Papers and Posters by Students and Faculty

Symposium – Dr. Martin K. Nielsen and Dr. Craig R. Reinemeyer

Banquet Address – Dr. Thomas Platt
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Acknowledgements

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For support of the LaRue, Cable, and Honorable Mention Awards and
other expenses.

*The 66th Annual Midwestern Conference of Parasitologists offers 4 Continuing Education Credits (4 CE). Your registration confirmation is proof of your attendance.*
Schedule

THURSDAY, JUNE 5, 2014

3:00-5:00 pm Dorm Check-in at Ingels Hall
   Registration packets available at Gluck Center until 5pm Thursday and in the lobby of Gluck Center Friday.

6:00 -9:00 pm Opening Mixer at Pazzos, 385 S. Limestone, Lexington.

FRIDAY, JUNE 6, 2013
Gluck Equine Research Center, Auditorium
1400 Nicholasville Rd., Lexington, KY 40546

8:00am Continental Breakfast, Poster Setup, Silent Auction Set Up

8:45 Opening Remarks and Welcome
   • Dr. Daniel Howe, Program Officer

CONTRIBUTED PAPERS
(STUDENT PAPERS INDICATED BY *)

9:00 1* Proterometra Macrostoma (Trematoda: Azygiidae): Effect Of Serotonin On Redial Movement And Emergence Of The Cercaria From The Redia And The Snail, Elimia Semicarinata (Gastropoda: Pleuorceridae). ERICKA BERG (UG) and RONALD ROSEN (MP), Biology Program, Berea College, Berea, Ky 40404.

9:15 2* Gut Helminths Of Two Species Of Light Geese In Illinois. EVAN BOONE (UG) and JEFF LAURSEN (MP), Department Of Biological Sciences, Eastern Illinois University, Charleston, Il 61920.

9:30 3* Environmental Conditions Significantly Impact Patterns Of Parasite Community Dissimilarity In A North American Bat Host (Eptesicus fuscus). ELIZABETH WARBURTON (GS) and MAARTEN VONHOF (MP), Department Of
Detecting *Cytaxzoon felis* In Field Collected Ticks From Southern Illinois. **ELLIOTT ZIEMAN (GS) AND AGUSTÍN JIMENÉZ (MP)**, Department Of Zoology, Southern Illinois University Carbondale, Il. 62901-6501.

**10:00** Break & Silent Auction Bidding, Poster Setup.

Parasites Of Bluegill In The Sangamon River: Impact Of Sewage Effluent And Seasonality On Infection Parameters And Correlation With Fish Condition. **MIRANDA WHITE (GS)**, **JEFFREY LAURSEN (MP)**, and **ROBERT COLOMBO (MP)**, Biological Sciences Department, Eastern Illinois University, Charleston, Il 61920

Analysis Of Horizontal Gene Transfer Between Schistosomes And Their Hosts. **BHAGYA K. WIJAYAWARDENA (GS)**, **J. ANDREW DEWOODY (MP)**, and **D. J. MINCHELLA (MP)** Purdue University, West Lafayette, In 47906

Evaluation Of The Systemic Inflammatory Response To Anthelmintic Treatment In Ponies. **MARTIN K. NIELSEN (MP)**, **ALEJANDRA BETANCOURT (GS)**, **EUGENE T. LYONS (PROFESSOR)**, **DAVID W. HOROHOV (MP)**, **STINE JACOBSEN (MP)**

Characterization And Localization Of *Sarcocystis neurona* Rhoptry Protein Snrop9. **MAGGIE SCHLICH (UG)**, **SRIVENY DANGOUDOUBIYAM (PD)**, AND **DANIEL K. HOWE (MP)**. Department Of Veterinary Science, University Of Kentucky, Lexington, Ky 40546-0099

Schistosome Therapeutics: Assays And Receptors For Discovering New Schistosome Chemotherapies. **PRINCE N AGBEDANU (PD)**, **MOSTAFA ZAMANIAN (PD)**, **ZACH NJUS (GS)**, **SANTOSH PANDEY (P)**, **MICHAEL J"
11:30 Lunch

THE AMCOP SYMPOSIUM
Gluck Equine Research Center, Auditorium

1:00 10 Martin K. Nielsen. University Of Kentucky
Anthelmintic Resistance – Survival Of The Fittest?

2:00 11 Craig R. Reinemeyer, East Tennessee Clinical Research
Biological Adaptations In Equine Parasites And Other Unintended Consequences Of Chemical Control.

POSTER SESSION
Gluck Equine Research Center, 2nd Floor

3:45 12* Sequencing Of Biomphalaria glabrata Upstream Immune Response Genes. FIARA ANDERSON (UG), Department of Biology, Lawrence University, Appleton, WI, 54911

13* In-Vitro Egg Development In The Trematode, Cotylaspis insignis (Subclass Aspidogastrea). LEAH PENG (UG), ERICKA BERG (UG) AND RONALD ROSEN (MP), Biology Program, Berea College, Berea, Ky 40404

14* Efficacy Of Injectable Ivermectin On Gastrointestinal Helminths In Captive Wild Elk. ALEJANDRA BETANCOURT (GS)1*, JOHN J. COX (MP)1, BRYAN M. TOM (T)1, EUGENE T. LYONS (PROFESSOR)2, MARTIN K. NIELSEN (PROFESSOR)2, 1department Of Forestry, University Of Kentucky. Lexington, Ky 40546, And 2gluck Equine Research Center, University Of Kentucky, Lexington, Ky 40546
15* Relationships Between Body Condition, Immune Function And Host Sex In Predicting Helminth Burdens Of Big Brown Bats (*Eptesicus fuscus*). **ELIZABETH WARBURTON (GS) AND MAARTEN VONHOF (MP), Department Of Biological Sciences, Western Michigan University, Kalamazoo, Mi 49008

16* Intraperitoneal Development Of The Filarial Nematode *Brugia malayi* In The Mongolian Jird (*Meriones Unguiculatus*). **YASEN MUTAFCHIEV¹ (PD), ODILE BAIN² (MP), ZACHARY WILLIAMS³ (GS), JOHN W. MCCALL⁴ (MP) and MICHELLE L. MICHALSKI³ (MP), (1) Department Of Animal Diversity And Resources, Institute Of Biodiversity And Ecosystem Research, Bulgarian Academy Of Sciences, Sofia, Bulgaria (2) Parasitologie Comparée Et Modèles Expérimmentaux, Muséum National D’histoire Naturelle, Paris, France (3) Department Of Biology And Microbiology, University Of Wisconsin Oshkosh, Oshkosh, Wi, Usa (4) Department Of Infectious Diseases, College Of Veterinary Medicine, University Of Georgia, Athens, Ga, Usa

17* Kin Selection And Virulence: Do Related Parasites Do Less Damage To Their Host? **ALYSSA GLEICHSNER (GS), KATIE REINHART (UG), AND DENNIS MINCHELLA (MP), Department Of Biological Sciences, Purdue University, West Lafayette, In 47907

18* Identification Of Surface Antigens In The Llama And Alpaca Parasite *Sarcocystis aucheniae*. **ALLISON YOUNG (UG), SRIVENY DANGOUDOUBIYAM (PD), ABLESH GAUTAM (GS), MICHELLE YEARGAN (T), and DANIEL HOWE (MP), M. H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546.

19* Proposed Research: Does The Abundance Of Parasitic “White Grub” In Snails Explain Its Abundance In Fish Hosts? **SAMI MCCARREL (GS) AND SHAWN MEAGHER (MP), Biological Sciences, Western Illinois University, Macomb, Il 61455**
20* Inoculation Of Ticks With *Acanthocheilonema viteae* As An Alternative To Natural Infection, JORDAN TRENTADUE (UG), STEVEN SCHAAR (T), LEAH MANN (T), JAMIE MIKRU (UG) AND M.L. MICHALSKI (MP), Department of Biology and Microbiology, University of Wisconsin Oshkosh, Oshkosh, WI 54901

21* Of Snails And Brains: The Story Of Neuropeptide Y And Parasitism. SAM LUEBKE (UG) and JUDITH HUMPHRIES (MP), Department of Biology, Lawrence University, Appleton, WI 54911

22* Examining The Putative Role Of The Nf-Kb Pathway In The Immune Response Of The Snail *Biomphalaria glabrata* To *Schistosoma mansoni* Infection. BRIANA HARTER (UG) and JUDITH HUMPHRIES (MP), Department of Biology, Lawrence University, Appleton, WI, 54911.

