Pew Research Proposal Form
Union University
Fall 2016

Cover Sheet

Name(s) of Applicant(s): **Jeremy D. Blaschke, MS, PhD**

Title of Proposed Project:

Tapeworms in Eden: Exploring Christian Thought, Scientific Tradition, and Modern Phylogenetics on the Origin of Parasitism

Primary Discipline: **Biology** Secondary Discipline(s): **Philosophy, Theology**

Has this proposal been submitted to another agency, publication, or program? **No**

If so, which one(s)?

Location of proposed research: **Union University, Jackson, TN**

Desired start date: **June 1, 2016**

Recommending Scholars and their disciplines:

External:
Joseph Francis, PhD
Chair, Dept. of Biological Sciences
The Master's University
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Union:
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In consultation together, we recommend the approval of the proposal as an acceptable project and affirm that the applicant has the professional wherewithal to accomplish the project satisfactorily.

Chair of your department _____ Date: _____

Dean of your school: _____Date: _____

PEW RESEARCH PROPOSAL

Title: Tapeworms in Eden: Exploring Christian Thought, Scientific Tradition, and Modern Phylogenetics on the Origin of Parasitism

Statement of the end products: This research will be published in the *Journal of Creation Theology and Science* and presented at the annual meeting of the Creation Biology Society (Origins 2018, Pittsburgh, PA) and the 8th International Conference on Creationism (Pittsburgh, PA). Additionally, results will be reformatted for use in a special topics course at Union University where students can discuss important questions about God's goodness and the presence of natural evil in our world.

Explanation of the scholarly activity:

I. Statement of the scholarly activity: The interaction of two specific questions will be explored: does nature reflect truths about the Creator? and did God intentionally create parasites?

II. Description of the activity and its goals: The following objectives will be pursued:

1. Examine the historical Judeo-Christian philosophies about nature and God. How have these philosophies changed throughout history, specifically during the Renaissance, after the discovery of major parasitic diseases of humans in the 18th and 19th centuries, and after Darwin? What does the Bible say about the natural world and its purpose for us?
2. Collect and evaluate hypotheses about the origin of parasites from diverse perspectives, including young-earth creationism, old-earth creationism, theistic evolution, and traditional evolution. What is the current evidence for and against each position?
3. Research historical and modern scientific theories about the evolution of parasites. Why do parasites exist biologically? From what kinds of animals have they evolved?
4. Conduct a meta-analysis of modern phylogenetic research that includes ancestral state reconstruction of parasitic groups. How often does parasitism evolve from within clades of mutualistic organisms? How do these results fit a creation narrative?
5. Analyze a novel phylogeny of parasitoid flies (Diptera: Tachinidae) using ancestral state reconstruction and interpret their evolution from both creationist and evolutionist perspectives. Why and how are tachinid flies so diverse (>10,000 species)? Is there any evidence that they have/had an ecological role other than parasitism?

III. Theoretical framework: If you sit in a meadow for a few minutes on a sunlit afternoon in August, you are sure to discover a multitude of fascinating plants and animals in abundance around you. If observant, you may spy a quick-flying insect with a brightly colored orange abdomen resting on goldenrod (*Solidago*) or Queen Anne's lace (*Daucus carota*). This beautiful fly gently probes the flowers with an elongated proboscis and sips nectar for energy as it picks up pollen grains in the elongated hairs on its hind legs. These pollen combs are what give *Trichopoda pennipes* its common name, the feather-footed fly. The ecological relationship between fly and flower is mutually beneficial. Flowers increase their genetic diversity through sexual reproduction and flies are provided an energy-rich gift in exchange.

Mutualistic relationships are easily understood from a Christian worldview. The flowers and flies appear perfectly designed to be helpful and even kind to one another. More importantly, they appear to thrive in a relationship. If nature communicates truths about the Creator, one very important truth is that God yearns for relationships. He has designed his creation to function best in relationships, and this applies to *Homo sapiens* above all other species as we are made in his image. We were created to prosper not only through relationships with each other or with other species, but ultimately through an intimate relationship with the Creator himself. This idea of unity through diversity is wonderfully visualized on a happy summer day when beauty abounds around us.

