

Jill A. Gallaher, Ph.D.

Applied Research Scientist

jill.gallaher@moffitt.org
jillgallaher.com

Department of Integrated Mathematical Oncology
Moffitt Cancer Center, Tampa, FL

EDUCATION

2004-2010	Ph.D. Biomedical Physics <i>Thesis: Ion Traffic Across Cellular Membranes.</i>	East Carolina University Greenville, NC
1998-2004	B.S. Physics <i>Concentration in biophysics, minor in Spanish.</i>	University of Missouri Columbia, MO

EXPERIENCE

2015-current	Applied Research Scientist Department of Integrated Mathematical Oncology	Moffitt Cancer Center Tampa, FL
2010-2015	Postdoctoral Fellow Department of Integrated Mathematical Oncology	Moffitt Cancer Center Tampa, FL
2010	Technical Assistant Math & Physics Department	Pitt Community College Greenville, NC
2008-2009	Instructor Math & Physics Department	Pitt Community College Greenville, NC
2004-2009	Teaching Assistant Physics Department	East Carolina University Greenville, NC
2005, 2006	Freelance Editor	Prentice Hall Online

CURRENT RESEARCH

MPI: Gatenby, Anderson, Gillies	Exploiting evolution to treat heterogeneous tumors <i>We use off-lattice agent-based models and ODE systems to test how adaptive treatment strategies can be used to prevent treatment resistance. These ideas are developed using a variety of models that are either non-spatial, spatially heterogeneous within the tumor and tissue, and heterogeneous amongst a system of distinct but connected metastases.</i>
MPI: Swanson, Canoll, Anderson	Defining heterogeneity in glioblastoma using multiscale data and models <i>A hybrid agent-based model is mapped to a brain atlas to fit to multiscale data from in vivo experiments. This is used to understand how intratumor heterogeneity affects growth and tumor recurrence in native brain cancer, define tradeoff constraints between proliferation and migration, learn how sex differences affect treatment response, and optimize treatments.</i>
MPI: Gallaher, Damaghi	Uncovering mechanisms for immunotherapy resistance with imaging <i>Multiplexed imaging from non-small cell lung cancer patient biopsies are combined with a 2D agent-based model to investigate mechanisms for resistance to immunotherapy.</i>
MPI: Brown, Gillies	Comparing optimal strategies for cells in fluctuating hypoxia <i>We develop a mathematical model to understand how cells optimize their HIF expression to maximize their payoff in environments with various frequencies of oxygen fluctuations. Rate-limited, facultative strategies are optimized and compared to those that favor constitutive expression, i.e. pseudohypoxia.</i>

FUNDING

2019	\$50K pilot grant <i>Preventing relapse in pediatric metastatic osteosarcoma using evolutionary-informed approaches</i>	Moffitt IMO workshop
2018	\$32K pilot grant renewal <i>Investigating phenotypic & microenvironmental mechanisms for immunotherapy response</i>	Moffitt PSOC
	\$50K pilot grant <i>Inference of evolutionary tumor-immune dynamics to predict treatment strategies in BRAF-mutant melanoma</i>	Moffitt IMO workshop
2017	\$10K pilot grant <i>Investigating phenotypic & microenvironmental mechanisms for immunotherapy response</i>	Moffitt PSOC
2013	\$50K Pilot grant <i>A real-time adaptive treatment platform to extend survival in lung cancers with EGFR mutation</i>	Moffitt IMO workshop
2012	\$50K Pilot grant <i>Improving treatment strategies for patients with metastatic castrate resistant prostate cancer through personalized computational modeling</i>	Moffitt IMO workshop