BANQUET  
Hilary J. Boone Center  
500 Rose St, Lexington.  
Cash bar opens 5:30  
Dinner begins at 6:00

DR. THOMAS PLATT  
Saint Mary's College
8:00  Continental Breakfast & Silent Auction Bidding

9:00  Silent Auction Bidding Closes

9:00  23. Intestinal Parasites In Indigenous Communities Near Tarapoto, San Martin, Peru. JORGE CARDENAS-CALLIRGOS (GS), UNIVERSIDAD RICARDO PALMA, LIMA, PERU, CARLOS MENDOZA (T), CENTRO DE SALUD, MORALES, TARAPOTO, PERU AND ERIC WETZEL (MP), Department Of Biology, Wabash College, Crawfordsville, In 47933


9:30  Business Meeting and Award Presentations. Dr. Agustin Jiménez AMCOP Presiding Officer
Abstracts


_Proterometra macrostoma_ is a digenetic trematode that parasitizes a snail intermediate host and a centrarchid fish definitive host. It is well documented that dark conditions acting as an exogenous trigger initiate the release of _P. macrostoma_ cercariae from rediae and snails. The redial stage is located in the peri-intestinal sinus, presumably in an osmotic environment approximating artificial snail water (ASW) rather than artificial pond water (APW) based on recent studies of redial appearance, movement and retraction of the cercarial body into its tail. During cercarial release from the snail intermediate host, the retraction of the cercarial body into its tail occurs within this peri-intestinal sinus following cercarial emergence from the redia. The cercaria subsequently enters the mantle cavity and is shed into the external environment through the mantle collar. The internal or endogenous trigger for this cercarial release has yet to be determined. Previous work has shown that the neurotransmitter, serotonin, promotes release of daughter sporocysts from mother sporocysts in _Schistosoma mansoni_, and that this molecule shows diurnal rhythms in snail hemolymph, being elevated at night in several gastropod species. The purpose of this study was to evaluate the effect of serotonin on _P. macrostoma_ redial movement and the release of cercariae from rediae in vitro and from snails in vivo. Serotonin dissolved in ASW increased the frequency of muscular contractions and movement of rediae, but the duration of these movements was not significantly different when compared to controls after four hours. Serotonin promoted the release of significantly more cercariae in vitro compared to controls. No significant difference was observed in the number of snails which released cercariae in APW with serotonin compared to controls over four days. Future experiments will refine these preliminary studies and also assess the possible role of melatonin in _P. macrostoma_ cercarial emergence.

2. GUT HELMINTHS OF TWO SPECIES OF LIGHT GEESE IN ILLINOIS. EVAN BOONE (UG) AND JEFF LAURSEN (MP), DEPARTMENT OF BIOLOGICAL SCIENCES, EASTERN ILLINOIS UNIVERSITY, CHARLESTON, IL 61920.

Parasite burdens in lesser snow geese (_Chen caerulescens caerulescens_) and Ross’s geese (_Chen rossii_) migrating through central Illinois were determined and compared to documented parasite burdens on the breeding grounds in northern Canada and the wintering grounds in southern Texas. The digestive tracts of 48 snow geese (38 lesser snow geese and 10 Ross’s geese) were collected from 4 February to 3 March, 2012, in Raymond, Illinois. Eight helminth taxa (two species
of Trematoda, four species of Nematoda, and two species of Cestoda) were recovered. Five of the eight helminth taxa were common in both species of host, while *Hymenolepis* species “B,” *Zygocotyle lunata*, and *Echinostoma revolutum* were only found in lesser snow geese. Prevalence of the eight helminth taxa ranged from 2.1% in *Zygocotyle lunata* to 97.7% in *Epomidiostomum sp.* and mean intensities ranged from 1.00 in *Echinostoma revolutum* to 22.89 in *Trichostrongylus tenuis*. Helminthes with direct life cycles had higher prevalences than helminthes with indirect life cycles. *Trichostrongylus tenuis* infections expressed higher prevalence and mean intensity in Ross’s geese than lesser snow geese and higher mean intensity in juvenile than adult Ross’s geese. The prevalence of *Heterakis dispar* was higher in adult birds than juveniles in pooled hosts. *Amidostomum sp.*, and *Epomidiostomum sp.* were seen to mimic documented burdens on the wintering and breeding grounds, while *Heterakis dispar* and *Trichostrongylus tenuis* seemed to fluctuate throughout the migration.

3. **ENVIRONMENTAL CONDITIONS SIGNIFICANTLY IMPACT PATTERNS OF PARASITE COMMUNITY DISSIMILARITY IN A NORTH AMERICAN BAT HOST (**EPTESISCU S FUSCUS**). ELIZABETH WARBURTON (GS) AND MAARTEN VONHOF (MP), DEPARTMENT OF BIOLOGICAL SCIENCES, WESTERN MICHIGAN UNIVERSITY, KALAMAZOO, MI 49008

Distance decay of community dissimilarity, where geographically close communities are more similar to one another than to communities that are geographically distant, has been described for a wide variety of organisms and understanding its underlying causes is key to understanding of mechanisms driving patterns of biodiversity. Parasites represent a unique opportunity with which to study distance decay, because their life cycle requires intimate interactions with other species, and rate of distance decay may therefore depend both on the parasites’ environmental requirements and dispersal capability and those of their hosts. We used big brown bats (*Eptesicus fuscus*) and their intestinal helminths to investigate: 1) independent contributions of geographical distance and environmental effects on dissimilarity of intestinal helminth component communities between populations of big brown bats; 2) which environmental variables best explained variation in community dissimilarity; and 3) whether similar patterns of decay with geographic or environmental distance were observed for within-host population and within-individual host parasite communities. We used both compositional measures of community dissimilarity at the component community and infracommunity levels for robust examination of how parasite communities change with distance and changing environmental conditions. We found that parasite compositional dissimilarity was significantly associated with landcover categories influenced by anthropogenic disturbance. These results indicate that human land use is driving significant patterns of parasite community dissimilarity, most likely by changing the presence or abundance of intermediate hosts in an area. Given that urbanization can change intermediate host populations and alter parasite transmission by changing definitive hosts’ exposure to infective propagules, we must continue to examine anthropogenic impact on the external
environment experienced by hosts and the role of internal host environment experienced by parasites in order to fully elucidate patterns of community dissimilarity in host-parasite systems.

4. DETECTING CYTAUZXOON FELIS IN FIELD COLLECTED TICKS FROM SOUTHERN ILLINOIS. ELLIOTT ZIEMAN (GS) AND AGUSTÍN JIMENÉZ (MP), DEPARTMENT OF ZOOLOGY, SOUTHERN ILLINOIS UNIVERSITY CARBONDALE, IL. 62901-6501.

Cytauxzoon felis infection in domestic cats (Felis catus) results in the highly fatal cytauxzoonosis. Even with treatment, this disease results in the mortality of 40% of cats exhibiting symptoms, without treatment 97% of cats succumb to the disease. Bobcats (Lynx rufus) are the natural reservoir host and show no apparent pathology associated with C. felis infection. The vectors of C. felis are the lonestar tick (Amblyomma americanum) and the American dog tick (Dermacentor variabilis).

