Undergraduate Research Highlights

Elizabeth Heppenheimer ’14
Recipient of the 2013 Michelle A. Kayal Memorial Scholarship Award
Liz has been actively engaged in research since her sophomore year. With Prof. Jorge Mena-Ali, she has studied the interaction between a fungal pathogen and its plant host, while her senior independent research with Prof. Dan Ardia examines the genetic diversity and population structure of local urban carnivores.

Maxwell Sechzer ’14
Max, with Prof. Ardia, is studying the effect of temperature variation during incubation on the physiology and behavior of bobwhite quail. The research is intended to mimic how increasing environmental temperature might have either adaptive or detrimental effects on developmental programming.

Jennifer Gay ’13
Equally interested in two topics - the disparity in HIV care and prevention in African communities and understanding deformities caused by Down syndrome - led this public health major to pursue both. For more information, visit: http://www.fandm.edu/news/article/a-double-dose-of-research.

Andrew Glunk ’15
Installing Weather Station in massive strangler fig tree in Monteverde, Costa Rica

Zachary Adams ’14
Zach, along with Prof. Kirk Miller, is creating a genetics and health survey of Plain communities - to explore whether we can use genetic information to improve the health of a whole community.
Letter from the Chair

Dear Students, Alumni, Family members and Friends,

Another year has quickly gone by, and I’m happy to present to you the third annual F&M Biology Department newsletter. I hope it finds you happy and well. Our faculty, staff and students have had a busy 2013, and in this newsletter you will find descriptions of many of the projects and activities we have undertaken and publications we have produced.

A few events deserve a special highlight. First, we would like to wish Kathleen Triman our best as she retires from the department. Kathleen has been a member of the department for 23 years, and was the first woman biologist at F&M to receive tenure, as well as the first female chair. She is a great teacher and adviser to her junior colleagues and students, and we will miss her warmth and wisdom in the classroom and departmental meetings. Luckily for us, although she is stepping down as Professor of Biology and Don of Weis College House, she will continue working here in the Life Sciences and Philosophy Building maintaining the Ribosomal Mutation database she pioneered as a focus of her research program. You can read more about Kathleen’s plans below.

In addition to changes among faculty, the Life Sciences and Philosophy Building has also been modified over the past year. New office space has been added on the second and third floors to accommodate the department’s growth. Also, in collaboration with the Psychology Department and the Provost’s Office, we have been able to develop a new “pathogen-free zone” in the Vivarium to allow us to house mice in a sterile environment, which will greatly advance the research of Beckley Davis, Rob Jinks and Clara Moore.

You can read more about their research with their students, as well as that of other faculty members, in the following pages. Please also take a look at what our great visiting faculty, staff, and emeriti are doing. We expect 2014 to be as busy and productive as 2013 has been, and we would love to hear from you about where you are and what you’ve been up to. Please don’t hesitate to send me, or any of your favorite faculty or staff, a note – it would make our day!

Best regards,
Peter Fields
Chair, Biology Department

Farewell

kathleen triman
retires from faculty

Although my retirement from teaching was official on July 1, 2013, I continue to keep a desk in LSP 361 and work on my ribosomal mutation database three afternoons a week. I am eternally grateful to the Biology Department for their generous support of retirees like myself. It is my great pleasure to see Weis College House students from the classes of 2014 and 2015 on campus. Some of these students were enrolled in my human genetics first-year seminar as well. I completed the Spring 2013 semester by serving on a team of poster judges at the Sigma Xi Undergraduate Science Fair during the Annual Mid-Atlantic Regional Conference at Georgia Mason University in Fairfax, VA. We met students from Maryland, Virginia and Washington DC colleges and universities. Our 1700-mile roundtrip drive also included celebration with two family reunions in Durham and Asheville, NC. My Summer 2013 Visiting Investigator Appointment at the Jackson Lab in Maine marked our 20th consecutive joyful summer in the same little unfinished cabin in the woods and my 4th year as a member of the JAX National Council. In October, I worked with the American Society for Human Genetics to evaluate Next Generation Standards for High School Genetics Education. During December 2013 and January 2014, I am serving on a Genetics, Genomics and Proteomics Panel for the National Science Foundation. Professor Sipe has graciously agreed to serve as the next President of the F&M Chapter of Sigma Xi upon his return from sabbatical leave in 2015. One of my last duties as President will be to serve as Chapter delegate to the Annual Sigma Xi Conference in November 2014. 2014 marks the 60th anniversary of our Chapter, which was founded in 1954. We continue to support speaker programs and science prizes for outstanding undergraduate researchers.

I look forward to hearing from students and alumni who remember me. Please stay in touch!
Welcome our new faculty

**Janine Everett**

Joins the department as Visiting Assistant Professor of Biology

In 2013, I shifted from part-time adjunct to a full time position as Visiting Assistant Professor of Biology and Public Health. My focus is strongly on the Public Health component of that role as I teach Intro to Public Health (PBH251), U.S. Health Policy (PBH410), Epidemiology (PBH351), and Public Health Research: Pregnancy Outcomes in American Women (PBH388), among other courses. I’ve also mentored students on various projects in 2013. Graduate Martha Stefaniak ’13 and I completed a yearlong research project examining factors related to the health of F&M student athletes (manuscript pending). Other projects include mentoring student research and learning on Comparative Effectiveness Research and the rapidly-changing U.S. Healthcare system (Amalia Antonoplos ’14), a semester examining the oral health of the Amish population (Josephine Ferenc ’14), and supervising a student continuing to raise funds to purchase wood stoves through the Impulso Project for residents of San Felipe, Guatemala (Anna Folz ’15). It is fair to say that all of my work, past and present, has been through the lens of health disparities, with a goal of working toward health equity for those facing disparities. My past research has focused on the areas of skin biomechanics, color, and injury and on digital imaging in health research. I maintain continued interest in these and related foci, as well as health policy, nutrition, and exercise-related health and performance risks, benefits, and influencing factors.

