Michael R. Garvin, Ph.D.
garvinmr@ornl.gov

Current Positions

Staff Scientist, Oak Ridge National Laboratory (2019-present)

- **Computational Systems Biology.** Using Artificial Intelligence and Machine Learning approaches to link genomic changes to phenotypes including
  - **Neurodevelopmental disorders**
  - **COVID-19**
  - **Cardiovascular disease**
  - **Substance abuse disorders**
  - **Suicidal behavior**

- **Molecular Evolution.** Development of novel approaches to track an danalyze the evolution of SARS-CoV-2 on a global scale.

- **Extensive grant writing to NIH, DOE, NSF, and internal ORNL grants.**

Genetic Consultant, Frontier Genomics, LLC (2012-2019)

- **Environmental and Ancient DNA Analysis.** Identifying community assemblages from marine, freshwater, and sediment core samples with NGS in collaboration with the National Marine Fisheries Service, the City and Borough of Yakutat, UC Santa Cruz, and the US Army Corps of Engineers.

Post-doctoral Scholar, Oregon State University (2016-2019)

- **Genomic Basis of Hatchery Domestication in Steelhead (*Oncorhynchus mykiss*).** Using Next-Generation Sequencing (NGS) technology and family-based ecological and behavioral experiments to determine the molecular processes that underlie the domestication of steelhead to hatcheries.

Post-doctoral Fellow, University of Haifa, Israel (2014-2016)

- **Local Adaptation in Fire Salamanders:** Working with Alan Templeton from Washington University in Saint Louis and Leon Blaustein at the University of Haifa to understand the genetic basis of the adaptation of fire salamanders (*Salamandra infraimmaculata*) to xeric environments with an emphasis on bioenergetics. Using a novel statistical approach to identify biological networks based on gene expression data from microarrays.

Post-doctoral Fellow, University of Alaska Fairbanks (2012-2014)

- **Population Structure, Genetic Stock Identification, and Local Adaption in Chum Salmon**: Led a collaborative project between University of Alaska Fairbanks,

Alaska Department of Fish and Game, the National Marine Fisheries Service, and Alaskan native tribal entities to identify genetic markers that show divergence and local adaptation among chum salmon populations with next-generation sequencing and other new technology.

Graduate school, University of Alaska Fairbanks (2004-2012)

- See **Education**, below

Research Associate, Tularik, Inc., (Now Amgen) (2001-2004)

- Assessment and use of gene expression technologies to develop drugs to treat metabolic disorders and cancer including RNA*i*, qPCR, and cDNA microarrays.

Research Associate, CV Therapeutics, Inc. (Now Gilead Biosciences) (1998-2001)

- Development of novel technology to measure expression of genes associated with cardiovascular disease.

Research Associate, Roche Molecular Systems (1997-1998)

- Development of technologies to identify viruses in human plasma based on their DNA content. This is the laboratory in which PCR was invented by Kary Mullis (who won the Nobel Prize for it in 1993).

Research Associate, University of Ottawa Heart Institute (1994-1997)

- Assess the expression of genes in human tissues affected by cardiovascular disease. I participated in the development of many molecular biology techniques as that field was first being developed.

Research Associate, University of Washington, Department of Pathology (1991-1994)

- Development of animal models to uncover the mechanism of restenosis after balloon angioplasty. This work was followed up with work with stents, which is currently the therapy of choice for many patients with coronary artery disease.

Education

Ph. D.	2012	University of Alaska Fairbanks
M.S.	2009	University of Alaska Fairbanks
B.S.	1991	University of Washington

Publications (28)

Kainer D, Templeton A, Prates ET, Allan E, Climer D, Jacobson DA, **Garvin MR** (2021) Structural Variants Are a Major Component of the Missing Heritability of Autism Spectrum Disorder medrxiv https://doi.org/10.1101/2021.10.10.21264819

Ko KI, Merlet JJ, DerGarabedian BP, Zhen H, Horiuchi Y, Hu E, Nguuyen AT, Prouty S, Alawi F, Walsch MC, Choi Y, Millar SE, Cliff A, Romero J, **Garvin MR**, Seykora JT, Jacobson D, Graves DT. NF-kB Perturbation Reveals Unique Immunomodulatory Functions in Prx1+ Fibroblasts that Promote Atopic Dermatitis (2021) Science Translational *Medicine in press*