However, nature also has a sinister side. After the female *T. pennipes* fills its belly with sugary nectar, it dives below the vegetation, its antennae twitching with the chemical signals of various plants and insects at ground level. It is looking for a specific chemical signature that is secreted by stink bugs (*Nezara viridula*). Stink bugs, as anyone who has handled them knows, use their potent smells to repel unwanted visitors. They also use these chemicals to communicate with other stink bugs about potential food sources, overwintering locations, and mating availability. The female feather-footed fly has tapped into these chemical communications and now uses them to her own advantage. When the signal is detected, she follows the aromatic trail upwind until the stink bug source is located. Immediately, the fly lands on the stink bug and a few seconds later abruptly flies away on a new quest.

During its remarkably brief contact with the stink bug, the female fly has laid two or three eggs on the dorsal side of the thorax – a place the stink bug cannot reach with any of its six squirming legs. After a few hours, the eggs hatch and a tiny fly larva uses razor sharp mandibles

to scrape away the exoskeleton of the stink bug until a hole large enough to squeeze through has been created. The larva burrows inside and attaches itself to the internal respiratory tubes of its host. Through these tubes, the larva receives oxygen and for the next 10-14 days it sways freely in the nutritive broth of the stink bug abdomen.

The fly needs its host to stay alive until development is complete, so rather than consuming any internal organ available – and thus potentially destroying its host quickly – the fly larva preferentially targets the non-essential reproductive cells of its host, the testes or ovaries. Once these are depleted, the larva targets the fat body (site of triglyceride storage and hormone synthesis) followed by a general feast of anything the larva can reach. At this point, the larva almost fills the entire abdominal cavity of the stink bug and no longer cares if its host lives or dies. The unfortunate host is usually still alive when the fully grown larva again bores through the abdomen and emerges from the gaping hole. The larva crawls away, pupates, and two weeks later emerges as a beautiful feather-footed fly ready for happy pollination in a sunny meadow.

Parasitic relationships like this are difficult to interpret from a Christian worldview. If we attribute the beauty and complexity of mutualistic relationships to a Creator who cares for his creation, how can we not also give the same Creator "glory" for parasites that consume their hosts from the inside out? What then do these terrors communicate about the Creator? How is he not cruel for allowing these horrifying events to occur? Worse, what if he intentionally created them in the first place? If God did create parasites, does that mean he delights in pain and suffering in the same way we posited he yearns for relationships?

Christian philosophy must contend with these questions. Were tapeworms in Eden itself, hooks embedded into the intestinal mucosa of the first humans? Alternatively, were they created free-living and subsequently "degenerated" into a parasitic lifestyle or did they have a beneficial purpose in Adam's body only to have their function warped by sin after the fall? Perhaps the creation narrative as communicated in Genesis is not meant to be literal truth about real events. Perhaps God never literally created Adam from the dust of the ground, never literally pronounced the creation "good". Perhaps modern science is correct and humans, apes, flies, and tapeworms all share a common ancestor. In that case, there never was a time when death was not preeminent, where parasites were absent, and where meadows were happy with pollinators without anything more sinister lurking beneath the surface. Which of these diverse theories enjoys the most supporting evidence from philosophy, theology, and science?

IV. Literature review:

Much has been written over the centuries by many great minds about God and the problem of pain, the problem of natural evil, and the consequences of the fall (Augustine 397-400; Aquinas 1265-1274; Lewis 1940). What remains absent from the discussion is new quantitative data and empirical tests of these philosophical ideas. Tapeworms used to be beneficial? There is no universal common ancestor? These questions can begin to be tested by using modern phylogenetic methods. While there will never be absolute proof for one theory over another, results from these studies will provide new evidence and support for old theories and uncover fertile research ground for further investigations. My goal for this research is to collect and summarize the historical and modern theories about the origins of parasitism and then apply new data from a meta-analysis of recent parasite phylogenies, including a novel one of my own, to the already existing framework of established ideas.

Objectives 1-3 of this research are themselves literature reviews, therefore in this section I will only provide a summary of the literature associated with objectives 4 and 5.