**Kathryn M. Flinn**

Joins the department as Visiting Assistant Professor of Biology

I am delighted to join the faculty in the Biology department at F&M this year. I am a plant ecologist with interests in the protection of rare species, the restoration of disturbed communities, the spread of invasive species, and the environmental impacts of agriculture. For example, my recent research has built a thorough understanding of the processes controlling the recovery of native plant diversity in forests growing on former farmlands. Having earned my Ph.D. in Ecology and Evolutionary Biology at Cornell, I completed a 3-year postdoc at McGill University in Montréal. Since then, I have taught at several small liberal arts colleges, including Bates College in Maine and, most recently, Juniata College in central Pennsylvania.

Currently, I am working with four students (Jessica Bechhofer ’14, Hannah Groff ’14, Matt Loiacono ’15 and Madelyn Malcolm ’15) on field- and lab-based projects that address the causes and consequences of plant invasions. Though increasingly common in forests, invasive shrubs such as Berberis thunbergii (Japanese barberry) may have far-reaching impacts that are only beginning to be understood. My students and I are comparing invaded and uninvaded plots in terms of their soil nutrients, soil moisture, understory light availability, and plant cover, richness and diversity. My students and I are also investigating the role of mating systems in the colonization of new habitats by Dennstaedtia punctilobula (hayscented fern), which has been called a “native invasive” for its tendency to suppress tree regeneration in logged stands. Specifically, we are comparing the ability to self-fertilize and inbreed among populations founded at varying times in the past by growing gametophytes in isolation and in pairs of varying relatedness. If recently founded populations have the greatest selfing ability, this will suggest that mating systems have played a key role in colonization.

I taught Ecological Concepts and Applications for the fall semester, and will teach Principles of Evolution, Ecology & Heredity in the spring.

I appreciate very much the support of the department and the F&M community, and I look forward to continuing work with students and faculty during this year.

**Afshan Ismat**

Joins the department as Visiting Assistant Professor of Biology

I have had an AMAZING first semester here at F&M! The whole Biology Department has been so incredibly welcoming and helpful! Before coming to F&M I was a postdoctoral fellow at Johns Hopkins University School of Medicine in Baltimore. My main interest has always been in understanding how cells migrate from point A to point B during embryogenesis. While at Johns Hopkins, I started looking at the interactions between cells and their extracellular environment during their migration -- more specifically, how modulating the extracellular environment around cells and tissues alters their migratory behavior. I characterized a protein that is known to modulate the extracellular matrix (ECM) around cells,
Welcome (continued)

afshan ismat...

and discovered a novel function for this protein in the process of cell migration.

In my own lab (it still sounds weird for me to say that), I am continuing the work I started as a postdoctoral fellow, examining the relationship between migratory cells and their extracellular environments. I use the fruit fly Drosophila melanogaster (best model system ever!) to study these relationships.

I taught a new course that I developed this semester (Cell Migration in Development and Disease), where we examined the dynamic nature of cells and tissues as they change shape, travel, and form more complex structures. I had a wonderful group of students that were intelligent, well rounded, and displayed a genuine interest in biology. Next semester I’ll be teaching Bio 230 (Cell Biology), and working with a few students in my lab. I am looking forward to another great semester!

eric v. lonsdorf

joins the department as Visiting Assistant Professor of Biology

Before starting as a visiting professor this fall, I worked on two projects as a research scientist for the Chicago Botanic Garden and a scholar-in-residence at the Wohlsen Center for Sustainability: conservation of migratory birds and crop pollination by native bees. For each project I worked with field ecologists to develop predictive models to aid in land use decisions made by conservationists and land managers. For the migratory bird project, I worked with the US Fish and Wildlife service to develop an ecological model that predicts how and where waterfowl (e.g., ducks) will go as they migrate from Canada to the southern United States. We are attempting to compare the results of this continental scale prediction with monitoring data collected throughout the continent. For the second project on crop pollination, I am continuing to collaborate with other researchers at universities and the USDA to develop and test a model that predicts the number of bees that visit pollinator-dependent crops, such as apples, cherries, pumpkins and blueberries. We plan to use the model to provide orchard and berry farm owners with guidance on land practices that will promote native bee pollination.

I am starting an urban ecology research project at F&M to investigate how the local mammalian community changes along an urban-to-rural gradient. I, along with Dan Ardia and F&M students, will place motion-triggered cameras out in patches of forests in Lancaster County. We will explore how the size of the forest patch and the amount of urban land cover that surrounds the patch influences the abundance and composition of the animals photographed by our cameras.

I currently teach Bio 110 (Introduction to Ecology, Evolution and Heredity) and Bio 210 (Biostatistics). I’m excited to be part of the F&M community and have thoroughly enjoyed my time so far with fellow faculty and hard-working, inquisitive students!

Faculty Highlights

dan ardia

It was a year of transition. We tied a bow on our three years of chickadee research: Hannah Scharf ’13 finally ‘cracked the nut’ and found patterns describing which chickadees are more dominant. Elise Gilchrist ’13 and Julia Sokel ’13 developed new techniques examining feather growth bars and feather corticosterone levels as factors explaining winter behavior. Austin Huffman ’13 looked at genotypic variation in dopamine receptors to explain differences in coping styles, while Max Sechzer ’14 developed and implemented new statistical techniques to describe movement behavior. The chickadee work will be on hiatus while I take a sabbatical and apply for state funding to support the work.

Amalia Handler ’13 earned honors defending her thesis examining diet along an urban-to-rural gradient using stable isotopes. We are currently preparing a manuscript for submission. Asurayya Worrede-Mahdi ’13 also earned honors for her study on how developmental temperature affects metabolic rate in quail (co-advised by Joe Thompson). Liz Heppenheimer ’13 (in collaboration with Prof. Jorge Mena-Alí) is continuing her work on population genetic structure in red foxes, now investigating historical changes using museum specimens. Ed Early ’14 continues fieldwork with a trail camera study across Lancaster County in collaboration with Prof. Eric Lonsdorf.

