Christopher V. **Rackauckas**

Mathematician · Theoretical Biologist

Your address here

(Put)111-1220 | contact@chrisrackauckas.com | www.chrisrackauckas.com | ChrisRackauckas | Chris Rackauckas | chrisrackauckas

Research focus: How do biological organisms control/use noise, and how can scientists/clinicians utilize the information in noise?

Summary

Applied Mathematician	Experience with computational mathematics, stochastic processes, dynamical systems, and statistics.
Scientist	Experimental and theoretical research in physics, biology, climatology, economics, and chemistry.
Software Engineer	Over eight years of experience with individual and team software engineering in academia and industry.
Programming Polyglot	Adept at transferring knowledge to quickly learn new mathematics, software, tools, and programming languages.
Well-Rounded Individual	Past activities include wrestling, track & field, theater, dance, scuba diving, and Model United Nations.

Research Interests

Mathematics	Stochastic (Partial) Differential Equations, Computational Differential Equations, Stochastic Analysis
Computation	High-Performance Computing, Machine Learning, "Big Data", Package Development
Biology	Systems, Developmental, Zebrafish, Craniofacial, Hindbrain, Cell Lineages, Breast Cancer

Education

University of California, Irvine — *Irvine, California*

Ph.D. in Mathematics — *Expected 2019*

University of California, Irvine — *Irvine, California*

M.S. in Mathematics — *2015*

- Certificate in Mathematical, Computational, and Systems Biology

Oberlin College — *Oberlin, Ohio*

B.A. with Honors in Mathematics with Minors in Computer Science, Physics, and Economics — *2013*

- GPA: 3.8/4.0, GRE: V166 (96%), Q169 (98%), W5.5 (96%)

Current Research Projects

High-Order Adaptive Methods for Stochastic ODEs — *Numerical SODEs*

PI: Prof. Q. Nie, University of California, Irvine — *2014-Present*

- Utilizing high-order Stochastic Runge-Kutta methods for SODEs to develop adaptive SODE methods.
- Investigating the statistics of the Brownian Bridge to apply arbitrary time steps.
- Implementing the solutions as high-performance open source packages.

Machine Learning for the Optimization Numerical Methods for Stochastic ODEs — *Numerical SODEs*

PI: Prof. Q. Nie, University of California, Irvine — *2014-Present*

- Analyzing the mathematical problem from an experimental viewpoint and applying scientific methods.
- Implementing machine learning methods to optimize the numerical methods for various properties.
- Identifying computationally-efficient high-order implicit methods.

Neural Crest Migration Patterns in Craniofacial Development — *Systems Developmental Biology*

PIs: Prof. Q. Nie and Prof. T. Schilling, University of California, Irvine — *2013-Present*

- Utilizing confocal microscopy to image the migration and cell-fate decisions of neural crest cells.
- Quantifying the outcomes of hypotheses via SDE models

Mechanisms for Control of Variability in Biological Organisms — *Mathematical Biology*

PI: Prof. Q. Nie, University of California, Irvine — *2013-Present*

- Developed phenomenological (S)PDE models of retinoic acid signaling pathways of zebrafish.
- Identified network motifs which are used to attenuate the noise in the response signal.

Detection of Superspace Symmetry in Incommensurate Crystallography

Crystallography

PI: Prof. J. Rowsell, Oberlin College

2013-Present

- Solved for and refined crystal structure from crystallography experiments using SHELX and Jana2006.
- First reported structure of "H-Acid", a commodity dye intermediate in heavy use since 1890.

Work Experience

Project Manager, Baidu, Inc.

Hong Kong, China

Research in Industrial Projects for Students (RIPS-HK)

Summer 2013

- Lead an international team of researchers on a mathematical/computational research project for Baidu, Inc.
- Developed new algorithms for movie recommendation utilizing machine learning techniques.

Research Assistant

Oberlin, Ohio

Oberlin College Department of Chemistry and Biochemistry

2012-2013

- Modeled incommensurate crystal structures using x-ray diffraction data from crystallography experiments.
- Solved for the modulated structure for low temperature crystals of "H-Acid", a commodity dye intermediate.

