# MILTON TAN, PHD

#### Curriculum Vitae

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#### **EDUCATION**

# 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**

# 2018 – National Science Foundation Postdoctoral Fellow

George Washington University Visiting Scholar

Smithsonian Research Collaborator

Funded by National Science Foundation Postdoctoral Research Fellowship in Research Using Biological Collections

Research Focus: Evolution of Defensive Traits and Diversification in Catfishes

Sponsor: Guillermo Orti, George Washington University

# 2016 – 2017 Emory University

Postdoctoral Fellow

Research Focus: Whale shark comparative genomics and bioinformatics

Advisors: Timothy D. Read, Alistair D. M. Dove

#### **PUBLICATIONS**

- 9. 2017. ED Burress, **M Tan**. Ecological opportunity alters the timing and shape of adaptive radiation. Evolution 71(11): 2650-2660. 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]

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/]

- 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 deplatation 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 (8th 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**

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

# **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*.

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)

from Auburn University College of Science and Mathematics to attend JMIH (2011) \$100

#### TEACHING EXPERIENCE

# Graduate Teaching Assistant

Comparative Anatomy – 1 semester 2016

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 Graduate student lecturer for Developmental Molecular Biology Spring 2011

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 Krahl (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.

Outside the Classroom

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

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

# **PRESENTATIONS**

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: <a href="https://youtu.be/nSNyejRKdW0">https://youtu.be/nSNyejRKdW0</a>]

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. <u>KC Benesh</u>, **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. <u>AA Boggio</u>, **M Tan**, JW Armbruster. Shape evolution in genus *Luxilus*. Auburn University "This Is Research!" Symposium.
- 18. <u>KE Wright</u>, **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.
- 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

<b>SERVICE</b>	
Organization	nal Service
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
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Editorship	
2016	Check List – Quality Editor
Peer Review	
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
Organization	as
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
PROFESSIO	ONAL DEVELOPMENT
2016	SciPhD: The Business of Science for Scientists program – This four-day certificate
2010	program provides hands-on preparation for academic scientists for professional
	positions.
2016 I	Larval Fish Workshop – This two-week workshop provided practical training in
2010	identification, curation, and photography of larval fishes
2013-2014 I	Preparing Future Faculty – This year-long certification program developed my skills
2015 20111	in teaching through seminars, discussion groups, workshops, and microteaching
	with teaching critique.
2014	NESCent Academy Summer 2014 Course: Next-generation sequencing for
<b>2</b> 017 1	phylogenetics and phylogeography – A one week workshop offered providing
	phylogenetics and phylogeography 11 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**

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 Outrea	ch
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
October 2007	Extensive editing and addition of pages, especially about catfishes, on Wikipedia. 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

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**

**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)