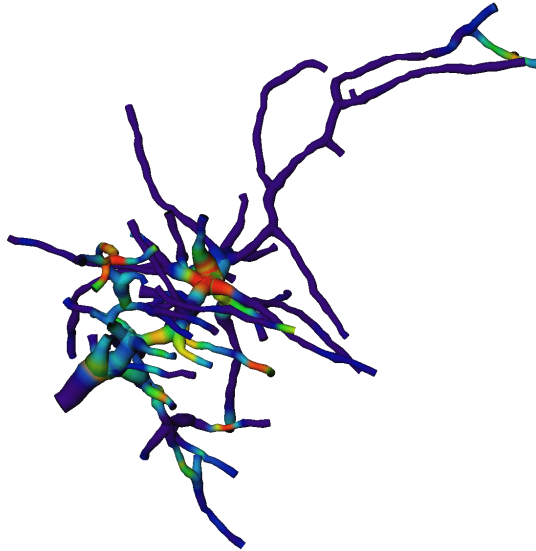


# The role of dendritic filopodia in postembryonic remodelling of dendritic architecture



Dissertation zur Erlangung des akademischen Grades des Doktors  
der Naturwissenschaften (Dr. rer. nat.)

eingereicht im Fachbereich Biologie, Chemie, Pharmazie  
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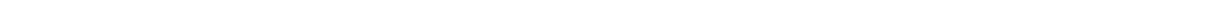
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Mai 2005





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- Disputation am 22. Juni 2005





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Chapters 2 and 3 are based on accepted publications and chapter 4 is based on a manuscript ready for submission. Chapter 5 describes work in progress which will need further labor after the thesis before being publishable.

**Chapter 2:** New Methods for the Computer-Assisted 3D Reconstruction of Neurons from Confocal Image Stacks

**Chapter 3:** Progress in Functional Neuroanatomy: Precise Automatic Geometric Reconstruction of Neuronal Morphology From Confocal Image Stacks

**Chapter 4:** Synaptogenic control of the shape of dendritic filopodia

**Chapter 5:** Computational analysis of dendritic signal integration at different developmental stages of the Motorneuron 5 of *Manduca sexta*.

The contribution of the different authors was as follows:

**Chapter 2:** This manuscript describes a joint project between Stephan Schmitt and me. I programmed the graphical user interfaces and statistic export filters. Stephan Schmitt developed the algorithmic principles for the reconstruction methodologies, which are part of his Diploma thesis. Algorithmic optimization was done in equal shares. Stephan Schmitt wrote the manuscript accompanied by continuous discussions with Carsten Duch and me.

M. Sibila (former Scholz) contributed by discussing the work.

**Chapter 3:** I developed the integration of automatic skeletonization algorithms to initialize the semi-automatic algorithms described in Chapter one. Further, I developed the quantification methods and data export of the localization of immunocytochemically stained proteins along neuronal surface for statistical analysis elsewhere. Stephan Schmitt contributed with the development of semi-automatic reconstruction algorithms as declared for Chapter one.

I wrote the manuscript and discussed the work with Stephan Schmitt and Carsten Duch.

**Chapter 4:** : I performed all experiments and the analysis of synaptotagmin distribution along filopodia projections and wrote the manuscript. Morphological analyses of filopodia was done in equal shares with Daniel Münch. Experimental data and the manuscript were discussed with Daniel Münch and Carsten Duch.

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**Chapter 5:** I have developed the export routines for geometric data into NEURON and also the routines to visualize NEURON modelling data in AMIRA. I have conducted the parameter fits for passive membrane properties and did the modelling of spike initiation (Fig. 5.4). The modelling work on synapse synchronicity is a collaboration with Alexander Maye (ZIB) with him conducting the computation and with both of us developing the intellectual framework.

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