

Curriculum vitae Martin Ackermann

Jan 2016

Career

- 2015 – present Full Professor for Molecular Microbial Ecology, ETH Zurich, Switzerland
- 2008 – 2015 Associate Professor for Molecular Microbial Ecology, ETH Zurich, Switzerland
- 2012 – present Head of the Department of Environmental Microbiology, Eawag, Switzerland
- 2006 – 2008 SNF Professor for Microbial Evolution, ETH Zurich, Switzerland
- 2004 – 2006 Research Scientist, ETH Zurich, Switzerland, in the group of Prof. S. Bonhoeffer
- 2002 – 2004 Postdoc, UC San Diego, USA, in the group of Prof. L. Chao
- 2002 PhD in Biology, University of Basel, Switzerland, with Profs. U. Jenal and S. Stearns

Research Group

Head of the Molecular Microbial Ecology group, ETH Zurich and Eawag: Located at the Eawag Department of Environmental Microbiology, and the ETH Department of Environmental Systems Science.

Supervision of students and postdocs since 2006

- 20 Bachelor theses
- 11 Master theses
- 8 PhD theses (4 ongoing) as direct scientific supervisor
- 5 PhD theses (4 ongoing) as PhD advisor with another direct scientific supervisor
- 9 Postdocs and scientists (5 ongoing)

All former group members have successfully completed their PhD or postdoctoral studies. All former PhD students and postdocs under my direct supervision stayed in academic research. Five former group members are now principal investigators in academia, or have been offered positions as principal investigators.

Research Interests

Bacterial individuality: molecular mechanisms and adaptive significance of phenotypic heterogeneity in clonal populations; relevance of phenotypic heterogeneity in natural environments; bacterial behaviour in dynamic environments.

Bacterial interactions: mutualistic and antagonistic interactions between bacterial cells; the impact of interactions on processes in natural systems.

Bacteria under adverse conditions: genetic and phenotypic responses to antibiotics and other stressors at the single-cell level; photobiology of solar disinfection.

Microbial communities: assembly, dynamics and emergent properties of microbial communities.

Invited Seminars and Talks

Selected examples from 2009-2015

- 2015** Models of Life Workshop, University of Copenhagen, Krogerup Højskole, DK
Royal Society International Scientific Seminar, Chicheley Hall, UK
EMBO/EMBL Meeting on New Approaches and Concepts in Microbiology, Heidelberg, DE
Rinkvorlesung, Kiel Life Science, CAU, Kiel, DE
Max Planck Institute for Terrestrial Microbiology, Marburg, DE
California Institute of Technology, Pasadena, Ca, USA
University of British Columbia, Biodiversity Seminar, Vancouver, CA
University of Basel, Biozentrum, Infection Biology seminar, Basel, CH
University of Groningen, Groningen Lectures in Theoretical Biology, Groningen, NL
IOP Institute of Physics, The Physics of Microorganisms, London, UK
ESF conference on Bacterial Networks, San Feliu, ES
FTNLS Symposium on 'Microbial Evolution: theory, simulation and experiment', Leuven, BE
- 2014** Annual Colloquium at the National Biotechnology Center in Madrid, Madrid, ES
Meeting of the Joint Genome Institute, Walnut Creek, Ca, USA
International Conference on Microbial Communication, Jena, DE
Synmikro, University of Marburg, Marburg DE
WE-Heraeus-Seminar on Mechanisms, Strategies, and Evolution of Microbial Systems, Bad Honnef, DE
Department of Bionanoscience, Delft University of Technology, Delft, NL
SPP1617 International conference on Phenotypic Heterogeneity, Kloster Irsee, DE
International Society of Microbial Ecology Conference, Seoul, South Korea
Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK
- 2013** Keynote Presentation at Water Research Conference, Singapore, SG
Meeting of the Swiss Life Sciences Society, Zürich, CH
MMEMS Workshop in Quantitative Evolutionary Dynamics, Devon, UK
Wageningen Evolution and Ecology Seminars, University of Wageningen, NL
CRC 973 Colloquium, Freie Universität Berlin, D
Workshop on Bridging theoretical and experimental evolution (CUSO), La Fouly, CH
NYU Center for Genomics and Systems Biology, Workshop on Synthetic Biology and Microbial Ecology, NYU, New York, USA
E-Norm Graduate School - Heinrich Heine Universität Düsseldorf, D
- 2012** Stanford University, BioX Symposium, Stanford, CA USA
University of Zurich, Plant Biology Forum, Zürich, CH
Global Health Institute, EPFL, Lausanne, CH
University of Berne, Population Genetics Seminar, Bern, CH
Swiss Society of Microbiology, General Meeting, Sankt Gallen, CH
University of Amsterdam, Microbial Systems Biology Workshop, Amsterdam, NL
Synmikro Symposium, Marburg, DE
Keynote presentation at the ISME Conference, Copenhagen, DK
University of Copenhagen, Opening Symposium of the Copenhagen Microbiology Center, Copenhagen, DK

