

Joseph A. Russell

Principal Scientist / Group Leader – Applied Biology & Bioinformatics
Life Science Resource Center, MRIGlobal
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Education

Ph.D., Marine Biosciences (*Concentration: Geomicrobiology*)
University of Delaware, 2010-2015

B.Sc., Microbiology
University of Arizona, 2003-2008

Specialties

- Microbial genomics
- Bioinformatics & machine learning for biological applications
- Microbial ecology
- Next-generation sequencing (NGS)
- Field-forward deployment of genomics technologies
- Development of nucleic acid extraction methods from various biological matrices
- Environmental microbiology; particularly the ecological drivers and response networks related to the balance of oxic and anoxic metabolisms in geological environments
- Design & testing of graphical user interface environments for applied microbial biosurveillance software
- Design, testing, & commercialization of ultra-mobile laboratory platform products
- U.S.G. Security Clearance Level: Secret (*most recent adjudication: 2023*)

Experience

Capability Manager II – Applied Biology & Bioinformatics, December 2020 – Present
Senior Scientist, December 2017 – December 2020
Post-Doctoral Research Associate, December 2015 – December 2017
MRIGlobal, Gaithersburg, Maryland

- Management, direction, and mentorship for a team of 6 computational biologists, bioinformaticians, and data scientists. Responsible for all bioinformatics deliverables across the Institute.
- Serve as Principal Investigator (PI) or Co-PI on government and commercial R&D programs.
- Responsible for maintenance, back-up, and 24/7 continuing operations of two (2) high-performance computing clusters that serve genomics programs throughout the Institute.
- Our team is focused on the development of novel computational approaches, platform systems, and workflow improvement for applied microbial ecology, biosurveillance, microbial forensics, genomic epidemiology, & public health. Research activity includes;
 - Streamlined interpretive analytics for metagenomics
 - Genotype-to-phenotype predictive modeling
 - Single-person portable/automated/ruggedized molecular biosurveillance platforms
 - Arbovirus ecology
 - Applied synthetic biology

Graduate Researcher – Biddle Lab, Univ. of Delaware, August 2010–December 2015
College of Earth, Ocean, & the Environment, Lewes, Delaware

- Use of microbial cultivations, molecular technologies and associated bioinformatics pipelines to characterize microbial ecology in geological environments.
- Study sites include microbialites from Pavilion Lake and Kelly Lake in British Columbia, the sediment and underlying basalt crust of 'North Pond' on the Mid-Atlantic Ridge, and the sediment of the Iberian continental margin.

Laboratory Technician II – Correlagen Diagnostics, May 2009–August 2010
Waltham, Massachusetts

- Performed wet lab duties in a clinical molecular diagnostics laboratory.
- Duties included DNA extraction and purification, PCR set-up and product purification, sequencing reactions and product purification, and operation of an ABI 3730 DNA sequence analyzer.
- Also assisted in development of novel assays for comprehensive detection of genetically-linked cardiovascular diseases. Assays were developed for use on the Heliscope, a next-generation DNA sequencing platform.

Research Assistant – University of Rhode Island, January 2009–March 2009
Equatorial Pacific Ocean

- Spent six weeks at sea aboard the R/V Knorr in the Equatorial Pacific Ocean as part of an international research team studying sub-seafloor microbial metabolism and community structure.
- Duties included; splitting and cataloging core sections, taking initial conductivity and temperature measurements, sub-sampling for micro/molecular biology work, assisting in CTD Niskin Rosette deployments for water column microbe sampling, assisting in rhizone sampling for interstitial water chemistry, and core storage.

Research Technician – Helicos Biosciences, August 2008–December 2008
Cambridge, Massachusetts

- Assisted a team of scientists in improving a novel genomic sequencing technology.
- Designed and performed experiments meant to improve uniformity of oligonucleotides binding to epoxide coated glass test suites.