Objective 4: Conduct a meta-analysis of modern phylogenetic research that includes ancestral state reconstruction of parasitic groups. Phylogenetics is a sub-discipline of biology that uses physical traits and/or genetic evidence to create hypotheses about the evolution of life (White *et al*. 1990). These hypotheses are visualized as diverging branches on a "tree". The end of each branch on the tree represents an organism alive today and each intersection throughout the tree represents an ancestral population of organisms. Recent advances in phylogenetic analysis have provided the opportunity to study deep nodes within a phylogeny in an attempt to discover the morphological and molecular characterization of the ancestors of extant organisms. This technique is called ancestral state reconstruction (ASR) and is a statistical method of tracing the changes of traits through time along the branches of a phylogenetic tree in an attempt to create hypotheses about the traits and behaviors of ancestral populations (Pagel 1999).

Most creationists have a very specific hypothesis about the ancestral state of parasitic organisms– the ancestral condition was non-parasitic (Wood 2005; Hennigan 2013). This proposal can be explicitly tested through phylogenetics and ASR analysis. For example, in the southwest US there exists a unique ecological relationship between yucca plants and their moth pollinators. Some species of yucca moths form a mutually beneficial symbiosis with the plants (Pellmyr & Huth 1994). The yucca rely on the moths to pollinate and in return, the plants

provide food and shelter for the growing moth larvae. This relationship has become so specialized that for many species neither can live without their inter-specific partner (Powell 1992). However, some yucca moths are parasitic. They trick the plant into providing food and shelter but refuse to provide anything beneficial in exchange. This often results in the death of the plant, giving these parasitic moths the ability to cause tremendous devastation to yucca populations in the wild (Pellmyr 2003). Which came first, parasitism or mutualism? To answer this question, a phylogeny of yucca moths was created and the evolution of parasitism was traced onto the tree (Sachs & Simms 2006). Interestingly, the parasitic moths were found to be phylogenetically nested within groups of mutualists. Meaning that in this case, parasitism most likely evolved from mutualism.

Similarly, the family Lycaenidae is a diverse group of butterflies that share a unique symbiosis with ants. As caterpillars, the lycaenids live with the ants in their nest. They secrete nutrients for the ants to eat while the ants in turn protect the caterpillars from predators (Pierce *et al*. 2002). But some species have abandoned this cooperative practice and instead use the ant's goodwill to consume their eggs and larvae (Pech *et al*. 2004). Similarly to the yucca moths, the parasitic caterpillars are phylogenetically nested within a larger clade of mutualists (Als *et al*. 2004). In these two examples, there is evidence that parasitism is a relatively recent degeneration from a cooperative interspecies relationship. Are these evolutionary anomalies, or, if more studies are added to these, would there be a statistically significant trend that shows parasitic clades descending from mutualists?

Objective 5: Analyze a novel phylogeny of parasitoid flies (Diptera: Tachinidae).

The parasitoid fly family Tachinidae is the second largest among Diptera (true flies) with over 8,000 described species (Stireman *et al*. 2006). Every species in this enormously diverse group is an obligate parasitoid (parasitism is a requirement for life). Most of their hosts are fellow insects and each one is brutally attacked by parasitoid larva from the inside out. The feather-footed fly discussed earlier provides a model for host finding strategy and larval development within the Tachinidae (Blaschke 2015).

If tachinids were originally created to have an ecological role other than parasitism, specific physical traits that are used solely for parasitism would have evolved after the fall. One such trait is the piercer found in two of the four tachinid subfamilies, Phasiinae and Exoristinae (O'Hara 1985). This piercer is used by some tachinids to physically insert their eggs into the

abdominal cavity of the host, thus bypassing the protective exoskeleton completely. Such a weapon is highly specialized for endo-parasitism and is unlikely to have been co-opted from a beneficial pre-fall structure.

A phylogeny will be created using 8 kilobases of DNA sequences extracted from >300 species of tachinids. A Bayesian phylogenetic algorithm will be used to reconstruct evolutionary trees. Using the ASR software package in the analysis program Mesquite 2.74 (Maddison & Maddison 2010), piercer evolution will be mapped onto the phylogeny using two kinds of statistical analyses (maximum parsimony and maximum likelihood). Results will be interpreted according to traditional evolutionary theory and young-earth creationism. If piercers are shown to have characterized the ancestral population of tachinids, it can be inferred that tachinids have most likely always been parasites. However, if piercers are a recent adaptation, it would reinforce the concept of post-flood degeneration into parasitism by tachinid flies.

