

# MILTON TAN, PhD

## *Curriculum Vitae*

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## EDUCATION

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- 2016 Aug 8 **Auburn University**  
Ph.D, Biological Sciences  
Cumulative GPA: 4.000  
Dissertation: Evolution of Miniaturization and Paedomorphism in Fishes of the Order Cypriniformes  
Major Advisor: Jonathan W. Armbruster  
Committee: Jason W. Bond, Eric Peatman, and Scott R. Santos
- 2009 May 30 **University of Delaware**  
Bachelor of Sciences, Biological Sciences with Concentration in Ecology and Organismal Biology, Honors Degree With Distinction  
Minors: Marine Studies, Business Administration  
Magna Cum Laude (Cumulative GPA: 3.859)  
Senior Thesis: The Effect of Alien Plants on the Survival of Larval Lepidoptera.  
University of Delaware, Senior Thesis. (Thesis Advisor: Doug Tallamy)

## APPOINTMENTS

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- 2016 – 2017 **Emory University**  
Postdoctoral Fellow  
Research Focus: Whale shark comparative genomics and bioinformatics  
Advisors: Timothy D. Read, Alistair D. M. Dove

## PUBLICATIONS

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9. *In press*. ED Burress, **M Tan**. Ecological opportunity alters the timing and shape of adaptive radiation. *Evolution*. doi: 10.1111/evo.13362
8. 2017. TD Read, RA Petit III, SJ Joseph, MT Alam, MR Weil, Maida Ahmad, R Bhimani, JS Vuong, CP Haase, DH Webb, **M Tan (corresponding author)**, ADM Dove. Draft sequencing and assembly of the genome of the world's largest fish, the whale shark: *Rhincodon typus* Smith 1828. *BMC Genomics* 18: 532. doi: 10.1186/s12864-017-3926-9
7. 2017. ED Burress, JM Holcomb, **M Tan**, JW Armbruster. Ecological diversification associated with the benthic-to-pelagic transition by North American minnows. *Journal of Evolutionary Biology* 30(3): 549-560. doi: 10.1111/jeb.13024
6. 2016. CC Stout, **M Tan (co-first author)**, AR Lemmon, EM Lemmon, JW Armbruster. Resolving Cypriniformes relationships using an Anchored Hybrid Enrichment approach. *BMC Evolutionary Biology* 16: 244. doi: 10.1186/s12862-016-0819-5  
*Media features:*  
Auburn University Featured Story [[http://ocm.auburn.edu/featured\\_story/minnows.html](http://ocm.auburn.edu/featured_story/minnows.html)]

5. 2016. **M Tan**, LS de Souza, JW Armbruster. A new species of *Panaqolus* (Siluriformes: Loricariidae) from the rio Branco. Neotropical Ichthyology 14(2): e150033. doi: 10.1590/1982-0224-20150033  
*Selected media features:*  
Amazonas Magazine Nov/Dec 2016: [http://www.reef2rainforest.com/2016/09/20/amazonas-magazine-table-of-contents-nov-dec-2016/]
4. 2016. **M Tan**, JW Armbruster. Two new species of spotted *Hypancistrus* from the Rio Negro Drainage (Loricariidae, Hypostominae). ZooKeys 552: 123-135. doi: 10.3897/zookeys.552.5956  
*Selected media features:*  
Amazonas Magazine Nov/Dec 2016: [http://www.reef2rainforest.com/2016/09/20/amazonas-magazine-table-of-contents-nov-dec-2016/]
3. 2015. JW Armbruster, DC Werneke, **M Tan**. Three new species of saddled loricariid catfishes, and a review of *Hemiancistrus*, *Peckoltia*, and allied genera (Siluriformes). ZooKeys 480: 97-123. doi: 10.3897/zookeys.480.6540  
*Selected media features:*  
CNN [http://www.cnn.com/2015/03/17/us/feat-greedo-catfish-species/]  
Auburn University Newsroom [http://ocm.auburn.edu/newsroom/news\_articles/2015/03/auburn-universitys-armbruster-discovers-catfish-species-names-it-for-star-wars-character.htm]  
Nerdist [http://www.nerdist.com/2015/02/the-closest-thing-to-star-wars-greedo-is-now-a-catfish/]
2. 2014. CK Ray, **M Tan**, & JW Armbruster. First record of *Chrosomus erythrogaster* (Cypriniformes: Cyprinidae) in the Mobile Basin. Southeastern Naturalist 13(4): N33-N36. doi: 10.1656/058.013.0402
1. 2012. **M Tan**, JW Armbruster. *Cordylancistrus santarosensis* (Siluriformes: Loricariidae), a new species with unique snout deplation from the Río Santa Rosa, Ecuador. Zootaxa 3243:52-58.  
*Selected media features:*  
National Geographic Daily News  
[http://news.nationalgeographic.com/news/2012/04/pictures/120410-new-armored-suckermouth-catfish-discovery-animals-science/]  
Zootaxa Top 10 most accessed papers 2012 (8<sup>th</sup> in March)  
[http://www.mapress.com/zootaxa/collections/mostaccess/2012.html]  
Auburn University Graduate School Magazine Fall 2012/Winter 2013  
[http://issuu.com/augraduateschool/docs/fall2012-winter2013]