Honors, Awards, & Funding

- IARPA Principal Investigator -- B24IC (Biointelligence & Biosecurity for the Intelligence Community) Program Title: VEx-SCANS (*Vulnerability and Exploitability of Side-Channel Attacks on Nanopore Sequencers*). IARPA Contract No. N66001-23-C-4507.
- MRIGlobal 'Rosalind Franklin Award for Patented Innovations' – 2022
- (FRBAA14-6-1007) "*Sequencing of tick-borne viral disease agents in Kazakhstan: identifying unique genomes in tick-borne encephalitis (TBE) and Crimean-Congo hemorrhagic (CCHF) viruses*" -- 2020-2023: Co-Investigator. DTRA Broad Agency Announcement HDTRA1-14-24-FRCWMD-BAA.

- MRIGlobal Leadership Council "Innovation Award" – 2019
- MRIGlobal Director's Award: Global Health Surveillance & Diagnostics – 2018
- Center for Dark Energy Biosphere Investigations (C-DEBI) Graduate Fellow: 2012 -2014
Project Title: "*Genomic Analyses and Microbial Cultivations in Unexplored Subseafloor Ridge-Flank and Continental Margin Environments*"
Total Award Amount: \$64,000
- NASA-Ames Honor Award (Group) - Pavilion Lake Research Project: 2014
- Schlanger Ocean Drilling Graduate Fellowship: 2012 - 2013
Project Title: "*Genomic Analyses of Microbial Cultivations in Unexplored Subseafloor Ridge Flank and Continental Margin Environments*"
Total Award Amount: \$30,000
- IODP Post-Expedition Award (United States Science Support Program): 2012
Total Award Amount: \$15,000
- Delaware Space Grant Consortium (NASA) Graduate Assistantship: 2011 – 2012
- Marian R. Okie Graduate Fellowship (University of Delaware): 2010 – 2011

Publications & Patents

Price, C. and **Russell, J.**, AMAnD: an Automated Metagenome Anomaly Detection methodology utilizing DeepSVDD neural networks. *Frontiers in Public Health*, 11, p.1181911.

Keenum, I., Player, R., Kralj, J., Servetas, S., Sussman, M.D., **Russell, J.**, Stone, J., Chandrapati, S. and Sozhamannan, S., 2023. Amplicon Sequencing Minimal Information (AsqMI): Quality and Reporting Guidelines for Actionable Calls in Biodefense Applications. *Journal of AOAC International*, p.qsad047.

Parker, K., Wood, H., **Russell, J.A.**, Yarmosh, D., Shteyman, A., Bagnoli, J., Knight, B., Aspinwall, J.R., Jacobs, J., Werking, K. and Winegar, R., 2023. Development and Optimization of an Unbiased, Metagenomics-Based Pathogen Detection Workflow for Infectious Disease and Biosurveillance Applications. *Tropical Medicine and Infectious Disease*, 8(2), p.121.

Davis, P. and **Russell, J.A.**, 2021. A Genotype-to-Phenotype Modeling Framework to Predict Human Pathogenicity of Novel Coronaviruses. *bioRxiv*. doi: <https://doi.org/10.1101/2021.09.18.460926>

Li, Po-E., **Russell, J.A.**, Yarmosh, D., Shteyman, A.G., Parker, K., Wood, H., Aspinwall, J.R., Winegar, R., Davenport, K.W., Lo, C., Bagnoli, J., Davis, P.E., Jacobs, J.L., and Chain, P.S.G. 2020. PanGIA: A Metagenomics Analytical Framework for Routine Biosurveillance and Clinical Pathogen Detection. *bioRxiv*. doi: <https://doi.org/10.1101/2020.04.20.051813>

Davis, P., Bagnoli, J., Yarmosh, D., Shteyman, A., Presser, L., Altmann, S., Bradrick, S., and **Russell, J.A.** 2020. Vorpal: A novel RNA virus feature-extraction algorithm demonstrated through interpretable genotype-to-phenotype linear models. *bioRxiv*. doi: <https://doi.org/10.1101/2020.02.28.969782>

Yeh, K.B., Wood, H., Scullion, M., **Russell, J.A.**, Parker, K., Gnade, B.T., Jones, A.R., Whittier, C. and Mereish, K., 2019. Molecular Detection of Biological Agents in the Field: Then and Now. *mSphere*, 4(6).

