

Dr. rer. nat. Philipp Martin Altrock
Curriculum Vitae

Professional Information

Affiliation:

Department of Theoretical Biology
Max Planck Institute for Evolutionary Biology
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Education and Employment

Education

Dr. rer. nat. (Theoretical Physics, Evolutionary Game Theory) **May 2011**

Mathematisch-Naturwissenschaftliche Fakultät, Christian-Albrechts-Universität zu Kiel

Diplom Physiker **Dec 2007**

Fakultät für Physik und Geowissenschaften, Universität Leipzig

Employment

Project Leader **since Aug 2021**

Max Planck Institute for Evolutionary Biology Plön, Germany

Assistant Member/Assistant Professor **Jan 2017-Jun 2021**

H. Lee Moffitt Cancer Center and Research Institute, Tampa, Florida

Research Fellow **Jan 2013-Jan 2017**

Harvard University, Dana-Farber Cancer Institute. Mentor: Franziska Michor, PhD
parental leave May 2015-Jul 2015

Research Assistant/Associate **Apr 2008-Dec 2012**

Max Planck Institute for Evolutionary Biology, Plön, Germany. Mentor: Dr. Arne Traulsen

Teaching Assistant and Tutor **Oct 2005-Feb 2008**

Institute of Theoretical Physics, Leipzig University, Germany. Mentor: Dr. Ulrich Behn

Research Interests

Mathematica Modeling in Medicine, Cancer Evolution, Tumor-Immune Interactions, Cellular Immunotherapy, Somatic Evolution, Gene and Cell Therapy, Evolutionary Game Theory.

Teaching Interests

Mathematical Biology, Evolutionary Medicine, Population Genetics, Evolutionary Game Theory, Theoretical Ecology, Quantitative Modeling for Medical Life Sciences.

Teaching Activities and Mentoring

Courses

Integrated Mathematical Oncology 2, (Course Director), Moffitt Cancer Center, USF	2021
Integrated Mathematical Oncology 1, Moffitt Cancer Center, USF	2020
Integrated Mathematical Oncology 2 (Course Director), Moffitt Cancer Center, USF	2020
Integrated Mathematical Oncology 1, Moffitt Cancer Center, USF	2019
Integrated Mathematical Oncology 2, (Course Director), Moffitt Cancer Center, USF	2019
Integrated Mathematical Oncology 1, Moffitt Cancer Center, University of South Florida (USF)	2018

Individual Lectures

Evolutionary and ecological applications in medicine MAMBE Course, Kiel University	2024
Evolutionary Game Theory MAMBE Course, MPI Plön and Kiel University	2021
Mathematics 243 (undergraduate) “Advanced topics of evolutionary dynamics”, Harvard University	2016
Graduate lecture “Evolutionary Dynamics of Cancer”, Harvard University	2013, 2015
Evolutionary Dynamics, University of Lübeck	2012-2014

Mentoring Experience

I have been fortunate to learn from, mentor, and supervise a number of talented students and postdocs.

Qianci Yang, PhD-student (IMPRS Evolutionary Biology, MPI Plön & RTG TransEvo, Kiel)	since 2022
Mohammadreza Satouri, predoctoral researcher (TU Delft)	2022
Álvaro Martínez Rubio, predoctoral researcher (University of Cádiz)	2022
Ioana Bouros, Dphil candidate (Oxford University, Moffitt Cancer Center)	2021
Dr. rer. nat. Tim Kodalle (Postdoc at Moffitt Cancer Center)	2020-2021
Brian Johnson, BSc (Summer Intern/Research Assistant/BSc honors thesis, Rutgers University)	2019-2021
Gregory J. Kimmel, PhD (Postdoc at Moffitt Cancer Center)	2017-2021
Meghan Ferrall-Fairbanks, PhD (Postdoc at Moffitt Cancer Center), now Assistant Professor	2017-2020
Kristofer Hammond (Undergraduate student at Dartmouth College)	2020