## OTHER PRODUCTS

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*Bioinformatic tools* (Available on GitHub: <https://github.com/miltontan>)

Stages analysis – Scripts for testing for differences in timing of diversification in two uni- or multivariate traits.

**FELLOWSHIPS & AWARDS**

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*Fellowships*

- 2017 National Science Foundation: Postdoctoral Research Fellowships in Biology in Research Using Biological Collections: “Evolution of Defensive Traits and Diversification in Catfishes” (2 years: \$138,000 stipend, \$30,000 research funds)
- Smithsonian National Museum of Natural History: Global Genome Initiative Fellowship. (2 years: \$104,000 = \$96,000 stipend, \$8,000 research funds). *Declined.*
- 2013–2015 Auburn University Cellular & Molecular Biosciences Peaks in Excellence Research Fellowship (awarded three times, \$13,500 total stipend)
- 2009–2010 Graduate Dean’s Fellowship from Auburn University (\$1,200)

*Society Awards and Honors*

- 2017 Society of Systematic Biologists Ernst Mayr Student Award Symposium Finalist at Evolution 2017 [Title: Diagnosing Effects of Systematic Error and Phylogenetic Signal in Phylogenomics: A Case Study on the Order Cypriniformes]
- 2013 American Society of Ichthyologists & Herpetologists Stoye Award for Best Student Oral Presentation in General Ichthyology at JMIH [Title: What is Miniaturization?: Lack of Miniaturization in the Evolution of Body Size in a Group Including Some of the Smallest Fishes in the World (Danioninae: Cyprinidae)]
- 2011 Neotropical Ichthyological Association Best Student Poster Award winner at JMIH [Title: Molecular phylogenetics of *Hypancistrus* (Loricariidae: Siluriformes) using cytochrome *b*]

*Travel Awards*

- \$250 from Auburn University College of Science and Mathematics to attend Evolution 2016
- \$250 from Auburn University Graduate School to attend Evolution 2016
- \$99 from Society of Integrative and Comparative Biology Charlotte Mangum Student Support to attend SICB annual meeting (2015)
- \$250 from Auburn University College of Science and Mathematics to attend Evolution 2014
- \$300 from American Society of Ichthyologists and Herpetologists to attend Joint Meeting of Ichthyologists and Herpetologists (2014)
- \$250 from Auburn University Biological Sciences Graduate Student Association (2014)
- \$500 from NESCent Academy to attend Next-generation Sequencing Data for Phylogenetics and Phylogeography course (2013)
- \$300 from University of Texas at Austin to attend “Symposium and Workshop on New Methods for Phylogenomics and Metagenomics” (2013)
- \$100 from Auburn University College of Science and Mathematics to attend JMIH (2011)

## TEACHING EXPERIENCE

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### *Graduate Teaching Assistant*

- 2016 Comparative Anatomy – 1 semester  
Tasks included assisting students with active learning through various laboratory activities based on specimens and dissections
- 2009–2015 Human Anatomy & Physiology lab – 15 semesters at Auburn University, AL  
Tasks included teaching anatomical terminology and leading laboratory activities (including cat dissection), and use of virtual laboratory experiments (simulated on computers), to diverse undergraduate students

### *Lecture and Guest Lecture*

- Summer 2016 Guest lecturer for Human Anatomy & Physiology II
- Fall 2015 Guest lecturer for Evolution & Systematics undergraduate class
- Fall 2012 Guest lecturer for Evolution & Systematics undergraduate class
- Spring 2011 Graduate student lecturer for Developmental Molecular Biology  
I prepared and gave four lectures for a graduate level class on topics in developmental molecular biology, such as axis specification, homeobox genes, and reproductive strategies.