In this study we aimed to determine the prevalence of C. felis in bobcats and A. americanum and D. variabilis in the southern region of Illinois. Both vector species and bobcats are highly abundant in southern Illinois. Presently C. felis has only been documented from Illinois on one occasion. It is likely that many cases are unreported or undiagnosed. We evaluated bobcat tissue samples and ticks for the presence of C. felis using polymerase chain reaction (PCR) with primers specific to C. felis. DNA from positive PCR’s was sequenced to confirm the presence of C. felis. Bobcats from Illinois showed C. felis prevalence of 70% (n=67). Our data indicate that C. felis poses a risk to domestic cats in the region. Further research is needed to determine the presence of C. felis in free ranging domestic cats. These data could be combined to construct a comprehensive risk map for C. felis infections. This map could enable veterinarians to recommend risk-based preventative care.

5. PARASITES OF BLUEGILL IN THE SANGAMON RIVER: IMPACT OF SEWAGE EFFLUENT AND SEASONALITY ON INFECTION PARAMETERS AND CORRELATION WITH FISH CONDITION. MIRANDA WHITE (GS), JEFFREY LAURSEN (MP), AND ROBERT COLOMBO (MP), BIOLOGICAL SCIENCES DEPARTMENT, EASTERN ILLINOIS UNIVERSITY, CHARLESTON, IL 61920

Posthodiplostomum minimum (white grub) metacercaria are internal parasites commonly found in Lepomis macrochirus (bluegill). However, it is under debate whether a high parasitism rate of white grub can affect the condition and survival of the intermediate host, bluegill. To assess this, bluegills were captured from fall 2012 to spring 2014 from 3 reaches along the Sangamon River in Illinois; above Lake Decatur reservoir, below Lake Decatur Dam, and below the Sanitary District of Decatur effluent outfall. Metacercariae abundance was calculated from the liver, kidneys, and heart. The gonadosomatic index (GSI) determined as gonad to weight ratio, and relative weight, controlled for sex, parasite abundance, and age were used to determine if parasite infection levels played a role in the condition of bluegill. A positive correlation existed between age of bluegill and parasite
abundance, suggesting the intermediate host will accumulate parasite cysts over time. Although there was no difference in parasite abundance between the fall and spring seasons, location influenced infection parameters. Bluegill below the dam had the highest number of metacercaria per fish. To date, condition does not appear to be affected by parasite abundance. Neither GSI nor relative weight was significantly different in bluegill exhibiting high infection levels than those with little to no infections.

6. ANALYSIS OF HORIZONTAL GENE TRANSFER BETWEEN SCHISTOSOMES AND THEIR HOSTS. BHAGYA K. WIJAYAWARDENA (GS), J. ANDREW DEWOODY (MP), D. J. MINCHELLA (MP) PURDUE UNIVERSITY, WEST LAFAYETTE, IN 47906

Horizontal gene transfer (HGT), the movement of genetic material between distinct evolutionary lineages, has long been known as a principal force of diversification and adaptation of prokaryotes. Recently, molecular data have increasingly contributed to the identification of possible gene transfers among various metazoan phyla such as Porifera, Cnidaria, Nematoda, Arthropoda, Rotifera, and Craniata. Although the exact mechanism of HGT in eukaryotes is often unknown, close associations such as host-parasite interactions provide increased opportunities for HGT. Schistosomes are multi-host parasites with complex life cycles that have been repeatedly implicated in HGT. We attempted to critically analyze the reports of schistosome-host HGT studies using molecular and bioinformatic approaches. Our studies suggest that reported cases of HGT in schistosomes may be due to technical artifacts (i.e., contamination) as opposed to biological reality. Thus, we emphasize the importance of multiple lines of evidence to conclusively document HGT.

7. EVALUATION OF THE SYSTEMIC INFLAMMATORY RESPONSE TO ANTHELMINTIC TREATMENT IN PONIES. MARTIN K. NIELSEN (MP), ALEJANDRA BETANCOURT (GS), EUGENE T. LYONS (PROFESSOR), DAVID W. HOROHOV (MP), STINE JACOBSEN (MP)

Grazing horses are widely exposed to infection with strongyle type parasites, infections which are largely controlled with administration of anthelmintic formulations to avoid parasitic disease. However, anthelmintic treatment can inadvertently induce inflammatory reactions and clinical disease. Very little research has been performed evaluating the inflammatory response to anthelmintic treatment, but one study indicates that treatment with moxidectin causes less of an inflammatory reaction than treatment with other drugs. Within the scope of this study, we aimed to explore the differences in inflammatory response following treatment with three different anthelmintic drugs: moxidectin, pyrantel pamoate, and oxibendazole. A population (n=30) of healthy, naturally parasitized ponies were allocated into the three treatment groups, based on age and worm fecal egg counts. All ponies were weighed and received the labeled anthelmintic dosage. Treatment efficacy was evaluated using the fecal egg count reduction test over a period of eight weeks, with weekly egg counts. The inflammatory response was
assessed at four measuring points during the 14 days following treatment. Measurements involved characterization of cytokine gene expression and systemic inflammatory reaction. The objective of this study was to determine the effect of de-worming treatment on pro-inflammatory cytokine gene expression in the peripheral blood, and to evaluate any correlation between the expression of inflammatory cytokines with levels of acute phase proteins and inflammatory markers. Fecal egg counts from the study confirmed resistance levels in the parasite population. Treatment with oxibendazole and pyrantel pamoate was unsuccessful in the elimination of luminal parasites. Moxidectin, however, was very effective and egg counts of zero persisted for several weeks. Analysis of cytokine gene expression data and evaluation of acute phase protein levels suggests that treatment with these anthelmintics provokes minimal peripheral inflammatory responses.

8. CHARACTERIZATION AND LOCALIZATION OF SARCOCYSTIS NEURONA RHOPTRY PROTEIN SNROP9. MAGGIE SCHLICH (UG), SRIVENY DANG OUDOUBIYAM (PD), AND DANIEL K. HOWE (MP). DEPARTMENT OF VETERINARY SCIENCE, UNIVERSITY OF KENTUCKY, LEXINGTON, KY 40546-0099

*Sarcocystis neurona* is the apicomplexan parasite most frequently associated with equine protozoal myeloencephalitis a commonly-diagnosed neurological disease in horses. Apicomplexans are obligate intracellular parasites that possess specialized organelles and proteins required for survival. Included in these are rhoptry organelles that aid in host cell invasion and establishment of a suitable intracellular environment. Previous research of rhoptry proteins in the apicomplexan *Toxoplasma gondii* has shown that they are secreted at the time of host cell invasion and function in creation of the parasitophorous vacuole and/or host cell modulation. Interestingly, *S. neurona* merozoites lack rhoptry organelles, and the intracellular stages (schizonts) of *S. neurona* do not reside in a parasitophorous vacuole. Paradoxically, however, rhoptry-related sequences are present in the *S. neurona* genome and are transcribed during the merozoite and schizont stages. In this study, a rhoptry protein homologue in *S. neurona*, SnROP9, was investigated to determine the fate and possible function of a rhoptry protein in supposedly rhoptry-less stages of this parasite. SnROP9 was expressed as a recombinant protein, and anti-SnROP9 antibodies were produced by immunization of a rat. Importantly, immunofluorescence microscopy with the α-SnROP9 rat serum localized the protein to the apical end of the merozoite, the typical location of rhoptry organelles. SnROP9 did not co-localize with the microneme protein SnMIC10, indicating that these proteins are present in different cellular compartments. After host cell invasion, SnROP9 was dispersed throughout the early schizont in a punctate fashion, becoming less distinct as the schizonts developed. The findings support that SnROP9 is expressed in the merozoite and schizont stages of *S. neurona*, suggesting utilization of rhoptry proteins in intracellular parasitism of host cells by this parasite. The identity of the merozoite structure containing SnROP9 and the specific function of this rhoptry protein remain to be determined.
Schistosomes continue to inflict devastating suffering throughout the poorest parts of the world. Praziquantel, the only anti-schistosomal drug available in most parts of the world, is largely ineffective at treating immature worms (schistosomules, or somules); a drug targeting early infections, at the schistosomule and juvenile stages, would provide a significant tool for resolving early infections and avoiding the pathology associated with mature infections. A major hurdle for developing treatments targeting schistosomules is a stunning dearth of bioassays reflecting the infection-associated behaviors of the young worms. Most attempts to interrogate the behavior of somules in vitro have been left looking only at decontextualized contractile behavior in supplemented media in petri plates that provides no guided motion. To circumvent the petri plate pitfall we have adopted both a plate and microfluidic chip technology that mimics host environments, to screen schistosome phenotypes resulting from pharmacological agents or RNA-mediated gene suppression. Using serotonin as a behavioral pre-screening platform, we show increased serotonin levels (50 μM) result in uncoordinated muscular contractions in the young parasite (schistosomula) in plates while the channel module gave a refined phenotype of inhibited curvature negotiation capability of the juvenile worms. Using RNA interference (RNAi) and a chip-based behavioral screening platform, we investigate the role of select peptides in the infectivity of juvenile schistosomes for the first time.