Daniel Glazar (Mathematical Oncology PhD program rotation Student)	2020
Rebecca Bekker (Mathematical Oncology PhD program rotation Student)	2019
Abigail Tan (Highschool Internship Program in Integrated Mathematical Oncology, “HIP IMO”)	2019
Benjamin Sherwin (HIP IMO student at Moffitt Cancer Center)	2019
Blake Bridge (HIP IMO student at Moffitt Cancer Center)	2018
Yixuan He (Undergraduate student at Dartmouth College)	2018
Ashley Kelly (HIP IMO student at Moffitt Cancer Center)	2017
Jeremy Ferlic (Graduate student at Harvard University)	2016
Shirly Mo (Undergraduate student at Harvard University)	2015

Awards, External Funding, and Collaborations

Awards

Heisenberg Program, Deutsche Forschungsgemeinschaft (DFG)	2024
2020 Junior Faculty Research Award, H. Lee Moffitt Cancer Center and Research Institute	2021
Postdoctoral Fellowship of the German Academy of Sciences Leopoldina	2013

Current Funding

DFG Heisenberg Professorship, transferable (Principal Investigator, €678,000)	2025-2030
KITE Pharma-Moffitt Alliance sub-award, non-transferable (Co-Investigator, €8000)	2023-2024

Past Funding

Bankhead-Coley Cancer Research Program, Florida, US (Co-Principal Investigator, \$636,610)	2020-2023
ACS-RSA Award (Co-Investigator), American Cancer Society (\$165,000)	2020-2023
Pilot Award, Moffitt Center of Excellence for Evolutionary Therapy (Co-PI, \$100,000)	2020-2021
Industry Alliance Award, (Co-Principal Investigator), KITE Pharma (\$423,000)	2019-2021
ACS-IRG Award, American Cancer Society (Principal Investigator, \$30,000)	2019-2020
Team Science Award, Moffitt Cancer Center (Co-Principal Investigator, \$75,000)	2019-2020
Concept Award, US Department of Defense (Co-Investigator, \$75,000)	2019-2020
Pilot Project Grant, NIH U54CA193489 (Co-Principal Investigator, \$20,000)	2017-2018
Pilot Project Grant NIH 5U54CA193461 (Co-Principal Investigator, \$100,000)	2017-2018
Moffitt Cancer Center Startup Funds (Principal Investigator, \$500,000)	2017-2021
BD-STEP Fellow, U.S. Department of Veterans Affairs, “Increasing the Use of Data Science”	2015-2016
Fellowship, German Academy of Sciences Leopoldina (approx. \$150,000)	2014-2017

Leadership and Service Experience

Active Memberships

Deutsche Physikalische Gesellschaft (since 2001), European Society for Mathematical and Theoretical Biology (since 2015), Society for Mathematical Biology (since 2015), American Society for Gene and Cell Therapy (since 2016), American Association for Cancer Research (since 2017), Association for Cancer Immunotherapy (since 2021), European Hematology Association (since 2023).

Activities as Editor

Academic Editor, Editorial Board Member, PLoS Computational Biology	since 2024
Editorial Board Member, Mathematical Biosciences	since 2024
Editorial Board Member, Journal of Nonlinear Science	since 2019

Activities as ad hoc Reviewer

Journals: PNAS, Blood, Cancer Research, Nature Communications, PeerJ, Bioinformatics, PLoS Computational Biology, PLoS Medicine, PLoS Genetics, PLoS One, Physical Review Letters, Physical Review E, Integrative Biology, Journal of Theoretical Biology, Bulletin of Mathematical Biology, New Journal of Physics, Journal of Statistical Physics, Physica A, European Physics Letters, Theory in Biosciences. Grants: European Research Council, NWO (Netherlands), FWO (Belgium), EPSRC (UK). Other: Florida Board of Education.

