Curriculum Vitae

Richard A. Neher

Research Statement

My group focusses quantifying and predicting the evolution of rapidly evolving RNA viruses such as influenza viruses and HIV. We develop theoretical models and software tools that integrate molecular evolution at the sequence level with predictive models and antigenic properties. As part of this effort, we built `nextflu.org` for real-time tracking of seasonal influenza viruses. Our theoretical models of influenza evolution predict which circulating virus variants are most likely to dominate future virus populations. We are currently integrating these models into nextflu to maximize their utility for the influenza virus research community.

Address

Max Planck Institute for Developmental Biology
Spemannstr. 35
72076 Tübingen
Germany
tel.: +49-70716011345
email: richard.neher@tuebingen.mpg.de

Personal Data

Date of birth: 30th of August, 1979
Place of birth: Göttingen, Germany
Nationality: German

Positions Held

since 10/2010	Independent Max Planck Research Group Leader
2007-2010	Post-Doctoral Fellow at the Kavli Institute for Theoretical Physics, University of California, Santa Barbara, USA
2004-2007	PhD student at the University of Munich, Germany

Education

05/2007	PhD in physics. Grade: **Summa cum laude** University of Munich Thesis advisor: Prof. Ulrich Gerland Thesis title: Dynamics aspects of DNA
07/2006	Les Houches Summer School of Theoretical Physics on Complex Systems

11/2003	Diploma in physics. Grade: **With distinction** University of Munich Thesis advisor: Prof. Herbert Wagner Thesis title: Stochastic Geometry and Percolation
2000–2003	Graduate studies in physics at the University of Munich
07/2000	Prediploma in physics. Grade: **Very good** University of Göttingen
1998–2000	Undergraduate studies in physics at the University of Göttingen

Fellowships & Awards

12/2012	ARCHES award of the German Secretary of Science and Education
03/2011	ERC Starting Grant
08/2009	Harvey L. Karp Discovery Award
2007-2010	Post-Doctoral Fellow at the Kavli Institute for Theoretical Physics
2005-2007	Scholar of the Elite-Network of Bavaria

Professional Activities

since 08/2014	Reviewing Editor at eLife
summer 2014	Co-organizer of the *Drug resistance evolution* program a two month meeting at the interface of evolutionary biology, public health, and physics at KITP, UC Santa Barbara
since 03/2011	Associate Editor, BMC Evolutionary Biology
12/2011	Guest Editor, PLoS Computational Biology
	Reviewer for many journals including PNAS, eLife, PRL, PRE, JSTAT, Genetics, MBE, PLoS Genetics, Trends in Ecology & Evolution
	Reviewer for grant agencies including ERC, ANR, SNF, HFSP, GIF, NWO.

Outreach Activities

04/2014	Tübinger Fenster für Forschung (lecture to the general public)
01/2014	XLAB science festival 2014 (lecture to approx. 450 high-school students).
03/2011	KITP science teacher conference
08/2009	Friends of KITP (lecture to the general public)

Publications

See Google Scholar for up-to-date citation statistics.
`http://scholar.google.de/citations?user=dfvX0rMAAAAJ`

37. Prediction, dynamics, and visualization of antigenic phenotypes of seasonal influenza viruses.
R.A. Neher, T. Bedford, R.S. Daniels, C.A. Russell, B.I. Shraiman, http://arxiv.org/abs/1510.01195 (2015)

36. Population genomics of intrapatient HIV-1 evolution
F. Zanini, J. Brodin, L. Thebo, C. Lanz, G. Bratt, J. Albert, R.A. Neher, http://arxiv.org/abs/1509.024831. (2015)

35. nextflu: real-time tracking of seasonal influenza viruses in humans.
R.A. Neher, T. Bedford, Bioinformatics, 10.1093/bioinformatics/btv381. (2015)

34. Challenges with Using Primer IDs to Improve Accuracy of Next Generation Sequencing.
J. Brodin , C. Hedskog , A. Heddini, E. Benard, R.A. Neher, M. Mild, J. Albert. PLoS ONE 10: e0119123 (2015)

33. Prediction evolution from the shape of genealogical trees.
R.A. Neher†, C.A. Russell, B.I. Shraiman, eLife, 03568 (2014)

32. Genetic diversity in the interference selection limit.
B. Good, A.M. Walczak, R.A. Neher, M.M. Desai, PLoS Genetics, PLoS Genet 10(3), e1004222 (2014).

