

CURRICULUM VITAE: Philipp M. Altrock

Current Position: Assistant Member
 Department of Integrated Mathematical Oncology (IMO)
 H. Lee Moffitt Cancer Center and Research Institute
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<https://www.ncbi.nlm.nih.gov/myncbi/philipp.altrock.1/bibliography/public/@evolsci>

EDUCATION:

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| 2008 – 2011 | Dr. rer. nat. (Ph.D.) | Natural Sciences, University of Kiel |
| 2002 – 2007 | Diplom Physiker (M.Sc.) | Physics, University of Leipzig |

POSTGRADUATE TRAINING AND FELLOWSHIP APPOINTMENTS:

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| Jul. 2013 – Jan. 2017 | Research Fellow, Department of Biostatistics, Harvard T. H. Chan School of Public Health |
| Feb. 2013 – Jan. 2017 | Postdoctoral Researcher, Department of Biostatistics and Computational Biology, Dana-Farber Cancer Institute |
| Mar. 2011 – Jan. 2013 | Postdoctoral Research Scientist, Max Planck Institute for Evolutionary Biology |
| Apr. 2008 – Mar. 2011 | Research Assistant, Max Planck Institute for Evolutionary Biology |

ACADEMIC APPOINTMENTS:

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| Jul. 2017 – present | Assistant Professor, Department of Oncologic Sciences, University of South Florida, Morsani College of Medicine |
| Jan. 2017 – present | Assistant Member, Department of Integrated Mathematical Oncology, H. Lee Moffitt Cancer Center and Research Institute |

HONORS AND AWARDS

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| Jan. 2020 – present | Member, Interdisciplinary Expert Panel, Research Foundation Flanders (FWO), Belgium |
| Oct. 2019 – present | Member of the Editorial Board, The Journal of Nonlinear Science |
| Feb. 2014 – Jan. 2017 | Research Fellowship, German Academy of Sciences Leopoldina |

TEACHING EXPERIENCE:**1. University Courses:**

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| 2021 | Course Director/Course Instructor: Integrated Mathematical Oncology II, Cancer Biology PhD Program, H. Lee Moffitt Cancer Center and Research Institute |
| 2020 | Course Director/Course Instructor: Integrated Mathematical Oncology II, Cancer Biology PhD Program, H. Lee Moffitt Cancer Center and Research Institute |
| 2020 | Course Instructor: Integrated Mathematical Oncology I, Cancer Biology PhD Program, H. Lee Moffitt Cancer Center and Research Institute |
| 2019 | Course Director/Course Instructor: Integrated Mathematical Oncology II, Cancer Biology PhD Program, H. Lee Moffitt Cancer Center and Research Institute |
| 2019 | Course Instructor: Integrated Mathematical Oncology I, Cancer Biology PhD Program, H. Lee Moffitt Cancer Center and Research Institute |

- 2018 Course Instructor: Integrated Mathematical Oncology I, Cancer Biology PhD Program
H. Lee Moffitt Cancer Center and Research Institute
- 2016 Course Instructor: Advanced topics of evolutionary dynamics, Program for Evolutionary Dynamics
Harvard University
- 2015 Course Instructor: Evolutionary Dynamics of Cancer, Department of Biostatistics
Harvard T. H. Chan School of Public Health
- 2013 Course Instructor: Evolutionary Dynamics of Cancer, Department of Biostatistics
Harvard T. H. Chan School of Public Health
- 2012 – 2014 Course Instructor: Evolutionary Dynamics, Institute of Mathematics
University of Lübeck

2. Other Courses and National symposia:

Masters Classes

- July 2019 Course Instructor: Mathematical modeling of cancer, q-bio summer school, Rice University

3. Teaching and Training Experience:

a. High School Training:

- June 2019 – July 2019 **Research Training Mentor:** High School Intern
Benjamin Sherwin, Strawberry Crest High School, Dover, FL
- Research Training Mentor:** High School Intern
Abigail Tan, Palm Harbor University High School, Palm Harbor, FL
- June 2018 – July 2018 **Research Training Mentor:** High School Intern
Blake Bridge, Tampa Preparatory School, Tampa, FL
- June 2017 – July 2017 **Research Training Mentor:** High School Intern
Ashley Kelly, Palm Harbor University High School, Palm Harbor, FL

b. Under Graduate Training:

