

John A. Burns

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Research Summary

I am a systems biologist, with broad interests in mutualist symbioses, biomineralization, and the evolution and regulation of cellular form. My work combines comparative genomics and classic molecular biology to reveal both evolutionary and mechanistic aspects of those processes at molecular, cellular, organismal, symbiotic, and ecological scales.

Current Appointments

August 2019-present: Senior Research Scientist, Bigelow Laboratory for Ocean Sciences, East Boothbay, ME

September 2018–present: Research Associate, American Museum of Natural History, NY, NY

Professional experience

December 2018-July 2019: Associate Research Scientist, Lamont-Doherty Earth Observatory of Columbia University, NY

September 2015-2018: Research Scientist, American Museum of Natural History, NY, NY , American Museum of Natural History, NY, NY

September 2013–2015: Post-doctoral Fellow, American Museum of Natural History, NY, NY

September 2012–2013: Assistant Research Scientist, Department of Biology, New York University, NY, NY

September 2013–May 2014: Adjunct Professor, John Jay College, NY, NY

May 2001–October 2002: Isotope geochemical analyst, USGS, Reston, VA

Education

2006–2012: Ph.D. in Biology, New York University, New York, NY

Dissertation: “RNA Polymerase II Transcription: Effects of DNA Damage and DNA Secondary Structure on Elongation and Fidelity”

Advisor: Dr. David Scicchitano

Committee: Dr. Edo Kussel, Dr. Nicholas Geacintov, Dr. Suse Broyde, and Dr. Bennet Van Houten

2004–2006: M.Sc. in Biology, New York University, New York, NY

Thesis: “DNA Secondary Structures as Regulators of Cellular Processes”

Advisor: Dr. David Scicchitano

1996–2001: B.A. in Geoscience, Franklin and Marshall College, Lancaster, PA

Scientific publications

Published articles (peer reviewed)

13. Tessler M, Brugler MR, **Burns JA**, Sinatra NR, Vogt DM, Varma A, Xiao M, Wood RJ, and Gruber DF. "Ultra-gentle soft robotic fingers induce minimal transcriptomic response in a fragile marine animal" (2020): *Current Biology*, 30(4), R157-R158. (<https://doi.org/10.1016/j.cub.2020.01.032>)
12. Kerney RK, Leavitt J, Hill E, Zhang H, Kim E, and **Burns JA**, 2019. "Co-Cultures of Oophila amblystomatis Between Ambystoma maculatum and Ambystoma gracile Hosts Show Host-Symbiont Fidelity" *Symbiosis* (2019): 1-13 (<https://doi.org/10.1007/s13199-018-00591-2>)
11. Torruella G, Grau-Bové X, Moreira D, Karpov S, **Burns JA**, Sebé-Pedrós A, Völcker E, and López-García P, 2018. "A complex functional gene set for the early-branching opisthosporidian Paraphelidium tribonemae." *Communications Biology*, 1, article 231 (<https://doi.org/10.1038/s42003-018-0235-z>)
10. Cádiz A, Reytor ML, Díaz LM, Chestnut T, **Burns JA**, Amato G, 2018. "The chytrid fungus, *Batrachochytrium dendrobatidis*, is widespread among Cuban amphibians." *EcoHealth*, pp.1-13 (<https://doi.org/10.1007/s10393-018-1383-9>)
9. Ezerskytea M, Paredesa JA, Malvezzia S, **Burns JA**, Olsson M, Scicchitano DA, Dreij K, 2018. "O6-methylguanine-induced transcriptional mutagenesis reduces p53 tumor suppressor function". *PNAS*, 115(18), pp.4731-4736. (<https://doi.org/10.1073/pnas.1721764115>)
8. **Burns JA**[†], Pittis AA, Kim E, 2018. "Gene Based Predictive Models of Trophic Modes suggest Asgard Archaea are not Phagocytotic" *Nature Ecology and Evolution*, 2(4), pp.697-704. [†]Corresponding author (<https://doi.org/10.1038/s41559-018-0477-7>)
7. **Burns JA**, Chowdhury MA, Cartularo L, Berens C, and Scicchitano DA, 2018. "Nucleotide excision repair does not contribute to the genetic instability associated with loop or stem-loop DNA located within transcription units". *Nucleic Acids Research*, 46(7), pp.3498-3516. (<https://doi.org/10.1093/nar/gky110>)
6. **Burns JA**[†], Zhang H, Hill E, Kim E, Kerney RK[†], 2017. "Transcriptome Analysis Illuminates the Nature of the Intracellular Interaction in a Vertebrate-Algal Symbiosis". *eLife*;6:e22054. [†]Corresponding author (<https://elifesciences.org/content/6/e22054>) ***selected for an "insight" article in eLife. The insight article can be found here:** Ball, Steven G., and Ugo Cenci, 2017. "Endosymbiosis: Gasping for air." *eLife*;6:e27004. (<https://elifesciences.org/content/6/e27004>)
5. Satjarak A, **Burns JA**, Kim E, and Graham LE, 2017. "Complete mitochondrial genomes of prasinophyte algae Pyramimonas parkeae and Cymbomonas tetramitiformis". *Journal of phycology*. 2017 Feb 12. (<http://onlinelibrary.wiley.com/doi/10.1111/jpy.12521/full>)
4. Nadkarni A*, **Burns JA***, Gandolfi A, Chowdhury MA, Cartularo L, Berens C, Geacintov NE, and Scicchitano DA, 2016. "Nucleotide excision repair and transcription-coupled DNA repair abrogate the impact of DNA damage on transcription." *Journal of Biological Chemistry*, 291(2), pp.848-861. *co-first authors (<http://www.jbc.org/content/291/2/848.long>) ***selected by the JBC editors to be included in the virtual special issue "DNA Polymerases, damage and repair"** (<http://www.jbc.org/site/vi/dna.xhtml>)
3. **Burns JA**, Paasch A, Narechania A, and Kim E, 2015. "Comparative genomics of a bacterivorous green alga reveals evolutionary causalities and consequences of phago-mixotrophic mode of nutrition." *Genome Biology and Evolution*, 7(11), pp.3047-306. (<http://gbe.oxfordjournals.org/content/7/11/3047.full>) ***selected as a featured article in the journal Genome Biology and Evolution. The feature article can be found here:** Venton, Danielle, 2015. "Highlight—What You Eat: Bacterivorous Green Algae Raises Questions about the Evolution of Eating, Photosynthesis." *Genome Biology and Evolution*, 7(11), pp.3115-3115. (<https://doi.org/10.1093/gbe/evv208>)
2. **Burns JA***, Dreij K. *, Cartularo L, and Scicchitano DA, 2010. "O6-Methylguanine induces altered

