

Matthew Christopher Hale

Curriculum Vitae

Department of Biology
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ACADEMIC BACKGROUND

Education

- Ph.D. 2007** University of Sheffield, Genetics.
M.Sc. 2002 Imperial College, London, Advanced Methods in Taxonomy and Biodiversity.
B.Sc. 2001 Roehampton University, Zoology with Honors (2:1).

Appointments

- Aug 2014 - Present **Assistant Professor**, Department of Biology, Texas Christian University, Fort Worth, Texas.
Aug 2013 - Aug 2014 **Instructor**, Department of Biology, Purdue University, West Lafayette, Indiana.
Aug 2009 - Aug 2013 **Postdoctoral Researcher**, Department of Biology, Purdue University, West Lafayette, Indiana, *advisor*: Dr. Krista M Nichols.
Sep 2007 - Aug 2009 **Postdoctoral Researcher**, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana, *advisor*: Dr. J Andrew DeWoody.
Mar 2007 - Sep 2007 **Research Assistant**, Department of Animal and Plant Sciences, University of Sheffield, UK, *advisor*: Dr. Terry Burke.

TEACHING

Courses Taught

Assistant Professor, Texas Christian University, Department of biology, Fall 2014 to present

- Biology 10503 (Fall semester): Introductory Biology I. A team-taught introductory biology course focusing on the cellular components of life. My classes focused on the process of Photosynthesis, and the molecular components of heredity.
- Biology 40123 (Spring semester): Genetics. An upper level course covering many topics in Genetics, from the basics of inheritance, to molecular genetics, to quantitative, evolutionary, and population genetics.
- Biology 70950 (Spring 2015 and Spring 2017): Assigned problems in Biology: Evolutionary Genetics. A graduate level discussion course designed to critique the literature in evolutionary genetics.
- Biology 40723 (Fall semester): Genomics. An upper level course focusing on the roles next generation sequencing plays in biology. This course includes a lab component, where students get hands on experience with large next-generation sequence datasets.

Instructor, Purdue University, Department of Biology, Fall 2013 to August 2014.

- Biology 241 (Fall 2013): Genetics. A sophomore level course covering introductory genetics.
- Biology 286 (Spring 2014): Ecology and Evolution. A sophomore level course covering the basics process of evolution (speciation, population genetics, phylogenetics), and ecology (mutualism, predation, population dynamics).

- Biology 587 (Spring 2014): Discussion in Evolution. A team-taught graduate level discussion course on evolution. My sections covered quantitative trait loci and linkage mapping analysis, use of association genetics in non-model populations, and sex-bias in gene expression.
- Biology 101 (Summer 2014): Introductory Biology I. Introductory Biology course that focused on the molecular basis of life. Classes focused on the fields of Genetics and Physiology, and covered topics such as transcription, translation, immunology, and lung function.

Guest Lecturer

Texas Christian University, Department of Biology, Spring 2015 – present.

- Conservation Genetics (spring 2015 and Spring 2017), upper level undergraduate and graduate course.

Purdue University, Department of Biology, Fall 2008-Spring 2011.

- Molecular Ecology (Fall 2008, and Fall 2010), graduate level course.
- Advanced Ornithology (Spring 2009), graduate level course.
- Seminar in Evolutionary Genetics (Fall 2009), graduate level discussion course.
- Ecology and Evolution (Spring 2010), sophomore level course.
- Quantitative Genetics (Spring 2011), graduate level course.

Teaching Assistant, University of Sheffield, Department of Animal and Plant Sciences, Fall 2004-Spring 2005.

- Wildlife Forensics (spring 2004 and 2005) sophomore level class.
- Wildlife Ecology (spring 2004) junior level class.
- Introductory Statistics (spring 2004) sophomore level class.

Student Research Supervision

Graduate Theses Directed

Andria Beal 2014 to 2016, “Using RNA-seq to study the sex-role reverse gulf pipefish: Are patterns of sex-bias in gene expression different when we are dealing with Mr. Mom”.

Spencer Weinstein 2016 to present, “Should I stay or should I go? Using NGS approaches to determine the genetic basis of migration in rainbow trout”.

Service on Graduate Theses Committees

Peter Bruns 2016 to present, “The Effects of Thyroid Disruption on Reproduction of Fathead Minnows”. Advisor: Marlo Jeffries

Honors Theses Directed

Tu Huynh, 2016-2017, “Determine phytoene desaturase gene copy number in *Hydrilla verticillata*”. Co-advised with Dean Williams.

