To help meet the need of providing experiences for veterinary students focused on serving the food animal industry, the Michigan State University College of Veterinary Medicine established the *Summer Food Systems Fellowship Program* in 2006. The goal of this program is to provide a training experience that broadens the student’s vision of and experiences in the food industry. This is facilitated by partnering with the animal agriculture industry in providing a unique and valuable summer experience that adds value to the student’s education.

2013 marked the 8th year for the *Summer Food Systems Fellowship Program*. One hundred four food animal interested students and twenty-three different partners have participated in the program since 2006. Partnerships have been forged locally, nationally (Kansas, Iowa, Washington DC) and internationally (Chennai, India). The willingness to participate in a new and innovative program underscores our partner’s commitment to the future of food animal agriculture and the need to train well qualified veterinarians to work in the food industry. Most importantly, their mentorship of students has provided invaluable experiences that have broadened the skills of food animal interested students. We believe these skills will make these future professionals better prepared to meet the needs of the food animal agriculture industry not only in Michigan but nationally and internationally. Our partners deserve most of the credit for making this program the successful.
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This summer, we were fortunate enough to be selected for the Merck Animal Health Food Systems Fellowship program. For the six years that Merck Animal Health (MAH) has been participating in this program, only one individual was selected from Michigan State University’s College of Veterinary Medicine (MSU-CVM). This year, three students were selected to accommodate the large scope of the project to be completed. Two students were from MSU-CVM and the third student was from The Ohio State University’s College of Veterinary Medicine. This was the first time the Food System Fellowship program included a student from another veterinary college.

Our first week of the program started at Michigan State University’s Diagnostic Center for Population and Animal Health (DCPAH) where we met up with Dr. Michael Bolton, Dr. Scott Nordstrom, and Dr. Dalen Agnew. Dr. Bolton was our supervisor from MAH and Dr. Agnew served as our supervisor for the research that we conducted this summer. With both of our supervisors, we learned that our project for the summer would be the three of us working together on a necropsy project examining the causes of Bovine Respiratory Diseases (BRD) in feedlots and calf ranches across the United States. This project would be a collaborative effort between Merck Animal Health and DCPAH to better understand BRD. While at DCPAH, we were taught and trained how to do a necropsy, and also how to correctly take samples for our research project once we were out in the field.

Our first trip as a group was to Lubbock, Texas with Dr. Bolton to attend a meeting for feedlot veterinarians and employees. The two-day workshop was held at Texas Tech University and put on by Merck Animal and information about a MAH product. The class consisted of one and a half days’ Health with the purpose of discussing the beef industry and providing training worth of lectures and activities that gave the attendees as much information on the product as possible. Being from primarily dairy backgrounds, this class introduced the three of us to the world of beef cattle and we learned a tremendous amount about beef cattle health, meat quality and processing.
and consumer considerations. We were very lucky to have the opportunity to attend this workshop and become introduced to the beef cattle industry before heading west to work on the feedlots and calf ranches.

Also on this trip to Texas, we were able to visit the well-known research facility managed by Dr. David Bechtol and meet two veterinarians in West Texas where we learned about beef cattle embryo transfer and feedlot consulting. One of the veterinarians, along with Dr. John Hutcheson from Merck Animal Health, showed us around the area and gave us tours of four feedlots. The feedlots we visited ranged in size from 28,000 to 50,000 cattle. This was the first time any of us had been on a commercial beef feedlot and was an eye opening experience for all three of us. The sheer scope of the facilities was not something we could have imagined and we were blown away with the amount of cattle at each feedlot. After our guided tours through the feedlots, the feed mills on the property, and the animal health and processing facilities, we were very impressed with the quality of animal care and the health of the animals. From rumors and misconceptions we had heard previously in our lives, we left Texas with a new viewpoint about the beef industry that we were excited to share with our friends and family after arriving home. However, we couldn't leave Texas without visiting Cadillac Ranch or The Big Texan Restaurant (as made famous to tourists by the Man vs. Food TV show)...the meal was delicious!

After our trip to Texas, we returned to DCPAH and continued doing some more necropsy and computer training that would further aid with our BRD research study. We included a few necropsies on the ground of the necropsy floor to make it more field-like. We were also able to practice with the small containers we would be using for our field-sample collection. This was found to be a very important part of our training so we could take samples of the correct size that would fix properly in the amount of formalin we had to work with. With the guidance of the pathologists and support staff, this introduction to the world of necropsies and work in a diagnostic lab was very useful and gave us the introductory skills that we would use for the remainder of the summer.

Our next group trip was to Canada to visit a veterinary clinic and consulting business for the feedlot industry that taught us their field necropsy techniques and also a little bit about their business practices. As we spent time with the many different veterinarians from different backgrounds, we were able to practice our own necropsy
skills and diagnose them alongside practicing veterinarians, but also learn more about feedlot medicine, and explore more of the endless possibilities of veterinary medicine. Our time at this veterinary clinic was an incredible experience for each of us and we were treated exceptionally well by the staff and consulting team of the clinic.

After our group trip to Canada, everyone split up and went to their starting point for our 6-week research study on BRD. One person went to California to the calf ranches, another person went to Colorado to the feedlots, and the third person went to DCPAH. Each of us was at a certain location for two weeks before rotating to the next location. Eventually all three of us were at every location. Every day, the two people at the calf ranches and feedlots would perform necropsies; take the required tissue samples, and overnight the research samples to the person at DCPAH in order to be processed. The first person to be stationed in each location had the difficult task of figuring everything out and then setting up materials and detailed instructions for the next person to ensure a smooth, consistent transition. We worked cooperatively with each other and the other various stakeholders in the project, communicating frequently by means of calls, emails, texts, conference calls, video chats, and regular mail.

The research study period was followed by a small group trip to Green Bay, WI accompanied again by Dr. Bolton. After a fun side trip and tour of Lambeau Field, the Green Bay Packers’ football stadium, we spent a day presenting our summer activities to a group of producers and head employees of four large WI dairies. Our main focus of the lunch meeting and training session was to teach the individuals how to perform field necropsies on cattle at their respective facilities using the systematic approach we had learned up in Canada. This gave us the chance to reflect on what we had learned over the last 11 weeks and work together to present and teach others in the industry.

