

**UNIVERSITY OF DAYTON**  
COLLEGE OF ARTS AND SCIENCES  
CURRICULUM VITAE

**Name:** Thomas M. Williams

**Date:** 09/2011

**School:** College of Arts and Sciences

**Department:** Biology

**Date hired at UD:** August 16, 2009

**Date eligible for tenure:** 2015

**Date tenured:** N/A

<b>Rank:</b>	<b>From</b>	<b>To</b>	<b>Institution</b>	<b>Full or Part Time</b>
<b>Instructor</b>	Does not apply.			
<b>Assistant Professor</b>	August 16, 2009	Present	University of Dayton	Full Time
<b>Associate Professor</b>	Does not apply.			

**Rank Applied for:** Assistant Professor

**I. Professional Training and Experience**

**A. Academic and Professional Training**

<b>1. <u>College or University</u></b>	<b><u>Degree</u></b>	<b><u>Date</u></b>
University of Michigan, Ann Arbor, MI Department of Human Genetics	PhD	2005
University of Michigan, Ann Arbor, MI Department of Human Genetics	M.S.	2003
Eastern Michigan University, Ypsilanti, MI Biochemistry	B.S. <i>Magna Cum Laude</i>	1999

**2. Current Study:** Does not apply.

**3. Scholastic Honors:** (prizes, honorary societies, scholarships, fellowships, awards, etc.)

2006-2008	NIH/NIGMS Kirschstein National Research Service Award Post-doctoral Fellowship, for training and research support in the Lab of Dr. Sean B. Carroll at the University of Wisconsin, Madison, WI.
2002	James V. Neel Fellowship for Academic Achievement, Department of Human Genetics, University of Michigan, Ann Arbor, MI.
2002-2004	Rackham/International Institute Travel Grant, Horace H. Rackham School of Graduate Studies, University of Michigan, Ann Arbor, MI.
2001-2003	NIH Genetics Training Program Pre-doctoral Fellowship, for training and research support in the Lab of Dr. Jeffrey W. Innis at the University of Michigan, Ann Arbor, MI.

1998-1999 Meta Helwig Research Apprenticeship, Department of Biology, for training and research support in the Lab of Dr. David H. Kass at Eastern Michigan University, Ypsilanti, MI.

4. **Professional Progress (Professional Schools):** Does not apply.  
Certification by Specialty Boards, with dates:

## **B. Professional Experience**

2009-Present Assistant Professor of Biology, Department of Biology, University of Dayton, Dayton, OH.

2009-Present Assistant Professor, Center for Tissue Regeneration and Engineering at Dayton (TREND), University of Dayton, Dayton, Ohio.

2005-2009 Post-doctoral Research Assistant, University of Wisconsin, Madison, WI.  
Advisor: Sean B. Carroll

2000-2004 Graduate Research Assistant, Department of Human Genetics, University of Michigan, Ann Arbor, MI.  
Advisor: Jeffrey W. Innis

2001 Graduate Research Lab Rotation, University of Michigan, Ann Arbor, MI.  
Advisor: Samir M. Hanash

1999-2000 Research Internship, Pfizer, Ann Arbor, MI.  
Advisor: Diane Alessi

1997-1999 Undergraduate Research Assistant, Department of Biology, Eastern Michigan University, Ypsilanti, MI. Advisor: David H. Kass

## **II. Professional Attitudes and Growth**

### **A. Significant Publications in Print -**

#### **1. Books, Pamphlets, and Monographs:**

Rebeiz M. and **Williams TM**. Experimental Approaches to Evaluate the Contributions of Candidate *Cis*-regulatory Mutations to Phenotypic Evolution. (2011) In: Orgogozo V, Rockman M, editors. *Molecular Methods for Evolutionary Genetics*. Humana Press (Vol. 772, ISBN 978-1-61779-227-4)

#### **2. Articles:**

Rogers WA, Stringer SJ, Grover S, Parks J, Rebeiz M, and **Williams TM**. (2013) A survey of the trans-regulatory landscape for *Drosophila melanogaster* abdominal pigmentation. (*Submitted*).

Salomone JR, Rogers WA, Rebeiz M, and **Williams TM**. (2013) The evolution of Bab paralog expression and abdominal pigmentation among *Sophophora* fruit fly species. (Accepted on 8/19/13 to *Evolution and Development*).

Rogers WA, Salomone JR, Tacy DJ, Camino EM, Davis KA, Rebeiz M, and **Williams TM**. (2013) Recurrent Modification of a Conserved *Cis*-Regulatory Element Underlies Fruit Fly Pigmentation Diversity. *PLoS Genet* 9(8): e1003740. doi:10.1371/journal.pgen.1003740

Rogers WA and **Williams TM**. (2011) Quantitative comparison of *cis*-Regulatory Element (CRE) activities in transgenic *Drosophila melanogaster*. *Journal of Visualized Experiments*. Dec; 58 (e3395): 1-6.

