Nikolaus Sonnenschein, Ph.D.

Contact Information

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Research Interests

Various aspects of computational systems biology, in particular models of metabolism, eukaryotic and prokaryotic gene regulation, dynamics on networks, analysis of high-throughput data, kinetic modeling of biological processes, scientific software development workflows

Education

Jacobs University Bremen, Germany — **September 2007 – January 2011**

Ph.D. in Bioinformatics, *with distinction*, MoLife graduate program

- Thesis title: *A topological characterization of metabolic flux predictions, medium-dependent essentiality and metabolic inconsistency.*
- Adviser: Prof. Marc-Thorsten Hütt

Technische Universität Darmstadt, Germany — **October 2002 – July 2007**

Diplom in Biology (equivalent to M.Sc.), — **July 2007**

- *Passed with distinction* ("*Mit Auszeichnung*", overall grade 1.0)
- Areas of study: Cell biology, Genetics and Plant physiology
- Thesis title: *Information transport in metabolic networks.* (German title: *Informationstransport in metabolischen Netzen.*)
- Adviser: Prof. Marc-Thorsten Hütt

Vordiplom in Biology (equivalent to B.Sc.) — **May 2004**

Research Experience

Postdoctoral researcher, **University of California, San Diego**, USA — **March 2011 – present**

Development of the next-generation modeling environment for metabolic systems. Work towards genome-scale kinetic models of the human erythrocyte and *Escherichia coli*. Detailed enzyme module reconstructions from bibliomic data and calibration using derivative based and derivative free optimization techniques.

Ph.D. student, **Jacobs University Bremen**, Germany — **September 2007 – January 2011**

Combination of constraint-based modeling techniques and graph theoretical methods for the following purposes: (1) Topological classification of medium-dependent essentiality, (2) integration of gene-expression data with metabolic reconstructions of *Escherichia coli* and the human, and (3) the analysis of metabolite correlation networks. Application of point-process statistics to the transcriptional regulatory network and spatial gene organization of *Escherichia coli*.

Diploma student, **Technische Universität Darmstadt**, Germany — **August 2006 – July 2007**

Correlation study of perturbed metabolic systems, comparing flux balance analysis and cellular automata dynamics.

Research assistant, **Technische Universität Darmstadt**, Germany — **October 2005 – July 2006**

Topological reasons for dynamical stability. Implementation of systems of linear ODEs and cellular automata dynamics on random network topologies. Adviser: Prof. Marc-Thorsten Hütt

Internship, **Max-Planck Institute for Brain Research**, Germany — **July 2005 – August 2005**

Cell migrations in the Rhombencephalon. In situ hybridization study of genes expressed during early mouse brain development (6 weeks). Adviser: Dr. Dieter Engelkamp

Teaching Experience

BENG 123. Systems Biology and Bioengineering
University of California, San Diego, undergraduate level, instructor — **2012 – 2013, annually**

Bioinformatics and Computational Biology I
Jacobs University Bremen, graduate level, substitute lecturer **2010, occasionally**

Advanced Bioinformatics Laboratory Course III: Genomics & Elementary Systems Biology
Jacobs University Bremen, undergraduate level, instructor **2007 – 2010, annually**

Publications

Thiele, I., Swainston, N., Fleming, R.M.T., Hoppe, A., Sahoo, S., Aurich, M.K., Haraldsdottir, H., Mo, M.L., Rolfsson, O., Stobbe, M.D., Thorleifsson, S.G., Agren, R., Blling, C., Bordel, S., Chavali, A.K., Dobson, P., Dunn, W.B., Endler, L., Hala, D., Hucka, M., Hull, D., Jameson, D., Jamshidi, N., Jonsson, J.J., Juty, N., Keating, S., Nookaew, I., Le Novere, N., Malys, N., Mazein, A., Papin, J.A., Price, N.D., Selkov Sr., E, Sigurdsson, M.I., Simeonidis, E., **Sonnenschein, N.**, Smallbone, K., Sorokin, A., van Beek, J.H.G.M., Weichart, D., Goryanin, I., Nielsen, J., Westerhoff, H.V., Kell, D.B., Mendes, P., Palsson, B.Ø., "A community-driven global reconstruction of human metabolism", *Nature Biotechnology*, Accepted (2012).