Christy Smith, 2015-2017, “Mapping genes involved in phototransduction in rainbow trout (*Oncorhynchus mykiss*).”

Sam Showalter, 2015-2017, “Using RNA-seq data from two years of sampling to determine levels of sex-bias in gene expression in brook trout (*Salvelinus fontinalis*).”

Ben Showalter, 2015-2017, “Using SNP data to uncover the genetic basis of migration between migratory steelhead, and resident rainbow trout (*Oncorhynchus mykiss*).”

Service on Honors Theses Committees

Gunnar Nystrom, 2016-2017, "Cause for concern: Biological implications of heavy metal contamination in Kazakhstan's Syr Darya river". Advisor: Marlo Jeffries.

Eric Reid, 2016-2017, "Testing the specificity and cytotoxicity of biotin-ferrocene compounds on cancer cells". Advisor: Giri Akkaraju.

Kaitlyn Upton, 2016-2017, "DNA barcoding insect species for Texas horned lizard diet analysis". Advisor: Dean Williams.

Elise Path, 2015-2016, "Identifying sensitive indicators of thyroid disruption in fathead minnows after exposure to thyroxine and propylthiouracil". Advisor: Marlo Jeffries.

Alexis Medders, 2015-2016, "Males, masculinity, and immunity: A test of the immunocompetence handicap hypothesis in fathead minnows". Advisor: Marlo Jeffries.

Kristin Scoggin, 2015-2016, "Historic genetic variance of the Texas horned lizard". Advisor: Dean Williams.

Rachel Alenius, 2015-2016, "Diet analysis of Texas horned lizards in urban environments". Advisor: Dean Williams.

Elli Hodge, 2015-2016, "The effects of hepatitis C viral protein, NS5A, on transcription factor NF-KB". Advisor: Giri Akkaraju.

Supervised Undergraduate Students, Texas Christian University (2015 to present).

Christy Smith

Phillip Crain

Courtney Bell

Jessie Yates

Ben Showalter

Sam Showalter

Lauren Burgess

Lauren Tooman

Gabby Nguyen

John-Paul DuBois

Jay Bumgarner

Lynsey Malin

RESEARCH AND CREATIVE ACTIVITIES

22 Refereed Publications (* = TCU graduate student authors, ** = TCU undergraduate student authors)

Claunch KC*, Bush M**, Evans CR*, Malmquist JA*, **Hale MC**, McGillivray SM. (in press).
Transcriptional profiling of the *clpX* mutant in *Bacillus anthracis* reveals regulatory connection with the *lrgAB* operon. *Microbiology*

Hale MC, McKinney GJ, Thrower FP, Nichols KM. (2018) Evidence of sex-bias in gene expression in the brain transcriptome of two populations of rainbow trout (*Oncorhynchus mykiss*) with divergent life histories. *PLoS One*. <https://doi.org/10.1371/journal.pone.0193009>.

Beal AP*, Martin FD, **Hale MC**. (2018) Using RNA-seq to determine patterns of sex-bias in gene expression in the brain of the sex-role reversed Gulf Pipefish (*Syngnathus scovelli*). *Marine Genomics* 37: 120-127.

Hale MC, McKinney GJ, Bell C**, Nichols KM. (2017) Using linkage maps as a tool to determine patterns of chromosome synteny in the genus *Salvelinus*. *G3: Genes, Genomes, Genetics* 6: 3821-3830.

Hale MC, McKinney GJ, Thrower FP, Nichols KM. (2016) RNA-seq reveals differential gene expression in the brains of juvenile resident and migratory smolt rainbow trout (*Oncorhynchus mykiss*). *Comparative Biochemistry and Physiology Part D: Genomics and Proteomics* 20: 136-150.

McKinney GJ, **Hale MC**, Goetz G, Gribskov M, Thrower FP, Nichols KM. (2015) Ontogenetic changes in gene expression in progeny from migratory and resident *Oncorhynchus mykiss*. *Molecular Ecology* 24: 1792-1809.

Hale MC, Colletti J, Gahr SA, Scardina J, Harmon M, Duge M, Phillips RB, Thorgaard GH, Rexroad CE, Nichols KM. (2014) Mapping and expression of candidate genes underlying a major development rate quantitative locus in rainbow trout (*Oncorhynchus mykiss*). *Journal of Heredity* 105: 506-520.

Doyle JM, Siegmund G, Ruhl JD, Eo SH, **Hale MC**, Marra NJ, Waser PM, DeWoody JA. (2013) Microsatellite analyses across three diverse vertebrate transcriptomes (*Acipenser fulvescens*, *Ambystoma tigrinum*, and *Dipodomys spectabilis*). *Genome* 56: 407-414.