Institutional Leadership Experience

Member of the Total Cancer Care Faculty Advisory Committee Moffitt Cancer Center, Tampa, Florida	2020-2021
Head of the Data Science Grand Rounds Seminar Series Steering Committee Moffitt Cancer Center, Tampa, Florida	2018-2021
Member of the High-Performance Computing Steering Committee Moffitt Cancer Center, Tampa, Florida	2018-2021
Member of the PhD Program in Mathematical Oncology Planning Committee Moffitt Cancer Center, Tampa, Florida	2017
Elected PhD Representative and Spokesperson Max Planck Institute for Evolutionary Biology, Plön, Germany	2009-2011
Elected Member of the Student Council Faculty of Physics and Earth Sciences, University of Leipzig, Germany	2005-2007

Scientific Presentations

Invited Presentations

Kinetics and Dynamics of ALL using MRD, Summer school of the CATCH ALL Clinical Research Unit, Eutin, Germany, May 2024.

Quantifying CAR T cells activity against AML, Mathematical Oncology Seminar Series, Moffitt Cancer Center, Tampa, FL, October 2023.

Modeling Cancer Ecology and the Immune System - Tutorial, Summer school of the CATCH ALL Clinical Research Unit, Rendsburg, Germany, June 2023.

Neighborhood size-effects shape growing population dynamics in evolutionary public goods games. EvoGamesPlus and Friends Meeting, virtual, April 2023.

Nonlinear and stochastic dynamics of cancer, Computational Modelling of Cancer Biology and Treatments, Banff International Research Station, Banff, CA, January 2023.

Modeling Cancer Ecology, Zentrum für Informationsdienste und Hochleistungsrechnen, Technische Universität Dresden, Germany, November 2022.

How can diversity indices help to understand cancer ecology and evolution? Mathematical Oncology Seminar Series, Moffitt Cancer Center, Tampa, FL, October 2022.

Cell-competition and stochastic extinction in chimeric antigen receptor T cell therapy. European Conference on Mathematical and Theoretical Biology, Heidelberg, Germany, September 2022.

Chimeric Antigen Receptor Therapy: nonlinear dynamics and stochastic kinetics. Centre International de Rencontres Mathématiques, Marseille, France, June 2022.

Chimeric Antigen Receptor Therapy, nonlinear T cell dynamics, and stochastic kinetics: interactions and efficacy. American Society for Clinical Pharmacology & Therapeutics Webinar Series, June 2022.

Modeling cancer ecology to predict tumor evolution. Northern Oncology Research & Development (NORD) Seminar, University Cancer Center Schleswig-Holstein, Kiel/Lübeck, Germany, May 2022.

Modeling Cancer Ecology to Understand Tumor Evolution. 742th WE-Heraeus-Seminar: Evolution of Cancer-Reconstructing the Past, Predicting the Future. Bad Honnef, Germany, March 2022.

Modeling kinetics of outcomes of cellular immunotherapy. UKSH Onco-Lunch, Kiel, Germany, January 2022.

Keynote: Modeling cancer ecology as the stage on which tumor evolution plays out. Conference "Evolution by the Sea", DFG Research Training Group for Translational Evolutionary Research, Kiel, Germany, September 2021.

Evolutionary dynamics of cancer: competition, cooperation, growth. Faculty of Physics and Earth Sciences, Leipzig University, Germany, April 2021.

Uncovering time-dependence of intra-tumor heterogeneity. Joint Mathematics Meetings, virtual event, January 2021.

Integrating mathematical modeling with high throughput imaging to examine how polyploid cells behave in nutrient-sparse environments. Applied Mathematics Seminars, University of Birmingham, UK, November 2020.

Evolutionary dynamics of public goods games in growing cell populations. XXIV Gliwice Scientific Meetings, Gliwice, Poland, November 2020.

Modeling eco-evolutionary interactions between engineered and wildtype T cells to quantify therapeutic success of anti-CD19 CAR T cell therapy. Center for Quantitative Biology Seminar, Rutgers University, NJ, September 2020.

Stochastic Dynamics of Cancer. qBio summer school, University of Maryland, July 2020 (postponed due to pandemic).

Identifying ecological principles that help us better understand cancer evolution. Cancer Biology and Evolution Seminar, Moffitt Cancer Center, Tampa, FL, April 2020 (postponed due to pandemic).

Theory of cellular immunotherapy: the example of CAR T cell therapy targeting lymphoma. Talk Series on Biomathematics, Hausdorff Center for Mathematics and ImmunoSensation2, Bonn, Germany, December 2019.