References:

Aquinas, T. 1265-1274. *Summa Theologica*. Translated by Fathers of the English Dominican Province. 5 vols. Westminster, Md. Christian Classics, 1948.

Augustine, St. 397-400. *The Confessions of St. Augustine*, translated by Edward Pusey. Vol. VII, Part 1. The Harvard Classics. New York: P.F. Collier & Son, 1909–14; Bartleby.com, 2001.

Blaschke J.D. 2015. Evolution and phylogeny of the parasitoid subfamily Phasiinae (Diptera: Tachinidae). PhD dissertation, University of Tennessee, Knoxville.

Hennigan, T.D. Is there a dominion mandate? Discussion: A response to Darek Isaacs. *Answers Research Journal*, 6 (2013): 137-138.

Lewis, C.S. *The Problem of Pain*. New York: Macmillan, 1962.

Maddison, W.P. and D.R. Maddison. 2010. Mesquite: a modular system for evolutionary analysis. Version 2.73, http://mesquiteproject.org.

O'Hara, J.E. 1985. Oviposition strategies in the Tachinidae, a family of beneficial parasitic flies. *Agriculture and Forestry Bulletin*, 8: 31-34.

Pagel, M. 1999. The maximum likelihood approach to reconstructing ancestral character states of discrete characters on phylogenies. *Systematic biology*, 48 (3), 612-622.

Pech, P., Z. Fric, M. Konvička, and J. Zrzavý. 2004. Phylogeny of *Maculinea blues* (Lepidoptera: Lycaenidae) based on morphological and ecological characters: evolution of parasitic myrmecophily. *Cladistics*, 20, no. 4: 362-375.

Pellmyr, O. and C.J. Huth. 1994. Evolutionary stability of mutualism between yuccas and yucca moths. *Nature,* 372, no. 6503: 257-260.

Pellmyr, O. 2003. Yuccas, yucca moths, and coevolution: a review. *Annals of the Missouri Botanical Garden,* 35-55.

Pierce, N.E., M.F. Braby, A. Heath, D.J. Lohman, J. Mathew, D.B. Rand, and M.A. Travassos. 2002. The ecology and evolution of ant association in the Lycaenidae (Lepidoptera). *Annual review of entomology,* 47, no. 1: 733-771.

Powell, J.A. 1992. Interrelationships of yuccas and yucca moths. *Trends in Ecology & Evolution,* 7, no. 1: 10-15.

Stireman III, J.O., J.E. O'Hara, and D.M. Wood. 2006. Tachinidae: evolution, behavior, and ecology. *Annual Review of Entomology,* 51: 525-555.

White, T.J., Bruns, T., Lee, S.J., and Taylor, J.W. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. *PCR Protocols: a Guide to Methods and Applications*. 18 (1), 315-322.

Wood, T.C. 2005. Visualizing baraminic distances using classical multidimensional scaling. *Origins,* 57:9-29.

Essay on Christian faith and biology: The question of natural evil being created by a loving God is far from academic for me. It has real and personal implications to my life and faith. I have no desire to worship a God who is loving and kind, but who does not really exist. Nor do I want to worship a God who does exist but is evil and enjoys the suffering of his creation – be they humans or stink bugs. This very dilemma is at least partially responsible for Darwin's own rejection of Christianity:

> *"I own that I cannot see…evidence of design and beneficence on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae* [parasitic wasps] *with the express intention of their feeding within the living bodies of caterpillars"*
>
> -Charles Darwin, letter to Asa Gray, 1860

I greatly empathize with Darwin's struggle, as do many former Christians who, when faced with this problem, have abandoned their faith in God altogether. At times, the personhood of God can seem distant and silent, but nature is always a tangible reminder of his love and goodness to me. There is something fascinating about the way nature communicates God's truths. To my ear, nature is constantly declaring the wonder of the Creator, as David also attests (Psalm 19:1). It is amazingly complex and beautiful. It tells of a God who is joyful and creative, whose intelligence far surpasses mine and whose imagination is beyond measure. If God seems far from me inside a church building, I have just to walk outside to feel God's presence and worship. While not everyone has this response to nature, the body of Christ is a diverse group and the way God communicates through his creation is hardly unique to me. Remarkably, even non-religious people will seek out solitude in the woods to intentionally commune with nature. Humans innately recognize that there is something in nature to commune with, something super-natural.