AWARDS

2020	Travel grant - poster presenter AACR Evolutionary Dynamics in Carcinogenesis & Therapy Response	Moffitt Quantitative Science Division Denver, CO
2017	Travel grant - workshop participant Women Advancing Mathematical Biology	MBI at OSU Columbus, OH
	Travel grant - invited speaker Maths in the CSBC & PSOC	The Mayo Clinic Scottsdale, AZ
2015	Travel grant - invited speaker Cancer Evolution through Space and Time	Max Planck Institute Plön, Germany
	Travel grant - workshop participant Many-cell Systems Modelling	NIMBioS at UT Knoxville, TN
	Travel grant - workshop participant Tumor Heterogeneity and the Microenvironment	MBI at OSU Columbus, OH
2014	Travel grant - invited Speaker Ecology and Evolution of Cancer	MBI at OSU Columbus, OH
2013	Travel grant - invited minisymposium speaker Society for Mathematical Biology	ASU Tempe, AZ
2012	Travel grant - contributed speaker Society for Mathematical Biology	UT Knoxville, TN
2011	Travel grant - contributed speaker ECMTB & SMB Joint meeting	Jagiellonian University Krakow, Poland
2006	Travel grant - poster presenter American Society for Laser Medicine and Surgery	Boston, MA

PROFESSIONAL MEMBERSHIPS Society for Mathematical Biology (2011-2013, 2018-2020)
American Association for Cancer Research (2011, 2014, 2020)
International Society for Evolution, Ecology and Cancer (2017)
Society for Industrial and Applied Mathematics (2016)
European Society for Theoretical and Mathematical Biology (2012, 2014)
Biophysical Society (2008-2009)
American Society for Lasers in Surgery and Medicine (2006)

LANGUAGES & SOFTWARE Java, MATLAB, Python, R, C++, FORTRAN, Mathematica, L^AT_EX, HTML, Processing, ImageJ.
Spoken: English, Spanish

REVIEWING Acta Biotheoretica
BMC Bioinformatics
Cell Reports
J of Can Res & Clin Onc
Journal of Theoretical Biology
Mathematical Biosciences
PLOS Computational Biology
Scientific Reports
Bulletin of Mathematical Biology
British Lung Foundation
Clinical and Translational Medicine
JRS Interface
J Translational Medicine
Nature Communications
PLOS One

MENTORING

2018-present	PhD student in Medical Engineering at USF	Moffitt Cancer Center
2016	Future Leaders in Interdisciplinary Cancer Research	Moffitt Cancer Center
2015-2019	High School Internship Program	Moffitt Cancer Center

SERVICE 2017 Moffitt Postdoctoral Association Social committee: website design
2020-2021 Data Dashers Team co-captain for Miles for Moffitt

ORGANIZED WORKSHOPS “ICML Workshop on Computational Biology.” Organization committee. *International Conference on Machine Learning*, 2020-2021, Virtual.

ORGANIZED MINISYMPOSIA “The cancer ecosystem: optimizing treatment based on evolution .” Co-organized with Alexander R. A. Anderson. *Society for Mathematical Biology*, Jul 2018, Sydney Australia.
“Predicting therapeutic outcomes using mathematical models of cancer.” Co-organized with Jana Gevertz. *SIAM Life Sciences*, Jul 2016, Boston, MA.
“Zooming in and out: connecting individual and population behavior.” *European Society for Mathematical and Theoretical Biology*, Jun 2014, Gothenburg, Sweden.
“Agent-based simulations in oncology: applications to therapeutics.” Co-organized with MunJu Kim. *Society for Mathematical Biology*, Jun 2013, Tempe, AZ.

PUBLICATIONS Strobl, M.A.R., Gallaher, J., West, J., Robertson-Tessi, M., Maini, P.K., Anderson, A.R.A. “Spatial structure impacts adaptive therapy by shaping intr-tumoral competition.” *Communications Medicine*. (2022).
Pressley, M., Gallaher, J.A., Brown, J.S., Tomaszewski, M.R., Borad, P., Damaghi, M., Gillies, R.J., Whelan, C.J. “Cycling hypoxia selects for constitutive HIF stabilization.” *Scientific Reports*. (2021).
Gallaher, J., Hawkins-Daarud, A., Massey, S., Swanson, K.R.S., Canoll, P., and Anderson, A.R.A. “From cells to tissue: How cell scale heterogeneity impacts glioblastoma growth and treatment response.” *PLOS Computational Biology*. (2020).

Bravo, R. R., Baratchart, E., West, J., Schenck, R. O., Miller, A., Gallaher, J., Gatenbee, C. D., Basanta, D., Robertson-Tessi, M., Anderson, A. R. A. “Hybrid Automata Library: A modular platform for efficient hybrid modeling with real-time visualization.” *PLOS Computational Biology*. (2020).