Jacobs, J.L., **Russell, J.A.** and Aspinwall, J.R., MRIGlobal Inc, 2022. *Modular mobile field-deployable laboratory for rapid, on-site detection and analysis of biological targets.* U.S. Patent 11,400,454.

Russell, J.A., Campos, B., Stone, J., Blosser, E.M., Burkett-Cadena, N. and Jacobs, J.L., 2018. Unbiased strain-typing of arbovirus directly from mosquitoes using nanopore sequencing: a field-forward biosurveillance protocol. *Scientific Reports*, 8(1), p.5417.

Russell, J.A., León-Zayas, R., Wrighton, K., and Biddle, J.F. “Deep subsurface life from North Pond: enrichment, isolation, characterization and genomes of heterotrophic bacteria,” *Frontiers in Microbiology*, 7, doi:10.3389/fmicb.2016.00678 (2016).

Russell, J.A. Active Populations and Preserved Signals: Molecular- and Cultivation-based Geobiological Analyses from Microbialites to the Marine Deep Biosphere. Doctoral Dissertation - University of Delaware (2015).

Russell, J.A., Brady, A.L., Cardman, Z., Slater, G.F., Lim, D.S.S., and Biddle, J.F. “Prokaryote populations of extant microbialites along a depth gradient in Pavilion Lake, British Columbia, Canada,” *Geobiology*, 12(3), doi:10.1111/gbi.12082: pp.250-264 (2014).

Select Invited Oral Presentations

“*Applications of genomic feature-engineering for emerging infectious disease biosurveillance.* June 2023. Sequencing, Finishing, & Analysis in the Future (SFAF) Meeting. Santa Fe, NM.

“*Field-forward threat sensing through raw nanopore electrical signal: a case study in arthropod-borne pathogen detection on Saint Catherines Island*”. October 2022. ASM Conference on Rapid Applied Microbial Next Generation Sequencing and Bioinformatics Pipelines.

“*Field-Forward Biosurveillance on an Ultra-Portable Molecular Biology Laboratory Platform*”. June 2021. 28th International Biodetection Technologies Conference. Bethesda, MD.

“*PanGIA Bioinformatics – A Metagenomics Analytical Framework for Routine Biosurveillance*”. May 2019. Sequencing, Finishing, & Analysis in the Future (SFAF) Meeting. Santa Fe, NM

“*Mercury Lab – Bring the Laboratory to the Sample*”. December 2018. NIAID, Bethesda, MD

“*Mercury Lab – Bring the Laboratory to the Sample*”. November 2018. USDA, Ames, IA

“PanGIA Bioinformatics Pipeline – Bioinformatics for the Busy Astronaut”. July 2018. NASA Johnson Space Center, Houston, TX

“Mercury Lab – An Integrated, Ultra-Mobile Laboratory Workbench for Field-Forward Molecular Testing”. June 2018. Diagnostics of Endemic & Emerging Diseases Meeting, Kansas State University, Manhattan, KS

“Unbiased Biosurveillance with Nanopore Sequencing – Reducing Turnaround Times and Operational Footprints”. May 2018. Sequencing, Finishing, & Analysis in the Future (SFAF) Meeting. Santa Fe, NM

“Unbiased Biosurveillance with Nanopore Sequencing – Reducing Turnaround Times and Operational Footprints”. March 2018. Nanopore Day Meeting, College Park, MD

“Unbiased Strain-typing of Arbovirus Directly from Mosquitoes Using Nanopore Sequencing: A Field-forward Biosurveillance Protocol”. October 2017. ASM – Next Generation Sequencing Meeting, Washington D.C.