I’ve been helping the Association of Field Ornithologists reorganize our investment policies. We recently traveled to Boston to meet with our new financial managers at Merrill Lynch and were surprised that one of the Merrill Lynch team members assisting us was none other than Michael Holden ’07, whom I had taught in Evolution in my first semester at F&M. It was reassuring to see a familiar face—small world in F&M nation.
Faculty Highlights

jaime blair
The Blair Lab has been busy over the past year optimizing our culture- and sequence-based approaches for studying oomycete diversity in both agricultural and natural ecosystems. Oomycetes are fungal-like microbial eukaryotes that play a number of important roles within the environment. Several species are devastating pathogens, such as Phytophthora infestans, the causal agent of potato and tomato late blight; however, we are also interested in studying the relatively unexplored diversity of saprotrophic species. We had some outstanding technical support this past summer from Steve Clipman ’13, who worked with our massive oomycete-specific metagenome project. Steve also created our beautiful new website — check us out at TheBlairLab.com! Lauren Coffua ’14 continues to work hard in the lab; for her senior independent research, Lauren is studying oomycete diversity among home gardens in Lancaster City and surrounding neighborhoods. Special thanks to the Biology faculty and staff who allowed us to collect samples from their yards this summer! Tyler Vetrano ’14 joined the lab last spring, and is collecting molecular and morphological data on a group of isolates from York County, which may represent a new species of Pythium. Lauren and Tyler presented their research this summer in Austin, Texas, at the joint meeting of the American Phytopathological Society and the Mycological Society of America. I was invited to give a talk at the same meeting during a special session, Schroth Faces of the Future: New Frontiers in Mycology, where I presented our preliminary metagenomic analysis of oomycete diversity from across southeastern PA. We also traveled to Blacksburg, VA for a three-day bioinformatics workshop. I look forward to recruiting a new batch of enthusiastic students for another productive year of research!

beckley davis
My research covers a broad range of topics related to host pathogen interactions, using mice and human tissue culture as model systems. My primary research focus includes characterization of novel members of the nucleotide-binding domain, leucine-rich repeat containing proteins termed NLRs. Mutations in NLRs are associated with diverse genetic diseases characterized by either uncontrolled inflammation or immunosuppression. Therefore, understanding the molecular mechanisms of the pathways associated with these proteins is of great interest.

My research students have been investigating different aspects of one NLR protein in particular, NOD2. NOD2 is associated with two inflammatory conditions that affect humans: Blau syndrome and Crohn’s disease. Dylan Smith ’13 and Sarah Pollock ’13 were instrumental in generating enough preliminary data for my grant submission to the NIH. This grant focuses on understanding the structure-function relationship between NOD2 and its interaction with a bacterial cell wall component, muramyl dipeptide and the nucleotide binding cycle. A culmination of our efforts was a trip to Hawaii to present our data! Dylan and Sarah enjoyed both the sun and the science in the Pacific.

New members of the laboratory include Laura Smith ’14, Aaron Tocker ’15, Kelsey Kreyche ’15, Suzanna Talento ’15, Brendan McShane ’15 and Alston Gremillion ’15. These students have been active in my research generating great data and helping fine-tune Cell Biology laboratory modules. This past semester I taught a Foundations course (Nature of Disease) for non-majors and a Virology seminar for majors. This course afforded me the opportunity to teach outside of my formal training and engage students in different types of classes. At the end of this academic year I will transition into my Junior Faculty Leave to focus on research.

peter fields
Over the past year I have continued to use proteomic approaches to study the responses of the mussel Geukensia demissa to environmental stresses. Geukensia lives in the salt marshes along the Atlantic coast, and has a central role in stabilizing and maintaining the habitat. Most recently we have been focusing on examining how it responds to acute bouts of hypoxia and high temperature. Each of these projects is the culmination of work done over the past few years — our hypoxia manuscript is co-authored by Bill Gao ’11, Bekim Cela ’14, and Chris Eurich, a high school teacher from Elizabethtown who collected the bulk of the data as a research fellow in the lab. The research is complete, and we are revising a manuscript submitted this past fall. The acute heat stress project represents the work of numerous students going back to the beginning of our proteomics research in 2009. Data on protein expression changes have been collected, and we intend to prepare the manuscript for submission in the next few months — co-authors on that work are Liz Burmester ’11, Kelly Cox ’12 and Kelly Karch ’12.

At the same time, we have begun work on an entirely new project, examining the biochemistry of the mutualistic relationship between reef-building corals and their photosynthetic algal symbionts. This work represents a return to my roots: we are expressing recombinant enzymes from each organism, examining the temperature sensitivity of their kinetics, and determining if the two species indeed are adapted to the same thermal environment. The answer to this question may help us better understand the process of coral bleaching, where stressed corals, in order to survive, expel the symbionts they rely on. Bekim Cela ’15 has taken the lead in this project, and I am very excited about its potential to provide a deeper understanding of the strengths and weaknesses of the coral-algal symbiosis.

janet fischer
Mark (Olson) and I are spending our 2013-14 sabbatical in Canada and having a wonderful time. Rachel (12) and Trevor (6) have adjusted well to their new Canadian schools. They have learned to wear a “toque” when it’s cold and say “zed” instead of “z".
Janet Fischer (continued)

Research in my lab continues to focus on the ecology of alpine lakes. Mark and I have been very lucky to hire Nora Theodore ‘13 as a part-time post-graduate research assistant this year and together we’ve been working through the data we’ve collected from lakes in the Canadian Rockies over the last eight years. At the moment, we’re working on a manuscript describing the key role that UV radiation plays in driving the vertical migration behavior of alpine zooplankton. Jin Hwang ‘14 (and his GoPro camera) joined Mark, Nora, and me in the field last summer and we sampled over 30 lakes, some of which were new to us and located in more remote areas. This broader dataset has helped us see our core study lakes in a new context and highlights the differential responses of individual lakes to common climate signals. Some lakes exhibit an amplified response to climatic variables like temperature and precipitation while others are more stable over time. The next step is to explore which factors distinguish the “amplifiers” from the “dampeners”.