Gallaher, J., Brown, J., and Anderson, A.R.A. “The impact of proliferation-migration tradeoffs on phenotypic evolution in cancer.” *Scientific Reports*. 9(2019). *In the Top 100 most downloaded articles from Scientific Reports - 2019.

Massey, S. C., Hawkins-Daarud, A., Gallaher, J., Anderson, A. R. A., Canoll, P., Swanson, K. R. “Lesion Dynamics Under Varying Paracrine PDGF Signaling in Brain Tissue.” *Bull Math Biol*. (2019).

Gallaher, J., Larripa, K., Renardy, M., Shtylla, B., Tania, N., White, D., Wood, K., Zhu, Li., Passey, C., Robbins, M., Bezman, N., Shelat, S., Cho, H. J., Moore, H. “Methods for determining key components in a mathematical model for tumor-immune dynamics in multiple myeloma”, *Journal of Theoretical Biology*. 458 (2018): 31-46.

Gallaher, J., Larripa, K., Ledzewicz, U., Renardy, M., Shtylla, B., Tania, N., White, D., Wood, K., Zhu, Li., Passey, C., Robbins, M., Bezman, N., Shelat, S., Cho, H. J., Moore, H. “A mathematical model for tumor-immune dynamics in multiple myeloma”, In *Understanding Complex Biological Systems with Mathematics*. Springer, 2018.

Gallaher, J., Enriquez-Navas, P. M., Luddy, K. A., Gatenby, R. A., and Anderson, A. R. A. “Spatial Heterogeneity and Evolutionary Dynamics Modulate Time to Recurrence in Continuous and Adaptive Cancer Therapies.” *Cancer Research*. 78(2018): 2127-39.

Juliano, J., Gil, O., Hawkins-Daarud, A., Noticewala, S. Rockne, R.C., Gallaher, J., Massey, S., Sims, P. A., Anderson, A.R.A., Swanson, K.R.S., and Canoll, P. “Comparative dynamics of microglial and glioma cell motility at the infiltrative margin of brain tumors.” *JR Soc Interface*. 15 (2018): 2017058.

Massey, S. C., Rockne, R. C., Hawkins-Daarud, A., Gallaher, J., Anderson, A. R. A., Canoll, P., Swanson, K. R. “Simulating PDGF-Driven Glioma Growth and Invasion in an Anatomically Accurate Brain Domain.” *Bull Math Biol*. (2017): 1-18.

Gallaher, J. A., Hawkins-Daarud, A., Massey, S. C., Swanson, K. R., and Anderson, A. R. A. “Hybrid approach for parameter estimation in agent-based models.” *BioRxiv*. (2017): 1-3.

Saeed-Vafa, D., Bravo, R., Dean, J. A., El-Kenawi, A., Mon Pèrè, N., Strobl, M., Daniels, C., Stringfield, O., Damaghi, M., Tunali, I., Brown, L. V., Curtin, L., Nichol, D., Peck, H., Gillies, R. J., and Gallaher, J. A. “Combining radiomics and mathematical modeling to elucidate mechanisms of resistance to immune checkpoint blockade in non-small cell lung cancer.” *BioRxiv*. (2017): 1-5.

Gatenbee, C., Folguera-Blasco, N., Daniels, C., Gallaher, J., Rockne, R., Nicholson, M., Maniati, E., Kennedy, J., Luddy, K., Locke, F. L., Robertson-Tessi, M. “Exploiting Homeostatic Repopulation to Increase DC Vaccine Efficacy in Multiple Myeloma.” *BioRxiv*. (2016): 1-3.

Gallaher, J. and Anderson, A.R.A. “The role of contact inhibition in intratumoral heterogeneity: An off-lattice individual based model.” *bioRxiv*, 036467 (2016): 1-3.

Gallaher, J., Cook, L. M., Gupta, S. Araujo, A., Dillon, J. Park, J. Y., Scott, J. G., Pow-Sang, J., Basanta, D., and Lynch C. C. “Improving treatment strategies for patients with metastatic castrate resistant prostate cancer through personalized computational modeling.” *Clinical & Experimental Metastasis*. 31 (2014): 991-999.