University of Groningen, Symposium of the Biomolecular Sciences and Biotechnology Institute, Groningen, NL

- 2011** Imperial College London, Workshop on Mathematics of Microbes, London, UK
LMU München, Max-von-Pettenkofer Institut, Munich, DE
Speaker at the Plenary Session, American Society for Microbiology, General Meeting, New Orleans, USA
FEMS, 4th congress of European Microbiologists, Geneva, CH
University of Edinburgh, Workshop on Modeling and Microbiology, Edinburgh, UK
Institute for Science and Technology Austria, Vienna, Klosterneuburg, AT
Helmholtz-Zentrum für Umweltforschung - UFZ, Leipzig, DE
- 2010** Institute for Population Genetics, University of Veterinary Medicine Vienna, Vienna, AT
Centre for Systems Biology, University of Edinburgh, UK
Departement de Mathematiques Appliquees, Polytechnique, Paris, FR
Symposium on Autonomous Systems, Max Planck Society, Stuttgart, DE
Symposium on Phenotypic Heterogeneity, University of Munich, Munich, DE
International Society of Microbial Ecology Conference, Seattle, USA
Center for Theoretical Biological Physics, UC San Diego, San Diego, Ca, USA
Workshop on Stochastic Effects in Microbial Infections, University of Edinburgh, Edinburgh, UK
Institute of Hygiene and Microbiology, University of Würzburg, Würzburg, DE
Keynote presentation at the Autumn Symposium, Institute of Systems and Synthetic Biology, Imperial College, London, UK
Department of Biology, University of Lausanne, Lausanne, CH
- 2009** Max Planck Institute for Marine Microbiology, Bremen, DE
Gordon conference for Applied and Environmental Microbiology, Mount Holyoke, MA, USA
Max Planck Symposium on Autonomous Systems, Stuttgart, DE
Institute of Environmental Engineering, EPFL, Lausanne, CH
Institute of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, CH
11th International EMBL PhD Student Symposium, Heidelberg, DE
Institute for Biology, Humboldt University Berlin, Berlin DE
Institute of Zoology, University of Basel, Basel, CH
Zentrum für Molekulare Biologie der Universität Heidelberg, Heidelberg, DE

Main Recent Grants

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| 2013 | SNF, research grant, single PI: SFR. 778'000. |
| 2010 | SNF, research grant, single PI: SFR. 670'000. - |
| 2006 | SNF, SNF-Professorship: SFR. 1'490'000. - |
| 2009-14 | Host for 3 Marie-Curie Postdoctoral Fellows, 2 ETH Fellows, 2 SNF Ambizione Fellows, 1 SystemsX Fellow |

Services to the Academic Community

Member of the Advisory Board for the MPI in Terrestrial Microbiology, Marburg, from 2016 on.

Editorial Board member of 'Environmental Microbiology' since 2014.

Reviewer for 45 different scientific journals (including Science, Nature, Nature Genetics, Nature Reviews Microbiology, Nature Biotechnology, PNAS, PLOS Biology, Physical Review Letters, ISME J,

Elife), and for 10 national and international funding agencies (including the Swiss National Science Foundation, NSF, ERC, MacArthur Foundation).

Member of 5 professorial hiring committees at universities in Switzerland.

Co-Organizer of 6 conferences and sessions (conference on 'Biology without Borders', 2007, Trento, IT; session on 'Sociomicrobiology and Biofilms', ISME Conference, 2010, Seattle USA; session on 'Single Cell Microbiology', FEMS Conference, 2011, Geneva, CH; conference on 'Environmental Microbiology', Eawag, 2013; symposium on 'Environmental Microbiology, ETH Zurich, 2013; session on 'Levels of Selection in Microbial Systems', ESEB Conference 2015, Lausanne, CH; 'Swiss Microbial Ecology Meeting', Ascona, CH).

Teaching at ETH Zurich

Bachelor

- Introduction to microbiology (752-4001-00L; >300 students from five study programs)
- Practical course in microbiology (701-0220-00L, mandatory for all environmental sciences students)

Master

- Term paper in Biogeochemistry (701-1303-00L, lead for three years, participation since 2008)
- Eawag PhD Skills seminar (701-0017-00L, since 2014)

Member of the Life Sciences Zurich PhD programs in Systems Biology, Microbiology and Immunology, and Ecology

Member of about 42 PhD committees since 2006

Publications

Total number of citations: 2094; h-index 23; average impact factor 9.2 (google scholar, Jan 2016).