On the teaching front, I’ve modified the way that I teach Bio 110 to place greater emphasis on supporting students as they learn to write manuscript-style lab reports. I now require revisions of every lab report AND extra meetings with me to discuss their progress! The new approach has been rewarding for me and, I hope, for the students as well.

Edie Gallagher

The beach might look like a bunch of uniform, smooth sand, but take a closer look next time you are there and you will see different sand sizes in different places. I use a digital imaging system to measure grain size quickly and easily on beaches. I look at small changes in grain size at different locations on the beach (in the dunes, in the ankle-deep water, in the surf). A recent paper focused on the importance of relatively small variations in sand grain size (and mixtures of sizes) for accurate prediction of beach changes (most models use a single average grain size to estimate beach changes). We are now looking at stratigraphy: as a beach erodes, what sediments are underneath? Do we need to know this to be able to predict beach erosion? This work is funded by the National Science Foundation. In 2014, the Army Corps of Engineers will be looking at the effects of using mixtures of grain sizes for beach nourishment. We are hoping to be part of this study.

I am also interested in bedforms (ripples, megaripples, dunes and bars) that are common wherever unconsolidated sediments are moved around by water or air. In the nearshore, bedforms are important for the prediction of wave dissipation, currents and sediment transport on beaches, because they make the seafloor bumpy or rough, they change the way the water flows and they are vehicles for sediment transport. I have developed a computer model to predict megaripples; these are the bumps and holes on the sandy bed that you might step in as you walk out through the waves to swim. The model is simple and general, so it is being extended to look at larger bedforms in rivers and tidal inlets. Continuing funds to support this work were recently obtained from the Office of Naval Research.

Sybil Gotsch

Research in my lab is focused on trying to understand how seasonal tropical forests will be affected by climate change. Our research takes place in the Tropical Montane Cloud Forests of Costa Rica. These forests are biodiversity hot spots and have a significant impact on regional water cycling. Unfortunately, these important and unique habitats are projected to experience changes in climate that may threaten a number of species and the ecosystem functioning of the forest in general.

Epiphytes are an important, but understudied, group of plants in this ecosystem. These plants are non-parasitic but live on the branches of other plants. Epiphytes often spend their entire lives atop branches of large canopy trees, 80-100 feet off the ground. They depend, either wholly or partially, on inputs of water and nutrients from clouds. In my lab we are trying to determine how vulnerable these plants are to changes in climate and how dependent they are on cloud water for survival.

I joined the biology faculty in 2012. Research started in my lab with a great group of sophomores who learned to construct and deploy transpiration sensors. In the spring of 2013 I had five research volunteers: Chouran Liu ‘14, Victoria Abel ‘15, Andrew Glunk ‘15, Minh Pham ‘15 and Lex Darby ‘15. I was incredibly fortunate to have Andrew, Minh, Lex and Mackenzie Dix ‘14 join me in the field last summer thanks to funding from Hacker, Huffnagle, Maoud and Mueller fellowships. My students and I climbed and instrumented a number of large fig trees with weather and transpiration sensors and we collected hundreds of samples for analyses in the lab. Andrew, Lex and Mackenzie have been analyzing our data as part of their independent research projects this semester and we are hoping to have a manuscript ready to submit this spring.

Pablo Jenik

Seeds are the most important dietary staple for all civilizations (think about it next time you look at your plate, and count how many products come directly or indirectly from seeds)! My lab uses a weed from the mustard family, Arabidopsis thaliana, to study two aspects of seed development: patterning and maturation. Patterning refers to the processes by which embryos gain their proper shape and size, and the cells in the embryo their proper fates. Maturation is the set of mechanisms that lead to a dry seed, full of nutrients. The main experimental approach is to study mutant embryos, in which patterning and/or maturation are defective. In our previous work (published in 2011 and 2012) we discovered new factors (microRNAs, proteins) that regulate these processes. We are now focusing on two proteins, ASIL1 and ASIL2, to understand how they regulate seed maturation, and how they are regulated during development. My talented crew for last year and the summer included Jackie Behr ‘13, Bethany Johnson ‘13, Kaiqi Du ‘13, Jon Marks ‘14 and Thai “Dat” Dao ‘15. In the fall 2012 I taught my staple core course, BIO 305 Genetics, with tweaks and improvements. In the spring 2013 I taught a revamped version of my Foundations course,
Faculty Highlights

pablo jenik (continued)

Modern Human Evolution, on how evolutionary forces have shaped who we are. I also introduced a new upper level seminar on Evolutionary Developmental Biology, a young field that attempts to explain the evolution of new species by changes in development. Both courses were well received and fun to teach. This year (2013-14) I’m enjoying my Junior Faculty Leave. So, no teaching! I have spent most of the Fall, with support from a Research Opportunity Award from NSF, in Dr. Brian Gregory’s lab at the University of Pennsylvania learning about a new technique (RNAseq) that I’m planning to use in both research and courses. In the spring semester I’ll be in my lab, using all my “free” time to move the research projects along.

rob jinks

Next-generation DNA sequencing accelerates disease gene discovery, though at present it outpaces functional studies needed to provide ‘proof of causation.’ The success of exome/genome sequencing as clinical diagnostic tools (e.g., in newborn screening) relies upon timely and accurate characterization of novel disease gene alleles.

My laboratory collaborates with the Clinic for Special Children to conduct functional studies of novel alleles associated with inherited neurodevelopmental disorders in Old-Order Amish and Mennonite communities. The goal is to investigate the causal link between recessive genetic defects and patient phenotypes for disorders including epilepsies, intellectual disability, bipolar disorder, and autism.

For example, lethal neonatal rigidity, microcephaly, and seizure syndrome (RMFSL) results from protein-truncating mutations in the BRAT1 gene that interrupt BRAT1:BRCA1 binding, suggesting that intact DNA damage repair is critical for normal brain development. We are investigating the hypothesis that mutations associated with RMFSL disrupt DNA damage repair resulting in apoptosis and reduced neuronal progenitor proliferation.