Gallaher, J., Babu, A., Plevritis, S., Anderson, A. R. A. . “Bridging population and

tissue scale tumor dynamics: A new paradigm for understanding differences in tumor growth and metastatic disease.” *Cancer Research*. 74 (2014): 426-435.

Gallaher, J., Anderson, A. R. A. . “Evolution of intratumoral phenotypic heterogeneity: the role of trait inheritance.” *Interface Focus*. 3 (2013): 20130016.

Bier, M., Gallaher, J. “Ion Traffic Through a Cell Membrane - and How its 1/f Noise Connects to Gambler’s Ruin, Catalan Numbers and Zipf’s Law.” *Fluctuation and Noise Letters*. 10 (2011): 419-430.

Gallaher, J., Wodzińska, K., Heimburg, T., and Bier, M. “Ion-channel-like Behavior in Lipid Bilayer Membranes at the Melting Transition.” *Physical Review E* 81 (2010): 061925.

Gallaher, J., Bier, M., and Siegenbeek van Heukelom, J. “First Order Phase Transition and Hysteresis in a Cell’s Maintenance of the Membrane Potential - An Essential Role for the Inward Potassium Rectifiers.” *Biosystems* 101 (2010): 149-155.

Barakat, I., Gallaher, J., Chen, H., and Lee, R. C. “In Vivo Electroporation: An Important Injury Mechanism in Electrical Shock Trauma.” In *Advanced Electroporation Techniques in Biology and Medicine*, edited by A. Pakhomov, D. Miklavcic, and M. Markov. Boca Raton, FL: CRC Press, 2010.

Gallaher, J., Bier, M., and Siegenbeek van Heukelom, J. “The Role of Chloride Transport in the Control of the Membrane Potential in Skeletal Muscle - Theory and Experiment.” *Biophysical Chemistry* 143 (2009): 18-25.

INVITED TALKS

“Agent-based modelling in glioblastoma”. *Keynote speaker at Workshop on Computational Modelling of Cancer Biology and Treatments*, July 2021, Virtual.

“Using tumor dynamics to characterize and treat metastatic cancer”. *Invited by Suzanne Sindi to the University of California, Merced Applied Mathematics department meeting*, May 2021, Virtual.

“Dynamics of spatial metastatic systems during adaptive therapy”. *Cancer Adaptive Therapy Models*, December 2020, Virtual.

“Improving systemic measures of tumor burden in metastatic prostate cancer: connecting PSA, AR, and testosterone dynamics to resistance mechanisms”. *Moffitt Virtual Scientific Symposium*, May 2020, Virtual.

“Applied mathematics in biology and cancer”. *May 12: A celebration of Women in Mathematics in honor of Miryam Mirzakhani*, May 2020, Virtual.

“Evolutionary Therapies”. *Darwin Days - Hillsborough County Schools*, Feb 2020, Tampa, FL.

“Systemic dynamics of multiple metastases during adaptive therapy”. *Society for Mathematical Biology*, Jul 2019, Montreal, Quebec, Canada.

“Growth-factor driven glioblastoma: connecting a hybrid agent-based model to multi-scale data”. *BIRS Workshop: Mathematical and Statistical Challenges of connecting models to biological data*, Nov 2018, Banff, Alberta, Canada.

“Modeling growth and treatment dynamics in PDGF-driven glioblastoma: how heterogeneity manifests across scales”. *Society for Mathematical Biology*, Jul 2018, Sydney, Australia.

“Adaptive vs continuous cancer therapy: Exploiting space and trade-offs in drug scheduling”. *International Society for Evolution, Ecology, and Cancer*, Dec 2017, Tempe, AZ.

“Adaptive therapy for heterogeneous tumors: exploiting trade-offs and space in drug

scheduling”. *Modeling Biological Evolution*, Apr 2017, Leicester, England.

“Growth-factor driven glioblastoma across scales: from the bulk to single cells in growth and treatment”. *Maths of the PSON & ICBP Meeting*, Feb 2017, Scottsdale, AZ.

“How a tumor’s phenotypic distribution can guide treatment strategy”. *Society for Industrial and Applied Mathematics*, Jul 2016, Boston, MA.

“Targeting the phenotype: treatment strategies for heterogeneous tumors”. *American Institute of Mathematical Sciences*, Jul 2016, Orlando, FL.

