

Curriculum Vitae

Benjamin Werner

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Personal Data

born September 15th, 1984 in Leipzig, Germany

Education and Scientific Career

- 06/2003 **Abitur**, Veit Ludwig von Seckendorff Gymnasium Meuselwitz.
grade 1.3
- 10/2004–
08/2006 **Vordiplom**, Faculty of Physics and Mathematics, University of Leipzig.
Physics, grade 1.2
- 10/2006–
03/2010 **Diploma in Physics**, Institute for Theoretical Physics, University of Leipzig.
Theoretical physics, grade 1.3
- 05/2010–
04/2013 **Phd-student**, Research Group for Evolutionary Theory with Arne Traulsen, Max Planck
Institute for Evolutionary Biology, Plön (Germany).
- 09/2013 **Phd-defense**, Max Planck Institute for Evolutionary Biology, Plön & Institute for Mathe-
matics, University of Lübeck (Germany).
Mathematics, grade 1.0 (summa cum laude)
- 09/2013–
01/2015 **Post Doc**, Department for Evolutionary Theory with Arne Traulsen, Max Planck Institute
for Evolutionary Biology, Plön (Germany).
- 02/2015–... **Post Doc**, Genomics and Modelling Group at The Centre for Evolution and Cancer with
Andrea Sottoriva, The Institute of Cancer Research, London (UK).

Awards

- 2003 Würdigungspreis of the German Physics Society for the results in the final school exam in
Physics
- 2014 Otto Hahn Medal of the Max Planck Society for the PhD thesis on: "Mathematical models
of cell population dynamics".

Grants

- 2012 Participant of the 62nd Lindau Nobel Laureate Meeting (10 young scientists cross all Max
Planck Institutes)

- 2013 Travel award of the Society of Mathematical Biology & Moffit Physical Sciences Oncology Center
- 2015 Geoffrey W Lewis Post-Doctoral Training fellowship 170.000 € in 3 years

Non-academic work experience

- 09/2003–07/2004 Community service at Tanzwerkstatt "No Limits", Berlin Weißensee
- 01/2013–01/2015 Council board member at Max Planck Institute for Evolutionary Biology, Plön, Germany

Independent Teaching

- 10/2007–06/2008 Teaching assistant *Quantum mechanics I & II*, Universität Leipzig, Prof. Dr. K. Sibold
- 10/2008–02/2009 Teaching assistant *Quantum mechanics*, Universität Leipzig, Prof. Dr. G. Rudolph
- 03/2009–02/2010 Teaching assistant *Statistical physics I & II*, Universität Leipzig, Prof. Dr. U. Behn

Work as Referee

Referee for Journals *Nature Genetics, PNAS, Nature Communications, PLoS Computational Biology, PLoS ONE, Journal of Mathematical Biology, Royal Society Interface, The Quarterly Review of Biology, Mathematical and Computer Modelling, PeerJ, Scientific Reports, Journal of Theoretical Biology, Cancer Research, Evolutionary Applications*

Work as Editor

Editor for Journals *Guest editor for PLoS Computational Biology*

Invited Conference Contributions and Seminars

- 2012
- Theory workshop at the Max Planck Institute for Evolutionary Biology, Plön (Germany)
 - Oberseminar at the Institute for Mathematics, University Lübeck (Germany)
 - Meeting of the Society for Mathematical Biology, Knoxville (USA)
- 2013
- ZIH-Seminar, Technical University Dresden (Germany)
 - IMO workshop 3.0/Personalized Medicine, Integrated Mathematical Oncology, Moffit Cancer Center in Tampa (USA)
- 2014
- Joint meeting of SMB and JSMB, Osaka (Japan)
 - Seminar at the Centre for Evolution and Cancer, The Institute for Cancer Research London (UK)
- 2015
- Stem cells and cancer, MBI Columbus Ohio (USA)
 - Integrating cancer evolution and genomic data, University of Leicester (UK)
 - Stem cells at lunch, King's College London (UK)
 - Seminar at Department of Mathematics, Chalmers University Gothenburg (Sweden)