Anthelmintic resistance in nematode parasites of veterinary importance is widely recognized as a serious, growing problem in animal welfare and husbandry. The first modern anthelmintics were benzimidazole (BZ) type drugs which were developed and introduced in the late 1950s and early 1960s. These drugs revolutionized veterinary parasite control, but apparent BZ treatment failure was reported within the same decade. Since then, resistance has been widely reported to the two other major drug classes, the pyrimidines and the avermectin/milbemycins (macrocyclic lactones). Although possible mechanisms have been suggested, there is no convincing evidence of reversion to susceptibility once resistance has developed. In fact, a long-term study conducted at the University of Kentucky
suggested the opposite. Molecular mechanisms of resistance are far from understood. Initial studies with benzimidazole resistance suggested a relatively simplistic model with a few identified point mutations in the target molecule, beta-tubulin, conferring resistance. This led to studies investigating the mode of inheritance, and computer simulation models have subsequently been developed based on this “one-gene:one-resistance model”. However, genomic sequencing technologies have illustrated that the reality is far more complex. Several studies have documented a role of several ABC-transporters and P-glycoproteins in anthelmintic resistance, independent of drug class. To add further complexity, different P-glycoproteins seem to be involved with resistance to the same anthelmintic in even closely related parasite species. Further, recent work has suggested that avermectin/milbemycins interact with both beta-tubulin and acetylcholine receptors, which were once thought to be specific targets for benzimidazoles and pyrimidines, respectively. Finally, avermectin/milbemycins have also been shown to affect chemosensory behavior, egg shedding, and amphid formation in nematodes. Taken together, the possible modes of action of anthelmintics and subsequent mechanisms of anthelmintic resistance have proven far more complex than we would like it to be, and much more work is needed to achieve a reasonable level of understanding. The ultimate goal of developing molecular tests for anthelmintic resistance in nematodes appears unrealistic with the current level of knowledge and available technology.

11. BIOLOGICAL ADAPTATIONS IN EQUINE PARASITES AND OTHER UNINTENDED CONSEQUENCES OF CHEMICAL CONTROL. CRAIG R. REINEMEYER, EAST TENNESSEE CLINICAL RESEARCH, ROCKWOOD, TN 37854

The earliest ancestors of the domestic horse (*Equus caballus*) first appeared approximately 50 million years ago, and it is assumed that the parasite fauna of equids co-evolved throughout a significant portion of this interval. Over tens of millions of years, the two most drastic selection pressures experienced by equid parasites were both quite recent: 1) domestication, begun ~4,000 B.C., and 2) the introduction of chemical anthelmintics, beginning in the 1950’s. Feral equids were nomadic grazers, but domestication, for the first time, facilitated continuous, unavoidable contact between horses and the infective stages of their parasites, and laid the groundwork for helminths to become serious pathogens. In general, the internal parasites of horses are unique to equids, and are not capable of infecting alternate hosts. It is also remarkable that the parasitic fauna of equids includes no representatives of several common nematode superfamilies. Anthelmintic resistance is the most well-known genetic adaptation by equine parasites, but other, less familiar changes have also occurred in the helminth populations of managed
horses. These putative adaptations include dramatic changes in prevalence compared to historical patterns, abbreviation of critical life cycle intervals, and possible alteration of age distributions within the host population. Other, unintended biological consequences of overzealous chemical control include widespread extermination of several species, and the development of depauperate nematode populations in intensively managed horse populations. Over the past three or four decades, helminth parasites of domestic equids have experienced an alarming loss of biodiversity, and the adaptive responses of equine parasites to the severe selection pressure of anthelmintic treatment afford numerous examples of evolution in progress. These changes apparently involve far more than anthelmintic resistance, however, and the animal health community must assume that other, unrecognized genetic adaptations have already taken place. Critical assessment of evolutionary selection factors may support novel and sustainable approaches to parasite management in the future.

12. **SEQUENCING OF BIOMPHALARIA GLABRATA UPSTREAM IMMUNE RESPONSE GENES.** FIARA ANDERSON (UG), Department of Biology, Lawrence University, Appleton, WI, 54911

My research involves working with *Biomphalaria glabrata*, relevant due to its relationship to the parasite *Schistosoma mansoni* as its host. Of particular focus are *B. glabrata* immune genes, and the regulation of said genes in response to *S. mansoni*. The immune genes that are looked at in particular are genes that appear to be upregulated during *S. mansoni* infection, and have the potential to be part of the nf-kB pathway, a signaling pathway that is known for its role in immune response. In order to determine whether or not a gene is part of the nf-kB pathway, 1000 bp upstream of the gene is sequenced and searched for nf-kB genes within that sequence. Current genes of interest include IKB, TLR and Ferritin. IKB and TLRs are genes commonly seen as part of the nf-kB pathway, and Ferritin is a candidate due to its role in immune response and increased regulation during infection via *S. mansoni*.

13. **IN-VITRO EGG DEVELOPMENT IN THE TREMATODE, COTYLASPIS INSIGNIS (SUBCLASS ASPIDOGASTREA).** LEAH PENG (UG), ERICKA BERG (UG) AND RONALD ROSEN (MP), BIOLOGY PROGRAM, BEREA COLLEGE, BEREA, KY 40404

*Cotylaspis insignis* belongs to the Subclass Aspidogastrea, which consists of a minor group of trematodes. The adult of *C. insignis* is found in freshwater mussels and resides externally at the gill and visceral mass junction. This worm produces unembryonated, ectolecithal eggs which contain a large number of vitelline cells surrounding the nucleus. The development of the embryo within the egg has not been previously described and was the objective of this study. Mussels, *Lampsilis siliquoidea*, were collected from North Elkhorn Creek in Scott County, Kentucky.
Adult worms were dissected from *L. siliquoidea*, isolated in plastic jars containing 6.0 ml of spring water, monitored for 48 h and then removed. The number of eggs shed by each adult was recorded. Over 36 days at 20° C, developing embryos within these eggs were photographed using interference contrast microscopy. Between 0-6 eggs were released from each adult worm. On day 0, eggs showed a large, centrally located nucleus surrounded by vitelline cells. By day 7, a small embryo was visible among the vitelline cells and was surrounded by an embryonic membrane. By day 28, a pair of eyespots was present within an elongated embryonic body. A ventral sucker and mouth (located at the opercular end of the egg) were clearly visible by day 32, and the vitelline cells were noticeably reduced in number. On days 34 and 36, larval movement was observed inside the egg, and by day 36, a portion of the eggs hatched, leaving empty shells with detached opercula. The released cotylocidium larvae had two visible eyespots and three patches of posterior cilia—two lateral patches and one abopercular patch. The cotylocidium was propelled forward by its cilia and was also capable of movement by expansion and contraction. Though many hatched eggs were observed, only three cotylocidia were found, likely attesting to a brief longevity of these larvae. A future project will draw from the timeline of embryonic development established in this study to address whether some unembryonated eggs are retained and develop in the gill/visceral mass junction where adults reside or simply pass into the water column. In addition, developmental rates in artificial pond water vs. artificial snail water will be assessed to further clarify the preferred osmotic environment for *C. insignis* embryo development within these eggs.