“How a tumor’s phenotypic distribution can guide treatment strategy”. *Invited by Rick Durrett to the Duke University Mathematics department meeting*, May 2016, Durham, NC.

“Steering phenotypic evolution in heterogeneous tumors”. *Cancer Evolution through Space and Time at the Max Planck Institute for Evolutionary Biology*, Sept 2015, Plön, Germany.

“Steering tumor heterogeneity: phenotypic selection vs clonal targeting”. *Ecology and Evolution of Cancer workshop at the Mathematical Biosciences Institute*, Sept 2014, Columbus, OH.

“Understanding the relative role of intrinsic and extrinsic heterogeneity in glioblastoma”, in the minisymposium: Spatial Models in Cancer. *European Conference on Mathematical and Theoretical Biology*, Jun 2014, Gothenburg, Sweden.

“Hurry up and wait!: an agent-based model of glioblastoma with saltatory migration of single cells”, in the minisymposium: Brain Oncology Network of Knowledge. *Society for Mathematical Biology*, Jun 2013, Tempe, AZ.

“Innate Sensitivity or acquired acclimation.” *Integrated Cancer Biology Program Math Meeting*, Mar 2012, Tampa, FL.

“Competition breeds insight: elucidating trait inheritance through environmental stress.” *Integrated Cancer Biology Program Jr Investigators Meeting*, Oct 2011, Cambridge, MA.

“From populations to cells and back again: linking primary growth rates to metastatic burden.” *Integrated Cancer Biology Program PI Meeting*, Sept 2011, New York, NY.

“Phenotypic Inheritance in a growing tumor.” *CWI Life Sciences seminar*, Jul 2011, Amsterdam, The Netherlands. Invited by Roeland Merks of the Biomodeling and Biosystems Analysis Group.

CONTRIBUTED TALKS

“Using adaptive therapy to characterize collective and individual characteristics of metastases.” *Society for Mathematical Biology Annual Meeting*, Jun 2021, Virtual.

“Traversing Scales: combining population statistics with tissue dynamics to link primary and metastatic disease.” *Society for Mathematical Biology Annual Meeting*, Jul 2012, Knoxville, TN.

“Phenotypic Inheritance Transforms heterogeneity in tumor growth.” *European Conference on Mathematical and Theoretical Biology & Society for Mathematical Biology Joint Meeting*, Jun 2011, Krakow, Poland.

“An analytic study of the bistable transmembrane voltage with hypokalemia.” *ECU Research and Creative Achievement Week*, Mar 2009, Greenville, NC.

POSTERS

Gallagher, J., Strobl, M., West, J., Robertson-Tessi, M., and Anderson, A. R. A. “The sum and the parts: dynamics of multiple and individual metastases during adaptive therapy.” *Moffitt Scientific Symposium*, Apr 2021, Virtual.

Gallaher, J., and Anderson, A. R. A. "The impact of metastatic seeding on adaptive therapy." *PSOC Annual Investigator's Meeting*, Sept 2019, Tampa, FL.

Gallaher, J., Gatenby, R. A., and Anderson, A. R. A. "Systemic versus local dynamics of multiple metastases during adaptive therapy." *Moffitt Scientific Symposium*, May 2019, Tampa, FL.

Gallaher, J., Tunali, I., Bravo, R., Anderson, A. R. A., Gillies, R. J., Robertson-Tessi, M., and Damaghi, M. "Investigating phenotypic and microenvironmental mechanisms for immunotherapy response ." *Moffitt Cancer Biology and Evolution Symposium*, Jun 2018, Tampa, FL.

Gallaher, J., Hawkins-Daarud, A., Massey, S., Swanson, K. R., Canoll, P., and Anderson, A. R. A. "Heterogeneity across scales in GBM: Multiscale modeling post-treatment dynamics in PDGF-driven glioblastoma ." *Moffitt Scientific Symposium*, May 2018, Tampa, FL.

Gallaher, J., Enriquez-Navas, P. M, Luddy, K. A. Gatenby, R. A. and Anderson, A. R. A. "Adaptive Therapy for Heterogeneous Cancer: exploiting space and trade-offs in drug scheduling." *Moffitt Scientific Symposium*, May 2017, Tampa, FL.