Our final week of the program was spent at DCPAH again as a group. We collected and reviewed all of the results of our study data and organized our findings in a cumulative spreadsheet to be shared with the pathologists and Merck Animal Health. Looking back, our summer internship through the Food Systems Fellowship program was much more than we anticipated or could have ever imagined. We were able to broaden our horizons about large animal veterinary medicine and meet many influential colleagues all over the United States and Canada. Aside from scientific and medical skills, we obtained significant exposure about business travel and work in the “real-world.” Staying in hotels for 7+ weeks, renting cars in multiple states, flying 20+ flights, and working with others as well as alone, we gained both valuable interpersonal and intrapersonal skills. We learned how to go with the flow, be flexible, expect the unexpected, and problem solving skills that we will forever use during our careers. We would like say a huge thank you to everyone at Merck Animal Health and those behind the scenes for the Food Systems Fellowship program that provided us the wonderful opportunity to participate in our endeavors this summer; we are extremely grateful for our experiences!
This summer I completed an internship at Neogen Corporation through the Food Systems Fellowship program at Michigan State University College of Veterinary Medicine. The food safety lab I worked in was responsible for the research and development of user friendly diagnostic test kits to detect various foodborne pathogens in food matrices. The research experiments I worked on over the summer were conducted under Dr. Jennifer Rice, Dr. Mark Mozola and Dr. Preetha Biswas in the Pathogen Detection laboratory at Neogen’s Center of Microbiological Excellence building in Lansing, Michigan.

I spent most of the summer working on the research and development of various protocols involving the use of selective and non-selective media for the detection of Salmonella spp. in food matrices. There are four major steps performed in the process of media development. First, a literature search is performed to get familiarized with current studies and generate ideas regarding the focus of a particular project. Then, Bioscreen, an incubator and culture growth monitoring instrument (OD-reader) was used for pilot trials to compare the growth of a given species of interest within various growth media conditions. Next, the enrichment media is formulated to best suit the needs of the experiment. Lastly, the media is then tested on a given food matrix for the isolation and detection of a target pathogen. Neogen’s Amplified Nucleic Single-temperature Reaction (ANSR) technology is a nucleic acid amplification system that is capable of detecting a range of target pathogens at a relatively fast rate. This equipment is unique because it operates using isothermal amplification methods. A fluorescent molecular beacon is responsible for the detection of the target pathogen’s DNA which allows for the analysis of a wide variety of sample matrices making this an ideal tool for foodborne pathogen detection. The two different matrices that I worked with while at Neogen were egg products and fish samples.

My lab partner Dr. Lei Zhang and I spent most of our time developing a protocol to detect Salmonella spp., an enteric Gram negative
organism, from high background fish and environmental samples. The mission of our project was two-fold; first to isolate and identify bacterial competitors from the samples, and secondly to develop and compare various selective and non-selective enrichment media combinations to ultimately determine the most viable enrichment broth in the detection of Salmonella spp.

Our fish and environmental samples had high levels of background bacteria which competed with our target pathogen, and ultimately interfered with the detection limits of our study. Using an Analytical Profile Index 20 (API 20) strip we were able to isolate and identify three different bacteria present on our matrices. The identification of these strains helped us develop a two-step enrichment protocol to selectively enrich Salmonella spp. using a selective broth. By implementing this enrichment procedure we were able to initially recover stressed cells and subsequently isolate and detect our target Salmonella spp. using a quick 24-hour enrichment incubation period.

After determining the ideal combination of enrichment broths for the isolation and detection of Salmonella spp., we experimented with various selective antibiotics as an alternative user friendly approach to isolating and detecting the pathogen from similar fish and environmental samples. Using Bioscreen we were able to evaluate the growth rates of all competitors and Salmonella spp. individually and as a group, while treated with different antibiotic combinations. Several strains were initially resistant to the antibiotics, so it took some trouble shooting to determine the combination that would best inhibit competitors, while allowing Salmonella spp. to still grow.

In addition to the fish project, I also worked with Dr. Zhang and Debra Foti on the Association of Analytical Communities (AOAC) validation of the ANSR Salmonella Assay testing five types of egg products. The AOAC is a scientific nonprofit association that standardizes chemical analysis methods to increase confidence in results of chemical and microbiological analyses. This ANSR Salmonella Assay project was undertaken to determine the best detection method for Salmonella spp. found in egg commodities against the appropriate reference method. Various governing bodies are responsible for the regulation and standardization of food products and testing methodologies at different points during processing and packaging. For example, the FDA-BAM methods are required to be met when working with raw shelled eggs; however, USDA-FSIS methods are required to be met when working with pasteurized eggs products. In this study, five different types of egg products were tested to determine the recovery and detection limits of the ANSR Salmonella Assay. The final ANSR Salmonella Assay protocol for egg products will be submitted for AOAC approval, which requires equal (or better) results compared to the USDA-FSIS and FDA-BAM methods, as appropriate for individual food types.

One last project I was involved in was sorting through research data that was generated for obtaining a label claim for an immunostimulant containing nonviable Propionibacterium acnes. This Neogen product is currently used intravenously in horses, under the name EqStim, as an adjunct to conventional therapy in the treatment of Equine Respiratory Disease and is also distributed under the name Immunoregulin.
for IV use in dogs. It has been demonstrated to be effective in increasing the rate of recovery when used in conjunction with antibiotic or hyperimmune therapy in the treatment of bacterial and viral infections associated with ERD. The main focus of this research was to design a study to expand the current EqStim label claim by demonstrating, through clinical trials, safety and efficacy as an immunostimulant for the prevention and recovery from other diseases such as Equine Herpes Virus, Rhodococcus equi and much more.