14. **EFFICACY OF INJECTABLE IVERMECTIN ON GASTROINTESTINAL HELMINTHS IN CAPTIVE WILD ELK.** ALEJANDRA BETANCOURT (GS)¹, JOHN J. COX (MP)¹, BRYAN M. TOM (T)¹, EUGENE T. LYONS (PROFESSOR)², MARTIN K. NIIELSEN (PROFESSOR)². ¹DEPARTMENT OF FORESTRY, UNIVERSITY OF KENTUCKY. LEXINGTON, KY 40546, AND ²GLUCK EQUINE RESEARCH CENTER, UNIVERSITY OF KENTUCKY, LEXINGTON, KY 40546

Kentucky supports the largest elk (*Cervus elaphus*) herd in the eastern United States, subsequent to translocation of the Rocky Mountain subspecies. One of the main concerns during translocation is parasite introduction into naïve ecosystems, which is often addressed with anthelmintic treatment. Data regarding efficacy and kinetics of anthelmintics in elk is lacking, and assumptions about dosages are extrapolated from studies in domestic ruminant species. In January of 2013, 51 wild elk were captured and kept in pens for health assessment and biological testing. During this quarantine period, fecal samples were collected to assess parasite prevalence pre and post anthelmintic treatment. Individual fecal samples were collected at time of capture and during individual workups. Subcutaneous ivermectin injections (0.2 mg/kg) were administered at the second workup. Elk were then divided into 2 pens, dependent on age; individuals over the age of 1 year were put into Pen 1, and those under the age of 1 were put into Pen 2. Fecal egg counts were then performed on the pooled fecal samples from each pen to assess drug effectiveness. Preliminary results suggest ivermectin was almost 100%
effective against strongylid-type parasites in both groups, successfully suppressing FEC numbers throughout the sampling period. Post-treatment FEC’s also showed an increase in Montiezia spp. in Pen 1, whereas Trichuris spp., Nematodirus spp., and Capillaria spp. numbers increased in Pen 2. Data acquired from this group of elk suggests that age may play a significant role in immune response following anthelmintic treatment, which should be taken into consideration when administering drugs, and can be especially important information when contemplating herd management tactics.

15. RELATIONSHIPS BETWEEN BODY CONDITION, IMMUNE FUNCTION AND HOST SEX IN PREDICTING HELMINTH BURDENS OF BIG BROWN BATS (EPTESICUS FUSCUS). ELIZABETH WARBURTON (GS) AND MAARTEN VONHOF (MP), DEPARTMENT OF BIOLOGICAL SCIENCES, WESTERN MICHIGAN UNIVERSITY, KALAMAZOO, MI 49008

Although faced with similar challenges, the sexes may approach consequences of parasitism with differential investment of their resources in order to attain their own optimal fitness outcome. Trade-offs between body condition, immunity, and host fitness could result in males investing more resources to mating success rather than immunity while females invest more energy into immunity. If limited energy modulates trade-offs between immune function and reproduction or growth, then the optimal strategy for a parasitized individual may be to tolerate rather than resist parasitism. Resistance involves energetic investment into a costly immune response whereas tolerance is less costly because it maintains fitness by limiting pathology caused by parasites and prioritizing self-maintenance rather than immunity. We used generalized linear models and tests for moderation to uncover the relationships between host resistance, tolerance, and sex in our host-parasite system, big brown bats (Eptesicus fuscus) and their helminths. Our goals were to determine: 1) which sex, if any, was more heavily infected, 2) determine how relationships between immune response (a measure of resistance), body condition (a measure of tolerance), and host sex impact helminth burden. We found that male and female bats had similar worm burdens with females experiencing slightly heavier infections. We also found no evidence for sex differences in parasite tolerance, and female bats only scored higher than males in agglutination, a measure of parasite resistance. Our top five models of helminth burden indicated an interaction between body condition index and agglutination score, a measure of immunocompetence, as well as an interaction between agglutination score and host sex. Tests of moderation revealed that body condition was significantly moderating the effect of sex on agglutination score ($p=0.0251$) and agglutination score on worm burden ($p=0.0132$). This means that the strength of the relationships between sex, agglutination, and helminth burden are affected by body condition index; thus, hosts may be investing in modes of parasite resistance based on body condition rather than sex. We propose that overall host health or nutritional status, rather than sex, regulates trade-offs between self-maintenance and immunity. Therefore, individuals with similar worm burdens could be managing their infections via different facets of the immune response depending on available energy reserves.
In the present study, we describe intraperitoneal development of the FR3 strain of *Brugia malayi* in Mongolian jirds (*Meriones unguiculatus*). The third molt for male worms occurred between 4 and 7 days postinfection (dpi) and between 4 and 8 dpi for females. The fourth and final molt occurred between days 21 and 29 for males and 25 and 34 for females, considerably earlier than the times reported for subcutaneous infection models using cats and jirds. The timing of the third molt coincided largely with reports for subcutaneous *Brugia pahangi* infections of cats and jirds, but the final molt occurred considerably later and lasted longer than those reported for subcutaneous *B. pahangi* models. Spermatogenesis occurred by at least 50 dpi in adult males, and insemination of females likely occurred between 50 and 60 dpi. Microfilariae were observed in the uteri and ovejectors of adult females at 65 dpi.

Kin selection and virulence: do related parasites do less damage to their host? Alyssa Gleichsner (GS), Katie Reinhardt (UG), and Dennis Minchella (MP), Department of Biological Sciences, Purdue University, West Lafayette, IN 47907

Understanding factors that influence parasite virulence, the damage a parasite does to its host, is important for disease management efforts. One aspect that has been linked to changes in virulence is the genetic composition of competing parasites within an infection. Kin selection theory predicts that related parasites will decrease virulence to extend host lifespan and increase their inclusive fitness, while unrelated parasites will increase their virulence as they compete for finite host resources. Studies testing this relationship have lacked the ability to validate co-infection status after parasite exposure, limiting their ability to make inferences from the data. To remedy this, we infected *Biomphalaria glabrata* snails with one (related) or two (unrelated) strains of *Schistosoma mansoni* and used quantitative polymerase chain reaction (qPCR) to validate treatments and examine competitive dynamics over time. We measured snail life history parameters (growth, reproduction, and mortality) for 10 weeks and parasite reproduction (cercariae
shed) over the host’s lifespan to test whether infections with relatives have lower virulence. Our findings suggest that: 1. With less than 50% of co-exposures yielding co-infection, treatment validation is essential in competition experiments, 2. Competition between strains is a dynamic phenomenon that often results in changes in strain dominance over the course of infection, 3. There is some evidence that infections between unrelated parasites are more virulent, in terms of snail life history traits, than related infections, but 4. Treatments did not differ in total cercariae numbers. These findings have implications for future competition studies and provide insight into the nature of parasite competitive interactions.

18. IDENTIFICATION OF SURFACE ANTIGENS IN THE LLAMA AND ALPACA PARASITE SARCOCYSTIS AUCHENIAE. ALLISON YOUNG (UG), SRIYENY DANGOUDUBIYAM (PD), ABlesh GAUTAM (GS), MICHELLE YEARGAN (T), and DANIEL HOWE (MP). M. H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY 40546.

Sarcocystis aucheniae is an apicomplexan parasite that infects llamas and alpacas. Infection by the parasite creates large cysts in the muscles of the animals, which causes substantial economic losses for people who raise these animals. Though S. aucheniae is both harmful and highly prevalent in regions of South America, little research has been conducted on this parasite. Previous work on related apicomplexans has shown that these organisms possess an orthologous gene family of surface antigens (SAGs) that likely play an important role in the invasion of the host cell and evasion of host immunity. Moreover, these SAGs are immunogenic and have proven useful for serologic testing to detect antibodies against the parasites. The present study focuses on the identification of SAGs of S. aucheniae in order to start documenting the molecular composition of this parasite and to develop an enzyme-linked immunosorbent assay that can identify infected animals. A draft assembly of the S. aucheniae genome sequence was searched with SAG sequences from Sarcocystis neurona. Multiple S. aucheniae SAGs (SaSAGs) were identified, including four paralogues similar to SAG2. The four SaSAG2 paralogues (SaSAGa-d) all had the characteristic SAG domain consisting of six conserved cysteine residues, and predicted signal peptide and GPI-anchor addition. Each of the SaSAG2 paralogues are being cloned and expressed as recombinant proteins, and will be used in ELISAs as diagnostic tests for S. aucheniae infection. The findings of this project have the potential to help decrease economic losses caused by S. aucheniae, as well as allow for further research on these immunogenic surface antigens of this parasite.