Hale MC, Thrower FP, Berntson EA, Miller MR, Nichols KM (2013) Genome-wide association of migration and residency in a non-model fish species, *Oncorhynchus mykiss*. *G3: Genes, Genomes, Genetics* 3: 1273-1285.

Marra NJ, Eo SH, **Hale MC**, Waser PM, DeWoody JA (2012) A priori and a posteriori approaches for finding genes of evolutionary interest in non-model species: osmoregulatory genes in the kidney transcriptome of the desert rodent *Dipodomys spectabilis* (banner-tailed kangaroo rat). *Comparative Biochemistry and Physiology: Part D Genomics and Proteomics*, 7: 328-339.

Hecht BC, Thrower, FP, **Hale MC**, Miller MR, Nichols KM (2012) The genetic architecture of migration related traits in rainbow and steelhead trout (*Oncorhynchus mykiss*) *G3: Genes, Genomes, Genetics* 2: 1113-1127.

Eo SH, Doyle JM, **Hale MC**, Marra NJ, Ruhl JD, DeWoody JA (2012) Comparative transcriptomics and gene expression in larval tiger salamanders (*Ambystoma tigrinum*) gill and lung tissues as revealed by pyrosequencing. *Gene* 492: 329-338.

Billing AM, Lee AM, Skjelseth S, Borg ÅA, **Hale MC**, Slate J, Pärn H, Ringsby TH, Sæther B-E, Jensen H (2012) Evidence of inbreeding depression but not inbreeding avoidance in a natural house sparrow population. *Molecular Ecology* 21: 1487-1499.

Watt PJ, Skinner A, **Hale MC**, Nakagawa S, Burke TR (2011) Small subordinate male advantage in the zebrafish. *Ethology* **117**: 1003-1008.

Hale MC, Xu P, Scardina J, Wheeler PA, Thorgaard GH, Nichols KM (2011) Differential gene expression in male and female rainbow trout embryos prior to the onset of gross morphological differentiation of the gonads. *BMC Genomics* **12**: 404.

Hale MC, Jackson JR, DeWoody JA (2010) Discovery and evaluation of candidate sex-determining genes and xenobiotics in the gonads of lake sturgeon (*Acipenser fulvescens*). *Genetica* **138**: 745-756.

Hale MC, McCormick CR, Jackson JR, DeWoody JA (2009) Next-generation pyrosequencing of gonad transcriptomes in the polyploid lake sturgeon (*Acipenser fulvescens*): the relative merits of normalization and rarefaction in gene discover. *BMC Genomics* **10**: 203. Highly accessed (>6000x).

Slate J, Gratten J, Beraldi D, Stapley J, **Hale MC**, Pemberton J (2009) Gene mapping in the wild with SNPs: guidelines and future directions. *Genetica* **136**: 97-107.

Hale MC, Jensen H, Birkhead TR, Burke TA, Slate J (2008) A comparison of synteny and gene order on the homologue of chicken chromosome 7 between two passerine species and between passerines and chicken. *Cytogenetics and Genome Research* **121**: 120-129.

Slate J, **Hale MC**, Birkhead TR (2007) Simple sequence repeats in zebra finch (*Taeniopygia guttata*) expressed sequence tags: a new resource for evolutionary genetic studies of passerines. *BMC Genomics* **8**: 52.

Hinten GN, **Hale MC**, Gratten J, Mossman JA, Lowder B, Mann MK, Slate J (2007) SNP SCALE: SNP scoring by colour and length exclusion. *Molecular Ecology Notes* **7**: 377-388.

Dawson DA, Burke T, Hansson B, Pandhal J, **Hale MC**, Hinten GN, Slate J (2006) A predicted microsatellite map of the passerine genome based on chicken-passerine sequence similarity. *Molecular Ecology* **15**: 1299-1320.

Book Chapters

Hale MC (in press) Genetic and Epigenetic basis of life history development: fish. In *Encyclopaedia for Reproduction*, 2nd edition. Elsevier.

DeWoody JA, **Hale MC**, Avise JC (2010) Vertebrate sex determining genes and their potential utility in conservation, with particular emphasis on fishes. In *Molecular Approaches in Natural Resource Conservation* (DeWoody JA, Bickham JW, Michler C, Nichols KM, Rhodes OE, Weste K, eds). Cambridge University Press.