My overall experience at Neogen this summer was enriching and rewarding. On a daily basis I was able to work side by side with professional microbiologists. My lab partners helped me grow as a student intern to improve my technique and understanding of scientific methodology. I would like to thank the Food Systems Fellowship program at MSU CVM, Dr. Jennifer Rice, Dr. Mark Mozola, Dr. Preetha Biswas, Dr. Lei Zhang and Debra Foti for this opportunity and their guidance along the way.
This summer I had the opportunity to work for Neogen Corporation at their Center of Microbiological Excellence in Lansing, MI. Neogen was founded in 1982 by Mr. Jim Herbert and currently has over 700 employees world-wide. In addition to the Lansing location where I worked, Neogen has facilities in Kentucky, Nebraska, California, Wisconsin, Colorado, Brazil, Scotland, Mexico, and China. The company’s focus is on food and animal safety, producing and distributing a wide range of products from vaccines to diagnostic equipment. I worked in the Pathogen Detection lab, under the supervision of Dr. Preetha Biswas, Dr. Mark Mozola, and Dr. Jennifer Rice.

I spent the first few weeks familiarizing myself with the lab and refreshing my memory on various microbiology procedures such as pouring plates, performing titers, and preparing media. I also searched the literature to become up-to-date on mastitis in cows and immune modulation with regards to respiratory disease in horses.

Next, I began working on a mastitis project. Environmental mastitis, caused by gram-negative bacteria, is typically not treated, whereas mastitis caused by gram-positive bacteria is treated with antibiotics. However, there is currently no rapid test to distinguish between the two. Currently used culture methods take at least 24-48 hours to provide results. Having to wait for one or more day for test results means cows are either not treated for a day when they should be (resulting in an extended period of time off the milking line) or that cows who don’t need to be treated are, resulting in needing to remove the cow from the milking line due to withdrawal times needed. In either case, the dairy farm is losing money. Neogen, therefore, is working on developing an antibody-based immunodetection assay to fill the need for a more rapid result. I screened rabbit serum using an enzyme-linked immunosorbent assay (ELISA), ensuring the blood had antibodies against our organisms of interest, but not against undesired organisms. The antibodies from the rabbit serum will then be used in developing the immunodetection assay. I also had the opportunity to visit the MSU Dairy Farm to collect milk for some of our experiments.
In my down time from lab, I worked on sorting through research data for a current Neogen product. This product, ImmunoRegulin, is used to modulate an animal’s immune system when facing infection. It is currently approved for use in dogs and horses, and has been shown to speed recovery from respiratory disease by inducing a non-specific cell-mediated immune response characterized by activation of macrophages and release of cytokines. This product has also been shown to improve reproductive performance of mares with persistent endometritis. I was looking for data to support its use in specific types of infection in a variety of species to broaden the product’s label claim.

I worked on another project evaluating the use of Neofilms for the detection of microorganisms in various food products. These films are easy to use and take up a fraction of the space of traditional agar plates. They also save time because a sample is pipetted directly onto a pad containing media, so there is no spreading step as in traditional culture methods. I evaluated these films using five different food matrices. Some matrices, such as raw milk and liquid egg, presented a challenge because they discolored the Neofilm pad, making counting bacterial colonies impossible. To try to fix this problem, we diluted the food matrix. Each type of Neofilm is optimized for detecting a specific type (or types) of organism. The colonies are easy to distinguish on the Neofilms because they turn a variety of colors, from red to blue or green.

Since the agar film project only took a few weeks to complete, I began a new project working with Campylobacter. Growing the organism microaerophilically requires the use of specialized equipment which takes up extra space. Traditional enrichment media for Campylobacter requires an added supplement, which reduces the background bacteria, in addition to microaerophilic incubation. Ideally this supplement would be added into the media, eliminating this extra step. In order to ensure the stability of the supplement once added into the media, I tested samples that had been stored for an extended period of time against samples with fresh supplement. First I used a Bioscreen to screen a number of different formulations and then I tested some of those formulations with food matrix. I also tested the effectiveness of adding a non-antibiotic supplement to enhance Campylobacter’s growth.

I enjoyed my time at Neogen and appreciated that it allowed me to build on skills I had learned from microbiology labs during my undergraduate studies and my time working in a microbiology lab at a pharmaceutical company. Of special interest to me was the project I worked on involving Neofilms, because I can envision myself using them in practice in the future. Since they are so compact and easy to use, they could speed up diagnosis by allowing testing to be performed in-house. Working on various Research & Development projects and learning new skills from different members of the laboratory, I now have a better understanding of what testing is involved for animal products, such as milk, eggs, and meat.
When I told my family and friends my summer plans, they frequently responded with: “I thought you were going to vet school?” The connection between agricultural legislation and my goal of working in food animal medicine was not easily understood by many at first, but I was tremendously excited to have the opportunity to spend my summer on Capitol Hill working as a Legislative Fellow with the United States Senate Committee on Agriculture, Nutrition, and Forestry. Senator Debbie Stabenow of Michigan is the Chairwoman of the committee and I worked with her committee staff to research policy issues and keep the Chairwoman and other members of the committee informed. The committee staff has the impossible job of keeping up with every topic affecting agriculture. Thankfully, the staff is large, dedicated, and each person is an expert in their field.

Working on The Hill is an experience by itself. Every morning I would take the Metro in and descend upon the city just before 9 am with thousands of other staffers – all necessary to keep the government running. I frequently got lost taking the underground passageways and trams that connect the House and Senate office buildings to the U.S. Capitol building, but I was never too disappointed, as I regularly passed by Senators and Representatives rushing off to the Senate Floor to speak or vote.

As the only veterinary student on committee staff, my primary role was to consult on scientific issues. Obviously, the Agriculture Reform, Food, and Jobs Act of 2013 (or the Farm Bill, as it is commonly known) got the most media coverage this summer, and I was fortunate to have the opportunity to work on it. The Farm Bill is the primary vehicle for changing agricultural policy and it is renewed every 5 years. I came to DC just in time to see the Farm Bill go through its committee mark-up. Weeks later I watched as it was debated on the Senate Floor. There is a great deal of behind the scenes work when your Senator has a large bill like that on the table. There were over 200 Farm Bill amendments and
each one needed summarized and a voting recommendation written. The final Senate-passed version of the Farm Bill is 1,162 pages long. This is where my summer started; I was thrown right into the fray and I loved it. I was worried that as a science student, I would not have the policy chops to make it in DC. Turns out, figuring out legislation is a lot like veterinary school. I would be given a topic I knew nothing about and a very short window of time to learn everything there is to know about it. I then had to summarize the information I discovered and make recommendations based on what I had learned. It was this process that really made me feel like my work was worthwhile.