- 2016
 - Meeting of European Society of Mathematical & Theoretical Biology (ECMTB), University of Nottingham (GB)
 - Stem Cell Lab, Hamburg (Germany)
 - Detecting selection in Cancer Seminar, UCL London (GB)
 - Meeting of Japanese Society of Mathematical Biology (JSMB), Fukuoka (Japan)
- 2017
 - Impact of space on cancer evolution, University of Leicester (UK)
 - Mathematical models of cell population dynamics, Biology Department at Sun-Yat-Sen University Guangzhou (China)
 - Intra tumour heterogeneity and clonal selection in cancer, Medicine Department at Sun-Yat-Sen University Guangzhou (China)
 - Forecasting cancer evolution, MME, City University London (UK)
 - Institute Seminar, Beijing Normal University (China)
- 2018
 - Molecular basis of ecology and evolution, NSFC, Jiangsu (China)
 - CONTRA meeting, Bertinoro (Italy)

Contributed Talks

- 2011
 - Mathematical modeling group, University Lisbon (Portugal)
 - Spring Meeting of German Physics Society in Dresden (Germany)
- 2012
 - Spring Meeting of German Physics Society in Berlin (Germany)
- 2013
 - Modeling Biological Evolution, University of Leicester (UK)
 - Ecological and evolutionary perspectives in cancer, Jacques Monod Conference, Roscoff (France)
 - Department of Computational Biology at ETH Zürich, Basel (Switzerland)
- 2014
 - Spring Meeting of German Physics Society in Dresden (Germany)
 - European Meeting for Mathematical and Theoretical Biology (EMTB), Gothenburg (Sweden)
- 2015
 - Cancer evolution through space and time, Max Planck Institute for Evolutionary Biology, Plön (Germany)
- 2016
 - A Pint of Science, London (GB)
 - Genomics modelling meeting, King's College London (GB)
- 2017
 - Resistance, Resilience, Robustness, ISEEC, Arizona State University, Phoenix (USA)

Other Attended Conferences

- 2011 16th Congress of European Hematology Association in London (UK)

- 2012 62nd Lindau Nobel Laureate Meeting, Lindau (Germany)
Stem Cell Lab, Technical University Dresden (Germany)
- 2014 Ecology and Evolution of Cancer, MBI Columbus Ohio (USA)
- 2015 Annual Meeting of the National Cancer Research Institute, Liverpool (UK)

Publications

- [1] Werner B, Dingli D, Lenaerts T, Pacheco JM, Traulsen A. Dynamics of mutant cells in hierarchical organized tissues. *PLoS Computational Biology*. 2011;7:e1002290.
- [2] Werner B, Lutz D, Brümmendorf TH, Traulsen A, Balabanov S. Dynamics of resistance development to imatinib under increasing selection pressure: a combination of mathematical models and in vitro data. *PLoS One*. 2011;6:e28955.
- [3] Huang W, Werner B, Traulsen A. The impact of random frequency-dependent mutations on the average population fitness. *BMC Evolutionary Biology*. 2012;12:160.
- [4] Werner B, Dingli D, Traulsen A. A deterministic model for the occurrence and dynamics of multiple mutations in hierarchically organized tissues. *Journal of The Royal Society Interface*. 2013;10:20130349.
- [5] Schulz R, Werner B, Behn U. Self-tolerance in a minimal model of the idiotypic network. *Frontiers in Immunology*. 2014;5:86.
- [6] Werner B, Gallagher RE, Paietta EM, Litzow MR, Tallman MS, Wiernik PH, et al. Dynamics of leukemia stem-like cell extinction in acute promyelocytic leukemia. *Cancer Research*. 2014;74:5386–5396.
- [7] Werner B, Beier F, Hummel S, Balabanov S, Lassay L, Orlikowsky T, et al. Reconstructing the in vivo dynamics of hematopoietic stem cells from telomere length distributions. *eLife*. 2015;e08687.
- [8] Werner B, Traulsen A, Dingli D. Ontogenic growth as the root of fundamental differences between childhood and adult cancer. *Stem Cells*. 2015;34:543–550.
- [9] Williams* M, Werner* B, Barnes CP, Graham TA, Sottoriva A. Identification of neutral tumor evolution across cancer types. *Nature Genetics*. 2016;48:238–244.
- [10] Werner B, Scott JG, Sottoriva A, Anderson AR, Traulsen A, Altrock PM. The cancer stem cell fraction in hierarchically organized tumors can be estimated using mathematical modeling and patient-specific treatment trajectories. *Cancer Research*. 2016;76(7):1705–1713.
- [11] Williams MJ, Werner B, Graham TA, Sottoriva A. Functional versus non-functional intra-tumor heterogeneity in cancer. *Molecular & Cellular Oncology*. 2016;e1162897.
- [12] Hindersin L, Werner B, David D, Traulsen A. Should tissue structure suppress or amplify selection to minimize cancer risk? *Biology Direct*. 2016;41:1–11.
- [13] Werner B, Traulsen A, Sottoriva A, Dingli D. Detecting truly clonal alterations from multi-region profiling of tumours. *Scientific Reports*. 2017;7(44991).
- [14] Lote H, Spiteri I, Ermini L, Vatsiou A, Roy A, McDonald A, et al. Carbon dating cancer: defining the chronology of metastatic progression in colorectal cancer. *Annals of Oncology*. 2017;28:1243–1249.