### *Undergraduate Research Mentees*

- 2014–2016 Kasey C. Benesh  
2016: Research featured by Office of Undergraduate Research:  
<http://us8.campaign-archive2.com/?u=3e46596f9c72b62dc63ec31c9&id=fc513d4861&e=14187db2c7>  
2015: Awarded Undergraduate Research Fellowship from Auburn University College of Sciences & Mathematics to perform research summer 2015 to spring 2016
- 2016 Travia Johnson
- 2015–2016 Nicholas Chaffin, Robin Lloyd, Jessica McCarthy, Danielle Sander
- 2014–2015 Audrey A. Boggio, Akaash Singh, Hunter Turner, Kristen E. Wright
- 2013–2014 Erika Krahle (Now pursuing Master's Degree)
- 2012–2013 Pamela B. Hart (Now pursuing Master's Degree)
- 2011 Erin Hartsfield, E. Claire Wheeler

### *Training in Teaching*

- 2013–2014 Auburn University Preparing Future Faculty program  
This program developed my skills in teaching through seminars, discussion groups, workshops, and microteaching with teaching critique.

### *Tutoring*

- 2015–2016 Biology Tutor for Office of Diversity and Multicultural Affairs  
Served as a tutor at drop-in center for minority students to receive free tutoring

### *Workshops*

- 2016 R workshop, Joint Meeting of Ichthyologists and Herpetologists 2016  
I helped design and give a one-day workshop to teach basics in data manipulation, analysis, basic programming, and graphics in R

## PRESENTATIONS

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Presentations are oral presentations unless indicated. Undergraduate mentees are underlined.

### *Invited Symposia*

- 2017 Symposium. “Diagnosing Effects of Systematic Error and Phylogenetic Signal in Phylogenomics: A Case Study on the Order Cypriniformes.” Ernst Mayr Symposium, Society of Systematic Biologists, Evolution 2017, Portland, OR.  
[ Watch online: <https://youtu.be/nSNyejRKdW0> ]
- 2015 Symposium. “The All Cypriniformes Tree of Life: a resource for comparative studies applied to diversification and evolution of body size.” American Society of Ichthyologists and Herpetologists, Joint Meeting of Ichthyologists and Herpetologists, Reno, NV.

### *Invited Departmental Seminars*

- 2017 Stephen F. Austin State University.
- Florida Museum of Natural History, University of Florida.
- Emory University, Population Biology, Ecology & Evolution

### *Contributed Presentations*

#### **2017**

36. **M Tan**. A New and Improved Genome Assembly of the Whale Shark (*Rhincodon typus*). Emory University Postdoc Research Symposium. Poster.
35. **M Tan**, ADM Dove, TD Read. A New and Improved Genome Assembly of the Whale Shark (*Rhincodon typus*). Joint Meeting of Ichthyologists and Herpetologists, Austin, TX.
34. **M Tan**, JW Armbruster. Phylogenomic Interrogation of Deep Relationships in the Cypriniformes: Diagnosing the Effects of Error, Signal, and Noise. Joint Meeting of Ichthyologists and Herpetologists, Austin, TX. Poster.

#### **2016**

33. **M Tan**, JW Armbruster. Functional genomic evolution of paedomorphic Cypriniformes. Joint Meeting of Ichthyologists and Herpetologists, New Orleans, LA.
32. ED Burress, O Říčan, L Piálek, J Casciotta, **M Tan**, JW Armbruster. Parallel phenotypic diversification and rapid speciation of *Crenicichla* species flocks: riverine analogs to the East African Great Lake cichlids. Joint Meeting of Ichthyologists and Herpetologists, New Orleans, LA.
31. ED Burress, O Říčan, L Piálek, J Casciotta, **M Tan**, JW Armbruster. Parallel phenotypic diversification and rapid speciation of *Crenicichla* species flocks: riverine analogs to the East African Great Lake cichlids. Evolution 2016, Austin, TX.