proteins at the level of transcription in human cells." *Nucleic acids research*, 38(22), pp.8178-8187. *co-first authors (<http://nar.oxfordjournals.org/content/38/22/8178.full>)

1. Dimitri A, **Burns JA**, Broyde S, and Scicchitano DA, 2008. "Transcription elongation past O6-methylguanine by human RNA polymerase II and bacteriophage T7 RNA polymerase." *Nucleic acids research*, 36(20), pp.6459-6471. (<http://nar.oxfordjournals.org/content/36/20/6459.full>)

Preprints

3. Jimenez V, **Burns JA**, Le Gall F, Not F, and Vaultot D, 2020 "No evidence of phago-mixotrophy in *Micromonas polaris*, the dominant picophytoplankton species in the Arctic." bioRxiv. (<https://doi.org/10.1101/2020.05.26.117895>)
2. **Burns JA**, Kerney R, Duhamel S, 2020 "Heterotrophic Carbon Fixation in a Salamander-Alga Symbiosis." bioRxiv. (<https://doi.org/10.1101/2020.02.14.948299>)
1. **Burns JA**, Korzec K, Dorris ER, 2019 "From intent to implementation: Factors affecting public involvement in life science research." bioRxiv. (<https://doi.org/10.1101/748889>)

Book chapters

2. Kerney RK, **Burns JA**, and Kim E, 2017. "Investigating mechanisms of algal entry into salamander cells". In: *Algal and cyanobacteria symbioses* (pp. 209-239).
1. Dreij K, **Burns JA**, Dimitri A, Nirenstein L, Noujnykh T, and Scicchitano DA, 2010. "DNA damage and transcription elongation: Consequences and RNA integrity." *The Chemical Biology of DNA Damage*: 399-437.