- [15] Huang W, Traulsen A, Werner B, Hiltunen T, Becks L. Dynamical trade-offs arise from antagonistic coevolution and decrease intraspecific diversity. *Nature Communications*. 2017;8(2059):1–8.
- [16] Williams M, Werner B, Heide T, Curtis C, Barnes C, Sottoriva A, et al. Quantification of subclonal selection in cancer from bulk sequencing data. *Nature Genetics*. 2018;50:895–903.
- [17] Werner B, Sottoriva A. Variation of mutational burden in healthy human tissues suggests non-random strand segregation and allows measuring somatic mutation rates. *PLoS Computational Biology*. 2018;14(6):e1006233.
- [18] Böttcher MA, Dingli D, Werner B, Traulsen A. Replicative cellular age distributions in compartmentalized tissues. *Journal of The Royal Society Interface*. 2018;15(145):20180272.
- [19] Khan KH, Cunningham D, Werner B, Vlachogiannis G, Spiteri I, Heide T, et al. Longitudinal Liquid Biopsy and Mathematical Modeling of Clonal Evolution Forecast Time to Treatment Failure in the PROSPECT-C Phase II Colorectal Cancer Clinical Trial. *Cancer Discovery*. 2018;.

Ongoing

- [20] Werner, B., . . . , Sottoriva, A., Measuring single cell divisions in human cancers from multi-region sequencing data. (*in review*).
- [21] Opasic, L., Werner, B., Dingli, D., Traulsen, A., Inferring clonal mutations from spatial models of tumour growth. (*in review*).
- [22] Boettcher, M., Werner, B., Dingli, D., Traulsen, A., Lenaerts T., Stem cell dynamics is crucial for cure of chronic myeloid leukemia. (*in preparation*).

Communications

- [23] Williams, M., Werner, B., et al. Reply: Uncertainties in tumor allele frequencies limit power to infer evolutionary pressures. *Nature Genetics*, (2017).
- [24] Werner, B., Williams, M. et al. Support for a model of neutral evolution in currently available bulk sequencing data. *Nature Genetics*, (*in press*).
- [25] Williams, M., Werner, B., et al. Revisiting tumour evolution theory in the light of complexity of cancer genomic data. *Nature Genetics*, (*in press*).
- [26] Williams, M., Werner, B., et al. Reply: Neutral tumor evolution? *Nature Genetics*, (*in press*).
- [27] Williams, M., Werner, B., et al. Reply: Is the evolution of tumours Darwinian or non-Darwinian *National Science Review*, (2018)

* joint first author

Contacts for Reference

- Prof. Dr. Arne Traulsen (PhD supervisor), Director of the Max Planck Institute for Evolutionary Biology in Plön (Germany) and head of the Evolutionary Theory Department. email: traulsen@evolbio.mpg.de
- Dr. Andrea Sottoriva (Post Doc supervisor), Head of the Genomics and Modelling Group at the Centre for Evolution and Cancer at the Institute of Cancer Research in London (UK). email: andrea.sottoriva@icr.ac.uk
- Prof. Dr. Trevor Graham (collaborator), Head of the Evolution and Cancer laboratory at the Barts Cancer Institute in London (UK). email: t.graham@qmul.ac.uk
- Prof. Dr. David Dingli (collaborator), Division of Haematology at Mayo Clinic in Rochester (USA). email: Dingli.David@mayo.edu