

# Andrew Tupper | PhD Biochemistry

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## Education

### McMaster University

*PhD Biochemistry and Astrobiology*

Hamilton, ON (Canada)

2015–2020

### Rensselaer Polytechnic Institute

*BS Interdisciplinary Science – summa cum laude*

Troy, NY (USA)

2011–2015

## Technical Skills

### Programming.....

- Proficient in Python, C, C++, R, and Bash. Basic knowledge of HTML, CSS, and javascript
- Parallel programming paradigms: MPI (MPICH and openMPI), threading (POSIX and openMP), and GPU (NVIDIA-CUDA)
- Python libraries: NumPy, SciPy, SymPy, Scikit-learn (Machine learning), and PyMC3 (Bayesian learning)
- Code development on Unix clusters: Docker and Conda, job scheduling with SLURM and SGE
- Dedicated to software development best practices such as Git/GitHub and test-driven development
- Server admin for the USDA, deployment and maintenance of databases and R-shiny websites
- Coded exclusively in VIM for 1-2 years

### Problem Solving.....

- Numerical analysis of stiff and ordinary differential equations using Runge-Kutta methods
- Monte-Carlo and Gillespie based simulations of chemical kinetics and thermodynamics

### Problem Solving (Cont.).....

- Surface and lattice based models of nearest-neighbor stochastic processes
- Kmer based algorithms for the analysis of genomic and population genetic data
- Development of CRISPR-based diagnostic assays of pathogens using SHERLOCK protocol

### Communication.....

- Proficient in scientific writing and presentations
- Author of 7 published papers (4 as first author)
- Awarded best PhD seminar twice, best poster once
- Mentored 5 graduate and 4 undergraduate students
- Led research lab during final year of PhD

### Relevant Coursework.....

- SHARCNET Advanced Research Computing
- Software Design and Documentation
- Parallel Programming
- Numerical Computing
- Machine Learning

## Professional Experience

### BenchSci

*Bioinformatics Software Engineer (remote)*

Canton, NY (USA)

2022–present

- Development of ETL pipelines using Apache beam and Google cloud infrastructure
- Extraction and analysis of large scale bioinformatics databases
- Development of novel bioinformatics tools to aid drug discovery

### Horticultural Crops Research Laboratory

*Research Associate with Dr. Niklaus J. Grünwald*

Corvallis, OR (USA)

2020–2021

- Development of python software packages for CRISPR-based diagnostic assays
- System administrator for the 'oomy' compute cluster and web server
- Population genetics of *P. ramorum*, causal agent of sudden oak death

### McMaster University

*Graduate Researcher with Dr. Paul G. Higgs*

Hamilton, ON (Canada)

2015–2020

- Software development of massively parallel programs for high performance computing
- Designing computational models of non-enzymatic and enzymatic RNA replication
- Lipid-catalyzed polymerization of unactivated RNA monomers in the 'Planet Simulator' - Origins lab

## Professional Experience (continued)

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**Rensselaer Polytechnic Institute**

**Troy, NY (USA)**

**Undergraduate Researcher with Dr. James P. Ferris**

2012–2013

- Clay-catalyzed polymerization of activated RNA monomers
- Banin protocol - Quantitative ion exchange of clay minerals
- Data analysis of chemical experiments

## Publications

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**Tupper, A. S., & Higgs, P. G. (2021).** Rolling-circle and strand-displacement mechanisms for non-enzymatic rna replication at the time of the origin of life. *Journal of Theoretical Biology*, 110822.

Cauret, C. M., Gansauge, M.-T., **Tupper, A. S.**, Furman, B. L., Knytl, M., Song, X.-Y., Greenbaum, E., Meyer, M., & Evans, B. J. (2020). Developmental systems drift and the drivers of sex chromosome evolution. *Molecular Biology and Evolution*, 37(3), 799–810.

**Tupper, A. S.**, Pudritz, R. E., & Higgs, P. G. (2019). Can the RNA world still function without cytidine? *Molecular biology and evolution*.

Shah, V., de Bouter, J., \*Pauli, Q., **Tupper, A. S.**, & Higgs, P. G. (2019). Survival of RNA replicators is much easier in protocells than in surface-based, spatial systems. *Life*, 9(3), 65.

Pearce, B. K., **Tupper, A. S.**, Pudritz, R. E., & Higgs, P. G. (2018). Constraining the time interval for the origin of life on earth. *Astrobiology*, 18(3), 343–364.

**Tupper, A. S.**, & Higgs, P. G. (2017). Error thresholds for RNA replication in the presence of both point mutations and premature termination errors. *Journal of theoretical biology*, 428, 34–42.

**Tupper, A.**, \*Shi, K., & Higgs, P. (2017). The role of templating in the emergence of RNA from the prebiotic chemical mixture. *Life*, 7(4), 41.

\* mentored undergraduate student

## Select Conferences

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**Gordon Research Conference for the Origins of Life**

**Galveston, TX (USA)**

**Poster Presentation**

2020

Non-enzymatic Rolling-circle Replication in an RNA World

- Andrew S. Tupper & Paul G. Higgs

**Astrobiology Science Conference (AbSciCon)**

**Bellevue, WA (USA)**

**Poster Presentation**

2019

Can the RNA World still function without cytidine?

- Andrew S. Tupper, Ralph E. Pudritz & Paul G. Higgs

**Science of Early Life Conference**

**Hamilton, ON (Canada)**

**Poster Presentation**

2018

Assessing the Plausibility of an AUG Alphabet for RNA Secondary Structure Formation and Replication

- Andrew S. Tupper, Ralph E. Pudritz, & Paul G. Higgs

**Astrobiology Science Conference (AbSciCon)**

**Mesa, AZ (USA)**

**Oral Presentation**

2017

Error thresholds for RNA replication in the presence of point mutations and premature termination errors

- Andrew S. Tupper & Paul G. Higgs

**Astrobiology Science Conference (AbSciCon)**

**Mesa, AZ (USA)**

**Oral Presentation – By Supervisor**

2017

The role of templating in the emergence of RNA from the prebiotic chemical mixture

- Andrew S. Tupper, Kevin Shi, & Paul G. Higgs