19. PROPOSED RESEARCH: DOES THE ABUNDANCE OF PARASITIC “WHITE GRUB” IN SNAILS EXPLAIN ITS ABUNDANCE IN FISH HOSTS? SAMI MCCARREL (GS) AND SHAWN MEAGHER (MP), BIOLOGICAL SCIENCES, WESTERN ILLINOIS UNIVERSITY, MACOMB, IL 61455
A fundamental problem in parasite ecology is to explain differences in parasite infection levels displayed by different hosts. If a parasite and host co-occur in the same habitat, differences in parasite transmission and infection rates could be explained by differences in host ecology or physiology, or the abundance of different parasite life cycle stages in other host species. *Posthodiplostomum minimum centrarchi*, or “white grub”, is the fish-infecting metacercaria stage of a trematode that uses two intermediate hosts, physid snails and centrarchid fishes, before completing its life cycle in the intestines of Great Blue Herons. In Spring Lake, there are two genetically distinct white grub types. One type infects bluegill (*Lepomis macrochirus*) and the other infects white crappie (*Pomoxis annularis*). A recent study found a 200-fold infection difference in these hosts by their respective white grub types. In my masters’ work, I will determine if this difference is due to infection levels of the 2 types in snail hosts. Snails will be collected from Spring Lake, McDonough County, IL and observed for shedding cercariae. Cercariae will be collected daily from each snail. Cercarial CO1 genes will be sequenced to determine if snails have single or multiple species infections, as well as the relative abundance of the two species of worms. The white grub parasites in Spring Lake fishes provide a unique opportunity to study the interactions between two anatomically similar, yet genetically distinct fluke species, and determine why infection levels of the two species in the metacercariae stage are drastically different.

20. **INOCULATION OF TICKS WITH ACANTHOCEILONEMA VITEAE AS AN ALTERNATIVE TO NATURAL INFECTION, JORDAN TRENTADUE (UG), STEVEN SCHAAR (T), LEAH MANN (T), JAMIE MIKRU (UG) AND M.L. MICHALSKI (MP), Department of Biology and Microbiology, University of Wisconsin Oshkosh, Oshkosh, WI 54901**

The soft tick *Ornithodoros tartakowski* is a natural host for the rodent filarial worm *Acanthocheilonema viteae*. We maintain the mammalian portion of the *A. viteae* life cycle experimentally in Mongolian gerbils (*Meriones unguiculatus*) that are injected with infective third stage parasite larvae isolated from infected ticks. Once gerbils are microfilaremic they are anesthetized to allow feeding of unexposed ticks, thus propagating the cycle. Preliminary observations on L3 recovery from infected ticks demonstrated that (a) adult stage ticks produce greater numbers of L3s than larval or nymphaal stages and (b) adult female ticks produce more L3s than adult male ticks. In an effort to increase L3 yields further and to avoid prolonged exposure of rodents to anesthesia we rectally inoculated adult ticks with microfilaremic gerbil blood and assessed L3 recoveries. In four separate trials of inoculation with 2 ul microfilaremic blood, adult tick mortality ranged from 0-25% and L3 recovery varied with the density of mf in the blood. Prevalence of infection ranged from 75-100% in adult males and 67-100% in adult females. Mean intensity of infection for adult males was 42, 32, 53, and 65 L3/tick and for adult females it was 27, 1, 212, and 33 L3/tick. These results were then compared to previous results of adult ticks fed on anesthetized gerbils, where the mean intensity of infected females was 240 L3/tick and for males was 22 L3/tick.
We will also present data gathered to test the hypothesis that *A. viteae* microfilariae require a maturation period to be infective for the tick vector.

21. OF SNAILS AND BRAINS: THE STORY OF NEUROPEPTIDE Y AND PARASITISM. SAM LUEBKE (UG) and JUDITH HUMPHRIES (MP), Department of Biology, Lawrence University, Appleton, WI 54911

Helminth parasites have evolved mechanisms to not only evade the host immune system, but also to exploit the neuroendocrine system of the host to benefit their own growth and reproduction. Furthermore, the parasite may secrete factors that alter the host’s hormone levels. Neuropeptides may be affected by parasitism, and in snails the nervous, neuroendocrine, and immune system are functionally linked. Neuropeptide Y (NPY) plays a key role in regulating energy budgeting concerning food intake, reproduction, and growth in vertebrates and invertebrates. Previous research found that there was a downregulation of NPY expression in the snail *Lymnaea stagnalis* during *Trichobilharzia ocellata* infection 6 weeks post infection and an up-regulation of NPY expression 8 weeks post infection. Interestingly, when infected with the parasite *Schistosoma mansoni*, Biomphalaria glabrata display a similar phenotype to *T. ocellata*-infected *L. stagnalis*, including decreased growth rate and suppressed reproductive activity. Elevated levels of NPY may explain the phenotype of infected *B. glabrata*. We have identified BgNPY (B. glabrata neuropeptide Y; accession no. JX013957) in our lab. NPY was found to be concentrated in the brain, and NPY was localized within the brain itself. NPY expression levels 4 weeks post infection were found to be downregulated.

22. EXAMINING THE PUTATIVE ROLE OF THE NF-κB PATHWAY IN THE IMMUNE RESPONSE OF THE SNAIL *BIOMPHALARIA GLABRATA* TO *SCHISTOSOMA MANSONI* INFECTION. BRIANA HARTER (UG) and JUDITH HUMPHRIES (MP), Department of Biology, Lawrence University, Appleton, WI, 54911.

Schistosomiasis is a neglected tropical disease affecting greater than 200 million people across South America, Africa, and Asia. This debilitating disease is caused from the infection of a parasitic blood fluke *Schistosa mansoni* which undergoes sexual reproduction in the human host, releasing several hundred eggs daily. Key to the schistosome’s maturation within the human host is its infection of an intermediate host, the freshwater snail *Biomphalaria glabrata*. The Bs90 snail strain has been found to be resistant to the parasite’s infection in that the strain is capable of destroying the parasite after infection, whereas the NMRI strain is susceptible to the parasite. Therefore, research interest has been directed at understanding the immune response of the snail to schistosome infection, specifically examining the putative role of NF-κB in schistosome resistance. The NF-κB pathway is highly conserved throughout vertebrates and functions in immune response to a variety of stimuli. Research at Lawrence University has recently focused at examining differences in gene expression of the p65 dimer of the NF-κB transcription factor and the transmembrane receptor TLR in *B. glabrata*
in response to schistosome infection. It is predicted that the resistant Bs90 strain will have a greater upregulation of p65 and TLR than NMRI, thus suggesting that this pathway is involved in its detection and destruction of Schistosoma.