I was also very involved with the committee hearing on the acquisition of American pork producer, Smithfield Foods, by a Chinese holding company, Shuanghui International. I was assigned to track the Smithfield issue which required a lot of reading the news (another key part of a hill staffer’s job). I think I read every article written on the topic this summer. Eventually, the letters and phone calls started rolling in; constituents were concerned about the implications of the deal. I compiled summaries of the most comprehensive news coverage and reached out to professors and industry leaders to figure out how the pork industry in China compared to that of the U.S. I learned about other international acquisitions of American companies and met with experts on the topic. When the Senator decided to hold a hearing on the topic, all that research was compiled into a giant memo for the staff. The hearing was scheduled, witnesses were invited, and I helped compile the supporting documents needed for the Senator. It was an incredibly interesting hearing. The witness testimony was informative and thought-provoking and Senator Stabenow was praised as a consumer advocate. It will be interesting to see what happens with the Smithfield/Shuanghui deal in the coming months.

One of my favorite parts of the fellowship was meeting with constituents and consumer groups. I saw more than a few friendly faces from Michigan and had the opportunity to network with industry leaders. These visits brought important issues to the table including Country of Origin Labeling, the Bovine Tuberculosis outbreak in Michigan, Horse Slaughter, Livestock Transportation legislation, Antibiotic Resistance, anti-Puppy Mill legislation, and the use of Methionine in Organic Poultry production.

My biggest success of the summer was convincing Senator Stabenow to cosponsor the Veterinary Medicine Mobility Act – a bill that would ensure Veterinarians can continue to transport controlled substances in the course of their work. It took a lot of research, following the bill as it was written and rewritten multiple times, and then many drafts of a memo – the primary way staff communicates with the Senator – to prepare my points. It was really rewarding to help move legislation forward that I had supported as a student.
Before board the plane for Washington, DC last spring, I had considered that this fellowship could leave me with a jaded view of politics. Amazingly, being this close to the process renewed my faith in our government. The Agriculture Committee is refreshingly removed from most of the partisan debates. Since agricultural commodities vary by climate, the debates were often more regionally conflicted with Senators championing their State’s commodities. While I heard my fair share of seemingly extreme comments from government officials, I also had friendly and insightful conversations with Michigan Senators and Representatives that really do care what their constituents have to say and are very much attuned to the needs of farmers.

For me, this fellowship was a life-changing opportunity that has inspired me to find other ways to get involved and advocate for the needs of the agricultural community. A veterinarian is a trusted source of information within a community and I now feel better prepared to provide for my future client’s needs. Animal health does not exist in a vacuum, it is affected by legislation so we as Veterinarian’s must keep informed and help influence policy that supports farmers and does not hinder their ability to provide the best possible care for their animals.
Richard Blair  
MSU CVM Class of 2015

This summer I was fortunate enough to work for the Michigan Department of Agriculture and Rural Development, in the Animal Industry Division (MDARD AID). To put it simply, I would recommend this position to any fellow student, regardless of what "path" they want to pursue within the vast realm of veterinary medicine. I can say for certain that the experience and knowledge I have gained from this summer internship will benefit me no matter what direction I take with my future.

The bulk of my summer was split up working on various different projects for the department. The first few projects spanned a variety of topics. I first researched state laws throughout the United States pertaining to cats, both domesticated and feral, in hopes of finding an ideal set of regulations to use as a guide for creating new laws here in Michigan. I next updated records on large carnivores (bears, cougars, etc.) and wolf-dog hybrids residing in the state of Michigan. For the third project I made biosecurity information sheets to give to county fairs throughout the state.

Though much of this work was accomplished in the office - a place that may not sound like the most fun to some (including me), it proved to be a great time! This was partly because I learned a great deal from the projects I worked on, but more importantly because I had the opportunity to work with many amazing MDARD employees. Everyone there was extremely helpful and supportive, and I have gained many awesome friendships through the experience.

On top of that, I improved many important skills necessary for my future. A lot of the work for these projects involved contacting various sources to gather information; sources such as animal control officers, fair board members, and even state veterinarians. It was a great opportunity for me to practice some formal communication skills while representing the state of Michigan. I also had the opportunity to work on public speaking as I presented information regarding projects during a department meeting.

Another great thing I can take away from this office experience is an understanding and appreciation of how things function within MDARD AID. I was able to sit in on many conference calls and meetings throughout my experience. It was eye-opening to see just how much collaboration takes place on a day-to-day basis between various departments and organizations within the state as well as on a national basis.

Finally, from these projects I was able to practice my ability to work towards a deadline, be accountable and meet work expectations. It was a chance for me to work under "pressure" (though everyone was very supportive and understanding) knowing that others were counting on me to complete my work on time. I consider this to be an important quality to possess regardless of professional career choice.
The last 2 months of the internship was spent on my primary project involving biosecurity at county fairs. Working with fellow intern Julie McGhan, we travelled to county fairs throughout the state distributing pamphlets and informational brochures that spoke on biosecurity. In other words, it was my responsibility to provide information to fairs on ways to prevent the spread of disease between animals, animals and humans, or human and animals. Aside from providing information we also met with fair board members and provided walkthrough assessments of their fairgrounds. During the assessment we would give suggestions for ways to maintain or improve biosecurity. Just as Julie helped with my project, I helped Julie complete her project, which consisted of testing poultry at county fairs for avian influenza. It turned out to be quite convenient and made for a great opportunity to work together as a team. By the end of the summer, Julie and I had attended 39 fairs throughout the state of Michigan!

Aside from projects, I also had some opportunities to ride-along with field staff veterinarians and experience their daily duties. Over the course of the summer I got to: walk through a stockyard and sit in on a live-auction, help inspect pet shop facilities and animal shelters, ride along for a TB trace visit, and be present on a farm for a drug-tissue investigation. Every field staff personnel I had the privilege of meeting was a blast to work with.