- Werner T, Koshikawa S, **Williams TM**, and Carroll SB. (2010) Generation and evolution of a complex wing color pattern controlled by the Wingless morphogen. *Nature*. Apr; 22: 464 (7292): 1143-8. (Cover)
- Williams TM** and Carroll SB. (2009) Genetic and molecular insights into the development and evolution of sexual dimorphism. *Nature Reviews Genetics*. Nov; 10: 797-804.
- Shirangi TR, Dufour HD, **Williams TM**, and Carroll SB. (2009) Rapid Evolution of Sex-Pheromone-producing Enzyme in *Drosophila*. *PLoS Biology*. Aug 7 (8): e1000168.doi:10.1371.pbio.1000168.
- Williams TM**, Selegue JE, Werner T, Gompel N, Kopp A, and Carroll SB. (2008) The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*. *Cell*. Aug 22; 134: 610-623. (Cover).
- Prud'homme B, Gompel N, Rokas A, Kassner VA, **Williams TM**, Yeh SD, True JR, Carroll SB. (2006) Repeated morphological evolution through cis-regulatory changes in a pleiotropic gene. *Nature*. Apr 20; 440 (7087): 1050-3.
- Williams TM**, Williams ME, Heaton JH, Gelehrter TD, and Innis JW. (2005) Group 13 HOX Proteins Interact with the MH2 Domain of R-Smads and Modulate Smad Transcriptional Activation Functions Independent of HOX DNA Binding Capability. *Nucleic Acids Research*. Aug 8; 33 (14): 4475-84.
- Williams TM**, Williams ME, Kuick R, Misek D, McDonagh K, Hanash S, & Innis JW. (2005) Candidate Downstream Regulated Genes of HOX Group 13 Transcription Factors with and without Monomeric DNA Binding Capability. *Developmental Biology*. Mar 15; 279(2): 462-80.
- Williams TM**, Williams ME, and Innis JW. (2005) Range of HOX/TALE superclass associations and protein domain requirements for HOXA13:MEIS interaction. *Developmental Biology*. 2005 Jan 15; 277 (2): 457-71.
- Innis JW, Mortlock D, Chen Z, Ludwig M, Williams ME, **Williams TM**, Doyle CD, Shao Z, Glynn M, Mikulic D, Lehmann K, Mundlos S, and Utsch B. (2004) Polyalanine expansion in HOXA13: Three new affected families and the molecular consequences in a mouse model. *Human Molecular Genetics*. 2004 Nov 15;13 (22): 2841-51.
- Innis JW, Goodman FR, Bacchelli C, **Williams TM**, Mortlock DP, Sateesh P, Scambler PJ, McKinnon W, and Guttmacher AE. A HOXA13 allele with a missense mutation in the homeobox and a dinucleotide deletion in the promoter underlies Guttmacher syndrome. *Hum Mutat*. 2002 May; 19 (5): 573-4.
- Hanash SM, Bobek MP, Rickman DS, **Williams T**, Rouillard JM, Kuick R, and Puravs E. Integrating cancer genomics and proteomics in the post-genome era. *Proteomics*. 2002 Jan; 2 (1): 69-75.
- Dua K, **Williams TM**, and Beretta L. Translational control of the proteome: Relevance to cancer. *Proteomics*. 2001 Oct; 1 (10): 1191-9.
- Kass DH, Raynor ME, and **Williams TM**. Evolutionary History of B1 Retroposons in the Genus *Mus*. *Journal of Molecular Evolution*. 2000 Sep; 51 (3): 256-64.

### 3. **Book Reviews (books reviewed, journals, volumes, pagination):**

- 2013 Reviewer: *Developmental Biology*, and *PLoS Genetics*  
Guest Editor: *PLoS Genetics*
- 2012 Reviewer: *Biology, Fly*, and *Proc. Nat. Acad. Sci.* (3x)
- 2011 Reviewer: *Nature*

2010 Reviewer: *Nature*

2009 Reviewer: *PLoS Biology*

- B. Recent Addresses or Papers (to learned or professional groups in your area of competence--title, groups addressed, date)

**1.) Published Abstracts and Poster Presentations**

Stringer SJ, Grover S, Rogers WA, Rebeiz MR, and **Williams TM**. "Defining the transcription factor genes and their target gene interactions for a model developmental and evolutionary trait." Published abstract, poster presentation at the annual meeting of the Society for Molecular Biology and Evolution, Chicago, IL (2013).

Rogers WA, Salomone JR, Tacy DJ, Camino EM, Rebeiz MR, and **Williams TM**. "The biased evolution of a pleiotropic cis-regulatory element underlies diversity in a sexually dimorphic pigmentation trait." Published abstract, poster presentation at the annual meeting of the Society for Molecular Biology and Evolution, Chicago, IL (2013).

Camino EM, Butts JC, Vellky JE, Rebeiz MR, and **Williams TM**. "A characterization of regulatory linkages in a genetic network for a derived fruit fly trait." Published abstract, poster presentation at the annual meeting of the Society for Molecular Biology and Evolution, Chicago, IL (2013).

Francis KR, Vellky JE, Camino EM, and **Williams TM**. "Inspecting the Regulatory Architecture of a Toolkit Gene Locus Governing Trait Development and Evolution." Published abstract, poster presentation at the annual meeting of the Society for Molecular Biology and Evolution, Chicago, IL (2013).

Rogers W, Salomone J, Tacy DJ, and **Williams TM**. "The mutations, molecular mechanisms, and constraints directing the evolution of a *Drosophila* cis-regulatory element." Published abstract, poster presentation and oral presentation in "Genomes and Evolution" concurrent session at the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, CA (2012).

Camino EM, Francis KR, Vellky JE, and **Williams TM**. "Inspecting the regulatory architecture of a toolkit gene locus governing trait development and evolution." Published abstract and poster presentation for the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, Canada (2012)

Butts JC, McNamee C, Rebeiz M, and **Williams TM**. "A characterization of regulatory linkages in a genetic network for a derived fruit fly trait." Published abstract and poster presentation for the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, Canada (2012)

Salomone JR, Rogers WA, and **Williams TM**. "Identifying cis-regulatory element changes that underlie gene expression and phenotypic evolution between species." Accepted abstract and poster presentation for the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, Canada (2012)

Werner T, Shigeyuki K, **Williams TM**, Bollepogu R, Komal K, and Carroll SB. "The role of toolkit genes in the evolution of complex wing, thorax, and abdominal color patterns in *Drosophila guttifera*. Published abstract and poster presentation for the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, Canada (2012)

Rogers WA, Davis KA, Salomone JR, and **Williams TM**. "The mutational and molecular paths underlying the repeated evolution of a cis-regulatory element generating morphological diversity." Published abstract and poster presentation at the 70<sup>th</sup> Annual Meeting, Society for Developmental Biology, Chicago, IL (2011).

