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Letter of Recommendation
for
Dr. Till Bretschneider

Knowing Dr. Till Bretschneider since his times as a fresh post-doc in my department -- i.e. since almost 8 years -- it is a pleasure for me to report on his scientific development and qualification as an outstanding young researcher on the interdisciplinary field between cell biology and biological systems theory.

During his career, he has successively moved forward by starting as a theoretical zoologist, working on mechanisms of aggregation and cooperative movement of the cellular slime mold *Dictyostelium* (then in the group of C. Weijer at Munich), over modeling and analysing single cell migration (in my group), towards now being one of the leading experts on cytoskeletal actin dynamics (still in the group of G. Gerisch at the MPI Martinsried). During this consecutive development, Till Bretschneider has evaluated new experimental techniques and produced excellent results for three most important topics of modern systems biology: cell-cell interaction, cell polarity, and cytoskeleton networks. Let me briefly indicate his essential contributions in these 3 areas:

1. One proto-typical problem in developmental biology is the 3-dimensional organization of cells in a moving slime mold, where a chemical signaling network between single cells is used to induce cooperative migration. Here the local rules of cell-cell interactions (direct contacts or force transduction via extracellular matrix) can only be quantified and tested by adequate physical modeling and corresponding computer simulations. Bretschneider has not only elaborated this complex problem, but also solved similar problems for epidermal keratinocytes in the context of wound healing and tissue repair. In his model he poses the essential hypothesis that the contractile actin network, responsible for cell adhesion and cell migration, is able to sense tensions in an underlying extracellular matrix; thereby the cell is able to respond not only to chemical, but also to mechanical signals of neighboring cells.

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2. Within our interdisciplinary group of "Theoretical Biology", Till Bretschneider has served with great success as major advisor for our graduate and undergraduate students by supervising their experiments at the Cell Biology Institute and, simultaneously, their use of appropriate methods in image processing and model based data analysis. One central problem to be solved was the development of cell polarity and its correlation to cell migration under different conditions of substrate adhesion. In order to test certain hypotheses on signal transductions from adhesion sites (integrin complexes) to the contracile apparatus (myosin, actin cross-linkers) that determine shape changes and cell translocation, Till Bretschneider worked on various algorithms for detecting and quantifying the movement of cell edges and the differentiation of cells from non-polarized (moving on spot) to polarized ones (able to migrate).

3. By using TIRF-microscopy within the last years at Gerisch's lab, Till Bretschneider discovered, analysed and characterized the fast motion of actin condensation spots along cortical filament networks and in lamellipods of adherent cells. In the mean time, by using genetically transfected cell mutants he has succeeded in determining the essential molecular components and their contributions to this phenomenon of intracellular motion, which is still not yet completely understood.

In all theses variant experimental and theoretical approaches, Dr. Bretschneider has shown an extraordinary ability to set up new hypotheses for very complex problem situations in modern cell biology and to construct appropriate statistical and numerical algorithms for describing the corresponding data, particularly those bearing relatively complex dynamics. This resulted in a series of excellent publications that cover a considerable spectrum of typical situations in biosystems theory.

Moreover, Till Bretschneider has proved himself as a very reliably researcher and collaborator, he possesses a brilliant and nevertheless modest spirit, making him a stimulating teacher and a clearly guiding advisor, and finally, he shows a deep knowledge and a broad interest in the various fields of modern systems biology.

Therefore, I can fully recommend him for a position as Assistant Professor in your Department of Biology and at your Biocomplexity Institute in Bloomington. In my opinion Till Bretschneider is one of the few top young scientists, who already during their career had been able to fully combine the approaches of the two scientific areas: Cell Biology on one side, Mathematical Modeling and Biocomputing on the other side. With this excellent interdisciplinary candidate you can be expected to have successful experiences.

With kind regards

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