Children with protein truncating mutations in a previously undescribed gene have global developmental delay, microcephaly, seizures, cortical blindness, dystonia, and die from end-stage renal disease. The function of this novel protein and its role in brain and kidney development and disease will be investigated in vitro and in a knockin mouse model.

Functional studies of three disease genes associated with recessive nonsyndromic intellectual disability (rNSID; IQ<70) are also in progress. For example, we previously associated CRADD p.G128R with rNSID, and are currently investigating the role of CRADD in CNS development and behavior, and the impact of CRADD G128R on dendritic spine remodeling and apoptosis using Cradd+/− mice in collaboration with Columbia University.

Data published through this novel collaboration were recently used in a high-profile clinical whole-genome sequencing project to rapidly diagnose a critically ill, non-Plain newborn with BRAT1-related lethal neonatal rigidity and seizure syndrome (RMFSL). This timely, high-impact outcome provides important proof-of-concept for accelerating novel disease gene functional studies through carefully mentored undergraduate research.

jorge mena-ali

This year brought new opportunities and continuation of on-going projects and collaborations. Our work on Integrative Evolutionary Biology focuses on ecological and evolutionary questions regarding plant population dynamics, especially those affecting reproductive strategies. My students and I are exploring new directions on two very different projects. The first one is an extension of our previous work on the breakdown of self-incompatibility (SI) in the common horseradish plant, Solanum carolinense. While most of our research has recently focused on the consequences of inbreeding depression in this species, we are examining more closely the epigenetic basis of lower fitness in inbred individuals. Samantha Porcelli ’15 and Billy Cappuccio ’15 spent the summer optimizing a methylation-specific assay protocol (MSAP) to measure genome-wide levels of DNA methylation. They also set up an experimental population from seeds set by maternal plants differing in breeding history; these seeds were germinated either under control conditions or in the presence of a demethylating agent; some of these plants were then subjected to experimental herbivory with tobacco longhorn caterpillars. By using fluorescent primers in a fragment analysis assay, we will be able to accurately quantify changes in methylation among these treatments and determine if DNA methylation is associated with the magnitude of inbreeding depression. In addition, we are carrying out bisulphite conversion sequencing to select a subset of genes with differential gene expression after herbivory in order to assess whether methylation of regulatory regions cosegregates with inbreeding depression. Our second project focuses on the application of molecular population genetics to characterize the genetic structure of local populations of red fox (Vulpes vulpes). In collaboration with Prof. Ardia, Liz Heppenheimer ’14 is focusing on historic samples of foxes from the Northeast USA in an attempt to measure the effect of rivers as natural barriers to gene flow, as well as the effect of bridges in decreasing population differentiation.

kirk miller

I’m late and I’m writing this in a hruuy. My wife tells me it’s good practice for me to be late; it will give me more sympathy for others who are late (her).

It’s been another busy year for Public Health. We graduated our first group of majors last May and they’re in graduate school in public health, law school, or working until they figure out what they want to do with their lives. Me, too. We hired Janine Everett as a 3-year visitor after a national search. Deb Schwab had a baby. Sociology is hiring a person with ties to public health. Joe Carlesky became Provost and Government is hiring his replacement (as if). We are progressing with our collaborations with the Clinic for Special Children, the Lancaster Lead Coalition, Lancaster General Health, and SouthEast Lancaster Health Services, and we’re beginning an interesting social networks analysis of drinking by F&M students. Ellie Rice and I took a course at Hopkins last summer on the Genetic Epidemiology of Populations. Evidently, Mendel was on to something.
clara moore

As a person who has to remind myself that “change is good!”, 2013 was challenging with saying goodbye to the old and preparing for the new. After years of maintaining mouse colonies to pursue my research into the altered gene expression that leads to the phenotypes we recognize as Down syndrome, the vivarium space was decommissioned to make way for a high tech system to keep the animals free of parasites and pathogens that had compromised progress. With a lot of planning and support from the College, the new space is up and running and we hope to get both strains of our Down syndrome models proliferating by summer.

The spring inevitably allows my most experienced researchers to cross the stage and move on to other adventures after F&M — usually in science. The dearth of samples made it tough for my graduating seniors, Eric Belser ’13, Jennifer Gay ’13 and Veronica Pickens ’13, to finish up their theses. But each found an ending point or handed off their projects into the capable hands of Gabby Ferry ’15, who had joined the lab in the spring. Gabby finished off our work with proteomic analysis with lots of gels and mass spectrometry as an HHMI Scholar during the summer and she continues in the Moore Lab with protein expression analysis of the proteins that were identified.

My Foundations course which focused on the impact of reproductive technology and how we view family was offered one final time in Spring 2013. I was pleased with the first offering of Genetic Susceptibility, a course I had envisioned for some time. The mix of sophomore, junior, and senior public health, biochemistry, and biology majors resulted in interesting discussions of privacy, policy, molecular mechanisms, and the value of genetic testing in the biological vs. cultural determinism debate.

mark olson

In the past year, I made the transition to life as an ex-department chair. I had a chance to teach my foundations class (Sustainability and the Sea) again before the curriculum changes occurred. Undoubtedly, the highlight of the course was a visit from Katie Schleit ’05. Katie was working with the Pew Oceans Group at the time (she is currently at the Ecology Action Centre in Halifax) and spoke with my students about Pew’s campaign to curb overfishing of bluefin tuna. I also worked with three independent study students, Hannah Ahrens ’13, Nick Barbieri ’13, and Dana Venditti ’13, who each developed research questions that examined ultraviolet radiation effects on aquatic invertebrates. They all had exciting results that beg further exploration. However, those projects are temporarily on hold as Janet and I are spending the 13/14 academic year on sabatical in the Canadian Rockies. After a cross-continent family road trip (driving through Saskatchewan builds character), we began an ambitious field season that involved intensive sampling of 25 lakes and lasted until the end of September. The hikes got longer and the packs got heavier, but we collected lots of good data and gained many new insights into the ecology of alpine lakes. We are spending the winter analyzing and writing up the data, and enjoying a little cross-country skiing.

