

# Ryan C. Thompson

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## Summary

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- Well-rounded computational biologist with deep knowledge of biology, mathematics, and programming
- 10 years of bioinformatics experience answering a wide range of complex biological questions through analysis of large NGS- and microarray-based whole transcriptome and epigenetic data sets
- Strong focus on sound statistical analysis, effective data visualization and communication, and making expert knowledge and successful analysis methods available as re-usable software tools
- Supportive team member with a strong ability to foster cross-disciplinary literacy by explaining concepts at the right level of abstraction

## Education

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### The Scripps Research Institute

Ph. D. in Bioinformatics, 2019

### University of Virginia

B.S. in Biology, B.A. in Mathematics, 2009  
Echols Scholar

## Research Experience

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Salomon Lab, The Scripps Research Institute

La Jolla, CA      2012 - 2019

**Contact:** Dr. Andrew Su, [asu@scripps.edu](mailto:asu@scripps.edu)

- Created an open source, reproducible workflow to analyze a large multi-omics next-gen sequencing dataset of 220 RNA-seq and ChIP-seq samples to reveal interactions between differential histone methylation and differential gene expression during T-cell activation, as well as key differences in activation between naïve and memory cells [3, 2].  
Links: [Reproducible workflow](#), [Slides](#), [Example results and visualizations](#)
- Investigated effects of life-span-extending drug on worm gene expression over time revealing that the drug retards age-related “transcriptional drift”, preserving a youthful phenotype at the molecular level. [6]  
Link: [PCoA Plot](#)

- Significantly improved performance of machine learning classifier for identifying transplant rejection by developing appropriate single-sample microarray normalization procedures[7], including training a custom set of frozen RMA normalization vectors. Classifier is currently being developed into a clinical test for transplant dysfunction. Links: [fRMA example code & plots](#), [Classifier Method Write-up](#)
- Implemented a systems biology tool to analyze and efficiently present and summarize differential expression for multiple gene set & pathway methods run on multiple pathway databases, as well as differential expression of individual genes within each pathway. Links: [Presentation](#), [Example Results](#), [Summary](#)
- Performed comparative analysis of multiple differential expression statistical models to define best practice for optimal sensitivity while maintaining false positive control. Presented on theoretical and practical similarities and differences between methods. Links: [RNA-seq Presentation](#), [Advanced RNA-seq Presentation](#), [Example plot](#)
- Taught basic RNA-seq theory and practical analysis for the graduate-level introductory bioinformatics course. Links: [Lecture Slides](#), [Hands-on lab section](#)
- Evaluated and optimized cost and performance of custom protocol for RNA-seq of human and primate blood samples while minimizing nuisance globin reads. Increased yield of useful reads nearly 2-fold. [4] Link: [Example results](#)
- Adapted common normalization methods from RNA-seq to improve performance in analysis of RASL-seq experiments. [5]
- Performed a comprehensive comparative evaluation of over 20 subtly different statistical models for differential methylation in Illumina 450k arrays, selecting a model that best explained the observed sources and trends of variation in the data, including cross-domain application of a method originally designed for RNA-seq data. Link: [Example diagnostic plots](#)
- Active member of the Bioconductor community and contributing developer for several Bioconductor packages. Links: [BiocParallel](#), [ChIPPeakAnno](#), [MyGene](#), [Support Profile](#)
- Mentored 2 coworkers in learning bioinformatics, one from a programming background and the other from a biology background.

Summer Internship, Informatics IT, Merck & Co.

Boston, MA 2011

**Contact:** Adnan Derti, [adnan.derti@gmail.com](mailto:adnan.derti@gmail.com)

- Built a transcriptome assembly and quantification pipeline using Cufflinks, including fully-automated cluster job control for high-throughput reproducible analysis, and presented a conceptual overview of Cufflinks' assembly and quantification algorithms to help the team understand Cufflinks. Link: [Presentation Slides](#)
- Assisted in a molecular genetics study to evaluate performance of two variant calling algorithms in detection of causal mutations in antibiotic-resistant bacterial genomes.