- Aug. 2019 – May 2020 **Honors Thesis Advisor:** BSc Student
Brian Johnson, Rutgers University
- Jan. 2020 – Mar. 2020 **Research Training Mentor:** Dartmouth Mathematical Biology Program
BSc Student Kristofer Hammond, Dartmouth College
- May 2019 – Aug. 2019 **Research Training Mentor:** SPARK program (Moffitt Cancer Center)
BSc Student, Brian Johnson, Rutgers University
- Jan. 2018 – Mar. 2018 **Research Training Mentor:** Dartmouth Mathematical Biology Program
BSc Student Yixuan He, Dartmouth College

c. Graduate Training:

- Sept. 2020 – present **Advisor:** Brian Johnson, BSc

d. Post-Doctoral Training:

- Nov. 2020 – present **Advisor and Mentor:** Dr. rer. nat. Tim Kodalle, Moffitt Cancer Center
- Aug. 2017 – Dec. 2020 **Advisor and Mentor:** Meghan Ferrall-Fairbanks, Ph.D., Moffitt Cancer Center
- Jul. 2017 – Apr. 2019 **Advisor and Mentor:** Gregory Kimmel, Ph.D., Moffitt Cancer Center

e. Research Scientist Mentoring:

- Apr. 2019 – present **Advisor and Mentor:** Gregory Kimmel, Ph.D., Moffitt Cancer Center

SHORT RESEARCH STATEMENT:

My research focuses on the design, analysis, and application of mathematical, computational and statistical models in biology and medicine. Our particular focus is on cancer dynamics, to which we apply nonlinear dynamics and stochastic processes theory. My current research mainly concentrates on the following four areas:

1. Clinical data integration and predictive modeling of cancer cellular immunotherapy (CAR T cell therapy).
2. Single-cell resolution heterogeneity, and clonal evolution in Leukemia progression and resistance evolution.
3. Digital pathology-based classification of the tumor microenvironment (fibroblasts, immune cells), tumor ecology.
4. Evolutionary public goods games as a way to understand complex interactions among (cancer) cells that co-evolve.

RESEARCH SUPPORT**External Grants Current:**

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| Account #: | 20B06 (PIs: Marusyk/Altrock/Basanta) |
| Dates: | 05/05/2020 – 04/30/2023 |
| Source: | FBRP, Bankhead-Coley Cancer Research Program |
| Title: | Impact of Stromal Architecture on the Response of Lung Cancers to Targeted Therapies |
| Effort: | 5% |
| Role: | Co-Principal Investigator |
| Total Direct Costs: | \$553,575 |
| Total Requested: | \$636,610 |

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| Account #: | RSG-19-215-01-LIB (PI: Padron) |
| Dates: | 01/01/2020 – 12/31/2023 |
| Source: | American Cancer Society |
| Title: | Cytokine-dependent Genetic Selection in Chronic Myelomonocytic Leukemia |
| Effort: | 5% |
| Role in Study: | Co-I |
| Total Direct Cost | \$660,000 |
| Total Amount of the Award: | \$792,000 |

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| Account #: | 2019-KMO-TM1 (PI: Locke) |
| Dates: | 12/26/2019 – 12/25/2021 |
| Source: | Kite Pharma |
| Title: | Predictive Markers and Evolutionary Dynamics of Axicabtagene Ciloleucel in NHL |
| Effort: | 20% |
| Role in Study: | Co-I |
| Total Direct Cost | \$774,647 |
| Total Amount of the Award: | \$1,256,565 |

External Grants Completed:

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| Account #: | W81XWH1910655 (PI: Manley) |
| Dates: | 08/15/2019 – 08/14/2020 |
| Source: | US Army, USAMRAA |
| Title: | KC180036-Modeling Spatial Ecology in Clear Cell Renal Cell Carcinoma Model |
| Effort: | 3% |
| Role in Study: | Co-I |
| Total Direct Cost | \$74,887 |
| Total Amount of the Award: | \$128,806 |

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| Account #: | Dana-Farber PS-OC pilot award |
| Dates: | 04/01/2017 – 03/31/2018 |