Butts JC, Rebeiz M, and **Williams TM**. "The evolution of a regulatory linkage mediating sexually dimorphic trait

development." Published abstract and poster presentation at the 70<sup>th</sup> Annual Meeting, Society for Developmental Biology, Chicago, IL (2011).

**Williams TM**, Selegue JE, Werner T, Gompel N, Kopp A, and Carroll SB. "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." Presented poster at The MSU Summer Symposium on Transcriptional Regulation and Systems Biology, Michigan State University, East Lansing, MI, July 18-20 (2008).

**Williams, T.M.**, Williams, M.E., Kuick, R., Misek, D.E., McDonagh, K.T., Hanash, S.M., and Innis, J.W. "Identification of Candidate HOX Effectors." Published abstract and poster presentation at the 2004 63<sup>rd</sup> Annual Meeting, Society for Developmental Biology, Calgary, Alberta (2004).

**Williams, T.M.**, Williams, M.E., and Innis, J.W. "Understanding the interaction between MEIS and AbdB-like HOX proteins: nature of interaction and *in vivo* applicability." Published abstract and poster presentation at the 62<sup>nd</sup> Annual Meeting, Society for Developmental Biology, Boston, MA (2003).

**Williams, T.M.**, Williams, M.E., and Innis, J.W. "Yeast two-hybrid analysis provides new information about interaction of HOX proteins with Meis-family cofactors." Published abstract and poster presentation at the 61<sup>st</sup> Annual Meeting, Society for Developmental Biology, Madison, WI (2002).

**Williams, T.M.**, Raynor, M.E., Kass, D.H. "Evolutionary History of B1 Retroposons in the Genus *Mus*." Presented poster at the meeting for The Society for the Study of Evolution, Madison, WI (1999).

## 2.) Invited Seminars and Conference Presentations

**Williams T.M.** "The mutations, molecular mechanisms, and constraints directing the evolution of a *Drosophila* cis-regulatory element." Oral presentation in "Genomes and Evolution" concurrent session at the 71<sup>st</sup> Annual Meeting, Society for Developmental Biology, Montreal, CA (2012).

**Williams, T.M.** "Beyond the birds and the bees: Molecular insights about the making and evolution of fruit fly sexually dimorphic traits." Department of Biological Sciences, University of Cincinnati, Cincinnati OH, 2011.

**Williams, T.M.** "Beyond the birds and the bees: Molecular insights about the making and evolution of fruit fly sexually dimorphic traits." Department of Biology, Eastern Michigan University, Ypsilanti MI, 2010.

**Williams, T.M.** "Beyond the birds and the bees: Molecular insights about the making and evolution of fruit fly sexually dimorphic traits." Department of Biology, Wright State University, Dayton OH, 2010.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." Department of Biology, University of Virginia, Charlottesville VA, 2009.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." Department of Zoology, University of Oklahoma, Norman OK, 2009.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." Department of Biology, University of Dayton, Dayton OH, 2009.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." Center for Ecology and Evolutionary Biology, University of Oregon, Eugene OR, 2009.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila*." School of Biological Sciences, Illinois State University, Normal IL, 2009.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in

*Drosophila.*" Department of Biology, Penn State University, State College PA, 2008.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila.*" Department of Biological Science, Florida State University, Tallahassee FL, 2008.

**Williams, T.M.** "The Regulation and Evolution of a Genetic Switch Controlling Sexually Dimorphic Traits in *Drosophila.*" Evolution Seminar Series, University of Wisconsin, Madison WI, 2008.

- C. **Research in Progress (including creative work) in Progress:** Brief description of the research. When do you expect to complete this work?

**The mutational and molecular paths underlying the repeated evolution of a cis-regulatory element generating morphological diversity**

A central goal of evolutionary biology is to elucidate the mutational steps by which development, and thereby traits evolve. Much of organismal development is wired in the genome as vast regulatory networks that turn genes on and off at the proper time and place. Empirical and theoretical studies implicate mutations in *cis*-regulatory element (CRE) sequences, which control gene expression, as a prominent route by which traits evolve. However, few studies have determined both the mutational (the identity of the relevant mutations) and molecular (biochemical property altered) basis of CRE evolution. Hence, this type of evolutionary path remains poorly understood. One excellent model trait to study CRE evolution is the diverse abdominal pigmentation patterns exhibited by species of the *Drosophilinae* subfamily. These patterns evolved by modifications to a well-characterized gene regulatory network. *Drosophila melanogaster* male-specific abdominal pigmentation is a particularly tractable trait controlled by the Bric-à-brac (Bab) transcription factors. Previously, we identified a CRE controlling female-specific Bab expression, and elucidated aspects of its function and evolution in one lineage. For this proposal, we will characterize the paths by which this CRE's gene-regulatory activity has evolved (1) at a variety of evolutionary depths and (2) to possess diverse sex-specific activities, including male- rather than female-specific expression. Characterizations will range from intraspecific differences between populations, to interspecific divergence between closely-related species, and finally in cases of convergent evolution in distantly-related lineages. Notably, we will reconstruct the sequence and activity of this CRE for several ancestors, making possible the determination of how descendant CREs with distinct activities evolved.

Gene regulatory networks are fundamental to animal development, and each CRE embodies a node in the network. Every mutation that modifies CRE function alters the shape of the network by changing upstream inputs, and thereby causing downstream effects. By characterizing the paths of evolution for a pivotal node in a model developmental network, we foresee providing several new insights into this important means of evolutionary change. Moreover, genetic differences in non-coding sequences are a major cause of phenotypic variation, yet our ability to discriminate functionally-relevant CRE mutations from the myriad of functionally-neutral mutations remains poor. When relevant mutations are identified, often their molecular effects remain enigmatic. Here we will identify such functionally-relevant CRE mutations and thereby reveal which, how many, and by what magnitude mutations alter a CRE's function. Furthermore, we will make connections between CRE mutations and their specific molecular effects, and, as this CRE evolved similar activities in independent lineages, we will empirically demonstrate whether the paths for a CRE's evolution are abundant or limited. Lastly, this study will reveal how evolution has configured orthologous CREs to possess either male- or female-specific activity. Collectively, from these efforts we will advance an understanding of CREs that includes their roles in development, phenotypic variation, sexual dimorphism, and evolution.