Book reviews

1. **Burns JA**, 2013. "Are We Listening to Genomic Noise?" *DNA and cell biology* 32, no. 7: 420-421

Scholarships, grants and awards

- 2020** Gordon and Betty Moore Foundation, " Plankton Photosymbiosis on Chip (SYMBIOCHIP)" (\$605,000 for 30 months – **Co-PI: JA Burns**, Johan Decelle, Ian Probert, Georg Pohnert, PI: Fabrice Not)
- 2017** Gordon and Betty Moore Foundation, "Solar Salamanders: Investigating the only known vertebrate-alga intracellular partnership." (\$1,031,671.07 for 3 years – **Co-PI: JA Burns**, Solange Duhamel, David Matus, PI: Ryan Kerney)
- 2016** Simons Foundation, Life Sciences-Project Awards, award # 488335: "Ancient metabolism: Austerity and the art of the steal." (\$521,384.00 for 2 years – **Co-PI: JA Burns**, A Narechania, PI: Rob DeSalle)
- 2014** NSF EAGER award #1428065: "Mechanisms of Establishing and Maintaining an Algal Endosymbiont in a Vertebrate Host " (\$176,582.00 for 2 years – **Co-PI: JA Burns**, E Kim, PI: Ryan Kerney)
- 2011** Gladys Mateyko Research Award for Excellence in Biology (*Awarded by NYU Biology: This award is given annually to a PhD student who demonstrates excellence in research, academic achievement, involvement and participation in departmental affairs and cooperation with fellow workers.*)

2006 NYU McCracken Graduate Fellowship

Scientific presentations

Invited seminars

- Burns JA**, " Harnessing diversity to reveal the genomic basis of complex traits", Smith College, Northampton, MA, March 23, 2020
- Burns JA**, " I am the same as a fish: A tour of life's diversity" Public Seminar, Sango Kura, Delaware Water Gap, PA, March 16, 2019
- Burns JA**, "Big data linking small things: Microbial systems from organisms to oceans", Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, March 4, 2019
- Burns JA**, " I asked for oxygen and got an alga: A systems biology approach to symbioses", University of Cincinnati, Cincinnati, OH, February 7, 2019
- Burns JA**, "Big data linking small things" University of Liverpool, Liverpool UK, March 26, 2018
- Burns JA**, "Something old and something new, the eukaryotic mold and a symbiotic milieu" Departmental seminar, Gettysburg College, Gettysburg, PA, March 19, 2018
- Burns JA**, Cadiz T, "Amphibian Tales with a Cuban Flair" public seminar at Kettle Creek Environmental Center, East Stroudsburg, PA, July 15, 2017
- Burns JA**, "Amazing Amphibians" public seminar at Kettle Creek Environmental Center, East Stroudsburg, PA, April 24, 2016
- Burns JA**, "Green for good? Exploration of a vertebrate-alga endosymbiosis" Zoology Departmental Seminar, Jagiellonian University, Krakow, Poland, June 19, 2016
- Burns JA**, "From green eggs to green bodies; probing the intracellular association of a salamander host and a green algal symbiont." BioColloquium Series, East Stroudsburg University, May 1, 2015
- Burns JA**, "Probing the relationship between transcription, nucleotide excision repair and DNA stem loops in human cells." Seminar talk at Dept. of Microbiology, Institute of Biomedical Sciences, University of São Paulo, Brazil, November 11, 2011

Professional presentations

Talks

- Burns JA**, Kerney R, Adikes R, Matus D, Duhamel S. Thinking about metabolite transfer from symbiont to host in a vertebrate algal endosymbiosis. ISS 2018, Corvallis, OR, July, 2018 (session chair)
- Burns JA**, Pittis A, Kim E. To eat or absorb? Predicting phagocytosis from genomes. ICOP 2017, Prague, Czech Republic, August, 2017
- Burns JA**, "Green for good? A snapshot of a vertebrate-alga endosymbiosis by dual RNA-Seq" Invited talk at Gordon Research Conference on animal-microbe symbioses, West Dover, VT June 14, 2017
- Burns JA**, Zhang H, Hill E, Kim E, Kerney RK. The green alga and the salamander: a suffocating love story. Protist2016, Moscow, Russia, June 6-10, 2016
- Paasch A, **Burns JA**, Kim E. Retention of bacterivory in the dominantly photoautotrophic green alga *Cymbomonas tetramitiformis* is influenced by phosphate limitation. Protist2016, Moscow, Russia, June 6-10, 2016
- Burns JA**, Zhang H, Hill E, Kim E, Kerney RK. Algal-Salamander symbiosis and single cell transcriptome. Plankton symbiosis and Radiolaria, Roscoff, France, October 16, 2015
- Burns JA**, Paasch A, Narechania A, Kim E. Comparative genomics of a bacterivorous green alga reveals evolutionary causalities and consequences of phago-mixotrophic mode of nutrition. Phycological Society of America (PSA) meeting, Drexel PA, August 12, 2015