david roberts

This past year, I had the opportunity to design and teach two new courses, Human Health Decisions and Multi-Drug Resistance. As a general education course, HHD challenged students to think broadly about how health related decisions are made at both individual and community levels. Following an interdisciplinary track, students used readings from biochemistry, neuroscience, psychology, geoscience, and government policy to examine topics ranging from diet choices to hydraulic fracturing. My senior seminar, MDR, focused on the molecular mechanisms leading to drug resistance in pathogenic bacteria and cancer cells. I really enjoyed teaching in the seminar format, where class discussions of primary literature were the driving force for learning. In Cell Biology, we implemented a new capstone module made possible through HHMI funding. In five weeks, students PCR-cloned disease-
Faculty Highlights

david roberts (continued)

associated genes identified at the Clinic for Special Children, transfected the DNA into cultured cells, and performed immunofluorescence studies to determine intracellular protein localization.

We made some exciting advances in the research lab during the past year, and were also fortunate to receive an NIH grant to fund our work for the next three years. My research interests focus on the tumor suppressor protein, Adenomatous Polyposis Coli (APC), which is a key member of the Wnt signaling pathway, and the most frequently mutated gene in colon cancer. In the lab, we use human cell lines in combination with Drosophila melanogaster (fruit flies) to study evolutionarily conserved aspects of APC biology. Using this approach, we have tested several prominent models of APC function by generating variants of Drosophila APC lacking particular binding sites. Our data are inconsistent with the proposed models, and instead suggest a novel model of how APC regulates Wnt signaling. Ultimately, we hope our studies will further elucidate how mutations in APC contribute to colon cancer and suggest novel therapies.

timothy sipe

Three students (two from F&M, one from Wabash College) completed independent studies last spring on forest light regimes, regeneration patterns, growth-climate relationships, and carbon storage at Allee Memorial Forest (AMF) in Indiana. Two students are working this fall on interspecific comparisons of photosynthesis by tree seedlings. Robert Yamulla ’14 is using a simulation model to determine how photosynthesis by five common tree species of varying shade tolerance may correlate with seedling growth rates and population densities in multiple sites at AMF and thus help explain a “missing generation” of juvenile trees in this nature preserve. Ben Martin ’16 is exploring how seedling photosynthesis, transpiration, and water-use efficiency differ between the native tulip poplar (Liriodendron tulipifera) and the invasive tree-of-heaven (Ailanthus altissima), which compete during forest regeneration on silvicultural harvest sites in southeastern Pennsylvania.

Students in the Plant Ecology course this fall measured woodybrowse use by white-tailed deer in Lancaster Country Central Park. This was the fourth time since 2005 the class has conducted field work there. Erika Jozwiak ’14 and Erin Peck ’14 are working with me on a report to the Department of Parks and Recreation about browse trends and their relationship to deer herd size estimates over the last eight years.

I’ve enjoyed working closely with Professor Jeff Nesteruk (Department of Business, Organizations, and Society) on a new interdisciplinary initiative titled “Science, Commerce, and Liberal Education” (SCALE). SCALE has generated considerable interest on campus and nationally through F&M’s participation in the Aspen Institute’s Consortium on Business and Liberal Learning. SCALE’s scope includes everything from the role of neuroscience technology in marketing to business management and environmental sustainability, with a special emphasis on how liberal education can address these and other important issues involving relationships among science, technology, business, and society.

joseph thompson

After spending the fall and early winter (2012) at the Darling Marine Center (DMC) in Walpole, ME, where I served as a Visiting Scholar during the first part of my sabbatical, my family and I returned to Lancaster for the spring. Although I spent most of the spring in relative isolation writing manuscripts and a grant proposal, I had the good fortune to co-adviser (with Prof. Dan Ardia) Asurayya Worrede Mahdi ’13. Asurayya investigated the effects of in ovo temperature on thermal acclimation and muscle development in tree swallows and Japanese quail. She defended her work successfully and was awarded honors in Biology.

I had the pleasure over the summer to work with Dan Clarici ’14 and Scott LaValva ’15 at the DMC. We investigated the in vivo properties of the head retractor muscles of squid as part of a larger project in my lab to assess the functional significance of oblique striation in muscles. They performed delicate surgeries on squid to attach transducers to measure head retractor muscle length changes and implanted electrodes to measure muscle activity. After monitoring muscle activity and dynamics in the squid as they jetted, Scott and Dan discovered that the head retractor muscles are unique in that they have high shortening velocities yet operate over an extraordinarily long range of lengths. Indeed, prior to their work, high shortening velocity and long operating ranges were thought to be mutually exclusive among striated muscles.

In addition to pushing back the limits of knowledge in muscle physiology, Dan and Scott pushed back a few other limits. Dan shattered the old record (held by Kari Taylor ’10) for the most squid bites in a single summer. Fortunately, Dan’s hide proved too tough for the squids’ beaks and he was able, heroically, to work through the pain. Unfortunately, Scott’s hide proved a little less tough, at least to the onslaught of mosquitoes that plagued his early evening workouts on a soggy local soccer field. Despite being nearly exsanguinated on a daily basis, Scott was able to set a new record for the speediest electrode implantation, a record that he’ll attempt to break this coming summer.

An adult Atlantic longfinned squid (Doryteuthis pealeii) swimming in an aquatic treadmill. Note the iridophores (iridescent spots) on the mantle that the squid uses for communicating with conspecifics.
**Emeriti Highlights**

**richard fluck**
I continue to work part time in College Advancement. In the past year, our office has helped to get grants for the quantitative skills center that will open soon and to support programming in the Office of Student and Post Graduate Development, faculty-mentored student cohorts (similar to the Posse cohorts), and programming to address high-risk alcohol consumption on campus. I also informally advise and mentor students who seek me out or are referred to me. I enjoy all of this very much. This is an exciting time to be at F&M and to be working in higher education, and I’m grateful for the opportunity to continue contributing my skills and energy to the problems and opportunities that F&M and other colleges and universities are facing.