The aforementioned research in progress will be completed in several increments, each being a peer-reviewed publication. Realistically, the final completion of these research goals will extend to at least 2015.

**The structure, function, and evolution of a genetic regulatory network (Collaborative research with Mark Rebeiz from the University of Pittsburgh)**

Over the past 40 million years fruit fly species have evolved a great diversity of pigmentation traits. These traits are developmentally controlled by a regulatory network of genes that specify the spatial- and often the sex-specific expression patterns of proteins involved in pigment metabolism. In the fruit fly subgenus *Sophophora*, sexually dimorphic abdominal pigmentation, in which males are darkly colored, evolved from a uniformly unpigmented

(sexually monomorphic) ancestral state. During the evolution of dimorphism, the pigmentation gene network was drastically modified, in part due to sex-specific changes in the expression of genes of the *bab* locus. These genes encode transcription factors whose expression correlates with a variety of pigmentation patterns exhibited among diverse species. This supports the hypothesis that the *bab* locus played an ancient role within this network by regulating the expression of various pigmentation genes. In this proposal, we integrate candidate gene and genome-scale approaches to test this hypothesis, and concomitantly elucidate how Bab-regulation is encoded in target gene *cis*-regulatory (CRE) sequences, how these regulatory sequences and Bab-regulated gene battery evolved to produce diverse pigmentation patterns, and the pleiotropic network effects resulting from natural variation in Bab expression. By characterizing a morphological trait and its underlying network that have dramatically evolved, this proposal offers outcomes that include an understanding of how changes in networks and at individual CRE sequences controlling gene expression modify phenotypes.

Gene regulatory networks are fundamental to animal development, and though the complexity of these networks has been mapped in model organisms, the critical connection between network evolution and phenotypic diversity remains unclear. This proposal provides a unique perspective to these complex networks by investigating how new phenotypic outcomes are achieved through the modification of linkages between pivotal gene members. The *Drosophila* pigmentation model is one of the few traits for which there is sufficient phenotypic diversity, phylogenetic coverage, and knowledge of the underlying gene batteries to connect network change to phenotypic change. An enhanced understanding of this model network will aid both the evolutionary and developmental biology communities in the construction and testing of hypotheses as to how other gene regulatory networks operate, and have changed to control diverse traits in diverse lineages. As this proposal will advance the general understanding of CREs, their individual transcription factor binding site inputs, and how CREs structure genes in networks, these outcomes bear upon the human condition as genetic differences in non-coding sequences are a major cause of phenotypic variation.

The aforementioned research in progress will be completed in several increments, each being a peer-reviewed publication. Realistically, the final completion of these research goals will extend to at least 2014.

#### **The molecular basis and commonality of functional cis-regulatory element variation**

A primary focus of genetic research is to elucidate the mutational changes and molecular mechanisms that alter the process of development and result in phenotypic variation. Several studies have implicated the non-coding portion of the human genome to harbor a substantial proportion of the mutations responsible for heritable health-related phenotypes. **Cis-regulatory elements (CREs)** are one important type of non-coding sequence, which function to specify gene expression patterns. Each CRE possesses an encoded **regulatory logic** derived from numerous sequences that serve as binding sites for certain transcription factor proteins. Some mutations in CREs alter the encoded regulatory logics, and thereby affect gene expression and development. Mutations in human CREs are known that contribute to phenotypic variation, including: plasma cholesterol levels, myocardial infarction risk, developmental disorders, and various disease susceptibilities. The full contribution of such mutations to phenotypic variation remains speculative due to the difficulty in distinguishing functionally-relevant CRE mutations from those that are functionally neutral, and the dearth of studies revealing the molecular mechanisms by which CRE mutations modify regulatory logics.

This proposal has two major goals pertaining to CREs, which will be accomplished using the model organism *Drosophila melanogaster*. First, we will trace the mutational and molecular mechanistic bases for the distinct regulatory logics and functionalities exhibited by alleles of the CRE called the **dimorphic element**. We previously characterized sequences within this CRE that are bound by body plan and sex determination pathway transcription factors. Together the dimorphic element and bound transcription factors specify the region- and sex-specific expression of the *bab* genes and ultimately control the development of male-specific abdominal pigmentation. Our preliminary studies identified functionally distinct dimorphic element alleles from various populations of *Drosophila melanogaster*. These alleles specify different levels and spatial domains of *bab* gene expression and underlie pigmentation variation. Second, we will explore whether other well-studied CREs possess functionally-relevant mutations among populations. Completion of these goals will support a new investigators independent development, and advance the understanding of how certain non-coding mutations make individuals phenotypically distinct. This research will be completed by 2013.