Understanding CAR T cell therapy using machine learning and mechanistic modeling. Giersch International Symposium, FIAS, Frankfurt, Germany, November 2019.

Math vs Machine in predictive modeling of cancer dynamics. FIAS, Frankfurt, Germany, October 2019.

Evolutionary Dynamics of Cancer. qBio summer school, Rice University, Houston, TX, July 2019.

Predictive modeling of co-evolution in growing tumor populations. Society of Math. Biology Annual Meeting, Montreal, Canada, July 2019.

Dynamics of Non-Hodgkin Lymphoma CAR T cell Therapy. University of Cologne, Germany, June 2019.

Evolutionary dynamics of non-Hodgkin's lymphoma CAR T cell therapy. University of Texas at Austin, TX, October 2018.

Evolutionary dynamics of non-Hodgkin's lymphoma CAR T cell therapy. Stochastic models of evolving populations: from bacteria to cancer, International Centre for Mathematical Sciences, Edinburgh, Scotland/UK, July 2018.

Evolutionary game dynamics in cancer. Charité Berlin, Germany, May 2018.

How do cellular selection and diversity contribute to leukemic progression? Max Planck Institute for Evolutionary Biology, Plön, Germany, May 2018.

Mathematical models of diversity in cancer: from clonal interactions to cancer stem cells to pre-cancer screening. Max Planck Institute for Dynamics of Complex Dynamical Systems, Magdeburg, Germany, March 2017.

Diversity and interactions in tumor growth and treatment. Wellcome Trust Centre for Human Genetics, Oxford, UK, September 2016.

Diversity and interactions in tumor growth and treatment. Max-Delbrück Center for Molecular Medicine, Berlin, Germany, September 2016.

Cellular diversity in tumor growth and treatment. BioCenter, Ludwig Maximilian University Munich, July 2016.

Mathematical Modeling of Erythrocyte Chimerism Informs Genetic Interventions for Sickle Cell Disease. Systems Biology of Human Disease 2016, Cambridge, MA, June 2016.

Heterogeneity and interactions in tumor growth and treatment. Symposium on Biological Physics, Max Planck Institute for Physics of Complex Systems, Dresden, Germany, June 2016.

Cellular interactions and diversity in tumor growth and treatment. Symposium on New Frontiers in Cancer Research, German Cancer Research Center (DKFZ), Heidelberg, Germany, May 2016.

Cellular interactions and diversity in tumor growth and treatment. Cancer Genomics Symposium, Dana-Farber Cancer Institute, Boston, MA, March 2016.

Hierarchical population structure in blood diseases and cancer. Mathematical Biology Seminar, Duke University, Durham, NC, February 2016.

Two examples of tumor heterogeneity: non-cell-autonomous driving and hierarchical organization. Max Planck Institute for Cell Biology and Genetics, Dresden, Germany, October 2015.

Bi-stable selection and gene flow. Institute for Theoretical Physics, University of Leipzig, Germany, September 2015.

Non-cell-autonomous driving of tumor growth supports sub-clonal heterogeneity. Feinberg School of Medicine, Northwestern University, Chicago, IL, August 2014.

Evolutionary Games and Application to Strategic Timing in Collective-Risk Dilemmas. HHL-Graduate School of Management, Leipzig, Germany, March 2014.

Seminar on Mathematics and Cancer. MIT School of Engineering, Cambridge, MA, August 2013.

Frequency-dependent selection. Dana-Farber Cancer Institute, September 2012.

Evolutionary Game Dynamics. Leipzig, Germany Graduate School of Management, Leipzig, Germany, March 2012.

Evolutionary game dynamics in finite populations – Fixation times. Program for Evolutionary Dynamics, Harvard University, Cambridge, MA, September 2011.

Stability and statistical properties of heterozygote disadvantage in subdivided populations. 3rd Workshop on Theoretical Biology, Plön, Germany, February 2011.

Evolutionary Game Theory. jDPG-Theory-Workshop 2010, Gersfeld (Rhön), January 2010.