**john mcdermott**
I now share an office with my two recently retired colleagues Carl Pike and Kathy Triman. As they will vouch, I monopolize the space, but we have worked out a compatible arrangement.

As indicated previously, my research no longer involves the fieldwork that dominated in the past. No more studies at exotic marine stations around the world! Thus, I am involved in writing previously completed research. For example, I have nearly finished papers on studies from Florida on the life cycles and biology of pea crabs (Brachyura) and isopods (Isopoda) that are symbiotic with other marine invertebrates. A more investigative study, involving previous fieldwork and recent observations by others, involves the Atlantic ghost crab (*Ocypode quadrata*), an inhabitant of coastal sandy beaches (those of you who have ever slept on the beach at night may have experienced this crab inspecting your toes). This crab’s invasive last larval stage has been found recently on the beaches of Maine well beyond the distribution of adult crab populations located south of Cape Cod. Ghost crabs inhabit the warmer waters of lower latitudes (all the way to Brazil). A recently published paper involves a discussion of factors that may be involved in the eventual northern establishment of this species.

**Periodically, as a spin off of past research, I contribute articles to popular publications, e.g., the Underwater Naturalist published by the American Littoral Society.**

**Jason Williams ’95,** (Hofstra University), former Honors student and research colleague, recently contributed to the first volume of *F&M Scientist* 2013. His research on burrowing barnacles and their hermit crab hosts elaborated on Darwin’s studies, and showed that these barnacles were egg predators of the crab host, a finding that eluded Darwin.

**karlla brigatti**
As Program Coordinator for our 2012-2016 HHMI Award, I have thoroughly enjoyed working with the many talented students and faculty at F&M on the initiatives of the grant, and I look forward to another fun and fruitful year! I continue to divide my time between F&M and The Children’s Hospital of Philadelphia, where I work as a genetic counselor in the Neurogenetics and Friedrich ataxia research programs.

**james engleman**
I provide support for the Department’s Plant Growth Facility (PGF) and lab courses, primarily Bio 110 and 220, and look forward to using our state-of-the-art, research-grade PGF to support the faculty’s various research programs.
I have enjoyed the experience I have had to work with the students thus far, and I am looking forward to everything that the future has to bring!

I thoroughly enjoy working with the Biology faculty and my interactions with the students, visitors and alums.

I continue to provide support for the Department’s prep room and lab courses.
Bekim Cela ’14 examining differences in enzyme kinetics between the reef-building coral Acropora millepora and its photosynthetic algal symbiont Symbiodinium

Gotsch lab students gearing up for summer field season in Costa Rica: Mackenzie Dix ’14, Minh Pham ’15, Alexander Darby ’15, Andrew Glunk ’15, and Prof. Sybil Gotsch

Madelyn Malcolm ’15 (left) and Jessica Bechhofer ’14 measuring soil moisture and collecting soil samples from plots with and without Japanese barberry in the Theodore A. Parker III Natural Area in southern Lancaster County

Ed Early ’14
Ed, along with Profs. Dan Ardia and Eric Lonsdorf, is studying the changes in mammal diversity within forest patches embedded in urban-rural gradient by placing motion triggered cameras in forest patches of Lancaster County parks and privately owned land.

Andrew Ardire ’13 and Erika Jozwiak ’14 working on a class-based research project studying the effects of elevated CO₂ on photosynthesis

Caitlin Fuller ’14 and Paige Robinson ’14 utilize a Yeast-Two-Hybrid approach to identify novel proteins that interact with the tumor suppressor protein Adenomatous Polyposis Coli (APC)

Nora Theodore ’13 celebrates the end of a second successful field season in the Canadian Rockies at the top of Buller Pass.

Lauren Coffua ’14 (left) and Elizabeth (Liz) Heppenheimer ’14 comparing growth patterns on oomycete cultures
Undergraduate Research

2013

Zachary Adams '14 Health survey of the Lancaster County Plain Communities (Miller)

Jessica Bechhofer '14 The effect of the invasive shrub Japanese barberry, *Berberis thunbergii*, on soil, moisture, and light availability (Flinn)

Bekim Cela '14 Biochemical assessment of the coral-algal symbiosis: are enzymes of each partner adapted to the same temperature regime? (Fields)

Daniel Clarici '14 Biomechanics and physiology of the obliquely striated nuchal retractor muscles of Atlantic longfin squid (*Doryteuthis pealeii*) (Thompson)

Lauren Coffua '14 Culture and sequence based approaches to studying oomycete diversity in home gardens with a focus on *Solanum lycopersicum* (Blair)

Alexander Darby '15 The prevalence and significance of foliar fog uptake in the epiphyte community in the tropical montane cloud forest of Monteverde, Costa Rica (Gotsch)

Mackenzie Dix '14 Coping with climate change: The effects of drying conditions on the hydraulic capacity of epiphyte species in the tropical montane cloud forest (Gotsch)

Thai 'Dat' Dao '15 Characterization of the expression profiles of the mutants *asil1* and *asil2* using qRT-PCR (Jenik)

Edward Early '14 Changes in mammal diversity within forest patches embedded in a urban-rural gradient (Lonsdorf/Ardia)

Josephine Ferenc '14 Oral health among the Plain People as compared to their English neighbors (Everett)

Gabrielle Ferry '15 Proteomic analysis of the Dp(16)1Yey mouse model for Down syndrome during organogenesis (Moore)

Anna Folz '15 Woodstove use and its impact on the health of rural Guatemalan families (Everett)

Caitlyn Fuller '14 Evolutionary conservation of the APC-Tankyrase protein interaction (Roberts)

Eleanor Garlow '14 Mental health outcomes in Lancaster County, Pennsylvania (Miller)

Andrew Glunk '15 Epiphyte functional diversity in the tropical montane cloud forest: trying to make sense of so many species (Gotsch)