D. **Creative Arts: Artistic Exhibitions, Performances, Composition:** Does not apply.

E. Grants and Contracts (agency, title, date, award amount); proposals:

1. External Research Grants (Awarded)

- 2013 **Title:** A Research Experience for Undergraduate (REU) Supplement to parent award "Collaborative Research: The structure, function, and evolution of a regulatory network controlling sexually dimorphic fruit fly development."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** February, 2013  
**Role:** Principal Investigator  
**Status:** Awarded, 3 months  
**Amount:** \$ 4,900
- 2012-2014 **Title:** "Collaborative Research: The structure, function, and evolution of a regulatory network controlling sexually dimorphic fruit fly development."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** July, 2011  
**Role:** Principal Investigator  
**Status:** Awarded, 3 years  
**Amount:** \$ 450,000
- 2012 **Title:** A Research Experience for Teachers (RET) Supplement to parent award "Collaborative Research: The structure, function, and evolution of a regulatory network controlling sexually dimorphic fruit fly development."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** February, 2012  
**Role:** Principal Investigator  
**Status:** Awarded, 2 months  
**Amount:** \$ 10,000
- 2011-2013 **Title:** "The molecular basis and commonality of functional cis-regulatory element variation."  
**Funding Agency:** American Heart Association, Great Rivers Affiliate  
**Date Submitted:** January, 2011  
**Role:** Principal Investigator  
**Status:** Awarded, 2 years  
**Amount:** \$ 130,302

2. Internal Research Grants (Awarded)

- 2013 **Title:** "Defining the transcription factor genes and their target gene interactions for a model developmental and evolutionary trait."  
**Funding Agency:** Research Counsel Seed Grant, University of Dayton  
**Date Submitted:** October, 2012  
**Role:** Principal Investigator  
**Status:** Awarded, 1 year  
**Amount:** \$ 6,500
- 2012 **Title:** "The structure, function and evolution of regulatory linkages controlling sexually dimorphic fruit fly development."  
**Funding Agency:** Research Counsel Seed Grant, University of Dayton  
**Date Submitted:** October, 2011  
**Role:** Principal Investigator  
**Status:** Awarded, 1 year



**Amount:** \$ 6,500

2011 **Title:** "The mutational and molecular paths underlying the functional modification of a fruit fly *cis*-regulatory element."  
**Funding Agency:** Research Counsel Seed Grant, University of Dayton  
**Date Submitted:** October, 2010  
**Role:** Principal Investigator  
**Status:** Awarded, 1 year  
**Amount:** \$ 11,500

2010 **Title:** "Tracing the mutation paths and molecular mechanisms generating phenotypic variation"  
**Funding Agency:** Research Counsel Seed Grant, University of Dayton  
**Date Submitted:** October, 2009  
**Role:** Principal Investigator  
**Status:** Awarded, 1 year  
**Amount:** \$ 5,000

### 3. External Research Grants (Submitted)

### 4. External Research Grants (Not Funded)

2013-2016 **Title:** "MRI: Acquisition of an Olympus FV1200 Confocal Microscope at the University of Dayton."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** February, 2013  
**Role:** Co-Principal Investigator  
**Total Project Cost:** \$281,467.  
**Status:** Declined

2013-2016 **Title:** "The mutational basis and molecular mechanisms underlying the parallel and divergent evolution of a *cis*-regulatory element."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** January, 2013  
**Role:** Principal Investigator  
**Status:** Declined

2012-2016 **Title:** "The mutational and molecular paths underlying the repeated evolution of a *cis*-regulatory element generating morphological diversity."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** May, 2012  
**Role:** Principal Investigator  
**Status:** Declined

2012-2016 **Title:** "The mutational and molecular paths underlying the repeated evolution of a *cis*-regulatory element generating morphological diversity."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** September, 2011  
**Role:** Principal Investigator  
**Status:** Declined

2012-2015 **Title:** "MRI: Acquisition of a Laser Scanning Confocal Microscope for the University of Dayton."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** January 26, 2012

**Role:** Co-Principal Investigator  
**Total Project Cost:** \$513,074.  
**Status:** Pending

- 2011-2015 **Title:** "The mutational and molecular paths underlying the repeated evolution of a cis-regulatory element generating morphological diversity."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** January, 2011  
**Role:** Principal Investigator  
**Status:** Declined
- 2011-2015 **Title:** "Collaborative Research: The structure, function, and evolution of a regulatory network controlling sexually dimorphic fruit fly development."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** January, 2011  
**Role:** Principal Investigator  
**Status:** Declined
- 2011-2012 **Title:** "Sloan Research Fellowship"  
**Funding Agency:** Alfred P. Sloan Foundation  
**Date Submitted:** September, 2010  
**Role:** Principal Investigator  
**Status:** Declined
- 2011-2014 **Title:** "The molecular nature and impact of gene-regulatory sequence variation on development."  
**Funding Agency:** March of Dimes  
**Date Submitted:** September, 2010  
**Role:** Principal Investigator  
**Status:** Declined
- 2011-2015 **Title:** "The mutational and molecular paths underlying the repeated evolution of a cis-regulatory element generating morphological diversity."  
**Funding Agency:** National Science Foundation  
**Date Submitted:** July, 2010  
**Role:** Principal Investigator  
**Status:** Declined

**F. Membership in Learned Societies:**

Society for Molecular Biology and Evolution	2013-Present	Member
Society for Developmental Biology	2011-Present	Member
Sigma Xi	2010-Present	Member
Society for Developmental Biology	2002-2004	Member

**G. Meetings of Professional Associations Attended During the Past Two Years**

Annual Meeting for the *Society for Molecular Biology and Evolution*, Chicago, IL, *Attendee* (July 2013).

71<sup>st</sup> Annual Meeting for the *Society for Developmental Biology*, Montreal, Canada, *Invited speaker* (July 2012).

70<sup>th</sup> Annual Meeting for the *Society for Developmental Biology*, Chicago, IL, *Attendee* (July 2011).