In addition to the publications listed below, members of my research group have published 36 papers since 2006 while being in the group without me as a co-author. I am only a co-author on papers from my group if I make a concrete scientific contribution.

R. Mathis and M. Ackermann, "The response of single bacterial cells to stress gives rise to complex history-dependence at the population level," **Proc. Natl. Acad. Sci. U. S. A.**, accepted for publication

I. Avalos Vizcarra, V. Hosseini, P. Kollmannsberger, S. Meier, S. S. Weber, M. Arnoldini, M. Ackermann, and V. Vogel, "How type 1 fimbriae help Escherichia coli to evade extracellular antibiotics," **Sci. Rep.**, vol. 6, p. 18109, Jan. 2016.

M. Ackermann, "A functional perspective on phenotypic heterogeneity in microorganisms," **Nat. Rev. Microbiol.**, vol. 13, no. July, pp. 497-508, 2015.

M. Ackermann, "The usefulness of evolutionary principles: predicting the unexpected," **Environ. Microbiol. Rep.**, vol. 7, no. 1, pp. 4-5, 2015.

M. Ackermann and F. Schreiber, "A growing focus on bacterial individuality," **Environ. Microbiol.**, vol. 17, no. 7, pp. 2193-2195, 2015.

A. R. Hall, D. C. Angst, K. T. Schiessl, and M. Ackermann, "Costs of antibiotic resistance--separating trait effects and selective effects," **Evol. Appl.**, vol. 2, no. 3, pp. 261-272, 2015.

S. van Vliet and M. Ackermann, "Bacterial Ventures into Multicellularity: Collectivism through Individuality," **PLOS Biol.**, vol. 13, no. 6, p. e1002162, 2015.