Therefore, my faith and my vocation (biology) are intimately intertwined. When my vocation says nature is a fascinating complex puzzle fill with new wonders and discoveries, my faith in the Creator is enriched. Similarly, when my vocation says there is no evidence for God – all things that are have always been – my faith can be placed in jeopardy. What is an appropriate

response to natural evil in creation? As I walk through the woods amazed by the beauty, what should I tell myself about the wasps that paralyze their prey so that their ravenous offspring can consume a helpless, still living host for weeks on end? What should I say about the cute little nestling birds that will brutally peck a diminutive nest mate to death so they will have more food for themselves? The birds are singing beautifully, yes, but they are singing death threats to rival males rather than hymns of praise to God. How can I maintain and deepen my faith in God while I study his creation?

One of the primary reasons I chose to pursue a career in Christian academia was to research difficult questions like these surrounded by a community of fellow scholars and fellow believers. Not everyone cares for issues such as these, it is often easier to suppress or ignore problematic questions of faith. But some of the people who struggle most with faith and science are undergraduate Christian biology majors. Many of these students are traveling the same path I did when I was an undergraduate struggling with my faith in light of the scientific evidence for evolution. These students share my passion for both animals and scripture and are wrestling with questions of natural evil and a loving God. My desire is to offer encouragement and assistance to them on their journey. While I certainly do not expect to answer these questions of faith in a single summer's research, I hope that applying philosophical arguments to real datasets will uncover new evidence and trends that will spur further academic conversation and research.

Timeline for completion and dissemination:

December 2016…….. Submit abstract for International Conference on Creationism

June 2017……... Complete objectives 1, 2, and 3

July 2017…… Complete objectives 4 and 5

May 2018……... Submit abstract for Origins 2018

July 2018…… Attend and present research at ICC and Origins 2018

August 2018…… Publish essays derived from research in *Journal of Creation Theology and Science* and other venues as appropriate

Fall 2018……. Design and teach reading/discussion class at Union University

April 2018…….. Attend and present results at Pew Research Luncheon

Budget:

Conference registration and travel expenses	$800
Books	$700
Stipend	$3,000
Total	$4,500

Letters of recommendation: A request for letters of recommendation has been submitted to Drs. Joe Francis and Jennifer Gruenke.

Curriculum Vitae

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Education

Ph.D. Entomology, University of Tennessee, Knoxville. August 2013 – August 2015.

M.S. Entomology, University of Tennessee, Knoxville. January 2012 – August 2013.

B.S. Biology, Bryan College, Dayton, TN. August 2006 – May 2010.

Publications

Blaschke JD. 2015. Evolution and phylogeny of the parasitoid subfamily Phasiinae (Diptera: Tachinidae). PhD dissertation, University of Tennessee, Knoxville.

Winkler IS, **Blaschke JD**, Davis DJ, Stireman III JO, O'Hara JE, Cerretti P, & Moulton JK. 2014. Explosive radiation or uninformative genes? Origin and early diversification of tachinid flies (Diptera: Tachinidae). *Molecular Phylogenetics and Evolution*, 88, 38-54.

Blaschke JD. 2014. Ancestral state reconstruction as a new method for identifying baramins of parasites and pathogens. *Journal of Creation Theology and Science Series B: Life Sciences*, Volume 4.

*Winkler IS, Stireman JO, Moulton JK, O'Hara JE, Cerretti P, & **Blaschke JD.** 2014. Progress towards a molecular phylogeny of Tachinidae, year two. *Tachinid Times*, 27: 11-14.

Blaschke JD. 2013. Student news. *Tachinid Times* 26: 19.

Blaschke JD, Molecular systematics of the subfamily Phasiinae (Diptera: Tachinidae). Master's Thesis, University of Tennessee, Knoxville.

Blaschke JD. 2011. The Hebrew taxonomy of living things. *Journal of Creation Theology and Science Series B: Life Sciences*, Volume 1:2.

Blaschke JD & Sanders RW. 2009. Preliminary insights into the phylogeny and speciation of *Scalesia* (Asteraceae), Galápagos Islands. *Journal of the Botanical Research Institute of Texas*, 3.1: 177-191.

*not peer-reviewed

Invited Lectures

Blaschke JD & Kerfoot JR. 2016. Are birds dinosaurs? Thelma Barker Elementary School, Jackson, TN.