23. INTESTINAL PARASITES IN INDIGENOUS COMMUNITIES NEAR TARAPOTO, SAN MARTIN, PERU. JORGE CARDENAS-CALLIRGOS (GS), UNIVERSIDAD RICARDO PALMA, LIMA, PERU, CARLOS MENDOZA (T), CENTRO DE SALUD, MORALES, TARAPOTO, PERU AND ERIC WETZEL (MP), DEPARTMENT OF BIOLOGY, WABASH COLLEGE, CRAWFORDSVILLE, IN 47933

Members of the Santa Cruz (n=122) and Chirick Sacha (n=129) communities (Tarapoto, El Dorado region) were surveyed for infection with intestinal parasites in August, 2012 as part of a health campaign performed in these communities. Anthropometric data and fecal samples were collected and materials for the Graham test (for pinworm) were distributed to community members. Fecal samples were examined by direct method for eggs and cysts of intestinal parasites. In Chirick Sacha there were 56 individuals with Graham test results; fecal samples were obtained from 84 individuals. Sixty-six percent (66%) of those sampled were infected with E. vermicularis. Other prevalent infections observed in fecal analysis were Ascaris lumbricoides (25%), Entamoeba coli (30%), and Hymenolepis nana (10%); overall, 75% of those sampled were infected with at least one parasite. In Santa Cruz, prevalence of E. vermicularis was 69% (n=67); 62% of those submitting fecal samples had intestinal parasites, including A. lumbricoides (19%), E. coli (30%) and H. nana (10%). Possible interactions with host age, size, and nutritional status will be discussed and compared with other communities in this region.


Since 2010 I have worked to develop a Global Health Initiative (GHI) at Wabash College. The mission of the GHI is “To transform the lives of our students through global public health education, investigation and service and in so doing to effect positive change in underserved communities globally.” Much of the GHI activity thus far has taken place in different regions of Peru, South America, with an increasing focus on zoonotic infections. Lines of research and multiple institutional collaborations have been cultivated in coastal, Andean, and rainforest regions of the country. With the possibility (and hope) that some of these connections might be of interest to members of AMCOP, I will outline some of the potential opportunities for work and collaboration that exist in this exciting region and with the GHI.
Summary of the 65th Annual Midwestern Conference of Parasitologists.

The 65th Annual Midwestern Conference of Parasitologists was held on June 6-8, 2013, at Purdue University College of Veterinary Medicine. Dr. Kimberly Bates of Winona State University served as Presiding Officer and Dr. Joe Camp of Purdue University made local arrangements and served as Program Officer. Forty nine persons registered for the conference. Thirteen platform presentations and 10 posters were presented. The C. A. Herrick Award and $300 for outstanding poster was awarded to Heather Stigge of Oklahoma State University for her poster “Experimental evidence for acquired immunity to *Halipegus* species in two species of freshwater snails.” The G. R. LaRue Award and $300 for outstanding platform presentation was awarded to Elizabeth Warburton of Western Michigan University for her presentation “Does host exposure or parasites establishment determine helminth burdens of *Eptesicus fuscus* (Chiroptera: Vespertilionidae)?” David Cordie of Lawrence University was awarded the R. M. Cable undergraduate award and $200 for his presentation “Testing alternate hypotheses of parasitic communities and aquatic invasive species interactions in Green Bay, Lake Michigan.” Honorable Mention awards (and $100) were given to Ablesh Gautam of The University of Kentucky for her poster entitled “Functional characterization of the surface antigens (SnSAGs) in *Sarcocystis neurona*.” and Bhagya Wijayawardene of Purdue University for her presentation “Transposable element dynamics in *Schistosoma mansoni* strains: new world vs. old world.” All of the students who won awards are invited to claim an additional $200 to support travel to another scientific meeting before the next AMCOP. Elizabeth Warburton was chosen as the AMCOP nominee for the American Society of Parasitologists’ student travel grant award for 2014.

The AMCOP symposium was presented by Dr. Mark Forbes of Carleton University who spoke on “Ecological parasitology of dragonflies: resistance to understanding.” and Dr. Sean Locke of Environment Canada who spoke on “Better understanding of the ecology of fish parasites with DNA barcodes.” The banquet speaker was Dr. Agustin Jiménez who spoke on “Biodiversity in the New World: “What is it?”,
still an important question." The annual silent auction was also held and raised $58.

AMCOP 66 will be held in 2014 at The University of Kentucky. Additional future meeting sites as determined by the Meeting Sites Committee are:

AMCOP 67 – 2015: Lawrence University, Appleton, WI
AMCOP 68 – 2016: Southern Illinois University, Carbondale IL
AMCOP 69 – 2017: Wilmington College, Wilmington OH
AMCOP 70 – 2018: Eastern Illinois University, Charleston, IL

Secretary-Treasurer Woodmansee presented the treasurer’s report for 2012 and the interim financial report for 2013. These reports were approved.

The AMCOP Student Research Grant Committee (S. Meagher, M. Bolek, A. Jiménez, T. Yoshino, K. Bates) reported its decisions for the second round of AMCOP-sponsored research grants. The awardees are: Sarah Sinclair, Wilmington College, “Attempted identification of homologues of genes encoding cysticercosis vaccine peptides in *Hymenolepis diminuta.*” ($500); Elliott Zieman, Southern Illinois University, “Examination of tick vectors for the presence of *Cytauxzoon felis* in southern Illinois.” ($500). Dan Howe and Tom Platt will be joining the committee, replacing Matt Bolek and Tim Yoshino who are rotating off.

The following committee reports were received and approved: Auditing (Lin Twining, Trudy Aebig), Symposium Suggestions (Shawn Meagher, Dennis Minchella), Meeting Sites (Dan Howe, Bob Sorensen), Nominating (Matt Bolek, Joe Camp), and Resolutions (Tom Platt, Jeff Laursen).

Officers elected for 2012 were: Dr. Agustin Jiménez, Southern Illinois University: Presiding Officer; Dr. Dan Howe, The University of Kentucky: Program Officer; Dr. Bob Sorensen, Minnesota State University Mankato: Secretary-Treasurer.
THE ANNUAL MIDWESTERN CONFERENCE OF PARASITOLOGISTS (AMCOP)

OBJECTIVES AND ORGANIZATION

NAME
The organization shall be known as the ANNUAL MIDWESTERN CONFERENCE OF PARASITOLOGISTS (AMCOP), hereinafter referred to as the Conference.

AFFILIATION
The Conference is an affiliate of the American Society of Parasitologists.

OBJECTIVES
The Conference is a gathering of parasitologists and students of parasitology for the purpose of informal discussion of research and teaching in parasitology and the furthering of the best interests of the discipline of parasitology.

MEMBERS
The Conference is open to all interested persons regardless of place of work, residence, or affiliation in other recognized societies. There are three categories of membership: Emeritus, Regular, and Student. When a member retires from industry, university or other professional occupation, that person shall be eligible for emeritus membership.

DUES
Annual dues are required for emeritus, regular and student membership. A registration fee is charged during registration at annual conferences.
The amount of this fee will be decided for each Conference by a committee composed of the Presiding Officer, the Secretary/Treasurer, and the Program Officer, who is to serve as its chair. Dues are established by the Policy Committee and collected by the Secretary/Treasurer.

**MEETINGS**

The Conference is held in the general midwestern area during early to mid-June, unless otherwise specified by a majority vote of the previous Conference or a majority vote of those listed members replying by mail.

**BYLAWS**

1. Simple majority vote of members in attendance at regularly scheduled meetings of the Conference shall determine the policies of the Conference.

2. The officers are a Presiding Officer, whose term of office is one year or until a successor is elected (normally the term expires with adjournment of the annual Conference over which the person presides); a Secretary/Treasurer, whose term of office is two years or until a successor is elected; a Program Officer whose term of office is one year; and a Policy Committee composed of the last five available retired Presiding Officers plus, *ex officio* and without vote, the current Presiding Officer and Secretary/Treasurer. All terms of office of each full member of the Policy Committee is five years, or so long as the person is one of the five most recent, available Presiding Officers. The most recent past Presiding Officer available chairs the Policy Committee and is the Vice-President of the current Conference.

3. The Presiding Officer, the Secretary/Treasurer, and the Program Officer are elected by a majority vote of those members attending a regularly scheduled business meeting of the Conference or by a majority vote of those replying to a mail ballot of the membership.

4. The Presiding Officer shall preside at all meetings of the Conference and shall arrange for a banquet speaker. On the first day of a Conference the Presiding Officer shall appoint the following committees, which shall serve until they have reported on the last day of the annual Conference:
(a) Nominating Committee,

(b) Committee to Recommend Future Meeting Places,

(c) Committee to Suggest Program Possibilities for Future Meetings,

(d) Resolutions Committee,

(e) Judging Committee,

(f) Audit Committee,

(g) such other *ad hoc* committees as may be required.

