower and fruit are derived from a small group of stem cells located at the tip of the shoot. This stem cell niche called the shoot apical meristem must stay undifferentiated for the whole life of the plant, while their immediate neighbors and descendants, only a few micrometres away, are continuously recruited into new organs. Several genes that define this stem cell niche are well known. What is much less clear is how the physical environment of these cells contributes to keeping them in an undifferentiated state

We recently found that this environment is actively controlled. The enzymes that remodel the cell wall are almost switched off in stem cells and become progressively more active towards the periphery of the meristem, under the control of the stem cell master regulator WUSCHEL. We recently found that changing the wall in stem cells alone is enough to make them lose their identity (Zerin et al., 2025). This suggests that a stem cell keeps a distinct kind of wall, and that this wall composition is required for maintaining “stemness”.

In this project you will test that idea directly, combining advanced genetics with quantitative imaging. Using CRISPR/Cas9 you will generate new mutants and fluorescent reporter lines, and with inducible, cell-type-specific tools developed in the group you will change wall composition in precisely defined cells of the living meristem. Confocal live imaging over several days, with cell-by-cell segmentation, will allow to follow cell identity changes, division orientation and the geometry of the niche. In parallel you will use newly established non-contact optical methods to map the mechanical properties of the meristem itself, so that

the physical state of the tissue can be measured. The project is hypothesis-driven basic research, and the results are intended for publication. You will be trained in Arabidopsis molecular genetics, cloning and CRISPR/Cas9, advanced confocal microscopy and quantitative image analysis. For more information, please contact sebastian.wolf@zmbp.uni-tuebingen.de.

Intended Degree: Dr. rer. nat. (PhD)

Type of the PhD Study: Funding Line A — full doctorate at the University of Tübingen (up to 48 months)

Required Degrees and Qualifications: MSc in Biology, Biochemistry, Plant Sciences, Molecular Life Sciences or a related subject, completed by the time the position starts. Practical experience in basic molecular biology (cloning, PCR) is welcome. Experience with Arabidopsis, CRISPR or microscopy is an advantage but not a requirement — full training is provided. What matters most is curiosity, care in experimental work, and enjoying work in a team. An interest in looking at things down a microscope is a real advantage in this project.

Language Requirements: English equivalent to IELTS 6.5 or TOEFL iBT 95. No German is required; the language of the laboratory and of the ZMBP graduate programme is English.

Relevant publications of the host group:

Zerin, T., Ruiz-Duarte, P., Schürholz, A.-K., ... Lohmann, J. U. & Wolf, S. (2025) The cell wall controls stem cell fate in the Arabidopsis shoot apical meristem. *bioRxiv*. <https://doi.org/10.1101/2025.05.19.654883>

El Arbi, N., Schürholz, A.-K., Handl, M. U., ... Lohmann, J. U. & Wolf, S. (2024) ARGONAUTE10 controls cell fate specification and formative cell divisions in the Arabidopsis root. *The EMBO Journal* 43, 1822–1842. <https://doi.org/10.1038/s44318-024-00072-x>

Biermann, D. & Wolf, S. (2024) Plant cell wall: interplay between structure and signalling. *eLife* 13, e99053. <https://doi.org/10.7554/eLife.99053>

Holzwardt, E., Huerta, A. I., Glöckner, N., ... Harter, K. & Wolf, S. (2018) BRI1 controls vascular cell fate in the Arabidopsis root through RLP44 and phytosulfokine signalling. *PNAS* 115, 11838–11843. <https://doi.org/10.1073/pnas.1814434115>

Schürholz, A.-K., López-Salmerón, V., Li, Z., ... Greb, T. & Wolf, S. (2018) A comprehensive toolkit for inducible, cell type-specific gene expression in Arabidopsis. *Plant Physiology* 178, 40–53. <https://doi.org/10.1104/pp.18.00463>