30. **M Tan**, JW Armbruster. Functional genomic evolution of paedomorphic Cypriniformes. Evolution, Austin, TX.

**2015**

29. **M Tan**, JW Armbruster. Minnows on the EDGE: Incorporating phylogeny into conservation biology. Southeastern Fishes Council, Gainesville, FL.
28. JW Armbruster, ED Burress, S Ferdous, **M Tan**. The evolutionary ecology of cyprinids. Southeastern Fishes Council, Gainesville, FL.
27. KC Benesh, **M Tan**, JW Armbruster. Range Stability of *Etheostoma tallapoosae* and *Etheostoma stigmaeum*. Southeastern Fishes Council, Gainesville, FL. Poster.
26. **M Tan**, JW Armbruster. Transcriptome Evolution of Paedomorphic Cyprinidae. Joint Meeting of Ichthyologists and Herpetologists, Reno, NV. Poster.
25. JW Armbruster, **M Tan**, M Hayes, CC Stout. The Cypriniform African Invasion. Joint Meeting of Ichthyologists and Herpetologists, Reno, NV.
24. CC Stout, **M Tan**, JW Armbruster. Phylogeography of Leuciscinae. Joint Meeting of Ichthyologists and Herpetologists, Reno, NV.
23. KC Benesh, **M Tan**, JW Armbruster. Shape variation and evolution of the genus *Phenacobius*. Joint Meeting of Ichthyologists and Herpetologists, Reno, NV. Poster.
22. ED Burress, **M Tan**, JW Armbruster. Craniofacial diversification across the cichlid fish adaptive radiation. Joint Meeting of Ichthyologists and Herpetologists, Reno, NV.
21. **M Tan**, JW Armbruster. Building the All Cypriniformes Tree of Life. Auburn University "This Is Research!" Symposium.
20. KC Benesh, **M Tan**, JW Armbruster. Investigation of the Correlation Between Shape Variation of Species in *Phenacobius* and Their Evolutionary Relationships. Auburn University "This Is Research!" Symposium.
19. AA Boggio, **M Tan**, JW Armbruster. Shape evolution in genus *Luxilus*. Auburn University "This Is Research!" Symposium.
18. KE Wright, **M Tan**, JW Armbruster. Geometric morphometrics and shape evolution of *Hybognathus*. Auburn University "This Is Research!" Symposium. Poster.
17. **M Tan**, JW Armbruster. Building the All Cypriniformes Tree of Life. Southeastern Ecology & Evolution Conference, University of Georgia, GA.
16. **M Tan**, CC Stout, AR Lemmon, EM Lemmon, JW Armbruster. Phylogeny of paedomorphic fishes of Cypriniformes using anchored phylogenomics. Society of Integrative and Comparative Biology, West Palm Beach, FL.

**2014**

15. CC Stout, **M Tan**, AR Lemmon, EM Lemmon, JW Armbruster. Preliminary phylogeny of Cypriniformes Based on Anchored Hybrid Enrichment with a Focus on Leuciscinae. Joint Meeting of Ichthyologists and Herpetologists, Chattanooga, TN.
14. **M Tan**, CC Stout, AR Lemmon, EM Lemmon, JW Armbruster. Phylogenomics and the evolution of paedomorphism in Cyprinidae. Joint Meeting of Ichthyologists and Herpetologists, Chattanooga, TN.
13. ED Burress, **M Tan**, JW Armbruster. Ecological diversification among adaptive radiations of Neotropical cichlids. Joint Meeting of Ichthyologists and Herpetologists, Chattanooga, TN.