Fixation times in evolutionary games under weak selection. Institute for Theoretical Physics, University of Leipzig, Germany, March 2009.

Contributed Presentations

Talk: Stochastic dynamics of cancer relapse in hematologic malignancies. Workshop on Computational Models in Biology and Medicine, University of Stuttgart, June 2023.

Talk: Stochastic dynamics of cancer relapse in hematologic malignancies. Workshop on Mathematical Models of Evolutionary Rescue, Ploen, Germany, June 2023.

Talk: Quantitative modeling of residual disease kinetics during cellular immunotherapy of leukemia and lymphoma. Society of Molecular Biology and Evolution Satellite Meeting on Evolutionary Rescue, Kiel, September 2022.

Talk: Cell-competition and stochastic extinction in chimeric antigen receptor T cell therapy. European Conference on Mathematical and Theoretical Biology, Heidelberg, September 2022.

Talk: Predictive modeling of co-evolving growing populations. National Cancer Institute's Division of Cancer Biology Mathematical Oncology Meeting, Portland, OR, May 2019.

Poster: Computational Modeling of Interactions Between Engineered and Wildtype T-Cells Quantifies Therapeutic Success of anti-CD19 CAR T-Cell therapy. Annual meeting of the American Society for Gene and Cell Therapy, Washington D.C., May 2019.

Talk: Evolutionary dynamics of non-Hodgkin's lymphoma CAR T cell therapy. Systems Approaches to Cancer Biology, Woods Hole, MA, November 2018.

Poster: Evolutionary dynamics of non-Hodgkin's lymphoma CAR T cell therapy. Annual meeting of the American Association of Cancer Research, Chicago, IL, April 2018.

Poster: Mathematical modeling of erythrocyte chimerism informs clinical strategies for sickle cell disease. Annual meeting of the American Society for Gene and Cell Therapy, Washington D.C., May 2016.

Talk: Estimating the self-renewal capacity in hierarchically organized tumors. Workshop "Cancer Evolution through Space and Time", Ploen, Germany, September 2015.

Talk: Estimating the self-renewal capacity in hierarchically organized tumors. Celebration of Jr. Investigators in Cancer Science, Dana-Farber/Harvard Cancer Center, Boston, MA, September 2014.

Talk: Tumor growth and clonal heterogeneity during expansion and treatment. MBI, Columbus, OH, September 2014.

Workshops and Symposia

Co-organizer of Mini-Symposium at the European Conference on Mathematical and Theoretical Biology, Heidelberg, Germany (2022).

Co-organizer of Mini-Symposium at the Society for Mathematical Biology Annual Meeting, Montreal, Canada (2019).

Co-organizer of "Modeling Diversity in Cancer and Virus Evolution", Workshop at the Max Planck Institute for Evolutionary Biology, Plön, Germany (2018).

Co-organizer of Mini-Symposium at the European Conference for Math. and Theoretical Biology, Lisbon, Portugal (2018).

Co-organizer of Mini-Symposium at the Society for Mathematical Biology Annual Meeting, Salt Lake City, UT (2017).

List of Original Publications

<https://scholar.google.com/citations?hl=en&user=pSwR6EoAAAAJ>

Preprints (under peer review):

1. B. Desai, T. Miti, S. Prabhakaran, D. Miroshnychenko, M. Henry, V. Marusyk, C. Gatenbee, M. Bui, J. Scott, **P. M. Altrock**, E. Haura, A. R. A. Anderson, D. Basanta, A. Marusyk. Peristromal niches protect lung cancers from targeted therapies through a combined effect of multiple molecular mediators. [bioRxiv.org:2024.04.24.590626](https://doi.org/10.1101/2024.04.24.590626), 2024. <https://doi.org/10.1101/2024.04.24.590626>.
2. G. J. Kimmel, J. West, M. Damaghi, A. R. A. Anderson, **P. M. Altrock**. Local contact inhibition leads to universal principles of cell population growth. [arXiv:2108.10000](https://arxiv.org/abs/2108.10000), 2021. <https://doi.org/10.48550/arXiv.2108.10000>.