Garcia BJ, Simha R, **Garvin MR**, Furches A, Jones P, Gazolla JGFM, Hyatt PD, Schadt CW, Pelletier D, Jacobson D (2021) A k-mer based approach for classifying viruses without taxonomy identifies viral associations in human autism and plant microbiomes. Computational and Structural Biotechnology Journal 19: 5911-5919

Garvin MR*, Prates ET*, Pavicic M, Jones P, Amos BK, Geiger A, Shah MB, Streich J, Gazolla JGFM, Kainer D, Cliff A, Romero J, Keith N, Brown JB, Jacobson DA (2020) Potentially adaptive SARS-CoV-2 mutations discovered with novel spatiotemporal and explainable AI models. Genome Biology 21:304 https://doi.org/10.1186/s13059-020-02191-0. PMID: 33357233
*contributed equally

Prates ET*, **Garvin MR*,** Pavicic MP, Jones P, Shah MB, Demerdash O, Amos BK, Geiger A, Jacobson DA (2020) Potential Pathogenicity Determinants Identified from Structural Proteomics of SARS-CoV and SARS-CoV-2. Molecular Biology and Evolution msaa231, https://doi.org/10.1093/molbev/msaa231. PMID: 32941612
*contributed equally

Garvin MR, Alvarez C, Miller JI, Prates ET, Walker AM, Amos BK, Mast AE, Justice A, Aronow B, Jacobson D (2020) A mechanistic model and therapeutic interventions for COVID-19 involving a RAS-mediated bradykinin storm. eLife 2020;9:e59177 DOI: 10.7554/eLife.59177. PMID: 32633718

Streich J, Romero J, Gazolla JGFM, Kainer D, Cliff A, Prates ET, Brown JB, Khoury S, Tuskan GA, **Garvin MR**, Jacobson DA (2020) Can exascale plant biology and explainable artificial intelligence deliver on the sustainable development goals? Current Opinion in Biotechnology 61: 217-225. PMID: 32086132

Aw WC, **Garvin MR**, Ballard JWO (2019) Exogenous factors may differentially influence the selective costs of mtDNA mutations. *In: Cellular and Molecular Basis of Mitochondrial Inheritance* - Mitochondrial Disease and Fitness

Aw WC, Towarnicki SG, Melvin RG, Youngson NA, **Garvin MR**, Nielsen S, Thomas T, Pikcford R, Bustamante S, Vila-Sanjurjo A, Smyth GK, Ballard JWO (2018) Genotype to phenotype: diet-by-mitochondrial DNA haplotype interactions drive metabolic flexibility and organismal fitness. PLoS Genetics 14(11): e1007735. PMID: 30399141

Aw WC, **Garvin MR**, Melvin RG, Ballard JWO (2017) Sex-specific influences of mtDNA mitotype and diet on mitochondrial functions and physiological traits in Drosophila melanogaster. PLoS ONE 12(11): e0187554. PMID: 29166659

Garvin MR, Templin WD, Gharrett AJ, DeCovich N, Kondzela CM, Guyon JR, and McPhee MV (2017) Potentially Adaptive Mitochondrial Haplotypes as a Tool to Identify Divergent Nuclear Loci. Methods in Ecology and Evolution, 8(7): 821-834

Garvin MR, Thorgaard GH, Narum SR (2015) Differential Expression of Genes that Control Respiration Contribute to Thermal Adaptation in Redband Trout (*Oncorhynchus mykiss gairdneri*). Genome Biology and Evolution, 7, 1404–1414.

Garvin MR, Bielawski JP, Sazanov L, and Gharrett AJ (2015) Review and Meta-analysis of Natural Selection in Mitochondrial Complex I in Metazoans. Journal of Zoological Systematics and Evolutionary Research: 53(1): Editor's Choice.