Gallaher, J., Stringfield O., and Anderson, A. R. A. "Integrating patient-specific quantitative imaging with a dynamic mathematical tissue model to infer lung adenocarcinoma growth and outcome." *3rd Annual Moffitt Anatomic Pathology Symposium*, Jan 2017, Sarasota, FL.

Gallaher, J., Hawkins-Daarud, A., Massey, S., Swanson, K. R., Canoll, P., and Anderson, A.R.A. "How heterogeneity influences post-treatment dynamics in PDGF-driven glioblastoma." *Moffitt Scientific Symposium*, May 2016, Tampa, FL.

Gallaher, J., Massey, S., Hawkins-Daarud, A., Swanson, K. R., Canoll, P., and Anderson, A.R.A. "Fitting models with single cell data in growth factor driven glioblastoma." *Many-cell system modeling workshop at the National Institute for Mathematical and Biological Synthesis*, Jul 2015, Knoxville, TN.

Gallaher, J., Tyson, D., Quaranta, V, and Anderson, A.R.A. "Heterogeneous responses to anticancer drugs." *Joint PSOC/ICBP Maths meeting*, Feb 2015, Tampa, FL.

Gallaher, J. and Anderson, A.R.A. "The velocity of phenotypic evolution." *Tumor Heterogeneity and the Microenvironment workshop at the Mathematical Biosciences Institute*, Feb 2015, Columbus, OH.

Gallaher, J. and Anderson, A.R.A. "Treating Intratumor heterogeneity: evolution and drug resistance." *Moffitt Scientific Symposium*, May 2014, Tampa, FL.

Gallaher, J. and Anderson, A.R.A. "Exploiting evolution to develop better personalized therapeutic strategies." *American Association for Cancer Research session on Cellular Heterogeneity in the Tumor Microenvironment*, Feb 2014, San Diego, CA.

Gallaher, J. and Anderson, A.R.A. "Treatment of Heterogeneous Tumors: shaping the phenotype space." *Integrated Cancer Biology Program Principle Investigators Meeting*, May 2013, Rockville, MD.

Gallaher, J., Canoll, P., Swanson, K. R., Anderson, A.R.A. "Does preexisting heterogeneity in glioblastoma inform post-treatment dynamics?" *Society for Neuro-Oncology*, Nov 2012, Washington D.C.

Gallaher, J., Babu, A., Plevritis, S., Anderson, A.R.A. "Traversing Scales: combining population statistics with tissue dynamics to link primary and metastatic disease." *Moffitt Scientific Symposium*, Apr 2012, Tampa, FL.

Gallaher, J., Tyson, D., Quaranta, V., Anderson, A.R.A. "Trait selection in a serum-

deficient environment.” *Integrated Cancer Biology Program Principle Investigator’s Meeting*, Sept 2011, New York, NY.

Gallaher, J., Anderson, A.R.A. “*In silico* investigation of the role of phenotypic inheritance in a heterogeneous tumor population.” *Moffitt Scientific Symposium*, Apr 2011, Tampa, FL.

Gallaher, J., Bier, M., and Siegenbeek van Heukelom, J. “Uncovering an Analytical Description of the Transmembrane Voltage Bistability at Low Extracellular Potassium Concentrations.” *Biophysical Society Annual Meeting*, Feb 2009, Boston, MA.

Gallaher, J., Bier, M., and Siegenbeek van Heukelom, J. “Control of the Membrane Potential by Chloride Transport in Skeletal Muscle - Theory and Experiment.” *Biophysical Society Annual Meeting*, Feb 2008, Long Beach, CA.

Gallaher, J., Bier, M., and Siegenbeek van Heukelom, J. “Isoprenaline Eliminates Cellular Transmembrane Voltage Bistability - Theory and Experiment.” *East Carolina University Research and Creative Achievement Week*, Mar 2007, Greenville, NC.

Gallaher, J. A., Bonnerup, C. A., Allison, R. R., and Sibata, C. H. “Fluorescence Response Quantification of Photofrin® Concentration in Optical Phantoms.” In *American Society for Laser Medicine and Surgery Annual Meeting*, Mar 2006, Boston, MA.