Web Developer

Oberlin, Ohio

Oberlin College Residential Education

2009 - 2013

- Created and maintained secure web forms and programs in PHP and Perl.
- Developed the associated MYSQL relational databases for the housing data.
- Wrote scripts to convert housing data into interactive Excel sheets for use by non-programmers.

Web Developer

Oberlin, Ohio

Freelance

2009 - 2013

- Created and maintained websites for professors and businesses.
- Scripted interfaces to ensure that information could be updated by individuals without programming experience.
- Examples: Fernando Gomez Herrero's personal page (fernandogomezherrero.com), Acoustik Musik LTD. (acoustikmusik.com), and my personal page (chrisrackauckas.com).

Model Developer and Technical Assistant

Oberlin, Ohio

Oberlin Modeling Initiative

2012

- Developed computational models for the Nova 2 Model Library and for classroom use.
- Wrote tutorials detailing how to script models using NovaScript.
- Created the World library for agent-based modeling in Nova.

Calculus Tutor

Oberlin, Ohio

Oberlin College Mathematics Department

2009-2010

- Responsibilities included teaching Oberlin College students first and second semester calculus.

Lighting/Sound Technician

Oberlin, Ohio / Mission Viejo, CA

Oberlin College and Mission Viejo High School Theater

2008-2010

- Designed and implemented lighting and sound for musical theater performances, dance showcases, and plays.
- Maintained technical equipment, utilized digital signal processing for sound design, and built sets.

Extracurricular Activity

Pro Bono Web and Data Analysis Software Engineer

Virtual

Maryland Department of Natural Resources

2012 - 2013

- Developed statistical analysis software for analyzing the output of data from continuous monitoring stations.
- Analyses were made to run through a graphical user interface (GUI) so that researchers and educators could be able to run the sophisticated statistical analyses without prerequisite programming knowledge.
- Developed an animated water quality map to be displayed on the Department of Natural Resources "Eyes on the Bay" website that would show the changes in the environment over time to help educate the public on the changing environmental conditions.

Representative for the Biological Sciences

UC Irvine

UC Irvine Associated Graduate Students

2014-2015

- Held positions in the Social and the Funding Committees

Honors & Awards

Fellowships and Scholarships

2014 **DMS160004**, Numerical Methods and Models Using Stochastic (Partial) Differential Equations in Biology — *XSEDE*

2014 **National Science Foundation Graduate Research Fellowship** , National Science Foundation — *NSF*

2014 **Ford Predoctoral Fellowship**, National Academies of Science — *Ford Foundation*

2013 **T32 Predoctoral Training Grant**, National Institute of Biomedical Imaging and Bioengineering — *UC Irvine*

2013 **Graduate Dean's Recruitment Fellowship**, University of California, Irvine — *UC Irvine*

2013 **Mathematical and Computational Biology (MCB) Fellowship**, University of California, Irvine — *UC Irvine*

2010 **S-STEM Scholarship**, National Science Foundation — *Oberlin College*

2009 **John F. Oberlin Scholarship**, Oberlin College — *Oberlin College*

Monetary Awards

2015 **Opportunity Award**, Center for Complex Biological Systems — *CCBS*

2013 **Margaret C. Etter Student Lecturer Award**, American Crystallographic Association, Service Crystallography SIG — *ACA*

2012 **Best Poster Presentation for Statistics**, Shenandoah Undergraduate Mathematics Conference — *JMU*

Miscellaneous

2013 **Certificate of Appreciation**, Maryland Department of Natural Resources — *DNR*

2007 **Eagle Scout**, Boy Scouts of America — *BSA*

2014 **Outstanding Presentation Award**, Mathematical Association of America — *MAA*

Presentations

Superspace Refinement of the (3+1) Dimensional Incommensurately Modulated Phase of the Hydrated Sodium Salt of a Commodity Dye Intermediate — *Sheraton Waikiki Beach Hotel*