Peer reviewed (in reverse chronological order):

1. S. Montazid, S. Bandyopadhyay, D. W. Hart, N. Gao, B. Johnson, S. G. Thrumurthy, D. J. Penn, B. Wernisch, M. Bansal, **P. M. Altrock**, F. Rost, P. Gazinska, P. Ziolkowski, B. Hayee, Y. Liu, J. Han, A. Tessitore, J. Koth, W. F. Bodmer, J. E. East, N. C. Bennett, I. Tomlinson, S. Irshad. Adult stem cell activity in naked mole rats for long-term tissue maintenance. *Nature Communications* 14:8484, 2023.
2. D. Miroshnychenko, T. Miti, P. Kumar, A. Miller, M. Laurie, N. Giraldo, M. M. Bui, **P. M. Altrock**, D. Basanta, A. Marusyk. Stroma-mediated breast cancer cell proliferation indirectly drives chemoresistance by accelerating tumor recovery between chemotherapy cycles. *Cancer Research* 83:3681–3692, 2023.
3. G. Chitadze, A. Stengel, C. John-Klaau, J. Bruckmüller, H. Trautmann, M. Kotrova, F. Darzentas, M. Kelm, K. Pal, N. Darzentas, L. Bastian, B. Kehden, W. Wessels, A.-S. Ströh, H.-H. Oberg, **P. M. Altrock**, C. Baer, M. Meggendorfer, N. Gökbuget, C. D. Baldus, C. Haferlach, M. Brüggemann. Somatic TP53 mutations are preleukemic events in acute lymphoblastic leukemia. *Blood* 141:1640–1644, 2023.
4. E. A. Dean, G. J. Kimmel, M. J. Frank, A. Bukhara, N. M. Hossain, M. D. Jain, S. Dahiya, D. B. Miklos, **P. M. Altrock**, F. L. Locke. Circulating Tumor DNA Adds Specificity to PET following Axicabtagene Ciloleucel in Large B-cell Lymphoma. *Blood Advances* 7:4608–4618, 2023.
5. N. H. Chakiryan, Y. Kim, A. Berglund, G. J. Kimmel, A. Chang, A. Hajiran, J. Nguyen, C. Moran, D. Saeed-Vafa, E. N. Katende, N. Lopez-Blanco, J. Chahoud, P. Rappold, P. E. Spiess, M. Fournier, D. Jeong, L. Wang, D. Du, J. K. Teer, J. Dhillon, A. Hakimi, **P. M. Altrock**, J. J. Mulé, B. J. Manley. Geospatial characterization of immune cell distributions and dynamics across the microenvironment in renal cell carcinoma. *Journal for ImmunoTherapy of Cancer* 11: e006195, 2023.
6. G. J. Kimmel, R. Beck, X. Yu, T. Veith, S. Bakhoun, **P. M. Altrock**, N. Andor. Intra-tumor heterogeneity, turnover rate and karyotype space shape susceptibility to missegregation-induced extinction. *PLoS Computational Biology* 19: e1010815, 2023.
7. M. C. Ferrall-Fairbanks, A. Dhawan A, B. Johnson, H. Newman, V. Volpe, C. Letson, M. Ball, A. M. Hunter, M E. Balasis, T. Kruer, N. A. Ben-Crentsil, J. L. Kroeger, R. Balderas, R. S. Komrokji, D. A. Sallman, J. Zhang, R. Bejar, **P. M. Altrock***, E. Padron*. Progenitor Hierarchy of Chronic