H. **Honorary Degrees, Professional Honors & Awards:** Does not apply.

I. **Leave of Absence (year, purpose, results):** Does not apply.

### III. Performance of Non-Instructional Duties

#### A. General Service

1. **Academic Administration:** None

2. **Non-Academic Administration:** None

3. **University-wide Committees:** None

<u>Name of Committee</u>	<u>Dates</u>
University of Dayton, Teaching Fellow	2011-2012

4. **College Committees**

<u>Name of Committee</u>	<u>Dates</u>
Pre-Medical Advising Committee	2009-Present

5. **Departmental Committees**

<u>Name of Committee</u>	<u>Dates</u>
Advising Committee	2009-Present
Tissue Regeneration & Engineering Dayton (TREND)	2009-Present
Graduate Coordinating, Curriculum and Assessment Committee	2010-Present
Graduate Admission Committee	2010-Present
Career Development Committee	2011-Present
Lancaster-McDougal Award Committee (Chair)	2012-Present
Undergraduate Recruitment	2012-Present

6. **Non-University Committees:**

<u>Agency</u>	<u>Nature of Work</u>	<u>Dates</u>
National Science Foundation (EEB)	Grant Reviewer	2010
National Science Foundation (IOS)	Grant Reviewer	2010
National Science Foundation (DEB)	Panelist	2011
National Science Foundation (IOS)	Grant Reviewer	2012

7. **Other Activities on Behalf of the University**

**Discovery Lab Day:** Hosted prospective undergraduate students and introduced them to my lab's research program and opportunities that are available to undergraduates in this program. (2010 -2013).

**Research Internships:** for Brandon Hampshire (DECA, 2012-2013) and Katie Poulsen (West Carrollton Middle School, 2013).

**Paws for a Cause (UD Chapter):** Faculty adviser (2012-2013)

#### **Outside seminar speaker recruitment and host:**

Scott Barolo, University of Michigan, "Working Out the Logic of Gene Regulation" October 17<sup>th</sup>, 2013.

Mike Levine, University of California at Berkeley, "Mechanisms of Transcriptional Precision in the Drosophila Embryo" September 20<sup>th</sup>, 2012. \*\* Invited as a Distinguished Speaker \*\*

Albert Erives, University of Iowa, "Evolution of Developmental Gene Regulation Across a Genome" March 15<sup>th</sup>, 2012.

Matthew Cox, Georgia Institute of Technology, Careers Seminar: "Pursuing sustainability for a living: Climate, Energy, and Environmental Policy", March 6<sup>th</sup>, 2012.

Douglas Hansen, University of Dayton Research Institute, Careers Seminar: "From Marine Biologist to Corrosion Electrochemist: A most Unusual Career Path" October 21<sup>st</sup>, 2011.

Mark Rebeiz, University of Pittsburgh, "Morphological evolution and the origination of regulatory novelties" March 10<sup>th</sup>, 2011.

Joshua Gross, University of Cincinnati, "Genetic basis for morphological evolution in the blind Mexican cavefish" September 30<sup>th</sup>, 2010.

Armin Moczek, Indiana University, "On the origin of novelty and diversity in development and evolution: a case study on beetle horns" April 8<sup>th</sup>, 2010.

B. Professional Activities in the Community: None

**Academic Outreach:**

Seminar on "Career and Family Planning" to the Summer Undergraduate Lunch Club at the University of Dayton (August 7<sup>th</sup>, 2013)

Provide job shadow experiences to West Carrollton School District students (2013-present).  
Katie Poulsen (2013, West Carrollton Middle School)

Poster Presentation judge for the for the Beta Beta Beta NE-4 District Regional Convention (March 23, 2013)

Mentoring Brandon Hampshire, a senior at the Dayton Early College Academy, through a molecular genetics research project (August 2012 – present).

Hosted West Carrollton High School teacher Mrs. Jennifer Parks as a NSF-sponsored RET scholar in my laboratory to participate in my research program and to develop a *Drosophila* exercise for her Biology classes. (June – August, 2012)

Hosted 20 West Carrollton High School Honors Biology Students for a lecture and lab exercise titled "*Switches that turn genes on: How we study them and why they are important.*" (May 10<sup>th</sup> 2012)

Hosted 25 West Carrollton High School Honors Biology Students for a lecture and lab exercise titled "*Switches that turn genes on: How we study them and why they are important.*" (April 25<sup>th</sup> 2011)

Developed a fruit fly lab exercise for Mrs. Jennifer Parks Honors Biology classes at West Carrollton High School, West Carrollton, OH (2010).

Provided job shadow experiences for Dayton Early College Academy students (2011-present).  
Brandon Hampshire (2011), Christopher Madison (2011), Jasmine McClure (2011)

C. Any Other Pertinent Information: None

**1. Undergraduate Advising and Mentorship**

### **Berry Scholar/Honors Thesis Advisor**

2012-Present	Samantha Stringer, "Determining the Transcription Factor Genes Populating a Fruit Fly Pigmentation Gene Network and Their Regulatory Connections."
2011-Present	Kaitlyn Francis, "Identifying the DNA sequences encoding a synergistic interaction between two cis-regulatory elements."
2011-Present	Jordan Vellky, "Red Light, Green Light: A Novel Approach to Study Interactions between Enhancers and Gene Promoters."
2010-2013	Connor McNamee, "The ancestry and evolution of the fruit fly <i>t_MSE</i> cis-regulatory element."
2010-2013	Joseph Salomone, "The Shaping of a Dimorphic Trait: The Evolution of Bab Paralog Expression and Abdominal Pigmentation among <i>Sophophora</i> Fruit Fly Species"
2010-2012	David Tacy, "Visualizing Evolution through Differences in Gene Expression."

### **Honors Students Symposium Presentations**

2013	Kaitlyn R. Francis, "Identifying the DNA Sequence Requirements for a Synergistic Interaction Between Two Cis-Regulatory Elements."
2013	Joseph R. Salomone, "The Shaping of a Dimorphic Trait: The Evolution of Bab Paralog Expression and Abdominal Pigmentation among <i>Sophophora</i> Fruit Fly Species ."
2013	Connor W. McNamee, "The Ancestry and Evolution of the Fruit Fly <i>t_MSE</i> Cis-Regulatory Element."
2012	David J. Tacy, "Visualizing Evolution through Differences in Gene Expression."