Source: NIH U54CA143798
 Title: Quantifying bone marrow alteration kinetics and cancer risk in Shwachmann-Diamond syndrome
 % Effort: 10%
 Role in the Study: co-PI
 Total Direct Costs: \$15,000
 Total Amount of Award: \$158,612

Internal Grants Current:

Account #: (PIs: Altrock/Locke)
 Dates: 08/01/2020 – 07/31/2021
 Source: Moffitt Cancer Center, Center of Excellence for Evolutionary Therapy
 Title: Predicting clinical response to CAR T cell therapy the rough evolutionary modeling by quantifying the likelihood of tumor extinction vs. tumor escape
 % Effort: 5%
 Role in the Study: PI
 Total Direct Costs: \$100,000
 Total Amount of Award: \$100,000

Account #: (PI: Mann/Altrock)
 Dates: 06/01/2019 – 12/31/2020
 Source: Moffitt Cancer Center, Team Science/NIH P30CA076292
 Title: Investigating Evolutionary Dynamics of Crenolinib Targeted Therapy for FLT3-Driven Myeloid Leukemia Using Sleeping Beauty Insertional Mutagenesis and Mathematical Modeling
 % Effort: 5%
 Role in the Study: co-PI
 Total Direct Costs: \$75,000
 Total Amount of Award: \$75,000

Internal Grants Completed:

Account #: ACS-IRG (PIs: Altrock/Padron)
 Dates: 09/02/2019 – 08/30/2020
 Source: American Cancer Society
 Title: Quantifiers of heterogeneity in Leukemia using single cell RNA sequencing
 % Effort: 5%
 Role in the Study: PI
 Total Direct Costs: \$30,000
 Total Amount of Award: \$30,000

Account #: U54CA193489 (parent)
 Dates: 01/01/2018 – 12/31/2019
 Source: NIH/Moffitt PS-OC
 Title: Evolutionary Dynamics of Non-Hodgkin Lymphoma CAR-T cell therapy
 % Effort: 2%
 Role in the Study: co-PI
 Total Direct Costs: \$20,000
 Total Amount of Award: \$20,000

Miscellaneous Grants

Feb. 2014 – Jan. 2017

German Academy of Sciences Leopoldina, approximately \$150,000

LEADERSHIP, SERVICE, AND MEMBERSHIP:**Moffitt Cancer Center****Committees:**

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|----------------|------------------------------------------------------------------------------|
| 2020 – present | Member of Total Cancer Care (TCC) Faculty Committee |
| 2019 – present | Member of the Collaborative Data Services Shared Resource Advisory Committee |
| 2018 – present | Member of the High-Performance Computing (HPC) Steering Committee |
| 2018 – present | Chair of the Quantitative Sciences Grand Rounds Organizing Committee |

Max Planck Institute for Evolutionary Biology

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| 2009 – 2011 | Elected PhD Representative and Spokesperson |
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University of Leipzig, Faculty of Physics and Earth Sciences

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| 2006 – 2007 | Student Representative in the Examination Board |
| 2005 – 2007 | Elected Member of the Student Board |

Ad-hoc Referee and Editor:

Editorial Board Member: The Journal of Nonlinear Science. **Editor:** PLoS Computational Biology. Journals: PNAS, blood, Nature Communications, PeerJ, Bioinformatics, PLoS Computational Biology, PLoS Medicine, PLoS Genetics, Physical Review Letters, 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:** NWO (Netherlands), FWO (Belgium), EPSRC (UK). **Other:** Florida Board of Education.