Posters

- Morrison E, **Burns JA**, " Inferring ancestry of three eukaryotic lineages using linked lateral transfers" Poster at Simons Conference on Theory and Biology, New York, NY, April 13, 2018
- Burns JA**, "Green for good? A snapshot of a vertebrate-alga endosymbiosis by dual RNA-Seq" Poster at Gordon Research Conference on animal-microbe symbioses, West Dover, VT, July 10, 12-13 2017
- Burns JA**, Chowdhury M, Scicchitano DA. "Simple repeat polymorphisms are not simply induced by DNA repair." Poster at Protist2016 meeting, Oslo, Norway, July 29-August3 2012
- Burns JA**, Gordon Research Conference on DNA Damage, Mutation & Cancer, March 21-26, 2010, Ventura, CA
- Burns JA**, Gordon Research Conference on DNA Damage, Mutation & Cancer, March 5-10, 2006, Ventura, CA
- Dimitri A, **Burns JA**, Broyde S, Geacintov NE, Farley SA, Guengerich F, Rizzo C, Goodenough AK, Scicchitano DA. "Transcriptional bypass of modified guanine bases and unpaired regions of DNA: Biochemical and modeling studies." 9th International Conference on Environmental Mutagens. San Francisco, CA, September 2-8 2005

Campus or Departmental Talks

- Burns JA**. "*Big data linking small things*" Presented to the Science Senate, American Museum of Natural History, June 2018
- Burns JA**. "*Genomics at the museum*" Presented to the Board of Trustees, American Museum of Natural History, May 2017
- Burns JA**. "*Green algal origins and a modern green alga-vertebrate symbiosis*" RGGGS Comparative Biology Seminar, American Museum of Natural History, September 2015

Teaching and mentoring

Teaching

- 2020** Co-instructor for "Transcriptome Data Processing and Analysis" – Richard Gilder Graduate School, American Museum of Natural History, NY, NY.
- 2019** Co-instructor for Environmental Biology II. I am teaching a section (1/3 of the course) on "Physiology at Different Scales". Defined as the evolution of the long-term carbon cycle; the flow of materials and energy within and between organisms and their environments, from microbes to the biosphere. – Columbia University, NY, NY
- 2017** Lecturer for the AMNH Ph.D. Program Richard Gilder Graduate School. Lectures on genome and transcriptome data filtering and on hidden Markov models.
- 2016** Co-instructor for "Transcriptome Data Processing and Analysis" – Richard Gilder Graduate School, American Museum of Natural History, NY, NY. I designed this course to guide students through large datasets. The course includes study design, basic statistics, and differential expression analysis in R as well as lessons on transcriptome assembly and read mapping and the tools and theory therein.
- 2014** Adjunct professor for "Paced Modern Biology I-B-LECTURE " – John Jay College of Criminal Justice, NY, NY
- 2013** Adjunct professor for "Modern Biology I-LAB" – John Jay College of Criminal Justice, NY, NY

- 2008-2010** Teaching assistant for "Molecular and Cell Biology II" – New York University, New York, NY. Designed and presented supplemental lectures to add depth to the main course material; lectures were mandatory.
- 2006-2010** Teaching assistant for "Molecular and Cell Biology I" – New York University, New York, NY. Designed and presented supplemental lectures to add depth to the main course material; lectures were mandatory.
- 2005-2006** Teaching assistant for "Principals of Biology Labs I&II" – New York University, New York, NY.

Mentoring

Postdoctoral researcher: Baptiste Genot (2020-present; BLOS)

Postdoctoral researcher: Dr. Erin Morrison (2017–2019; AMNH)

Outreach

November 2, 2018: Organized a community "science night" with the CYTC group. Brought three microscopy experts and many microscopes for a hands-on session introducing the community to the microbial world around them.

(<https://www.facebook.com/CYTCEastStroudsburg/videos/1203953746421469/>)

May 2018: Co-authored a "Science Breaker" article to introduce non-experts to our vertebrate-alga symbiosis system. (<https://doi.org/10.25250/thescbr.brk101>)

April 22, 2018: Organized a citizen science event for the CYTC community mentoring group. Had young community members participate in a scientific study by putting on waders and collecting salamander egg clutches. (https://www.youtube.com/watch?v=8OuLO1FEv_g)

January 2018: Selected as an eLife ambassador, a group of over 150 scientists around the world committed to implementing strategies to promote responsible practices in science and science publishing. I joined the diversity initiative.

December 2017: Joined outreach group CYTC, "Challenge Yourself To Change", in my hometown of Stroudsburg, PA. My role will be to bring my passion for science to troubled youths to provide positive examples of what they can do in life.