- Myelomonocytic Leukemia Identifies Inflammatory Monocytic-Biased Trajectory Linked to Worse Outcomes. *Blood Cancer Discovery* 3:536–553, 2022. (*co-senior authors)
8. M. C. Ferrall-Fairbanks, N. H. Chakiryan, B. I. Chobrutskiy, Y. Kim, J. K. Teer, A. Berglund, J. J. Mulé, M. Fournier, E. Siegel, J. Dhillon, S. S. A. Falasiri, J. F. Arturo, E. N. Katende, G. Blanck, B. J. Manley*, **P. M. Altrock***. Quantification of T- and B-cell Immune Receptor Distribution Diversity Characterizes Immune Cell Infiltration and Lymphocyte Heterogeneity in Clear Cell Renal Cell Carcinoma. *Cancer Research* 82:929–942, 2022. (*co-corresponding authors)
 9. P. Gerlee, **P. M. Altrock**, A. Malik, C. Krona, S. Nelander. Autocrine signaling can explain the emergence of Allee effects in cancer cell populations, *PLoS Computational Biology* 18:e1009844, 2022.
 10. A. Andor, **P. M. Altrock**, N. Jain, A. P. Gomes. Tipping cancer cells over the edge: the context-dependent cost of high ploidy. *Cancer Research* 82:741–748, 2021.
 11. N. H. Chakiryan, G. J. Kimmel, Y. Kim, J. O. Johnson, N. Clark, A. Hajiran, A. Chang, L. Zemp, A. M. Aydin, E. N. Katende, J. Chahoud, M. C. Ferrall-Fairbanks, P. E. Spiess, N. Francis, M. Fournier, J. Dhillon, J.Y. Park, L. Wang, J. J. Mulé, **P. M. Altrock**, B. J. Manley. Geospatial Cellular Distribution of Cancer-Associated Fibroblasts Significantly Impacts Clinical Outcomes in Metastatic Clear Cell Renal Cell Carcinoma. *Cancers* 13:3743, 2021.
 12. B. Johnson, **P. M. Altrock***, G. J. Kimmel*. Two-dimensional adaptive dynamics of evolutionary public goods games: finite size effects on fixation probability and branching time. *Royal Society Open Science* 8:210182, 2021. (*equal contribution)
 13. N. H. Chakiryan, G. J. Kimmel, Y. Kim, A. Hajiran, A. M. Aydin, L. Zemp, E. N. Katende, J. Nguyen, N. Lopez-Blanco, J. Chahoud, P. E. Spiess, M. Fournier, J. Dhillon, L. Wang, C. Moran-Segura, A. El-Kenawi, J. J. Mulé, **P. M. Altrock**, B. J. Manley. Spatial clustering of CD68+ tumor associated macrophages with tumor cells is associated with worse overall survival in metastatic clear cell renal cell carcinoma. *PLoS One* 16:e0245415, 2021.
 14. G. J. Kimmel, F. L. Locke*, **P. M. Altrock***. The roles of T cell competition and stochastic extinction events in chimeric antigen receptor T cell therapy. *Proceedings of the Royal Society B* 288:20210229. (*co-corresponding authors)
 15. M. Damaghi, J. West, M. Robertson-Tessi, L. Xu, M. C. Ferrall-Fairbanks, P. A. Stewart, E. Persi, B. L. Fridley, **P. M. Altrock**, R. A. Gatenby, P. A. Sims, A. R. A. Anderson, R. J. Gillies. The Harsh Microenvironment in Early Breast Cancer Selects for a Warburg Phenotype. *PNAS* 118:e2011342118, 2021.
 16. M. D. Miroshnychenko, E. Baratchart, M. C. Ferrall-Fairbanks, R. Vander Velde, M. A. Laurie, M. M. Bui, **P. M. Altrock**, D. Basanta, A. Marusyk. Spontaneous Cell Fusions as a Mechanism of Parasexual Recombination in Tumor Cell Populations. *Nature Ecology and Evolution* 5:379, 2021.
 17. M. C. Ferrall-Fairbanks and **P. M. Altrock**. Investigating Inter- and Intra-Sample Diversity of Single-Cell RNA Sequencing Datasets. In *Springer Methods in Molecular Biology: Translational Bioinformatics for Therapeutic Development*, 2194:1-240. doi:10.1007/978-1-0716-0849-4, 2021.
 18. G. J. Kimmel, M. Dane, L. Heiser, **P. M. Altrock**, N. Andor. Invasion of homogeneous and polyploid populations in nutrient-limiting environments. *Cancer Research* 80:5109-5120, 2020.
 19. H. Enderling, **P. M. Altrock**, N. Andor, D. Basanta, J. S Brown, R. A. Gatenby, A. Marusyk, K. A. Rejniak, A. Silva, A. R. A. Anderson. High school Internship Program in Integrated Mathematical Oncology (HIP IMO)—five-year experience at Moffitt Cancer Center. *Bulletin of Mathematical Biology* 82:91, 2020.