All in all, this was the ideal summer experience for me. It allowed me to experience first-hand what regulatory medicine is all about. I improved many practical skills. I got to work with many wonderful professionals and built many new friendships along the way. As I said before, I would recommend this internship to anyone. I would like to sincerely thank everyone involved with the Food Systems Fellowship Program for providing these summer opportunities that undoubtedly expand our horizons and help shape our futures. Also, thank you to the Michigan Department of Agriculture and Rural Development Animal Industry Division for selecting me to work with you all for the summer. It was a great honor and privilege.
Zoetis (zō-EH-tis) is the leading animal health company in terms of sales. Previously known as Pfizer Animal Health, Zoetis discovers, develops, manufactures, and markets veterinary pharmaceuticals. Zoetis has a focus on both farm and companion animals, with farm animals making up 65% of annual revenues. The company is large, with more than 9,300 employees worldwide, a local presence in approximately 70 countries, and products serving 120 countries.

On June 24th, Zoetis officially separated from Pfizer and became a standalone company. Since I was here during that change, I was able to experience some exciting changes like seeing “Zoetis Orange” everywhere, learning more about Pfizer stock vs. Zoetis stock, and hearing about the new Zoetis brand packaging debut. I was based at the Richland farm site with two other interns, and the rest of the interns worked mainly at the downtown facility. I was able to perform investigative literature searches and determine inventive ways to gather meaningful experiences without the traditional studies.

The building that I was based in is a biosecurity level 2 building with the animals housed in isolation rooms. The measures taken to maintain sero-negative status, to ensure proper animal care and welfare, and to protect human health were way beyond what I expected. Everything was shower in-shower out, extensive personal protective equipment was required, and trafficking orders were enforced. While my skin may not have enjoyed taking an average of 6 showers per day, it was a necessary part of the research process that kept everything separate to ensure nothing was transmitted between animals via humans.

During my internship, I worked mainly with swine and cattle. I participated in numerous activities including vaccinations, challenges, and necropsies. My necropsy skills greatly improved, as did my animal handling skills. Being a first year vet student, I had not taken any pathology classes, but my knowledge and familiarity with the agents we were working with improved dramatically. I am looking forward to the moment when I’ll be sitting in class and realize “I know all about that – we were working with that at Zoetis!”

The changes happening at Zoetis allowed me to craft this internship into my own and I was able to work some variety into my weeks. I was able to work with companion animals (dogs and cats), horses, and ferrets! While these species were not my main focus at Zoetis, it was still a great experience to understand what happens with research and development of products for these animals as well.

At Zoetis, there are multiple internships offered each summer. Most are for undergraduate students that work downtown, so there were enough other interns that
Zoetis organized some intern activities and “field trips.” I had the privilege of attending a trip to Kellogg Biological Station and Bird Sanctuary. It was a great experience to network with my fellow interns and to learn about the facility connected with Michigan State. At the Kellogg dairy site they have a pasture dairy with robotic milkers that we were able to observe and learn about as well. The other big intern trip was down to Fair Oaks in Indiana. This area is truly ruled by dairy operations and has developed into a huge tourist attraction. There is an adventure center and tours of a working dairy that milks using a rotary parlor. Fair Oaks just finished a new swine adventure center this summer, so we were the first Zoetis group to be able to visit this educational site. It was great to see the ways that this area is really reaching out to the public to educate about agriculture and allow a certain transparent look into livestock operations.

Overall, my internship at Zoetis was an amazing experience. The effect that this opportunity will have on my future is immeasurable. After this experience, I could definitely see myself working as a veterinarian for a pharmaceutical company. I have also developed a much larger respect for the amount of time, work, and money that goes into research and development of pharmaceutical products. When I reach to grab a drug off the shelf, I’ll know a lot more of the meaning behind the label and will be able to connect to the client more when I use a product.
Ashley Cooley  
MSU CVM Class of 2016

Dairy products are highly incorporated into the lives of consumers and are also one of the most tightly regulated and safest foods in agriculture. Michigan Milk Producers Association is a cooperative, meaning it is owned and controlled by its members. Currently there are over 2,300 dairy farmers served in Michigan, Indiana, Ohio, and Wisconsin. The focus of the cooperative is to ensure a market, and paycheck, for all of their member’s milk.

My role with the MMPA this summer has been a dynamic one. I spent the first part of my summer working with field representatives to better understand the MMPA’s role in keeping our milk safe. Field representatives provide onsite assistance and consultations to producers when needed. They regularly visit farms to perform routine inspections that help farmers know what improvements they need to make in order to stay in compliance with the Grade A milk standards. We would also visit farms flagged for high pre-incubated (PI) counts, high raw bacteria counts (RBC), high somatic cell counts (SCC) and low freeze points. These counts suggest certain milk quality problems that can be identified and resolved.

Furthermore, I assisted with performing MSPAP’s (Milking Systems Performance Assurance Program). We used a Triscan to determine milk let down of individual cows, the pulsation ratio, and vacuum levels to ensure ideal milking efficiency. CIP (Clean In Place) checks were also performed to ensure that milking equipment is staying clean and being properly sanitized. The CIP checks help to confirm that the mechanics are working properly and the correct amount of detergent, acid, and sanitizer are being used to keep the equipment clean after each milking. The water temperature is also evaluated to make sure that it enters the cleaning cycle at 160 degrees or more and does not exit the wash under 120 degrees.

I also worked with some member representatives who were certified to perform energy audits. They evaluate every energy usage on the farm from the lighting usage and ventilation, to the vacuum pumps and milk cooling. They then compiled and analyzed the data into a report that offered suggestions on how to maximize energy efficiency.
A voluntary program that the MMPA is advocating for its members to participate in is the FARM (Farmers Assuring Responsible Management) program. The purpose of the program is to showcase to consumers that dairy producers are responsible and take pride in ensuring the welfare of the cattle in their care. The FARM evaluator presents the producer with a set of questions to answer about how they handle and take care of their livestock, and then score the cattle in the areas of Locomotion, Body Condition score, Hock condition, and hygiene.