“Bringing Sequencing Far Afield — The Promise & Challenge of ‘Omics in the Nanopore Age’”. 2017 Next-Gen Sequencing Workshop. May 2017. Los Alamos National Laboratory, NM

“Metatranscriptome-based Detection and Phylogeny of Alphavirus Directly from Mosquitoes Using Nanopore Sequencing: A Field-Forward Biosurveillance Protocol”. May 2017. Sequencing, Finishing, and Analysis in the Future (SFAF) Meeting, Santa Fe, NM

"Furthering the Discussion on Aerobic Heterotrophy in Deep Sediments". December 2014. American Geophysical Union Fall Meeting, San Francisco, California

"The QIIME Workflow: Making Sense of Your 16S Amplicon Data". October 2013. Bioinformatics Seminar, Banyuls-Sur-Mer, France

"Who is Active in the Iberian Margin Deep Biosphere?" October 2013, Center for Dark Energy Biosphere Investigations (CDEBI) Fall Meeting, Marina, California

"Microbial Communities of Pavilion Lake Microbialites". May 2013, University of Delaware Graduate Research Symposium, Lewes, DE

"Microbial Communities of Pavilion Lake Microbialites". January 2013, Gordon Geobiology Research Seminar and Conference, Ventura, CA

"Cyanobacteria of Pavilion Lake Microbialites". April 2011, Delaware Space Grant Spring Research Symposium, Newark, DE

Select Invited Poster Presentations

Russell, J.A., Blosser, E., Burkett-Cadena, N., Parker, K., Campos, B., Stone, J., Jacobs, J. *"Ultra-Portable Technologies for On-Site Arbovirus Surveillance of Mosquitoes: Bringing the Lab to the Sample"*. February 2017, ASM Biothreats Meeting, Washington D.C.

Russell, J.A., Jacobs, J.J., Winegar, R., Zimmerman, C., Aspinwall, J.R., Bagnoli, J.S., Parker, K., Stone, J., Campos B., Slezak, T., Chain, P.S., Davenport, K.W., Li. P., Anderson, J.J., Bishop-Lilly, K.A., Frey, K.G., Postlethwaite, T., Spain, T., Jakobsen, J., Boysen, C., Werking, K., Cassler, M. "*Development and Validation of Metagenomics Sequencing Pipelines for Biosurveillance and Diagnostics*". June 2016. Sequencing and Finishing in the Future Meeting (SFAF), Santa Fe, New Mexico

Russell, J.A., Orsi, W., Edgcomb, V., Biddle, J.F. "*Molecular Insights into Microbial Ecology of the Iberian Margin Deep Biosphere*". May 2015, Deep Carbon Observatory (DCO) International Science Meeting, Lisbon, Portugal

Russell, J.A., Orsi, W., Edgcomb, V., Biddle, J.F. "*Molecular Insights into Microbial Ecology of the Iberian Margin Deep Biosphere*". January 2015, CDEBI NSF Site Visit, Los Angeles, CA

Russell, J.A., Gartman, A., Luther, G.W., Biddle, J.F. "*Microbial Cultivations from Mid- Atlantic Ridge Hydrothermal Vent Plumes*". February 2014, Ocean Sciences Meeting, Honolulu, HI

Russell, J.A., Orsi, W., Edgcomb, V., Biddle, J.F. "*Archaeal Populations and their Associations with Geochemical Conditions on the Iberian Margin*". December 2013, American Geophysical Union Fall Meeting, San Francisco, CA

Russell, J.A., and Biddle, J.F. "*Microbial Cultivations of Heterotrophic Bacteria and Marine Fungi in North Pond Sediments and Underlying Basalt Crust*". January 2013, Gordon Geobiology Research Seminar and Conference, Ventura, CA

Russell, J.A., and Biddle, J.F. "*Microbial Cultivations of Heterotrophic Bacteria and Marine Fungi in North Pond Sediments and Underlying Basalt Crust*". June 2012, CDEBI RCN Meeting, Bremen, Germany

Russell, J.A. and Biddle, J.F. "*Microbial Communities of Pavilion Lake Microbialites*". December 2011, American Geophysical Union Fall Meeting, San Francisco, CA

Russell, J.A. and Biddle, J.F. "*Cyanobacterial Communities of Pavilion Lake Microbialites*". November 2010, DENIN External Advisory Board Poster Session, Newark, DE

Russell, J.A. and Biddle, J.F. "*Cyanobacterial Communities of Pavilion Lake Microbialites*". October 2010, Penn State Astrobiology Research Conference, State College, PA