12. **M Tan**, CC Stout, AR Lemmon, EM Lemmon, JW Armbruster. Phylogenomics and the evolution of paedomorphism in Cyprinidae. Evolution 2014, Raleigh, NC.
11. **M Tan**, CC Stout, AR Lemmon, JW Armbruster. Many Trees for Mini Fishes: Phylogenomic analysis and gene tree discordance in paedomorphic cyprinid fishes. Southeastern Ecology and Evolution Conference, Georgia Southern University, GA.
10. CC Stout, **M Tan**, AR Lemmon, JW Armbruster. Preliminary phylogeny of Cypriniformes based on anchored hybrid enrichment with a focus on Leuciscinae (true minnows). Southeastern Ecology and Evolution Conference, Georgia Southern University, GA.
9. **M Tan** & JW Armbruster. What is Miniaturization? Evolution of body size in diminutive southeast Asian minnows of the subfamily Danioninae. Auburn University Graduate Scholars Forum.

**2013**

8. **M Tan** & JW Armbruster. What is Miniaturization?: Lack of Miniaturization in the Evolution of Body Size in a Group Including Some of the Smallest Fishes in the World (Danioninae: Cyprinidae). Joint Meeting of Ichthyologists and Herpetologists, Albuquerque, NM. **ASIH Stoye Award for best student oral presentation in General Ichthyology.**
7. **M Tan**. Little Fish, Big Questions: In Search of the Genomic Basis of Paedomorphism in Miniature Fishes (Cyprinidae). Auburn University 3 Minute Thesis competition.
6. **M Tan** & JW Armbruster. Body size evolution of the Danioninae. Southeastern Ecology and Evolution Conference, University of Central Florida, FL.

**2012**

5. **M Tan** & JW Armbruster. Molecular phylogenetics of *Hypancistrus* (Loricariidae: Siluriformes) using cytochrome *b*. Evolution 2012, Montreal, Canada. Poster.
4. **M Tan** & JW Armbruster. Phylogenetics of Venezuelan *Hypancistrus* (Loricariidae: Siluriformes): a recent radiation of catfishes? Southeastern Ecology and Evolution Conference, Clemson University, SC.

**2011**

3. **M Tan**, EC Wheeler, JW Armbruster. Geometric morphometric analysis of the genus *Hybopsis* (Cyprinidae: Ostariophysi). Southeastern Fishes Council, Chattanooga, TN.
2. **M Tan** & JW Armbruster. Molecular phylogenetics of *Hypancistrus* (Loricariidae: Siluriformes) using cytochrome *b*. Joint Meeting of Ichthyologists and Herpetologists, Minneapolis, MN. Poster. **Neotropical Ichthyological Association Best Student Poster Award winner.**
1. **M Tan**. Three new species of suckermouth armored catfishes (Siluriformes: Loricariidae: Ancistrini). Southeastern Ecology and Evolution Conference, Auburn University, AL. Poster.

**SERVICE**

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*Organizational Service*

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| 2017      | Emory-LGS STEM Research and Career Symposium volunteer: abstract reviewer               |
| 2016      | JMIH 2016 R workshop planning and teaching  |
| 2014–2015 | Auburn University Biological Sciences Graduate Student Association Biolunch Coordinator |
| 2015      | Session moderator, Oral presentation judge: Southeastern Ecology & Evolution Conference |
| 2015      | Session Co-Chair: Society of Integrative and Comparative Biology                        |
| 2013–2014 | Auburn University Biological Sciences Graduate Student Association President            |

*Editorship*

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| 2016 | Check List – Quality Editor |
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*Peer Review*

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| 2017 | Molecular Phylogenetics & Evolution (2), Reviews in Fish Biology and Evolution, Royal Society Open Science, Scientific Reports, Systematics & Biodiversity, Zootaxa (2) |
| 2016 | Biological Journal of the Linnean Society, Hydrobiologia, Journal of Fish Biology, ZooKeys  |
| 2015 | Journal of Fish Biology, Zoological Scripta   |
| 2014 | Biodiversity Data Journal, ZooKeys  |

*Organizations*

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| 2010–      | American Society of Ichthyologists and Herpetologists                          |
| 2016–      | Society of Systematic Biologists   |
| 2010–2015  | Southeastern Fishes Council  |
| 2009–2016  | Auburn University Biological Sciences Graduate Student Association             |
| 2015       | Society of Integrative and Comparative Biology                                 |
| 2012, 2014 | Society for Study of Evolution   |
| 2012       | Canadian Society for Ecology and Evolution                                     |
| 2009       | University of Delaware chapter Phi Beta Kappa – honors society                 |
| 2006       | University of Delaware chapter Alpha Lambda Delta – first years honors society |