31. Characterization of Genetic Diversity in the Nematode Pristionchus Pacificus from Population-Scale Resequencing Data.
C. Rödelsperger, R.A. Neher, A.M. Weller, G. Eberhardt, H. Witte, W.E. Mayer, C. Dieterich, and R.J. Sommer. Genetics. doi:10.1534/genetics.113.159855 (2014)

30. Quantifying the range of a lipid phosphate signal in vivo.
A. Mukherjee, R.A. Neher, A. D. Renault. J. Cell Sci., 126, 5453-5464 (2013)

29. Coalescence and genetic diversity in sexual populations under selection.
R.A. Neher†, T.A. Kessinger, B.I. Shraiman. PNAS, 110, 15836-15841 (2013)

28. Inferring HIV escape rates from multi-locus genotype data.
T.A. Kessinger, A.S. Perelson and R.A. Neher†. Front. Immunol., 4:252 (2013)

27. Quantifying selection against synonymous mutations in HIV-1 env evolution.
F. Zanini, R.A. Neher†. Journal of Virology, 87, 11843-11850 (2013)

26. Genetic draft, selective interference, and population genetics of rapid adaptation.
R.A. Neher†, Annual Reviews of Ecology, Evolution, and Systematics, vol 44, 195-215 (2013)

25. The emergence of clones in sexual populations.
R.A. Neher, M. Vucelja, M. Mezard, B.I. Shraiman, JSTAT, P01008, (2013)

24. Mathematical modeling of escape of HIV from cytotoxic T lymphocyte responses.
V.V. Ganusov*, R.A. Neher*, A.S. Perelson, JSTAT, P01008 (2013)

23. Genealogies of rapidly adapting populations.
R.A. Neher† and Oskar Hallatschek. PNAS, vol. 110 pp. 437-442 (2013)

22. FFPopSim: An efficient forward simulation package for the evolution of large populations.
Fabio Zanini and R.A. Neher†. Bioinformatics, vol. 28 pp. 3332-3333 (2012)

21. Dynamic Mutation Selection Balance as an Evolutionary Attractor.
S. Goyal, D.J. Balick, E.R. Jerison, R.A. Neher, B.I. Shraiman, and M.M. Desai, Genetics, 191:1309-1319 (2012)

20. Fluctuations of fitness distributions and the rate of Muller's ratchet.
R.A. Neher†, B.I. Shraiman, Genetics, 191:1283-1293 (2012)

19. Estimation of selection coefficients from deep population diversity data.
P.W. Messer, R.A. Neher†, Genetics, 191:593-605 (2012)

18. Target search on a dynamic DNA molecule.
T. Schötz, R.A. Neher, and U. Gerland. Phys. Rev. E., Vol. 84, p. 051911 (2011)

17. Statistical Genetics and Evolution of Quantitative Traits.
R.A. Neher, B.I. Shraiman, Rev. Mod. Phys, Vol 83(4), pp. 1283 (2011)

16. Genetic Draft and Quasi-Neutrality in Large Facultatively Sexual Populations.
R.A. Neher, B.I. Shraiman, Genetics, 188, 975-996 (2011)

15. Correlated Evolution of Nearby Residues in Drosophilid Proteins.
B. Callahan, R.A. Neher, D. Bachtrog, P. Andolfatto, B.I. Shraiman, PLoS Genet. 7(2) e1001315 (2011)

14. Recombination rate and selection strength in HIV intra-patient evolution .
R.A. Neher† and T. Leitner. PLoS Comput Biol 6 (1) pp. e1000660 (2010)

13. Rate of Adaptation in Large Sexual Populations.
R.A. Neher, B. I. Shraiman and D. S. Fisher. Genetics, 184 pp. 467-481 (2010)

12. Competition between recombination and epistasis can cause a transition from allele to genotype selection
R.A. Neher and B.I. Shraiman. PNAS, Vol. 106, pp. 6866-6871 (2009)

11. Blind source separation for the analysis of fluorescence microscopy images
R.A. Neher, M. Mitkovski, E. Neher, F. Kirchhoff, F. Theis and A. Zeug. Biophys. J., 96, pp. 3791-3800 (2009)

10. Blind Decomposition of Spectral Imaging Microscopy: A Study on Artificial and Real Test Data
F. Theis , R. Neher, and A. Zeug. in *ICA '09: Proc. 8th Int. Conference on Independent Component Analysis and Signal Separation.*, pp. 548–556, (2009)

9. Topological estimation of percolation thresholds
R.A. Neher†, K. Mecke, H. Wagner. JSTAT, P01011, (2008)

8. Optimal stiffness for conformational transitions in macromolecules
R.A. Neher, W. Moebius, E. Frey and U. Gerland. Phys. Rev. Lett., Vol. 99, p. 178101, (2007)

7. Force-Induced DNA slippage
F. Kühner, J. Morfill, R.A. Neher K. Blank and H. Gaub. Biophys. J., 92:2491-2497 (2007)

6. Kinetic Accessibility of Buried DNA Sites in Nucleosomes
W. Möbius, R.A. Neher and U. Gerland. Phys. Rev. Lett., Vol. 97, p. 208102, (2006)