### **Undergraduate Student Laboratory Mentorship**

2013-present	Mary List (BIO)	2012-present	Molly Cremons (BIO)
2012-present	Samantha Stringer (MED)	2011-present	Jordan Vellky (BIO)
2011-present	Kaitlyn Francis (HHS)	2011-2012	Paul Berning (BIO)
2010-2013	Connor McNamee (MED)	2010-2012	David Tacy (BIO/PSY)
2010-2013	Joseph Salomone (BIO)	2010	Kelly Gartland (CHM)
2009-2011	Eric M. Camino (BIO)	2009-2011	John Butts (BIO)
2009-2011	Kristen A. Davis (MED)	2009-2010	Sophia Raptis (BIO)

### **Learn Lead and Serve Award Mentor**

None

### **Faculty Advisor: UD Annual Stander Symposium Undergraduate Research Forum**

- 2013 Salomone JR and **Williams TM**. "The Shaping of a Dimorphic Trait: The evolution of Bab paralog expression and abdominal pigmentation among *Sophophora* fruit fly Species." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2013 Francis KR, and **Williams TM**. "Identifying the DNA sequence requirements for a synergistic interaction between two cis-regulatory elements." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).

- 2013 Vellky JE, Camino EM, and **Williams TM**. "Red Light, Green Light: A Novel Approach to Study Interactions between Enhancers and Gene Promoters." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2013 Stringer SJ, Grover S, Rogers WA, and **Williams TM**. "Defining the transcription factor genes and their target gene interactions for a model developmental and evolutionary trait." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2013 McNamee CW and **Williams TM**. "The ancestry and evolution of the fruit fly t\_MSE cis-regulatory element." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2012 Salomone JR, Rogers WA, and **Williams TM**. "Identifying cis-regulatory element changes that underlie gene expression and phenotypic evolution between species." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 18 (2012).
- 2012 Tacy DJ, and **Williams TM**. "Visualizing Evolution through Differences in Gene Expression." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 18 (2012).
- 2011 Camino EM, Rogers WA, and **Williams TM**. "Elucidating the role of cis-regulatory interactions in development and evolution." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 13 (2011).
- 2011 Butts JC, and **Williams TM**. "The molecular mechanisms of Drosophila pigmentation gene network structure and evolution." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 13 (2011).

### Undergraduate Student Awards

- 2013 Samantha J. Stringer received a Research Experience for Undergraduate (REU) award to support her summer research in the Williams Lab.
- 2013 Joseph R. Salomone received the John E. Dlugos, Jr. Memorial Award of Excellence to the Outstanding Senior major in Biology.
- 2013 Honors Thesis Research Proposal and Grant Request titled "*Identifying the DNA sequences encoding a synergistic interaction between two cis-regulatory elements.*" Awarded to Kaitlyn R. Francis.
- 2013 Honors Thesis Research Proposal and Grant Request titled "*Determining the Transcription Factor Genes Populating a Fruit Fly Pigmentation Gene Network and Their Regulatory Connections.*" Awarded to Samantha J. Stringer.
- 2013 Honors Thesis Research Proposal and Grant Request titled "*Red Light, Green Light: A Novel Approach to Study Interactions between Enhancers and Gene Promoters.*" Awarded to Jordan E. Vellky.
- 2013 Joseph Salomone was recognized with the Joseph E. Scherger, MD, MPH Leadership in Medicine Award to a Graduating Premedical Student who has Demonstrated Leadership toward Improving the Health of the Public through better Health Care.
- 2012 David Tacy received the John E. Dlugos, Jr. Memorial Award of Excellence to the Outstanding Senior major in Biology.
- 2012 Joseph Salomone's poster titled "*Identifying cis-regulatory element changes that underlie gene expression and phenotypic evolution between species*" was awarded 2<sup>nd</sup> place among undergraduate students at the 71<sup>st</sup> annual meeting for the *Society for Developmental Biology*, in Montreal, CA.

- 2012 Lancaster-McDougall Award recognizing undergraduate students who demonstrate extraordinary skill and creativity in research and scholarship. Awarded to Joseph R. Salomone.
- 2012 Honors Thesis Research Proposal and Grant Request titled "Resurrecting dead cis-regulatory elements to trace the mutational basis of new gene activities." Awarded to Joseph R. Salomone.
- 2012 Honors Thesis Research Proposal and Grant Request titled "The ancestry and evolution of the fruit fly *t\_MSE* cis-regulatory element". Awarded to Connor W. McNamee.
- 2012 Berry Summer Thesis Institute membership awarded to Kaitlyn R. Francis for her research project titled "Identifying the DNA Sequence Requirements for a Synergistic Interaction Between Two Cis-Regulatory Elements".
- 2011 Lancaster-McDougall Award recognizing undergraduate students who demonstrate extraordinary skill and creativity in research and scholarship. Awarded to David J. Tacy.
- 2011 Honors Thesis Research Proposal and Grant Request titled "Visualizing Evolution through Differences in Gene Expression". Awarded to David J. Tacy.
- 2011 Szabo Scholarship. Awarded to Joseph R. Salomone to sponsor his undergraduate research efforts.

**Undergraduate Student Advising:**

Spring	2013:	5 Premed Majors; 20 Biology Majors
Fall	2012:	5 Premed Majors; 20 Biology Majors
Spring	2012:	3 Premed Majors; 20 Biology Majors
Fall	2011:	3 Premed Majors; 20 Biology Majors
Spring	2011:	5 Premed Majors; 12 Biology Majors
Fall	2010:	4 Premed Majors; 12 Biology Majors
Spring	2010:	5 Premed Majors; 7 Biology Majors
Fall	2009:	6 Biology Majors

**2. Graduate Student Advising and Mentorship:**

**Doctoral Dissertation**

None

**Masters Thesis**

- 2012 John Butts successfully defended his Masters Degree thesis research titled "*Tracking the sequences of regulatory linkages and their evolution within a fruit fly gene regulatory network*". (August 8<sup>th</sup> 2012)

**Graduate Student Awards:**

- 2013 PhD Student, Sumant Grover, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "*Identifying the transcription factor genes and regulatory sequence interactions for a model developmental and evolutionary trait.*"
- 2013 PhD Student, Eric Camino, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "*The making and evolution of a composite gene expression pattern controlling pigmentation development.*"