Blaschke JD. 2014. Bug eaters: the natural history of phasiine parasitoids. University of Guyana, Georgetown, South America.

Blaschke JD. 2012. Aquatic insect diversity and identification. Grace Christian Academy HS, Knoxville, TN.

Presentations

Cerretti P, Stireman III JO, O'Hara JE, Moulton JK, Winkler IS, and **Blaschke JD.** 2016. The evolution of reproductive strategies in tachinid parasitoids (Diptera: Tachinidae). International Congress of Entomology. Orlando, FL. September 2016.

Stireman III JO, Moulton JK, Cerretti P, O'Hara JE, Winkler IS, and **Blaschke JD**. 2016. Phylogeny and diversification of world Tachinidae (Diptera). International Congress of Entomology. Orlando, FL. September 2016.

Blaschke JD. 2014. Evolution and phylogeny of the parasitoid subfamily Phasiinae (Diptera: Tachinidae). Entomological Society of America, Southeastern Branch Meeting. Greenville, SC. March 2014.

Francis J, **Blaschke JD**, Sanders RW, & Wood TC. 2014. Research update: pine bark beetle associated tree destruction in North America. Origins 2014. Colorado Springs, Colorado. July 2014.

Blaschke JD. 2014. Ancestral state reconstruction as a new method for identifying baramins of parasites and pathogens. Origins 2014. Colorado Springs, Colorado. July 2014.

Blaschke JD. 2014. Molecular systematics of the Phasiinae (Diptera: Tachinidae). Entomological Society of America, Southeastern Branch Meeting. Greenville, SC. March 2014.

Blaschke JD. 2011. The Hebrew taxonomy of living things. Origins 2011. Rapid City, South Dakota. July 2011.

Posters

Blaschke JD. 2014. Molecular systematics of the Phasiinae (Diptera: Tachinidae). Southeastern Branch of the Entomological Society of America. Greenville, SC. March 2014.

Blaschke JD. 2011. Classification systems of the ancient Near East. Origins 2011. Rapid City, South Dakota. July 2011.

Blaschke JD & Sanders RW. 2008. Origin and morphological diversification of *Scalesia* (Asteraceae), Galápagos Islands. Botany 2008. Vancouver, British Columbia. June 2008.

Grants and Awards

Undergraduate Research Grant (Joey Bakeer), $1,000. 2016. “Detecting novel antibiotics from a parasitoid fly (*Trichopoda pennipes*)”. Union University, Jackson, TN.

Professional Development Grant, $750. 2016. Union University, Jackson, TN.

Chancellor’s Distinguished Graduate Fellows Program Award, $4,500. 2013 – 2014. University of Tennessee, Knoxville, TN.

CASNR Student Travel Award, $1,500. 2014. University of Tennessee, Knoxville, TN.

2nd place in M.S. Student Oral Presentation, $100. 2014. Southeastern Branch of the Entomological Society of America, Greenville, SC.

Phi Kappa Phi honor society. 2013 – Present.

Gamma Sigma Delta honor society. 2013 – Present.

National Science Foundation Graduate Research Fellowship, Honorable Mention. 2013.

Fred and Dot Wagoner Scholarship for Student Excellence in a Scientific Field, $1,500. 2009 – 2010. Bryan College, Dayton, TN.

Professional Experience

Assistant Professor of Biology, Union University (August 2015 – present).

Reviewer for *Answers* magazine and *Journal of Creation Theology and Science* (2013 – present).

Lecturer, Taxonomy of Adult Insects, University of Tennessee (August 2014 – December 2014).

Teaching Assistant, Taxonomy of Adult Insects, University of Tennessee, Knoxville (August 2013 –December 2013).

Research Assistant, University of Tennessee (January 2012 – Present).

Taxonomic Consultant, AquaTer (February 2013 – July 2013).

Taxonomic Specialist, All Taxa Biodiversity Inventory GSMNP (May 2011 – April 2012).

Chemical Analyst, TestAmerica Laboratories (June 2010 – December 2011).

Teaching Assistant (Chemistry, Biology, Botany, Zoology), Bryan College (August 2008 – May 2009).

Lab Technician (microbiology), High Plains Veterinarian's Outlet (March 2005 – August 2008).