Professional Association Memberships:

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|----------------|-------------------------------------------------------------------|
| 2017 – present | Member, American Association for Cancer Research |
| 2016 – present | Member, American Society for Gene and Cell Therapy |
| 2015 – present | Member, European Society for Mathematical and Theoretical Biology |
| 2015 – present | Member, Society for Mathematical Biology |
| 2001 – present | Member, German Physical Society |

CONFERENCE, WORKSHOP, SYMPOSIUM, AND MEETING ORGANIZATION

- Co-organizer of Mini-Symposium at the Society for Mathematical Biology Annual Meeting, Montreal (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 (2018)
- Co-organizer of Mini-Symposium at the Society for Mathematical Biology Annual Meeting, Salt Lake City (2017)

PEER-REVIEWED PUBLICATIONS:

<https://scholar.google.com/citations?hl=en&user=pSwR6EoAAAAJ>
<https://www.ncbi.nlm.nih.gov/myncbi/philipp.altrock.1/bibliography/public/>

1. 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*. 2021, accepted for publication. (*equal contribution)
2. 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*. 2021;288:20210229. PubMed PMID: 33757357 (*co-corresponding authors)
3. M.D. Miroshnychenko, E. Baratchart, Meghan 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*. 2021;5:379–391. PubMed PMID: 33462489

4. 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. PMID: 33452133.
5. G. J. Kimmel, M. Dane, L. Heiser, **P. M. Altrock**, N. Andor. Invasion of homogeneous and polyploid populations in nutrient-limiting environments. *Cancer Research* 2020;80:5109. PMID: 32938640.
6. H. Enderling H, **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*, 2020;82:91. PMID: 32648152
7. 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.
8. P Gerlee, **P.M. Altrock**. Persistence of cooperation in diffusive public goods games. *Physical Review E* 99:062412, 2019. PMID: 31330651.
9. 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. *Co-corresponding authors. PMID: 31145529.
10. G. J. Kimmel, P. Gerlee, J. S. Brown, **P. M. Altrock**. Neighborhood size-effects shape growing population dynamics in evolutionary public goods games. *Communications Biology* 2:53, 2019. PMID: 30729189.
11. 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. PMID: 30995123.
12. **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 CCI* 2018(2):1-12, 2018. PMID: 30652561.
13. P. Gerlee and **P. M. Altrock**. Extinction Rates in Tumor Public Goods Games. *Journal of the Royal Society Interface* 14:20170342, 2017. PMID: 28954847.
14. **P. M. Altrock**, A. Traulsen, M. A. Nowak. Evolutionary games on cycles with strong selection. *Physical Review E* 95:022407, 2017. PMID: 28297871.
15. **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. PMCID: PMC5093908.
16. 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. PMCID: PMC4900896.
17. **P. M. Altrock***, L. Liu*, F. Michor. The mathematics of cancer: integrating quantitative models. *Nature Reviews Cancer* 15:730-745, 2015. *Equal contribution. PMID: 26597528.
18. P. Gerlee, **P. M. Altrock**. Complexity and stability in growing cancer cell populations. *PNAS* 112:E2742-E2743, 2015. PMID: 25941414.
19. 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. PMCID: PMC4528578.
20. 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. PMCID: PMC4184961.
21. 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. PMCID: PMC3973373.
22. P. Ashcroft, **P. M. Altrock**, T. Galla. Fixation in finite populations evolving in fluctuating environments. *Journal of the Royal Society Interface* 11:20140663, 2014. PMCID: PMC4191092.
23. R. G. Reeves, j. Bryk, **P. M. Altrock**, J. A. Denton, F. A. Reed. First steps towards underdominant genetic transformation of insect populations. *PloS one* 9:e97557, 2014. PMID: 24844466.
24. S. Franzenburg, S. Fraune, **P. M. Altrock**, S. Künzel, J. Baines, A. Traulsen, T. C. G. Bosch. Bacterial colonization of hydra hatchlings follows a robust temporal pattern. *ISME Journal: Multidisciplinary Journal of Microbial Ecology* 7:781-790, 2013. PMCID: PMC3603398.