20. G. J. Kimmel, P. Gerlee, **P. M. Altrock**. Time scales and wave formation in non-linear spatial public goods games. *PLoS Computational Biology* 15:e1007361, 2019.
21. P Gerlee, **P.M. Altrock**. Persistence of cooperation in diffusive public goods games. *Physical Review E* 99:062412, 2019.
22. M. C. Ferrall-Fairbanks, D. Glazar, R. Brady, G. J. Kimmel, M. U. Zahid, **P. M. Altrock** *, H. Enderling*. Re: Simulation analysis for tumor radiotherapy based on three-component mathematical models. *Journal of Applied Clinical Medical Physics* 20:204-205, 2019. (*co-corresponding authors)
23. G. J. Kimmel, P. Gerlee, J. S. Brown JS, **P. M. Altrock**. Neighborhood size-effects shape growing population dynamics in evolutionary public goods games. *Communications Biology* 2:53, 2019.
24. M. C. Ferrall-Fairbanks, M. Ball, E. Padron and **P. M. Altrock**. Leveraging single cell RNA sequencing experiments to model intra-tumor heterogeneity. *JCO Clinical Cancer Informatics* 2019(3):1-10, 2019.
25. **P. M. Altrock**, J. Ferlic, T. Galla, M. H. Tomasson and F. Michor. Computational Model of Progression to Multiple Myeloma Identifies Optimum Screening Strategies. *JCO Clinical Cancer Informatics* 2018(2):1-12, 2018.
26. P. Gerlee and **P. M. Altrock**. Extinction Rates in Tumor Public Goods Games. *Journal of the Royal Society Interface* 14:20170342, 2017.
27. **P. M. Altrock**, A. Traulsen, M. A. Nowak. Evolutionary games on cycles with strong selection. *Physical Review E* 95:022407, 2017.
28. **P. M. Altrock***, C. Brendel*, R. Renella, S. H. Orkin, D. A. Williams, F. Michor, Mathematical modeling of erythrocyte chimerism informs genetic intervention strategies for sickle cell disease. *American Journal of Hematology* 91:931-937, 2016. (*equal contribution)
29. B. Werner, J. G. Scott, A. Sottoriva, A.R.A. Anderson, A. Traulsen and **P. M. Altrock**. The cancer stem cell fraction in hierarchically organized tumors can be estimated using mathematical modeling and patient-specific treatment trajectories. *Cancer Research* 76:1705-1713, 2016.
30. **P. M. Altrock***, L. Liu*, F. Michor. The mathematics of cancer: integrating quantitative models. *Nature Reviews Cancer* 15:730-745, 2015. (*equal contribution)
31. P. Gerlee, **P. M. Altrock**. Complexity and stability in growing cancer cell populations. *PNAS*, 112:E2742-E2743, 2015.
32. X.-Y. Li, C. Pietschke, S. Fraune, **P. M. Altrock**, T. C.G. Bosch, A. Traulsen. Which evolutionary games are growing bacterial populations playing? *Journal of the Royal Society Interface* 12:20150121, 2015.
33. A. Marusyk, D. P. Tabassum, **P. M. Altrock**, V. Almendro, F. Michor, K. Polyak. Non-cell-autonomous driving of tumour growth supports sub-clonal heterogeneity. *Nature* 514:54-58, 2014.
34. J. Du, B. Wu, **P. M. Altrock**, L. Wang. Aspiration dynamics of multi-player games in finite populations. *Journal of the Royal Society Interface* 11:20140077, 2014.
35. P. Ashcroft, **P. M. Altrock**, T. Galla. Fixation in finite populations evolving in fluctuating environments. *Journal of the Royal Society Interface* 11:20140663, 2014.
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