Through my work with member representatives, I observed every style of dairy farm, from the smaller Amish farms where every worker was family, to farms milking thousands of cows and employing many workers. No two farms are alike, and every parlor is different. I observed cows being milked in stanchion barns, in rotary parlors, and even by robotic milkers. I find it fascinating to see how well cows adapt to the various parlor styles.

In addition to working with member representatives out in the field, I also learned more about how milk is manufactured into the products we know and love. I visited two manufacturing plants, one owned by the MMPA, and Michigan Dairy, which bottles milk for Kroger. I also learned more about quality control when I visited MMPA's main office in Novi, MI. The lab there tests samples from each farm for antibiotic residues, bacteria count, components, and somatic cell count. All milk is tested before it enters any manufacturing plant.

Education was an important part of my internship this summer, so I attended many meetings that helped to inform me of important current issues in the dairy industry. I attended the Indiana Board of Health meeting in Indianapolis to learn about issues in Indiana, attended the Michigan Department of Agriculture Dairy Industry review to learn about Manufacturing milk exclusions and Grade A Milk exclusions in Michigan, and sat in on an advisory committee meeting to learn about current events and issues within the MMPA.

I also assisted in educating milkers at a Spanish milker training school that focused on improving milk quality and udder health. A PowerPoint was presented that showed the importance of following proper udder prep procedure. Hands on training was then
provided with the utilization of udder models. Milkers were educated about how proper stimulation and lag time before attaching the milking unit allows for maximum milk letdown and complete milking out of the cow.

Another important aspect of the MMPA is the education of our younger generations and the promoting of animal agriculture. I assisted with the 4-H milk marketing tour that provided educational opportunities for a dozen youth aspiring to have careers in agriculture. I also was a judge for the 4-H Dairy Quiz Bowl and helped run an exhibit at the great dairy adventure that let youth of all ages and backgrounds practice proper udder prep and milking unit attachment on a fake udder. I also assisted with a Breakfast on the Farm where I taught kids and adults how milk is safely cooled and transported after it leaves the cow and provided insight into how highly regulated milk really is.

The leading focus of my internship with the MMPA was to conduct research in collaboration with Dr. Erskine at MSU CVM. The study emphasized intramammary teat infusions and their impact on mastitis. The study hoped to determine herd practices related to intramammary infusions including dry off protocols, the prevalence of subclinical and clinical mastitis in the herds, and the effectiveness of proper protocol training for mastitis therapy. 24 herds were enrolled in the study and divided into intervention/control herds, and are to complete the study in 12 months. The first part of the study was the portion that I was working on this past summer, while the last part of the study involving gathering results next summer is scheduled to be completed by the next FSF MMPA intern. My duty was to visit each farm and collect information regarding mastitis therapy, milking techniques, vaccination programs, and the farms facilities as relates to mastitis. I then provided training to milkers and owners on proper dry off protocol and offered 70% alcohol soaked baby wipes as an alternative to commercial alcohol pads used in intramammary infusions. I also provided sample collection kits and trained milkers/owners in taking clean aseptic samples of milk from quarters infected with clinical mastitis. Each farm was instructed to take samples of all clinical mastitis on their farm and a MSU employee picked up the frozen samples every two weeks to be analyzed at MSU. The intervention farms are to have follow up training at regular intervals over the next year, and then next summer, the survey and sampling is to be repeated to discover the results of our study and the extent of procedural drift. As part of the research, I also helped to plate and read the milk samples in order to identify the type of bacteria infecting each quarter of clinical mastitis cows. Unusual pathogens including *Prototheca Sp.* and *Mycoplasma* were also tested for. I am confident that the results of the study will prove useful to dairy farmers.

My summer with MMPA will always be remembered because it opened my eyes to so many facets of the dairy industry that I had never before even considered. I know that the skills I have learned will help to further my knowledge of dairy medicine in the future and allow me to offer even more to clients by way of my understanding of common management issues. I am forever grateful to Michigan Milk Producers Association and the Michigan State University College of Veterinary Medicine Food System Fellowship Program for providing me with this one of a kind chance to expand my interest and knowledge in the dairy industry.
Julie McGhan
MSU CVM Class of 2015

This was my second summer working for the Michigan Department of Agriculture and Rural Development in the Animal Industry Division (MDARD AID). I worked with Dr. Nancy Barr, the Program Manager for the Avian, Swine, and Aquaculture programs. Although my top priority was conducting Avian Influenza surveillance testing at county fairs across the state of Michigan, fair season in Michigan doesn’t kick off until mid-June. So, I spent May and the first part of June in Constitution Hall of Lansing, in the MDARD AID office working on a variety of projects. I updated program brochures, learned about Avian Influenza and its activities globally, and created a fact sheet about Porcine Reproductive and Respiratory Syndrome. During the beginning of the summer I was also able to ride along with the field veterinarians as they performed their daily activities to get a feel for what regulatory veterinarians do in the state of Michigan. I was able to see a drug residue investigation on a dairy farm, tuberculosis testing and trace work, Equine Infectious Anemia testing, and animal shelter inspections. I was also given the opportunity to attend several meetings about Emergency Preparedness, One Health, Vector-Borne Diseases, as well as attend a conference by the Michigan Department of Community Health. This was a particularly interesting conference to attend, because the medical community is just starting to look at the concept of One Health. It was surprising to see how few of the local doctors, nurses, and other human medical professions had heard of One Health. The keynote speaker even made a comment that veterinarians are a key resource that should be utilized by doctors. Later in the summer, the two other student interns and I, Anna Groll and Richard Blair, created a display for the division to use at Ag Expo, an agricultural fair held on campus at MSU every year. I also assisted with the Great Dairy Adventure with other Food System Fellowship students at the MSU Livestock Pavilion.