American Crystallography Association Annual Meeting — *July 22, 2013*

Was the Earth Entirely Covered by Glaciers? A Mathematical Investigation of "Snowball Earth" — *Oberlin College*

Honors Presentation — *May 9, 2013*

Did Glaciers Cover the Planet? An Inquiry Into "Snowball Earth" — *Oberlin College*

Senior Symposium — *April 26, 2013*

Did a Jormungand state exist? An investigation using the Budyko-Widiasih model — *Webinar*

Mathematics of Climate Research Network — *March 6th and 20th , 2013*

Water Quality Monitoring of Maryland's Tidal Waterways — *James Madison University*

Shenandoah Undergraduate Mathematics Conference (SUMS) — *September 29, 2012*

Publications

Noise modulation in retinoic acid signaling sharpens segmental boundaries of gene expression in the embryonic zebrafish hindbrain — *eLife Sciences*

Sosnik J, Zheng L, Rackauckas C, Digman M, Gratton E, Nie Q, Schilling T — *April 12, 2016*

On The Budyko-Sellers Energy Balance Climate Model with Ice Line Coupling — *Discrete and Continuous Dynamical Systems – Series B*

Walsh J, Rackauckas C — *September 2015*

An Application of Robust Regression to Bernanke's Analysis of Nonmonetary Effects in the Great Depression — *Journal of Statistical and Econometric Methods*

Rackauckas C — *February 7, 2014*

Assessment of Statistical Methods for Water Quality Monitoring in Maryland's Tidal Waterways

SIAM Undergraduate Research Online

Le R, Rackauckas C, Ross A, Ulloa N.

April 17, 2013

Technical Reports

Doubly Ensemble Movie Prediction with Social Media Data Using TBEEF

MLOSS Repository

Rackauckas C, Cai W, Jarvis C, Xu C, Ching A

August 10, 2013

The Jormungand Climate Model

OhioLINK Electronic Theses and Dissertation Center

Rackauckas C

July 11, 2013

Water Quality Monitoring of Maryland's Tidal Waterways, HPCF-2012-12

UMBC HPCF

Le R, **Rackauckas C**, Ross A, Ulloa N. Advisors: Popuri S, Neerchal N, Smith B

October 2012

Notable Software

Triple Bagged Ensemble Ensemble Framework (TBEEF)

MLOSS Repository

Rackauckas C, Cai W, Jarvis C, Xu C, Ching A

August 10, 2013

- Machine learning software for recommendation problems using double ensembles.
- Over 800 downloads as of April 15, 2016.

Skills

Mathematics	**Stochastic** (partial) differential equations, real/complex analysis, abstract algebra, computational algebra, differential geometry, dynamical systems, mathematical modeling, numerical analysis, scientific computing, optimization, probability, mathematical statistics, computational statistics, Bayesian statistics, information theory, machine learning, time series analysis, algorithmic analysis, and theory of computation.
Programming	**Julia**, MATLAB, Mathematica, Java, C (MPI), C++, R, Python, Javascript, PHP, MYSQL, Perl, and HTML5/CSS3
Science	**Systems** biology, molecular biology, developmental biology, evolutionary biology, electrodynamics, classical/Lagrangian/Hamiltonian mechanics, quantum mechanics, statistical mechanics, general relativity, micro/macroeconomics, econometrics, biophysics, general chemistry, physical chemistry, and analytical chemistry.
Software	**Linux**, Adobe Master Collection, SPSS, Stata, SHELX, Jana2006, Mercury, Diamond, and Nova.
Engineering	**Software** engineering, audio engineering, digital signal processing, and control theory.

Professional Affiliations

American Crystallographic Association, ACA
American Mathematical Society, AMS
Mathematical Association of America, MAA
Mathematics of Climate Research Network, MCRN
Society for Industrial and Applied Mathematics, SIAM
Society for the Advancement of Chicanos and Native Americans in Science, SACNAS
Sigma Xi