- D. R. Johnson, D. E. Helbling, T. K. Lee, J. Park, K. Fenner, H.-P. E. Kohler, and M. Ackermann, "Association of biodiversity with the rates of micropollutant biotransformations among full-scale wastewater treatment plant communities," **Appl. Environ. Microbiol.**, vol. 81, no. 2, pp. 666-75, 2015.
- M. Zimmermann, S. Escrig, T. Hübschmann, M. Kirf, A. Brand, R. F. Inglis, S. Müller, A. Meibom, M. Ackermann, and F. Schreiber, "Microbial Physiology and Metabolism Phenotypic heterogeneity in metabolic traits among single cells of a rare bacterial species in its natural environment quantified with a combination of flow cell sorting and NanoSIMS," **Front. Microbiol.**, vol. 6, no. 243, 2015.
- R. Kümmerli, K. T. Schiessl, T. Waldvogel, K. McNeill, and M. Ackermann, "Habitat structure and the evolution of diffusible siderophores in bacteria," **Ecol. Lett.**, vol. 17, no. 12, pp. 1536-1544, 2014.
- M. Diard, M. E. Sellin, T. Dolowschiak, M. Arnoldini, M. Ackermann, and W. D. Hardt, "Antibiotic Treatment Selects for Cooperative Virulence of Salmonella Typhimurium," **Curr. Biol.**, vol. 24, pp. 2000-2005, 2014.
- D. Blank, L. Wolf, M. Ackermann, and O. K. Silander, "The predictability of molecular evolution during functional innovation," **Proc. Natl. Acad. Sci. U. S. A.**, vol. 111, no. 8, pp. 3044-9, 2014.
- M. Arnoldini, I. Avalos Vizcarra, R. Pena-Miller, N. Stocker, M. Diard, V. Vogel, R. Beardmore, W.-D. Hardt, M. Ackermann, "Bistable expression of virulence genes in Salmonella leads to the formation of an antibiotic tolerant subpopulation," **PLOS Biol.**, vol. 12, no. 8, p. e1001928, 2014.
- N. Bodenhausen, M. Bortfeld-Miller, M. Ackermann, and J. A. Vorholt, "A Synthetic Community Approach Reveals Plant Genotypes Affecting the Phyllosphere Microbiota," **PLoS Genet.**, vol. 10, no. 4, p. e1004283, 2014.
- B. B. Fischer, M. Kwiatkowski, M. Ackermann, J. Krismer, S. Roffler, M. J. F. Suter, R. I. L. Eggen, and B. Matthews, "Phenotypic plasticity influences the eco-evolutionary dynamics of a predator-prey system," **Ecology**, vol. 95, no. 11, pp. 3080-3092, 2014.
- P. Kaiser, R. R. Regoes, T. Dolowschiak, S. Y. Wotzka, J. Lengefeld, E. Slack, A. J. Grant, M. Ackermann, and W.-D. Hardt, "Cecum Lymph Node Dendritic Cells Harbor Slow-Growing Bacteria Phenotypically Tolerant to Antibiotic Treatment," **PLoS Biol.**, vol. 12, no. 2, p. e1001793, 2014.
- P. S. Ocampo, V. Lázár, B. Papp, M. Arnoldini, P. A. zur Wiesch, R. Busa-Fekete, G. Fekete, C. Pál, M. Ackermann, and S. Bonhoeffer, "Antagonism is prevalent between bacteriostatic and bactericidal antibiotics," **Antimicrob. Agents Chemother.**, vol. 58, no. 8, pp. 4573-4582, 2014.
- M. Diard, V. Garcia, L. Maier, M. N. P. Remus-Emsermann, R. R. Regoes, M. Ackermann, and W.-D. Hardt, "Stabilization of cooperative virulence by the expression of an avirulent phenotype," **Nature**, vol. 494, no. 7437, pp. 353-356, Feb. 2013.
- W. Mohr, T. Vagner, M. M. M. Kuypers, M. Ackermann, and J. LaRoche, "Resolution of Conflicting Signals at the Single-Cell Level in the Regulation of Cyanobacterial Photosynthesis and Nitrogen Fixation," **PLoS One**, vol. 8, no. 6, p. e66060, 2013.
- N. Nikolic, T. Barner, and M. Ackermann, "Analysis of fluorescent reporters indicates heterogeneity in glucose uptake and utilization in clonal bacterial populations," **BMC Microbiol.**, vol. 13, no. 1, p. 258, 2013.
- R. F. Inglis, B. Bayramoglu, O. Gillor, and M. Ackermann, "The role of bacteriocins as selfish genetic elements," **Biol. Lett.**, vol. 9, no. 3, p. 20121173, 2013.
- M. Ackermann, "Microbial individuality in the natural environment," **ISME J.**, vol. 7, pp. 465-467, 2013.
- M. Arnoldini, R. Mostowy, S. Bonhoeffer, and M. Ackermann, "Evolution of Stress Response in the Face of Unreliable Environmental Signals," **PLOS Comput. Biol.**, vol. 8, no. 8, p. e1002627, 2012.
- D. R. Johnson, F. Goldschmidt, E. E. Lilja, and M. Ackermann, "Metabolic specialization and the assembly of microbial communities," **The ISME Journal**, vol. 6, no. 11, pp. 1985-1991, 2012.
- B. Stecher, R. Denzler, L. Maier, F. Bernet, M. J. Sanders, D. J. Pickard, M. Barthel, a. M. Westendorf, K. a. Krogfelt, a. W. Walker, M. Ackermann, U. Dobrindt, N. R. Thomson, and W.-D. Hardt, "Gut inflammation can boost horizontal gene transfer between pathogenic and commensal Enterobacteriaceae," **Proc. Natl. Acad. Sci.**, vol. 109, no. 4, pp. 1269-1274, 2012.
- R. Peña-Miller, D. Lähnemann, H. Schulenburg, M. Ackermann, and R. Beardmore, "Selecting against antibiotic-resistant pathogens: optimal treatments in the presence of commensal bacteria," **Bull. Math. Biol.**, vol. 74, no. 4, pp. 908-934, 2012.