June 2017-February 2018: Participating in an art-science collaboration through the NYC based organization LIGO (<https://www.ligoproject.org/about>). Teamed up with audio artist John Roach to develop an art project from his experiences working with me in the lab (<http://johnroach.net/ligo-the-art-of-science/>). The work will be displayed in a public exhibition in February of 2018.

April 25-26, 2017: Participated in the Biological and Ecological Sciences Coalition's "Congressional Visits Day". Met with congressional offices to discuss federal funding for the sciences.

January 28, 2017: Provided a lab tour and arranged scientific lectures for Boy Scout Troop 14 from Little Falls, NJ at the AMNH.

October 5, 2016: Arranged and gave a museum labs tour to students in the Research Aligned Mentorship (RAM) Program from Farmingdale State College, New York.

2015: Helped make a video in the AMNH "Shelf Life" series on our salamander-alga endosymbiosis project. Link: <http://www.amnh.org/shelf-life/episode-11-green-grow-the-salamanders>.

June 11, 2015: Communicated research activities to social media leaders in a "Speed Science" Tumblr event at the AMNH.

March 15, 2014: Communicated research activities to local middle school students as part of the

Fordham University Career Education Mentoring Program (CEMP).

March 22, 2013: Abstract Art Gallery: FACSAlad (Fluorescent Activated fruit Sorting) Installation. Science-art outreach project 2.

March 1, 2013: Abstract Art Gallery: Exploring the Role of Branched DNA Structures in Human Disease. Science-art outreach project 1.

Fieldwork

2020

- **Trinidad head line sampling and collections research**, Humboldt State University, Arcata, CA
- **10-day Radiolarian sampling with international team**, Sognefjord, Norway

2015

- **10-day road trip for sampling of *Ambystoma gracile* egg masses**, Oregon and Washington states, USA

2013-2014

- **Local sampling of *Ambystoma maculatum* egg masses**, Pennsylvania and New York states, USA

2012

- **One week plankton net sampling for Radiolaria**, Villefranche-sur-Mer, France

2012

- **One week plankton net sampling for Radiolaria**, Songdalfjord, Norway

Professional activities

Literature reviews

Journals: PLOS ONE (2019x3); Symbiosis (2017x1, 2019x1); (Journal of Phycology (2016x1); Mitochondrial DNA Part B (2016x1); Toxicological Sciences (2015x1)

Institutional activities

Member of the ORCA committee on research commercialization at BLOS, August 2019-present. Presented research to AMNH Board of Trustees, Science Policy Committee meeting, May 2017.

Conference activities

Session chair, International Symbiosis Society meeting, July 2018

Other

Societies

- American Institute for the Biological Sciences (AIBS, <https://www.aibs.org/>) member
- *eLife* ambassador (selected for 2018), early career researchers committed to open source publishing and helping other researchers in their careers around the world (<https://elifesciences.org/inside-elifescience/912b0679/early-career-advisory-group-elifescience-welcomes-150-ambassadors-of-good-practice-in-science>).

Popular press

- Frazer J, "Algae living inside salamanders aren't happy about the situation", May 18, 2018 (<https://blogs.scientificamerican.com/artful-amoeba/algae-living-inside-salamanders-arent-happy-about-the-situation/>)
- Hays B, "New phagocytosis model predicts which cells can eat other cells", Feb 20, 2018 (<https://www.upi.com/New-phagocytosis-model-predicts-which-cells-can-eat-other-cells/>)

cells/1571519154785/)

- Campbell P, "Algae lives inside salamander", Pocono Record (front page), May 29, 2017 (<http://www.poconorecord.com/news/20170529/algae-lives-inside-salamander>)
- Dvorsky G, "Scientists Just Found a Completely New Kind of Symbiotic Relationship" Gizmodo, May 2, 2017 (<http://gizmodo.com/scientists-just-found-a-completely-new-kind-of-symbioti-1794811939>)
- McRae M, "We Have Weird New Details on The Strangest Symbiotic Relationship Ever Found" Science Alert, May 3, 2017 (<http://www.sciencealert.com/researchers-dig-into-the-genes-of-a-one-of-a-kind-of-symbiotic-relationship>)
- Norman A, and Galeon D "We Have a New Understanding of the Rarest Symbiotic Relationship in Nature" Futurism.com, May 4, 2017 (<https://futurism.com/we-have-a-new-understanding-of-the-rarest-symbiotic-relationship-in-nature/>)
- Horowitz K, "These Algae Live Inside Growing Baby Salamanders", Mental Floss, May 3, 2017 (<http://mentalfloss.com/article/500575/these-algae-live-inside-growing-baby-salamanders>)