5. Intermediate phase in DNA melting
R.A. Neher† and U. Gerland. Phys. Rev. E., Vol. 73, p. R030902, (2006)

4. DNA as a viscoelastic nanoelement
R.A. Neher and U. Gerland. Biophys. J., Vol. 89, p. 3446-3855, (2005)

3. Dynamics of Force-Induced DNA Slippage
R.A. Neher and U. Gerland. Phys. Rev. Lett., Vol. 93, p. 198102, (2004)

2. Applying Spectral Fingerprinting to the Analysis of FRET Images
R.A. Neher and E. Neher, Micros. Res. Tech., Vol. 63, p.185-195, (2004)

1. Optimizing imaging parameters for the separation of multiple labels in a fluorescence image
R.A. Neher and E. Neher, J. of Microscopy, Vol. 213(1), p.46-62, (2004)

† denotes corresponding author, * denotes co-first author.

Patents

Method and device for conducting the spectral differentiating, imaging measurement of fluorescent light. US Patent 7304733, German Patent 10222359.
E. Neher and R.A. Neher.

Theses

PhD thesis: Dynamic aspects of DNA – DNA-slippage and nucleosome dynamics
University of Munich, 2007. Thesis advisor: Prof. Ulrich Gerland

Diploma thesis: Stochastic Geometry and Percolation
University of Munich, 2003. Thesis advisor: Prof. Herbert Wagner

Invited Conference contributions

07/2015	"Forecasting Evolution". Instituto Gulbenkian, Lisbon
06/2015	"Probability and Biological Evolution". CIRM, Luminy
05/2015	"Next generation sequencing of viruses". Institute Pasteur, Paris
06/2014	Heraeus-Seminar on "Mechanisms, Strategies, and Evolution of Microbial Systems", Bad Honnef, Germany
05/2014	Molecular Frontiers in Ecology and Evolution, Tübingen, Germany
02/2014	Physics of Evolution, Regulation and Signaling, Munich, Germany
08/2013	European Society for Evolutionary Biology, Lisbon, Portugal
12/2012	KITP program on "Quantitative Immunology", Santa Barbara, CA, USA
05/2012	Selection in Population Genetics, Radcliffe Institute, Harvard University, MA, USA
02/2012	Cologne Spring Meeting (Satellite meeting on viral evolution)
12/2011	Population Genetics, ENS, Paris, France
09/2011	Mind the Gap 2011, Cologne, Germany
03/2011	Kavli Future Conference: Evolution of Novelty, Aspen, CO, USA
03/2011	KITP program on "Viral and Microbial Evolution", Santa Barbara, CA, USA
03/2010	American Physical Society Annual Meeting: Symposium on evolutionary dynamics, Portland, OR, USA
01/2010	Aspen Center for Physics: Populations, Evolution, and Physics, Aspen, CO, USA
06/2009	DIMACS Workshop: Identifying genetic signatures for the evolution of complex phenotypes, Rutgers, USA

Invited Talks & Seminars (selection)

02/2015	Pacific Center for Emerging Infectious Diseases. University of Hawai'i
11/2014	CeNS Colloquium, LMU Munich, Germany
10/2014	Population Genetics Seminar, University Berne, Switzerland
04/2014	BioQuant Seminar, Heidelberg, Germany
12/2013	Virological Colloquium, Medical School Tübingen, Germany
05/2013	Seminar at the Institute for Molecular Virology, University Ulm, Germany
09/2012	Seminar at the Institute for Ecology and Evolution, ETH Zürich, Switzerland
06/2012	Microbiological Colloquium, Medical School Tübingen, Germany
04/2012	Seminar, Biophysics Seminar series, Princeton University, NJ, USA

01/2012	Seminar, Transregio Seminar, University Duisburg-Essen, Germany
11/2011	Seminar, Institute for Evolution and Ecology, University Münster, Germany
04/2011	Colloquium, Max-Planck Institute for Dynamics and Self-Organization, Göttingen, Germany
07/2010	T6 Seminar, Los Alamos National Lab, Los Alamos, NM, USA
04/2010	Biophysics/Population genetics Seminar, Stanford University, Palo Alto, CA, USA
11/2009	Biophysics Seminar, Max-Planck-Institute for Complex Systems, Dresden, Germany
07/2009	SFB 680 Colloquium, Institute for Genetics, University of Cologne, Germany
05/2009	Biophysics Seminar, Princeton University, USA
07/2008	Soft matter and Biophysics seminar, LMU Munich, Germany
02/2007	Soft Matter Theory Seminar, University of Erlangen-Nuernberg, Germany
01/2007	Biophysics seminar, ENS Paris, France
09/2005	Theory Seminar at the Max-Planck-Institute for Colloid- and Interface Research, Golm, Germany
12/2003	Theory Seminar at the Max-Planck-Institute for Solid State Physics, Stuttgart, Germany