Awards

Funded External Grant Proposals

Great Lakes Fisheries Commission. Behavioural and genetic diversity amongst ecotypes of Lake Superior brook trout. (PI = **Matt Hale**, Co-PIs = Krista Nichols, Robert McLaughlin, Chris Wilson, Robert Mackereth), \$53,453 (2015-2017).

The Genome Consortium for Active Teaching – NextGen Sequencing in Undergraduate Education Workshop. 2015. Masculinity and immunity: Using global gene expression data to uncover the relationship between sexual ornamentation and pathogen resistance in male fathead minnows. Funds awarded to cover travel to the workshop (\$800) and next-generation sequencing costs (\$1500). Marlo Jeffries and **Matt Hale**.

Funded Internal Grant proposals

Science and Engineering Research Centre. 2016-2017 \$1,411. Examining sex bias in gene expression in the brain tissue of brook trout. \$1,411. Awarded to Sam Showalter. P.I. **Matt Hale**.

Science and Engineering Research Centre. 2016-2017. \$1,451. Finding polymorphisms associated with migration in the rainbow/steelhead trout genome. \$1,451. Awarded to Ben Showalter. P. I. **Matt Hale**.

Honor's College Research Grant. 2016-2017 \$1,000. Mapping phototransduction genes in the rainbow trout genome. \$1,000. Awarded to Christy Smith. P. I. **Matt Hale**.

Science and Engineering Research Centre. 2016-2017. Mapping phototransduction genes in rainbow trout \$1498. Awarded to Christy Smith. P.I. **Matt Hale**.

TCU Research and Creative Activities Fund. 2016-2017. There and back again: Using genomic methods to determine the genetic basis of migration in rainbow and steelhead trout (*Oncorhynchus mykiss*). \$3744. **Matt Hale**.

TCU Research and Creative Activities Fund. 2015-2016. The genetic basis of freshwater adaptation in gulf pipefish (*Sygnathus scovelli*) \$3996. **Matt Hale**.

Texas Christian University Junior Faculty Summer Research Program. 2015. The genetic basis of freshwater adaptation in gulf pipefish. \$6000. **Matt Hale**.

Texas Christian University Junior Faculty Summer Research Program. 2016. There and back again: Using genomic methods to determine the genetic basis of migration in rainbow and steelhead trout (*Oncorhynchus mykiss*). \$6000. **Matt Hale**

Student Accomplishments

Other Student Awards

Second place for “Adaptation of seahorses and pipefish: Is it in their genes?” by Andria Beal. TCU Three Minute Thesis competition, College of Science and Engineering. Fall 2015.

Second place for “Adaptation of seahorses and pipefish: Is it in their genes?” by Andria Beal. TCU Three Minute Thesis competition. Campus wide. Spring 2016

Presentations (* = TCU graduate student authors, ** = TCU undergraduate student authors)

Weinstein SY*, **Hale MC**, Thrower FP, Nichols KM. 2017. Should I stay or should I go? Analysing the genetic basis of migration-related traits in rainbow trout (*Oncorhynchus mykiss*). **American Society of Evolution**, Portland, Oregon.

Smith C**, Bell C**, **Hale MC**. 2017. Determining the genetic inheritance of phototransduction genes and their influence on migration using linkage mapping. **American Society of Evolution**, Portland, Oregon.

Smith C**, Bell C**, **Hale MC**. 2016. Determining the genetic inheritance of phototransduction genes and their influence on migration using linkage mapping. National Collegiate Honors Council Conference, Seattle, WA. First appearance on annual report.

Beal AP*, Martin D, **Hale MC**. 2016. Using RNA-seq to study the sex-role reverse gulf pipefish: Are patterns of sex-bias in gene expression different when we are dealing with Mr. Mom? **American Society of Evolution**, Austin, Texas.

Smith C**, Bell C**, **Hale MC**. 2016. Mapping phototransduction genes in the *Oncorhynchus mykiss* genome. **American Society of Evolution**, Austin, Texas.

Medders AM**, **Hale MC**, Jeffries MK. 2016. Male fathead minnow phenotypes: Implications for toxicity testing. **South Central Society of Environmental Toxicology and Chemistry Meeting**, Fort Worth, TX.

Hale MC, McKinney GJ, Thrower FP, Nichols KM. 2016. Changes in sex-bias in gene expression in migrant and resident *Oncorhynchus mykiss* during the first two years of development. **Plant and Animal Genome Conference**, San Diego, California.

Hale MC, Thrower FP, Bernston E, Miller MR, Nichols KM. 2013. Using population genomic and association analysis techniques to determine the genetic basis for migration in rainbow and steelhead trout (*Oncorhynchus mykiss*). **American Society of Evolution**, Snowbird, Utah.