Gaasterland Lab, UCSD Bioinformatics

La Jolla, CA 2010 - 2012

**Contact:** Terry Gaasterland, [gaasterland@ucsd.edu](mailto:gaasterland@ucsd.edu)

- Designed and implemented Deloxer, a critical software step in a new Illumina mate-pair sequencing protocol using Cre recombination. Deloxer is published[8] and now in use in several labs around the world. Links: [Documentation](#); [Code](#)

- Performed a molecular genetics study to find potential causal mutations for [fatal iron overload disease](#) in critically endangered black rhinoceros by *de novo* assembly of transcriptomes for black rhino and closely-related white rhino. Developed a custom pipeline to match up ortholog gene pairs, discover single-nucleotide differences between them, and functionally annotate these differences, and delivered a list of potential causal variants to collaborators for follow-up.  
Link: [Example results](#)
- Helped design & implement a large-scale high-throughput exome sequencing pipeline for SNP discovery and functional annotation, including QC and validation of on-target coverage depth and reproducibility of coverage.  
Links: [Example 1](#); [Example 2](#); [Example 3](#)
- Created a fully-automated pipeline to produce quality-control metrics and plots for Illumina high-throughput sequencing data for early identification of failed runs or samples.  
Link: [Example results](#)
- Investigated the binding motif specificity of ZASC1 transcription factor in mouse T-cells using Affymetrix expression microarrays in ZASC1 siRNA knockdown experiment.
- Analyzed miRNA target predictions using GO & KEGG grouping to identify target pathways of autophagy-related miRNAs for biological validation.  
Link: [Example results](#)

Timko Lab, U. of Virginia Biology

Charlottesville, VA

2007 - 2009

**Contact:** Paul J. Rushton, [Paul.Rushton@sdstate.edu](mailto:Paul.Rushton@sdstate.edu)

- Undergraduate thesis: Designed and implemented Contig Farmer, an algorithm for efficient selective contig assembly starting from “seed” sequences of interest, and used Contig Farmer to accelerate transcription factor gene discovery in cowpea and tobacco shotgun genomic sequence data[9].
- Investigated transcription factors mediating plant stress response using expression microarray time-course, and refined the custom microarray design using data from previous runs to identify and eliminate uninformative probes, yielding an improved design for future studies.  
Link: [Code](#)
- Acted as interpreter to explain complex biological concepts to programmers and explain complex computational problems to biologists.  
Link: [Presentation Slides](#)

## Skills

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**Computing Skills** R/BioConductor, Python, Perl, Lisp, Java, C#, C++; Git version control; Remote UNIX system administration & software compilation, computing cluster job management & parallel computation  
Public code: <https://github.com/DarwinAwardWinner>  
StackOverflow Profile: <http://stackoverflow.com/users/125921>

**Statistics & Data Analysis** Multi-omics NGS & microarray analysis, multi-factor linear and generalized linear regression, experimental design and parametrization, empirical Bayesian methods, predictive modeling of clinical outcomes, machine learning classifier training & validation, survival analysis, data visualization & presentation, reproducible research practices

**Wet Lab:** PCR, molecular cloning, recombinant protein purification, epitope mapping, site-directed mutagenesis, 2D gels, real-time PCR, and associated data analysis

**Languages:** English: native speaker; German: written and spoken

## Other Work Experience

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Computing Advisor & Help Desk, U. Va. IT Dept. Charlottesville, VA      2005 - 2007

- Provided support via phone and on-site for students, faculty, and staff having problems with computers, phone system, network access, malware, hardware setup, and university web services
- Tasks included support for university-provided software, virus removal, iPod recovery, printer setup and repair, diagnosis of hardware malfunctions, and data recovery from failing hard disks