When the county fairs started, Richard Blair and I traveled to as many of them as we could and distributed information from MDARD, National Pork Board, United States Department of Agriculture, Centers for Disease Control and Prevention, and Michigan State University. We brought posters, brochures, business cards, and information sheets to each county fair regarding animal disease issues, biosecurity, and hand-washing. By the end of our summer in mid-August, we had attended 39 fairs, literally all over the state. While we were at the fairs, we also walked around the fairgrounds to get a feel for how thorough the biosecurity is at Michigan’s fairs. This information will be shared in a report given by MDARD AID at a conference for fairs and exhibitions in January. At some of these fairs, we were able to tour the fairgrounds with a fair board member, and give verbal recommendations and/or praise regarding their fair biosecurity. Fair biosecurity was my main project when I worked for MDARD last summer, so it was very interesting to see the changes that had been made between last year and this year. I was very impressed to see that the recommendations I had made last year were being followed to the best of the fairs’ abilities. Overall, we saw an increase in the number of hand-washing stations and hand sanitizers, as well as an increase in the number of
signs posted instructing guests to wash their hands and not eat or drink in the animal barns. The areas that had the most room for improvement were still having adequate signage, and keeping people from eating and drinking in the animal barns.

Of those 39 fairs, we were able to conduct Avian Influenza surveillance testing at 14 of them, twice what we were able to the year before. At each fair we tested an average of 7 households, with 3-4 birds per household. Testing consisted of taking a tracheal or pharyngeal swab from all birds except waterfowl, which required a cloacal swab. We then put up to five swabs from the same household in a test tube with liquid AI media and delivered them to the Diagnostic Centers for Population and Animal Health for a Polymerase Chain Reaction (PCR) Avian Influenza test. The PCR test looks for H5 or H7 avian influenzas, since these are the strains that are known to be highly pathogenic, or that may mutate into highly pathogenic strains. Over the past several years, MDARD’s testing at county fairs has not found a positive household, which is a very good thing. However, it is important to keep looking for highly pathogenic AI, to protect and better serve the poultry industry in Michigan and keep our egg and meat supply safe.

I would like to thank MDARD AID for welcoming me back for a second summer! Thank you to Drs. Baer, Roth, Chickering, Livermore, and Brunner for letting me ride along with you and for helping with the AI surveillance testing. Also thank you for Dr. Nancy Barr and Tina Moreno for letting me work alongside of you and for a great experience!
My summer was spent gaining an understanding of the vital role team work and integrative services play in the success of dairy and beef farms. Companies like NorthStar Cooperative support the dairy industry in a vital way by enabling improved production, increased profitability, access to and assistance in the implementation of new technology, diagnostic services and expert council. There are two unique aspects of NorthStar in that unlike many companies in the agricultural industry it is a cooperative, owned by those it serves, and provides integrated services to support producers in all aspects of dairy and beef operation management. NorthStar incorporated many farm services such as semen sales, artificial insemination services and training in artificial insemination for farm employees, dairy herd information services through full service milk testing, disease screening and diagnostics, and support for record keeping systems such as PCDART. These services are provided through the various branches or business units of NorthStar, Dairy Herd Information (DHI), Select Mating Services (SMS), Select Reproductive Services (SRS), Select Sires, and AntelBio Systems.

I was fortunate to work with AntelBio, which strives to be a “global leader in the development and implantation of innovative diagnostic solutions for the animal industry.” AntelBio provides testing for pregnancy in lactating cows, Johne’s Disease, Bovine Viral Diarrhea, Leukosis, Bovine Neospora caninum, and mastitis causing bacteria. Through NorthStar’s Learning Center courses, I also learned about each disease, the principles of the associated diagnostic test, herd health goals, and basic epidemiology concepts. My time with AntelBio involved learning the various diagnostic tests they routinely run for their clients, riding along with partners from the other branches of NorthStar to learn about their role in providing integrative services to producers, and working on a research project focused on modeling the economic value of the recently released milk-based pregnancy test to dairy producers. Rather than rotating through these different aspects of my internship throughout the summer, I
appreciated that all three areas were incorporated into each week. I typically spent a part of each day learning about the ELISA and polymerase chain reaction (PCR) based tests the diagnostic lab conducted or conducting the milk sample based pregnancy ELISA test myself once I became proficient. I really enjoyed the trips with other branches of NorthStar, which were spread across the summer. Through these trips I was able to practice heat detection and palpation techniques and learn about artificial insemination, how semen is sold and stored, and the role of SRS and SMS personnel in helping producers improve the genetics and overall performance of their herds.

The rest of my time focused on my research project, investigating the economic value of pregnancy confirmations during various time points throughout gestation. This involved several weeks of literature reviews and re-familiarizing myself with dairy reproductive physiology. I had not had any previous experience with economic modeling, so this entailed a lot of practice with online modeling tools. I also had to contact researchers at other universities to initiate collaborative efforts. We began to work closely with Dr. Victor Cabrera from the Animal Science Department of the University of Wisconsin. Dr. Cabrera specializes in economic models for various aspects of dairy production and works through an extension appointment to help dairymen improve their management skills and productivity. Using one of his economic modeling tools and several related papers we developed a spreadsheet which incorporated multiple aspects of reproduction, such as pregnancy rate, cull rate, and pregnancy loss rate. The spreadsheet allowed us to generate model herds and evaluate how the herd dynamics change based on adding pregnancy confirmations at various points in gestation. We used Dr. Cabrera’s tool to evaluate the theoretical value of the herds we generated. This allowed me to compare different reproductive management programs with the end goal of determining the value of using the milk based pregnancy test offered by AntelBio to confirm pregnancy. I was not able finish the project by the time my internship was over, but it gave me valuable insight into the complexity of economic modeling, the difficult decisions producers must make in managing reproductive efforts, and the potential ways producers can use tools such as the milk-based pregnancy test to make those decisions.

I enjoyed working in the highly collaborative and encouraging environment of AntelBio. I appreciated the patience of the people I worked with and their willingness to teach me in the lab, on the farm, and in a research setting. I gained a firm grasp of dairy reproductive physiology and a deeper understanding of the economic pressures that drive producers’ decisions.
The six of us were selected to go to Chennai, India for six weeks as part of the Food Systems Fellowship India program. At first it was a culture shock to see so many people and a way of life seeming so different than our own, but everyone was so welcoming and kind. During this experience we became great friends while working on our projects, learning about food systems throughout the country, attending conferences, and experiencing the culture. Our research projects included disinfectant efficacy on poultry farms, beta lactam antibiotic residues in milk, effectiveness of phytochemical treatment for bovine mastitis, the impact of antimicrobial resistance in the Indian dairy system, and nanoparticle cytotoxicity. As the number one dairy-producing nation in the world, India was an excellent site to study food systems.