Sonnenschein, N., Marr, C., Hütt, M.-T. "A topological characterization of medium-dependent essential metabolic reactions" *Metabolites* 2(3):632–647 (2012)

Beber, M.E., Fretter, C., Jain, S., **Sonnenschein, N.**, Müller-Hannemann, M., Hütt, M.-T. "Artefacts in statistical analyses of network motifs: general framework and application to metabolic networks" *Journal of The Royal Society Interface*, 9(77):3426–35 (2012)

Sonnenschein, N., Dzib, J.F.G, Lesne, A., Eilebrecht, S., Boulkroun, S., Zennaro, M.-C., Benecke, A., Hütt, M.-T. "A Network Perspective on Metabolic Inconsistency." *BMC Systems Biology*, 6:41 (2012).

Sonnenschein, N., Geertz, M., Muskhelishvili, G., Hütt, M.-T. "Analog regulation of metabolic demand." *BMC Systems Biology*, 5:40 (2011).

Sonnenschein, N., Hütt, M.-T., Stoyan, H. Stoyan, D. "Ranges of control in the transcriptional regulation of *Escherichia coli*." *BMC Systems Biology*, 3:119 (2009).

Conferences and Workshop participation

Winter q-bio Meeting, Waikiki, USA, February 2013, Contributed talk: "Dynamic modeling for the masses: the MASS toolbox" Sonnenschein N., Zielinski, D.C., Bordbar, A., Jamshidi, N., Palsson, B.Ø.

ICSB 2010, Edinburgh, UK, October 2010, Poster presentation: "A Network Perspective on Metabolic Inconsistency" Sonnenschein, N., Golib Dzib, J.F., Boulkroun, S., Lesne, A., Zennaro, M.-C., Benecke, A., and Hütt, M.-T.

Emergence and Design of Robustness: General Principles and Applications to Biological, Social and Industrial Networks, Palma de Mallorca, Spain, April 2010

Challenges in experimental data integration within genome-scale metabolic models, Institut Henri Poincaré, Paris, France, October 2009

Symposium: Frontiers in network science – advances and applications, Volkswagen Stiftung, Berlin, Germany, September 2009, Poster presentation: "The topology of rare reactions in *Escherichia coli* metabolism.", Sonnenschein, N., Yordanov, P., Hütt, M.-T.

Steps in Evolution: Perspectives from Physics, Biochemistry and Cell Biology – 150 Years after Darwin., Wilhelm und Else Heraeus Stiftung, Jacobs University Bremen, Germany, July 2009

Systems Biology Short Course & Human Reconstruction Jamboree, Center of Systems Biology, Reykjavik, Iceland, DAAD Travel stipend, June 2009

A complex systems view on production and distribution networks, Volkswagen Stiftung, Berlin, Germany, April 2009

Summer school on statistical physics of gene regulation, Wilhelm und Else Heraeus Stiftung, Jacobs University Bremen, Germany, July 2007

Bremen Molecular and Marine Biology Meeting (BMMB), Schloss Etelsen, Germany, January 2007, Poster presentation: "Analyzing effects of *in silico* gene deletions on flux distributions and information flow in metabolic networks.", Sonnenschein, N., Marr, C., Hütt, M.-T.

Editorial & Peer Review Duties

Reviewer for *BMC Evolutionary Biology*, *Physical Review E*, *Biotechnology and Bioengineering*

Editor for *EPJ Nonlinear Biomedical Physcis* (since 2013)

Technical Skills

Programming: Mathematica, Python, R, C, Matlab, SQL, Perl

Computer Applications: LaTeX, Adobe Creative Suite (Photoshop, Illustrator, InDesign)

Operating Systems: Apple OS X, Linux, BSD, and other UNIX variants, Microsoft Windows

Public code repository: https://github.com/phantomas1234

Language Skills

German: Native language

English: Fluent

Greek (modern): Fluent