25. C. Hilbe, M. A Chakra, **P. M. Altrock**, A. Traulsen. The evolution of strategic timing in collective-risk dilemmas. *PLoS one* 8:e66490, 2013. PMID: PMC3682992.
26. **P. M. Altrock**, A. Traulsen and T. Galla. The mechanics of stochastic slowdown in evolutionary games. *Journal of Theoretical Biology* 21:94-106, 2012. PMID: 22814474.
27. **P. M. Altrock**, A. Traulsen A, F. A. Reed. Stability properties of underdominance in finite subdivided populations. *PLoS Computational Biology* 7:e1002260, 2011. PMID: 22072956.
28. B. Wu, **P. M. Altrock**, L. Wang, A. Traulsen. Stochastic slowdown in evolutionary processes. *Physical Review E* 82:046106, 2010. PMID: 21230344.
29. **P. M. Altrock**, C. S. Gokhale, A. Traulsen. Stochastic slowdown in evolutionary processes. *Physical Review E* 82:011925, 2010. PMID: 20866666.
30. **P. M. Altrock**, A. Traulsen. Deterministic evolutionary game dynamics in finite populations. *Physical Review E* 80:011909, 2010. PMID: 19658731.
31. **P. M. Altrock**, A. Traulsen, R. G. Reeves, F. A. Reed. Using underdominance to bi-stably transform local populations. *Journal of Theoretical Biology*,267:62-75, 2010. PMID: 20691703.
32. F. Senf, **P. M. Altrock**, U. Behn. Nonequilibrium phase transitions in finite arrays of globally coupled Stratonovich models: strong coupling limit. *New Journal of Physics* 11:063010, 2009. PMID/PMID: n/a.
33. **P. M. Altrock**, A. Traulsen. Fixation times in evolutionary games under weak selection. *New Journal of Physics* 11:013012, 2009. PMID/PMID: n/a.

PUBLICATIONS UNDER REVIEW:

1. N. H. Chakiryan, G. J. Kimmel, Y. Kim, A. Hajiran, A. Aydin, L. Zemp, E. Katende, J. Nguyen, N. Lopez-Blanco, J. Chahoud, P. Spiess, M. Fournier, J. Dhillon, L. Wang, C. Moran-Segura, A. El-Kenawi, J. Mule, **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. Preprint: bioRxiv.org 2021:425197.

BOOKS, BOOKCHAPTERS, AND INVITED PUBLICATIONS:

1. 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, 2020. doi:10.1007/978-1-0716-0849-4.
2. F. A. Reed, A. Traulsen and **P. M. Altrock**. "Underdominance". S. Brenner`s Online Encyclopedia of Genetics (2012).

PERR-REVIEWED ABSTRACTS:

1. M. C. Ferrall-Fairbanks, G. J. Kimmel, **P. M. Altrock**. Scales and dynamics of intratumor heterogeneity. *Cancer Research* 80 (16 Supplement), 5490-5490, 2020.
2. **P. M. Altrock**, G. J. Kimmel, M. A. Menges, F. L. Locke. Computational Modeling of Interactions between Engineered and Wildtype T-Cells Quantifies Therapeutic Success of Anti-CD19 CAR T-Cell Therapy. *Molecular Therapy* 27, S270, 2019.
3. **P. M. Altrock**, G. J. Kimmel, F. L. Locke. Evolutionary dynamics of non-Hodgkin's lymphoma CAR T cell therapy. *Cancer Research* 78 (13 Supplement), 1791-1791, 2018.
4. **P. M. Altrock**, C. Brendel, R. Renella, S. H. Orkin, D. A. Williams, F. Michor. Mathematical Modeling of Erythrocyte Chimerism Informs Clinical Strategies for Sickle Cell Disease. *Molecular Therapy* 24, S126-S127, 2016.

INVITED PRESENTATIONS:

- Uncovering time-dependence of intra-tumor heterogeneity. Joint Mathematics Meeting, Washington D.C., 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.
- Evolutionary Dynamics of Cancer. qBio summer school, University of Maryland, MD, July 2020 (postponed due to covid19).
- 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 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.
- A quantitative evaluation of screening strategies to reduce the prevalence and mortality of multiple myeloma. Max Planck Institute for Evolutionary Biology, Plön, Germany, March 2017.
- 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. 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 hierarchal 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.

- Frequency-dependent selection. Dana-Farber Cancer Institute, September 2012. Seminar Mathematics and Cancer. OEOP, MIT School of Engineering, Cambridge, MA, August 2013.
- 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, January 2010.
- Fixation times in evolutionary games under weak selection. Institute for Theoretical Physics, University of Leipzig, Germany, March 2009.
- Workshop: Deterministisches Chaos. Meeting of Graduate Students 2007, Studienwerk Villigst, Germany, Nov. 2007.

CONTRIBUTED PRESENTATIONS:

- 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.