## PROFESSIONAL DEVELOPMENT

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- 2016 SciPhD: The Business of Science for Scientists program – This four-day certificate program provides hands-on preparation for academic scientists for professional positions.
- 2016 Larval Fish Workshop – This two-week workshop provided practical training in identification, curation, and photography of larval fishes
- 2013–2014 Preparing Future Faculty – This year-long certification program developed my skills in teaching through seminars, discussion groups, workshops, and microteaching with teaching critique.
- 2014 NESCent Academy Summer 2014 Course: Next-generation sequencing for phylogenetics and phylogeography – A one week workshop offered providing tools for analysis of next-generating sequencing data for assembling the Tree of Life, delimiting species, and understanding speciation.

## OUTREACH

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### *Research Features*

- 2017 Georgia Aquarium Research & Conservation Newsletter Winter 2017  
[<http://www.georgiaaquarium.org/docs/default-source/pdfs/georgia-aquarium-research-and-conservation-newsletter-winter-2017.pdf>]
- 2013 Auburn University's Graduate School Magazine cover story in Fall 2012/Winter 2013 [<http://issuu.com/augraduateschool/docs/gradmagvolume6>].

### *Public Outreach*

- 2013–2016 Auburn University Biodiversity Learning Center open house events  
Showcase fish research and specimens in the fish collection to educate on fish diversity and the importance of museum collections in research several times a year
- 2010–2016 AU Explore  
Set up and run hands-on exhibits for middle-school children to showcase fish research as part of the Auburn University College of Sciences & Mathematics annual, spring outreach event.
- 2007–2009 Wikipedia  
Extensive editing and addition of pages, especially about catfishes, on Wikipedia.
- October 2007 Coast Day  
Helped run fish biology exhibit as part of the University of Delaware's College of Marine and Earth Studies annual outreach event open to the public.

**FIELD EXPERIENCE**

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2011–2016 Fish collection by seine/electrofishing in various rivers in the Southeastern US.  
January 2016 Fish collection by seine and dip-net across northern Thailand in collaboration with Florida Museum of Natural History.  
June 2012 Lead organizer on collecting trips in Delaware.  
Jan 2012 Fish collection by seine/electrofishing in Ubon Ratchathani province, Thailand.  
July 2011 Fish collection by seine/electrofishing in Michigan, Minnesota, and Wisconsin.  
Dec 2010 Suriname: Contract work with ERM and Suralco involving fish collection by seine and identification of fishes on Nassau plateau.  
Summer 2008 Performed fieldwork as part of senior thesis work in Dr. Douglas Tallamy's entomology lab at the University of Delaware. Tasks included experimental garden maintenance, data collection, and sample sorting.  
Fall 2007 Trained in various field collection techniques such as seining, coring sediments, and trawling in a number of coastal habitats of the Delaware Bay.

**SKILLS**

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**Bioinformatics**

Familiar with using command line interface and submitting jobs for various cluster computing environments (LSF, SGE, SLURM)

Computing languages: bash, R, python

Next-generation DNA sequence assembly and analysis (eg. FastQC, BWA, samtools, Bowtie, Tuxedo pipeline, Trinity, DESeq2)

Statistical analysis in various R packages and basic R scripting skill focusing on comparative phylogenetic methods (eg. ape, phytools, geiger, BAMMtools, etc.)

Phylogenetic analysis (PAUP\*, RAxML/ExaML, mrBayes, Beauti/BEAST, ASTRAL-II, PAML, etc.)

Basic molecular laboratory techniques (DNA extraction, RNA extraction, PCR, gel electrophoresis)

Fish collection by seine, backpack electrofishing, dip net, international fieldwork

Fish specimen preservation/curation, clearing and staining

Fish husbandry

Web design with HTML, CSS, Google Sites, WordPress

Experience with Word, Excel, Powerpoint/Keynote

Graphic design in Adobe Photoshop, Illustrator, Flash

Designed t-shirts for AU Biological Sciences Graduate Student Association

**Training**

Red Cross CPR Training (2011, 2013)

National Safety Council Defensive Driving Course Online 9<sup>th</sup> Edition (2011-present)

Coaching Systems LLC Coaching the Van Driver – 15 passenger program (2011-present)