While traveling throughout Tamil Nadu, we stopped to take samples for our projects and do some research. One such place we visited was the greater Narmakkal region which is the second largest egg producing region in India, and this success is due - in part - to sustained efforts to maintain safe and clean living conditions for their birds. At a typical poultry farm, microbial quality of the ambient air is tested every month by standard plate tests, which are followed by disinfection of the pens. The study we performed evaluated the efficiency and cost effectiveness of three different types of disinfectants recently launched in the market for on-farm use. Three culture plates were placed at 8 locations throughout the barn. Plates were exposed to the environment for 15 minutes and then incubated for 24 hours at 25 degrees Celsius. Colony counts were performed to serve as a reference to compare to the floor disinfection efficiency. To test the disinfectants, a one-inch square of the facility floor was swabbed for total bacterial count, coliform count, and fungal count. Adjacent one-inch squares were treated with the selected disinfectants in three increasing concentrations and swab samples were taken at intervals after initial
disinfectant application. This test was repeated at several other laying facilities throughout the state.

While traveling through Tamil Nadu, we collected milk samples from collection centers and farms we visited in addition to samples from Madras Veterinary College clinic and consumer sources such as milk sachets and road-side tea stands. There are currently no required tests for antibiotic residues in milk in India. Furthermore, due to lack of record-keeping, treatment by food control officers, and ignorance, farmers may not know whether there are residues in their milk. We used Neogen’s BetaStar Plus rapid migration assay to test our milk samples for the presence of beta lactam antibiotic residues. We found one positive sample from a clinic cow that was claimed to be without treatment. This highlights the need for residue testing. Future research is needed to test a wider variety of samples, and to determine whether a testing requirement is feasible in India.

Using the milk that we collected at various farms and collection centers throughout southern India, as well as other samples collected by the Madras Veterinary College graduate students, we screened for the presence of both *Staphylococcus aureus* and *Mycobacterium avium paratuberculosis* for another research project. The growing problem of antimicrobial resistance is not only a challenge facing public health in the United States, but one that spans across the globe. When positive milk samples were found, the bacteria was cultured and DNA was extracted. We used PCR on bacterial DNA in an attempt to isolate a known resistance gene from the positive samples. We double-checked for antimicrobial resistance with the use of antibiotic-infused discs on a petri dish containing a lawn of a suspected resistant strain. The resistant strain of *S. aureus* we were looking for was Methicillin-Resistant *Staphylococcus aureus*, or MRSA, which is an important public health concern globally. Many positive resistant samples were cultured, which underscores the importance for promoting the issue of antimicrobial resistance both in America and abroad.

Mass production and distribution of foods of animal origin such as eggs, milk and meat has increased the risk of foodborne infections and the ability to detect pathogens in these products is important to ensure the safety and quality of food. Thus, creating a sensitive and quick test that detects pathogens such as *Salmonella* and *E. coli* is critical for strengthening our surveillance of food sanitation and implementing timely and effective control measures during foodborne outbreaks. Another study investigated the ability to characterize isolates of *Salmonella* and *E. coli* from milk, meat and eggs using conventional and molecular techniques (PCR).
At one of the farms we visited near Thanjuvar, we learned about Dr. Punniamurthy's research developing a combination of phytochemical therapy that is cost effective and does not involve antibiotics. Clinical and subclinical mastitis cause a lot of economic loss to small and marginal farmers in the villages within Tamil Nadu. In fact, the cost involved in treatment discourages farmers from seeking veterinary help. The therapy developed by Dr. Punniamurthy uses a combination of aloe vera plant, turmeric powder, which is used mainly for its active ingredient curcumin, and calcium hydroxide. The therapy should cure mastitis in three days when applied onto the udders ten times during the first day and 5-8 times the next two days. During our research, we used the California Mastitis Reagent to test cows with clinical or subclinical mastitis. These animals were milked and samples were tested in the laboratory for somatic cell count and pH. Those cows that were positive for mastitis were treated with the phytochemical therapy and milk samples were re-tested to check for treatment effectiveness.

We also spent time doing research at Madras Veterinary College in Chennai, India. Their Animal Nutrition Department has been doing research on creating nanoparticles to use as a more efficacious mineral supplement to animals as nanoparticles have more surface area for interaction with enzymes and cofactors in the body. We performed an in vitro assay to test the cytotoxicity of one of the nanoparticles, copper. We used a cell line and applied the nanoparticles for 24 hours at varying concentrations. After incubation, we looked for evidence of cytotoxicity.

In addition to our research projects, we followed several cases at Madras Veterinary College and attended two conferences. At the International Symposium on Dairy Value Chain, we attended lectures given by veterinarians from throughout India about topics ranging from dairy farming to agribusiness to value addition. We also attended the 5th International Clinical Case Conference on Farm and Companion Animal Practice for Veterinary Students, where we presented the cases we followed at the clinic. Members of our group won 1st place in
the surgical division and 3rd place in the internal medicine division. Not only was it a great experience to present a case in front of peers, but it was an unforgettable experience to see the clinical manifestations of the diseases that we don't commonly get to see in the United States.

With India’s culture and economy, it was very interesting to compare their food systems to those in the United States. Not only did we learn about their agricultural industry but also their culture. While traveling to the tip of India, we utilized overnight trains and buses of all kinds. We got to see family run businesses as well as larger companies. This included the production and sale of products such as milk, ghee, yogurt, paneer, and ice cream. We also got to sample all of these delicious dairy products. We visited an Exotic Cattle Breeding facility, a feed mill, and many small farms. We also visited many temples, met a lot of friendly caring people, and toured some animal reserves. We got to eat plenty of delicious Indian food, attend an Indian wedding, work through language barriers, wear traditional Indian clothes, and drink lots of tea. Overall the India program was an amazing opportunity to experience a new culture, perform research, observe a different agricultural industry, practice working through communication barriers, observe diseases that are less common in the United States, develop new friendships, and most of all, grow into better people and future veterinarians.
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