- R. Pena-Miller, D. Lahnemann, H. Schulenburg, M. Ackermann, and R. Beardmore, "The optimal deployment of synergistic antibiotics: a control-theoretic approach," **J. R. Soc. Interface**, vol. 9, no. 75, pp. 2488-502, 2012.
- O. K. Silander, N. Nikolic, A. Zaslaver, A. Bren, I. Kikoin, U. Alon, and M. Ackermann, "A genome-wide analysis of promoter-mediated phenotypic noise in Escherichia coli," **PLoS Genet.**, vol. 8, no. 1, p. e1002443, 2012.
- T. Bergmiller, M. Ackermann, and O. K. Silander, "Patterns of Evolutionary Conservation of Essential Genes Correlate with Their Compensability," **PLoS Genet.**, vol. 8, no. 6, p. e1002803, 2012.
- T. Bergmiller and M. Ackermann, "Pole Age Affects Cell Size and the Timing of Cell Division in Methylobacterium extorquens AM1.," **J. Bacteriol.**, vol. 193, no. 19, pp. 5216-5221, 2011.
- T. Bergmiller, R. Peña-Miller, A. Boehm, and M. Ackermann, "Single-cell time-lapse analysis of depletion of the universally conserved essential protein YgjD," **BMC Microbiol.**, vol. 11, no. 1, p. 118, 2011.
- B. M. Pecson, M. Ackermann, and T. Kohn, "Framework for using quantitative PCR as a nonculture based method to estimate virus infectivity.," **Environ. Sci. Technol.**, vol. 45, no. 6, pp. 2257-2263, 2011.
- I. Ispolatov, M. Ackermann, and M. Doebeli, "Division of labour and the evolution of multicellularity," **Proc. R. Soc. B**, vol. 279, pp. 1768-1776, 2011.
- D. E. Helbling, M. Ackermann, K. Fenner, H.-P. E. Kohler, and D. R. Johnson, "The activity level of a microbial community function can be predicted from its metatranscriptome," **ISME J.**, vol. 6, pp. 902-904, 2011.
- A. Sturm, M. Heinemann, M. Arnoldini, A. Benecke, M. Ackermann, M. Benz, J. Dormann, and W.-D. Hardt, "The Cost of Virulence: Retarded Growth of Salmonella Typhimurium Cells Expressing Type III Secretion System 1," **PLoS Pathog.**, vol. 7, no. 7, p. e1002143, 2011.
- A. Boehm, M. Kaiser, H. Li, C. Spangler, C. A. Kasper, M. Ackermann, V. Kaefer, V. Sourjik, V. Roth, and U. Jenal, "Second messenger-mediated adjustment of bacterial swimming velocity," **Cell**, vol. 141, no. 1, pp. 107-116, 2010.
- A. Boehm, S. Steiner, F. Zaehring, A. Casanova, F. Hamburger, D. Ritz, W. Keck, M. Ackermann, T. Schirmer, and U. Jenal, "Second messenger signalling governs Escherichia coli biofilm induction upon ribosomal stress," **Mol. Microbiol.**, vol. 72, no. 6, pp. 1500-1516, 2009.
- O. K. Silander and M. Ackermann, "The constancy of gene conservation across divergent bacterial orders," **BMC Res. Notes**, vol. 2, no. 1, p. 2, 2009.
- M. Novak, T. Pfeiffer, M. Ackermann, and S. Bonhoeffer, "Bacterial growth properties at low optical densities.," **Antonie Van Leeuwenhoek**, vol. 96, no. 3, pp. 267-274, 2009.
- M. Ackermann, B. Stecher, N. E. Freed, P. Songhet, W.-D. Hardt, and M. Doebeli, "Self-destructive cooperation mediated by phenotypic noise.," **Nature**, vol. 454, no. 7207, pp. 987-990, 2008.
- N. E. Freed, O. K. Silander, B. Stecher, A. Böhm, W.-D. Hardt, and M. Ackermann, "A simple screen to identify promoters conferring high levels of phenotypic noise.," **PLoS Genet.**, vol. 4, no. 12, p. e1000307, Dec. 2008.
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- M. Ackermann, "Bacteria as a new model system for aging studies: investigations using light microscopy.," **Biotechniques**, vol. 44, no. 4, pp. 564-567, 2008.
- M. Ackermann, A. Schauerte, S. C. Stearns, and U. Jenal, "Experimental evolution of aging in a bacterium," **BMC Evol. Biol.**, vol. 7, no. 1, p. 126, 2007.
- M. Ackermann, L. Chao, C. T. Bergstrom, and M. Doebeli, "On the evolutionary origin of aging.," **Aging Cell**, vol. 6, no. 2, pp. 235-244, 2007.
- M. Ackermann and S. D. Pletcher, "Evolutionary biology as a foundation for studying aging and aging-related disease," in *Evolution in Health and Disease*, 2007, pp. 241-253.
- M. Ackermann and L. Chao, "DNA sequences shaped by selection for stability," **PLoS Genet.**, vol. 2, no. 2, p. e22, 2006.
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- G. Denecker, S. Töttemeyer, L. J. Mota, P. Troisfontaines, I. Lambermont, C. Youta, I. Stainier, M. Ackermann, and G. R. Cornelis, "Effect of low- and high-virulence *Yersinia enterocolitica* strains on the inflammatory response of human umbilical vein endothelial cells," **Infect. Immun.**, vol. 70, no. 7, pp. 3510-3520, 2002.
- M. Ackermann, R. Bijlsma, A. C. James, L. Partridge, B. J. Zwaan, and S. C. Stearns, "Effects of assay conditions in life history experiments with *Drosophila melanogaster*," **J. Evol. Biol.**, vol. 14, no. 1957, pp. 199-209, 2001.
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