Hannah Groff '14 The influence of mating systems in the colonization of the hayscented fern *Dennstaedtia punctilobula* in logged habitats (Flinn)

Elizabeth Heppenheimer '14 Urban Carnivores: Assessing spatial and temporal changes in the genetic structure of populations of the red fox, *Vulpes vulpes* via natural history collections (Mena-Ali/Ardia)

Kelsey Kreyche '14 Superantigen mediated inflammasome activation in human monocytes (Davis)

Scott LaValva '15 Biomechanics and physiology of the obliquely striated nuchal retractor muscles of Atlantic longfin squid (*Doryteuthis pealeii*) (Thompson)

Matthew Loiacono '15 The role of selving in post-disturbance populations of *Dennstaedtia punctilobula* (Flinn)

Madelyn Malcolm '15 Effects of *Bergeris thungbergii* on Species Richness and Composition of the Surrounding Understory Plant Community (Flinn)

Jonathan Marks '14 Promoter deletion analysis of *ASIL1* and its paralog *ASIL2* during *Arabidopsis thailiana* seed development (Jenik)

Jung Min Park '14 Functional characterization of a splice-site variant in the *BRAT1* gene, in compound heterozygosity with a protein truncating *BRAT1* mutation, associated with an ataxia-telangiectasia-like neurological phenotype (Jinks)

Samantha Porcelli '15 Quantification of DNA methylation levels in *Solanum carolinense* with different breeding histories (Mena-Ali)

Margaret ‘Maggie’ Provencher '14 Functional studies of a frameshift mutation in a novel gene associated with nephrocerebellar syndrome in Amish patients (Jinks)

Paige Robinson '14 Functional studies to evaluate the impact of a novel APC-Tankyrase interaction on β-catenin regulation (Roberts)

Maxwell Sechzer '14 Metabolism, movement, and behavior in Carolina chickadees (*Poecile carolinensis*) (Ardia)

Jeffrey Smith '14 Characterization of protein:protein interaction partners for a novel protein associated with nephrocerebellar syndrome in Amish patients (Jinks)

Laura Smith '14 Superantigen mediated inflammasome activation in human monocytes (Davis)

Martha Stefaniak '13 Environmental health risks facing Franklin & Marshall student athletes (Everett)

S. Tyler Veterano '14 Morphological and molecular characterization of novel *Pythium* species from southeastern Pennsylvania (Blair)

Robert Yamulla '14 Testing the models: Phosphorylation of high-affinity β-catenin binding sites is not required for APC mediated β-catenin destruction (Roberts)
2013


2012


Roberts, D.M., M.I. Pronohis, J.S. Poulton, E.G. Kane, M. Peifer. 2012. Regulation of Wnt signaling by the tumor suppressor adenomatous polyposis coli does not require the ability to enter the nucleus or a particular cytoplasmic localization. Molecular Biology of the Cell 23(11): 2041-56.


I went to sleep in Costa Rica and woke up transfecting SW480 cells in the good ol’ cell culture.

A strong gravitational-like force (inversely proportional to the distance squared) pulled me back to LSP ButterFly Conservatory in Costa Rica.

Despite the distance I put between myself and the lab this summer, kayaking trip with my Dad off the coast of Vancouver, Canada and spent six weeks volunteering at a Butterfly Conservatory in Costa Rica. After July and August, however, I did enjoy an ocean kayaking trip with my Dad off the coast of Vancouver, Canada and spent six weeks volunteering at a Butterfly Conservatory in Costa Rica.

Brittany Guidos ’13 (left) has joined the US Peace Corps, taking her F&M education and volunteer spirit to Cambodia. Brittany is a volunteer in Peace Corps’ Community Health program. After technical and Khmer language training she will be placed in the countryside working with local communities on health and education. One focus she developed here at F&M is nutrition, and as a Peace Corps volunteer she will help develop programs to improve child nutrition and access to vitamins. Work in the Peace Corps is generally a mix of established programs and independent projects developed by volunteers. If you are interested in more information on becoming a US Peace Corps volunteer go to: http://www.peacecorps.gov/ or speak with Prof. Ardia, who served in the Peace Corps in Costa Rica.

Andrew Foley ’13 - Costa Rica and Chile

After graduating last May, I stayed in Lancaster to work for two months in the Roberts Lab. Then, for the first time in four years, I left the building. Just kidding! In July and August, however, I did enjoy an ocean kayaking trip with my Dad off the coast of Vancouver, Canada and spent six weeks volunteering at a Butterfly Conservatory in Costa Rica. Despite the distance I put between myself and the lab this summer, a strong gravitational-like force (inversely proportional to the distance squared) pulled me back to LSP 338 -- I went to sleep in Costa Rica and woke up transfecting SW480 cells in the good ol’ cell culture room! In reality, Dr. Roberts graciously hired me to work in his lab this fall before I leave in February for a Rotary International Fellowship in Santiago, Chile. I have really enjoyed the opportunity to work in the Department this fall with such an exceptional crew of faculty, staff, and students.
ALUMNI...Share your news!
Please keep in touch with us year-round on Facebook, Twitter and Instagram - or send an email to jkaufman@fandm.edu.

Biology Department
2013 Senior Reception

SPRING 2014 SEMINARS

**JANUARY**
Chris Martine, PhD, Bucknell University

**FEBRUARY**
Jay Shapiro, MD ‘53, Kennedy Krieger Institute; Johns Hopkins
Aaron Haines, PhD, Millersville University
Aravinda Chakravarti, PhD, Johns Hopkins School of Medicine

**MARCH**
Paul Harnik, PhD, Franklin & Marshall College

**APRIL**
Matthew Willmann, PhD, University of Pennsylvania
Taylor Ricketts, PhD, University of Vermont

For specific dates and times, please visit our website page at: http://www.fandm.edu/biology/lectures-and-seminars

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ESTATE PLANNING: For information on how to benefit F&M’s biology department through your estate plan, please contact Stefanie Valar, Director of Gift Planning (717.291.4272; stefanie.valar@fandm.edu.)