Garvin MR & Gharrett AJ (2014) Evolution: Are the Monkeys' Typewriters Rigged? Royal Society Open Science 1: 140172. PMID: 26064538

Garvin MR, Masuda MM, Pella JJ et al. (2014) NOAA Technical Memorandum NMFS-AFSC-283 A Bayesian Cross-Validation Approach to Evaluate Genetic Baselines and Forecast the Necessary Number of Informative Single Nucleotide Polymorphisms.

Garvin MR, Kondzela CM, Martin PC, Finney B, Guyon J, Templin WD, DeCovich N, Gilk-Baumer S, & Gharrett AJ (2013) Recent Physical Connections May Explain Weak Genetic Structure in Western Alaskan Chum Salmon (*Oncorhynchus keta)* Populations. Ecology and Evolution 3(7): 2362-2377.

Garvin MR, Marcotte RW, Palof KJ, Riley RJ, Kamin LM, & Gharrett AJ (2011) Diagnostic Single Nucleotide Polymorphisms Identify Pacific Ocean Perch and Delineate Blackspotted and Rougheye Rockfish. Transactions of the American Fisheries Society 140(4):984-988.

Garvin MR, Bielwaski JP, & Gharrett AJ (2011) Positive Darwinian Selection in the Piston that Powers Proton Pumps in Complex I of the Mitochondria of Pacific Salmon. PLoS One 6(9):e24127.

Garvin MR, Saitoh K, & Gharrett AJ (2010) Application of Single Nucleotide Polymorphisms to Non-model Species: A Technical Review. Molecular Ecology Resources 10(6):91-108.

Garvin MR, Saitoh K, Brykov V, Churikov D, & Gharrett AJ (2010) Single Nucleotide Polymorphisms in Chum Salmon (*Oncorhynchus keta*) Mitochondrial DNA Derived from Restriction Site Haplotype Information. Genome 53:501-507.

Garvin MR & Gharrett AJ (2010) Application of SNP Markers to Chum Salmon (*Oncorhynchus keta*): Discovery, Genotyping, and Linkage Phase Resolution. Journal of Fish Biology 77(9):2137-2162.

Garvin MR & Gharrett AJ (2007) DEco-TILLING: An Inexpensive Method for SNP Discovery that Reduces Ascertainment Bias. Molecular Ecology Notes 7:735-746.

Oram JF, Lawn RM, **Garvin MR**, & Wade DP (2000) ABCA1 is the cAMP-Inducible Apolipoprotein Receptor that Mediates Cholesterol Secretion from Macrophages. Journal of Biological Chemistry 275(44):34508-34511.

O'Brien ER, Urieli-Shoval S, **Garvin MR**, Stewart DK, Hinohara T, Simpson JB, Benditt EP, & Schwartz SM (2000) Replication in Restenotic Atherectomy Tissue. Atherosclerosis 152(1):117-126.

Lawn RM, Wade DP, **Garvin MR**, Wang X, Schwartz K, Porter GJ, Seilhamer JJ, Vaughan AM, & Oram JM (1999) The Tangier Disease Gene Product ABC1 Controls the Cellular Apolipoprotein-Mediated Lipid Removal Pathway. Journal of Clinical Investigation 104:R25-R31.

Garvin MR, Labinaz M, Pels K, Walley VM, Mizgala HF, & O'Brien ER (1997) Graft Vascular Disease: Potential Involvement of the Plasminogen Activator System. Cardiovascular Research 35(2):241-249.

O'Brien ER, Bennet KL, **Garvin MR**, Zederic TW, Hinohara T, Simpson JB, Kimura T, Nobuyoshi M, Mizgala HF, Purchio A, & Schwartz SM (1996) Big-H3, a Transforming Growth Factor-beta-inducible Gene, is Overexpressed in Atherosclerotic and Restenotic Human Vascular Lesions Arteriosclerosis, Thrombosis and Vascular Biology 16:576-584.

O'Brien ER, **Garvin MR**, Dev R, Stewart DK, Hinohara T, Simpson JB, & Schwartz SM (1994) Angiogenesis in Human Coronary Atherosclerotic Plaques. American Journal of Pathology 145(4):883-894.