- 2013 PhD Student, William Rogers, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "The mutations, molecular mechanisms, and constraints directing the evolution of a *Drosophila* cis-regulatory element."
- 2012 PhD Student, Williams A. Rogers, John J. Comer Graduate Research Award of Excellence to the Biology Graduate Student who best demonstrates research excellence in Biomedical Science. Awarded by the UD Biology Department.
- 2012 MS Student, John C. Butts, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "A genetic investigation of the cis-regulatory element encodings responsible for an evolved pigmentation trait."
- 2011 PhD Student, Williams A. Rogers, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "The mutational and molecular paths underlying the functional modification of a fruit fly *cis*-regulatory element."
- 2011 MS Student, John C. Butts, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "The molecular mechanisms of *Drosophila* pigmentation gene network structure and evolution."
- 2010 MS Student, Williams A. Rogers, UD Graduate School Dean's Summer Fellowship Award for the proposal titled, "Determining the Mutational Paths and Molecular Mechanisms Generating Phenotypic Variation."
- 2010 MS Student, Williams A. Rogers, The Graduate Teaching Award of Excellence to a Teaching Assistant for Outstanding Teaching of Advanced Biology Laboratory Classes, Awarded by the UD Biology Department.

#### **Graduate Faculty Mentor:**

- |              |                                |
|--------------|--------------------------------|
| 2012-present | Sumant Grover, PhD student     |
| 2011-present | Eric M. Camino, PhD student    |
| 2010-2012    | John C. Butts, MS student      |
| 2009-present | William A. Rogers, PhD student |

#### **Graduate Advisory Committee Member**

- |              |                                                                     |
|--------------|---------------------------------------------------------------------|
| 2011-present | PhD student Wei Wang, University of Alabama (Lab of Dr. John Yoder) |
| 2010-present | PhD student Konstantinos Sousounis (Lab of Dr. Takis Tsonis)        |
| 2009-present | PhD candidate Alissa Blystone (Lab of Dr. Karolyn Hansen)           |

#### **Graduate Student Stander Symposium Advisor:**

- 2013 Grover S, Stringer SJ, Rogers WA, and **Williams TM**. "Defining the transcription factor genes and their target gene interactions for a model developmental and evolutionary trait." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2013 Rogers WA, Salomone JR, and **Williams TM**. "The mutations, molecular mechanisms, and constraints directing the evolution of a *Drosophila* cis-regulatory element." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2013 Camino EM, Vellky JE, Cremons MK, List MP, and **Williams TM**. "A Characterization of Regulatory Linkages in a Genetic network for a Derived fruit fly Trait." Poster at the Stander Symposium, University of Dayton, Dayton, OH, April 17 (2013).
- 2012 Rogers WA, Tacy DJ, Salomone JR, and **Williams TM**. "The mutations, molecular mechanisms, and constraints



directing the evolution of a *Drosophila* cis-regulatory element." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 18 (2012).

- 2012 Camino EM, Francis KR, Vellky JE, and **Williams TM**. "The bab Locus Model for Synergistic Gene Regulatory Interactions in Development and Evolution." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 18 (2012).
- 2012 Butts JC, McNamee CW, and **Williams TM**. "An evolutionary characterization of regulatory linkages in a genetic network for an evolved fruit fly trait." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 18 (2012).
- 2011 Rogers WA, Davis KA, Salomone JR, and **Williams TM**. "The mutational and molecular paths underlying the repeated evolution of a cis-regulatory element generating morphological diversity." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 13 (2011).
- 2010 Rogers WA, Davis KA, and **Williams TM**. "Determining the Mutational Paths and Molecular Mechanisms Generating Phenotypic Variation." Poster at Stander Symposium, University of Dayton, Dayton, OH, April 13 and 14 (2010).

### 3. Teaching Overview

#### Courses Taught at the University of Dayton

**BIO 299 "Sophomore Seminar"**, 1 credit hour Sophomore-level required course for BIO and EVB majors.

**BIO 312 "General Genetics"**, 3 credit hour lecture course. Sophomore-level requirement for BIO and EVB majors; elective for MED, DEN and other majors.

**BIO 312H "Honors General Genetics"**, 3 credit hour lecture course. This is an advanced section of General Genetics that additionally assigns students reading and writing assignments on contemporary genetics research. Sophomore-level requirement for BIO and EVB majors; elective for MED, DEN and other majors.

**BIO 312 L "Genetics Lab"**, 1 credit hour lab course that uses laboratory experiments to reinforce key concepts of the General Genetics course (BIO 312).

**BIO 421 "Biological Problems"**, 1 credit hour BIO major independent research project.

**BIO 445 "Evolution and Development"**, 3 credit hour honors course covering the genetic bases for animal development and evolution.

**BIO 477 "Honors Thesis: Independent Research"**, 3 credit hour honors thesis supervision.

**BIO 478 "Honors Thesis: Independent Research"**, 3 credit hour honors thesis supervision.

**BIO 545 "Evolution and Development"**, 3 credit course tailored to the needs of graduate students and that covers the emerging understanding of animal evolution through the study of development.

**BIO 596 "Genetic Networks"**, 2 credit hour graduate-level course (undergraduate students allowed with instructors permission) that covers contemporary literature on gene expression regulation during the process of animal development.

**BIO 596 "Regulatory Evolution"**, 2 credit hour graduate-level course (undergraduate students allowed with instructors permission) that covers contemporary literature on the evolution of developmental gene expression patterns.

**BIO 596 "Genome Evolution"**, 3 credit hour graduate-level course that looks at whether a combined consideration of population genetics and development makes the path of genome evolution predictable.

**BIO 596 "Modern Genetics"**, 2 credit graduate-level course focused on an in depth reading of contemporary genetics research publications.

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