Hale MC, Hecht BC, Bernston E, Thrower FP, Nichols KM. 2012. Dissecting the genetic basis for migration in rainbow and steelhead trout (*Oncorhynchus mykiss*). **Plant and Animal Genome**, San Diego, California.

Hale MC, Hecht BC, Thrower FP, Bernston E, Miller MR, Nichols KM. 2011. Association genetics of migration and residency in Rainbow and Steelhead trout (*Oncorhynchus mykiss*). **American Fisheries Society**, Seattle, Washington.

Hale MC, Xu P, McIntyre L, Scardina J, Wheeler P, Thorgaard G, Nichols KM. 2011. Transcriptome profiling of sex and development rate during embryogenesis in rainbow trout (*Oncorhynchus mykiss*). **Plant and Animal Genome**, San Diego, California.

Hale MC, Colletti J, Scardina J, Thrower F, Nichols KM. 2010. Candidate gene discovery and association of embryonic development rate in rainbow trout (*Oncorhynchus mykiss*). **American Society of Evolution**, Portland, Oregon.

Hale MC, Xu P, McIntyre L, Scardina J, Wheeler P, Thorgaard G, Nichols KM. 2010. Transcriptome profiling of sex and development rate during embryogenesis in rainbow trout (*Oncorhynchus mykiss*), **World Aquaculture Society**, San Diego, California.

Hale MC, Jackson R, DeWoody JA. 2009. Transcriptome based discovery and evaluation of candidate sex determining genes and reproductive proteins of lake sturgeon. **America Society of Evolution**, Moscow, Idaho.

Hale MC, Jackson R, DeWoody JA. 2009. Transcriptome based discovery and evaluation of candidate sex determining genes and reproductive proteins of lake sturgeon. **Society for Molecular Biology and Evolution**, Iowa City, Iowa.

Invited Seminars

Hale MC, McKinney, G, Nichols KM. 2016. Should I stay or should I go? Using genetic information to determine the genetic basis of migration in rainbow trout. University of Texas at Tyler.

Hale MC, Thrower F, Nichols KM. 2013. Using genome wide sequence data to determine the genetic basis of migration in rainbow and steelhead trout. Texas Christian University.

Hale MC, Thrower F, Berntson E, Miller MR, Nichols KM. 2013. Genome sequencing of rainbow trout using RAD-tag methodology. Purdue University.

Hale MC, Hecht BC, Thrower F, Bernston E, Miller MR, Nichols KM. 2011. Dissecting the genetic basis for migration in rainbow and steelhead trout. Purdue University.

Hale MC, Lucas J, Jackson RJ, DeWoody JA. 2009. Using and abusing the transcriptome: what you can do with 473,577 sequences? Purdue University.

Hale MC, Jensen H, Birkhead TR, Burke TA, Slate J. 2007. Synteny and gene order on the homologue of chicken chromosome 7 between two passerine species and between passerines and chicken. Purdue University.

Hale MC, Jensen H, Birkhead TR, Burke TA, Slate J. 2006. Constructing Genetic Linkage Maps for Passerine Birds. University of Sheffield.

Hale MC, Slate J. 2005. Methods in Determining Levels of Genetic Polymorphism in Non-Model Species. University of Sheffield.

SERVICE

Departmental Service

Member, Mondays at TCU, 2015-present.

Minute taker for Biology department faculty meetings. 2016-present

Member, Committee on Graduate Studies. 2016-present.

College Service

Member, High power Computer Committee, 2015-present.

Member, Health Professions Advising Committee, 2015-present.

Judge, College of Science and Engineering Honors symposium, April 2016.

Campus Service

Judge, Boller Honors finalists. April 2016.

Professional Service

Member of the Graduate Committee, Department of Animal and Plant Sciences, University of Sheffield, Oct 2004-Oct 2005.

Manuscript Referee

BMC Genomics (15), *BMC Genetics* (2), *Heredity* (5), *PLoS One* (4), *Sexual Development* (1), *Molecular Ecology* (3), *Molecular Ecology Resources* (6), *Genetics* (3), *Journal of Applied Ichthyology* (1), *G3: Genes, Genomes and Genetics* (5), *Evolutionary Applications* (1), *Conservation Genetics* (1), *Comparative Biochemistry and Physiology, Part D- Genomics* (5), *Aquatic Biology* (2).

Professional Affiliations

American Fisheries Society
Genetics Society of America
Society of Ecology and Evolution
American Ornithologist Union