Summer Sailing Instructor, Raritan Yacht Club Perth Amboy, NJ      2006 - 2009

- Instructed children ages 8-18 in sailing skills, safety, seamanship, knots, rigging & de-rigging boats, navigation, and racing strategy and technique, with an emphasis on building character and self-reliance
- Ensured safety of students and staff by maintaining boats and equipment in good repair, by being vigilant to traffic and hazards on a busy waterway, and by communicating and coordinating efficiently with other staff
- Helped organize, run, and referee several regattas per season for students from RYC and neighboring yacht clubs

## Writings and Publications

- [1] Sunil Kurian, Enrique Velazquez, **Ryan Thompson**, Thomas Whisenant, Stanley Rose, Nicole Riley, Frank Harrison, Terri Gelbart, John Friedewald, Susan Brietigam, Michael Abecassis, and Daniel Salomon. Orthogonal comparison of molecular signatures of kidney transplants with subclinical and clinical acute rejection – equivalent performance is agnostic to either technology or platform. *American Journal of Transplantation*, 2017.
- [2] Sarah LaMere, **Ryan C. Thompson**, Xiangzhi Meng, H. Kiyomi Komori, A. Mark, and Daniel R. Salomon. H3K27 methylation dynamics during CD4 T cell activation: regulation of JAK/STAT and IL12RB2 expression by JMJD3. *Journal of Immunology (accepted)*, 2017.
- [3] Sarah LaMere, **Ryan C. Thompson**, H. Kiyomi Komori, Adam Mark, and Daniel R. Salomon. Promoter H3K4 methylation dynamically reinforces activation-induced pathways in human CD4 T cells. *Genes & Immunity*, May 2016.
- [4] **Ryan C. Thompson**, Terri Gelbart, Steven R. Head, Phillip Ordoukhanian, Courtney Mullen, Dongmei Han, Dora M. Berman, Amelia Bartholomew, Norma S. Kenyon, and Daniel R. Salomon. Optimizing yield of deep RNA sequencing for gene expression profiling of peripheral blood samples from cynomolgus monkeys (*Macaca fascicularis*). *Journal of Biological Methods (in review)*, 2016.
- [5] Erick R. Scott, H. Benjamin Larman, Ali Torkamani, Nicholas J. Schork, Nathan Wineinger, Max Nanis, **Ryan C. Thompson**, Reza B. Beheshti Zavareh, Luke L. Lairson, Peter G. Schultz, and Andrew I. Su. RASLseqTools: open-source methods for designing and analyzing RNA-mediated oligonucleotide Annealing, Selection, and, Ligation sequencing (RASL-seq) experiments. *Nucleic Acids Research (in review)*, 2016.
- [6] Sunitha Rangaraju, Gregory M Solis, **Ryan C Thompson**, Rafael L Gomez-Amaro, Leo Kurian, Sandra E Encalada, Alexander B Niculescu, Daniel R Salomon, and Michael Petrascheck. Suppression of transcriptional drift extends *C. elegans* lifespan by postponing the onset of mortality. *eLife*, 4, 2015.
- [7] SM Kurian, AN Williams, T Gelbart, D Campbell, TS Mondala, SR Head, S Horvath, L Gaber, **R Thompson**, T Whisenant, et al. Molecular Classifiers for Acute Kidney Transplant Rejection in Peripheral Blood by Whole Genome Gene Expression Profiling. *American Journal of Transplantation*, 14(5):1164–1172, 2014.
- [8] Filip Van Nieuwerburgh, **Ryan C. Thompson**, Jessica Ledesma, Dieter Deforce, Terry Gaasterland, Phillip Ordoukhanian, and Steven R Head. Illumina Mate-Paired DNA Sequencing Library Preparation Using Cre-Lox Recombination. *Nucleic Acids Research*, page gkr1000, 2011.

- [9] **Ryan C. Thompson**, Paul J. Rushton, Tom W. Laudeman, and Michael P. Timko. [Contig Farmer: a tool for extracting maximal-length contiguous sequences from a database of short sequence reads](#) (Undergraduate Thesis). June 2009.
- [10] **Ryan C. Thompson**. [The sources and limits of geometric rigor from Euclid through Descartes](#). May 2008.