The Presiding Officer shall appoint the Conference Representative to the Council of the American Society of Parasitologists for the year, who must be a member of that society. The current Presiding Officer serves as a member without vote of the Policy Committee.

5. The Secretary/Treasurer shall issue annual dues notices and about four months prior to each Conference a call for participants in the program for each Conference; inform the new Presiding and Program Officers concerning their duties and the members of the Policy Committee of their tenure and the Secretary of the American Society of Parasitology within three weeks after the annual election; serve as member without vote and the Secretary of the Policy Committee: and supervise all funds of the Conference.

6. The Program Officer shall be responsible for the general format of the Conference and for arranging suitable facilities and funding. It shall also be this person's responsibility to chair the special committee to determine and collect the registration fee for the Conference. The format of the Conference may vary, but should include both a demonstration session and a session of contributed papers, both open to all members. A symposium may also be included or may replace a session of contributed papers.
The Policy Committee shall determine by majority vote all matters of procedure and policy pertaining to the Conference upon which decision must be reached between consecutive Conferences, as well as all matters referred specifically to it by the membership. Such a vote may be requested by any member of the Conference but must be directed through the Secretary/Treasurer. The Chairperson of the Policy Committee shall request approval by the membership for all decisions of the Committee at the earliest subsequent business meeting of the Conference.

8. The Conference confers three major awards during its annual meeting to student participants. These are the Chester A. Herrick Award, sponsored by the Eli Lilly Co., for the best poster/demonstration of parasitological research, the George A. LaRue Award for the best oral presentation of parasitological research, and the Raymond M. Cable Award for best presentation given by an undergraduate student. Honorable mention awards will be given to the second place poster/demonstration and second place oral presentation at the discretion of the awards committee. All awards except for the Herrick Award are supported by donations from the AMCOP membership.

9. (a) The winner of each award will be selected by a 3-person committee appointed at each annual meeting by the Presiding Officer. The criteria for judgment will be established each year by the committee.

   (b) The size of the Herrick and LaRue awards shall traditionally be $300.00. The Cable undergraduate award and honorable mention awards shall traditionally be $100. Awards may vary according to funds available from contributors.

   (c) No person may win the same award more than one time while in student status. Likewise, no student may win both awards at the same meeting. However, one person may win both awards while a student in different years.
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<th>Year</th>
<th>Meeting Site (Conference No.)</th>
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<td>1949</td>
<td>Univ. Wisconsin, Madison, WI (AMCOP I)</td>
<td>Harley J. VanCleave</td>
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<td>J.C. Baer, ST=J. R. Lincicome</td>
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<td>1950</td>
<td>Univ. Michigan, Ann Arbor, MI (II)</td>
<td>R.V. Bangham</td>
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<td></td>
<td>W.W. Cort, Trends in Helminthological Research.</td>
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<td>Purdue University, Lafayete, IN (III)</td>
<td>L.O. Nolf</td>
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<td>J.E. Ackert, Some Observations on Hookworm Disease.</td>
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<td>ST=W. Balamuth</td>
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<td>R.J. Porter</td>
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<td>Iowa State College, Ames IA (V)</td>
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<td>R.M. Cable, Parasitological Experiences in Puerto Rico.</td>
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<td>1955</td>
<td>Notre Dame Univ., IN (VII)</td>
<td>R.M. Cable</td>
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<td>G.R. LaRue, Relationships in the Development of Digenetic Trematodes.</td>
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<td>ST=W.D. Lindquist</td>
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<td>W.H. Headlee, ST=F.J. Krudenier</td>
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<td>Univ. of Michigan, Ann Arbor, MI (IX)</td>
<td>J.E. Ackert</td>
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<td>A.C. Chandler, ST=F.J. Krudenier</td>
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<td>Kansas St. Univ., Manhattan, KS (X)</td>
<td>G.R. LaRue</td>
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<td>H.W. Manter, Trematodes of Many Waters.</td>
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<td>1959</td>
<td>Northwestern Univ., Evanston, IL (XI)</td>
<td>G.F. Otto</td>
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<td>H. Van der Schalie, Contrasting Problems in Control of Schistosomiasis in Egypt and the Sudan.</td>
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<td>ST=D.T. Clark</td>
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<td>1960</td>
<td>Purdue Univ., Lafayette, IN (XII)</td>
<td>F.J. Krudenier</td>
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<td>P.P. Weinstein, Aspects of Growth and Differentiation of Parasitic Helminths in vitro and in vivo.</td>
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1961 Ohio State Univ., Columbus, OH (XIII) .......... N.D. Levine
B. Schwartz, Parasitology Old and New.
ST=D.T. Clark
1962 Univ. of Nebraska, Lincoln, NE (XIV) G.W. Kelley, Jr
ST=D.T. Clark
1963 Univ. of Minnesota, St. Paul, MN (XV) M.F. Hansen
F.G. Wallace, Observations on the Louisiana State University
Inter-American Program in Tropical Medicine
ST=D.T. Clark
1964 Univ. of Chicago, Chicago, IL (XVI) D.T. Clark
R.E. Kuntz, Paragonimiasis in Formosa.
ST=E. J. Hugghins
1965 Kellogg Biological Station, Gull Lake, MI (XVII) P.E. Thompson
L. Jacobs, Toxoplasmosis.
ST=E.J. Hugghins
1966 Univ. of Illinois, Urbana, IL (XVIII) M.J. Ulmer
ST=E.J. Hugghins
1967 Iowa State Univ., Ames, IA (XIV) P.J. Silverman
N.D. Levine, Parasitology, Problems and Promise.
ST=E.J. Hugghins
H=P.M. Nollen [FIRST HERRICK AWARD]
1968 Univ. of Wisconsin, Madison, WI (XX) F.G. Wallace
D.R. Lincicome, The Goodness of Parasitism. (with APS & AIBS)
ST=J.H. Greve,
H=W.G. Barnes
1969 Univ. of Cincinnati, Cincinnati, OH (XXI) H.W. Manter
H.W. Stunkard, Life Histories and Systematics of Parasitic Flatworms.
ST=J.H. Greve,
H=B. Caverny, H=T.P. Bonner
1970 Loyola Univ., Chicago, IL (XXII) J.L. Crites
M.J. Ulmer, Helminths from Midwest to Mediterranean.
ST=J.H. Greve,
H=H. Blankespoor
1971 Univ. of Louisville, Louisville, KY (XXIII) F. Etges
H. Van der Schalie, Dam Large Rivers-Then What?
ST=J.H. Greve,
H=R. Campbell
1972 Southern Illinois Univ., Carbondale, IL (XXIV) B.J. Jaskowski
R.M. Cable, The Lighter Side of Parasitology.
PO=T.T. Dunagan, ST=J.H. Greve
H=E.M. Cornford
1973 Notre Dame Univ., Notre Dame, IN (XXV) R. Shumard
R.F. Rick, Babesiosis and the Development of Babesia in Ticks.
PO=R. Thorson, ST=J.H. Greve,
H=D. Danley
1974 Univ. of Michigan, Ann Arbor, MI (XXVI) D. Ameel
M.J. Ulmer, Snails, Swamps and Swimmer's Itch.
ST=J.H. Greve,
H=P.T. LaVerde and D. Prechel

1975 Iowa State Univ., Ames, IA (XXVII) W. Bemrick
P.M. Nollen, Studies on the Reproductive Systems of Parasitic Flatworms or
All You Wanted to Know About Sex in Worms and Were Afraid to Ask.
ST=J.H. Greve,
H=D. Wittrock, L=V.M. Nelson [FIRST LARUE AWARD]

1976 Univ. of Nebraska, Lincoln, NE (XXVIII) J. Greve
A.C. Todd, A Redefinition of Subclinical Parasitism and its Impact on
World Politics.
ST=W.H. Coil, PO=M.H. Pritchard,
H=W.L. Current, L=C.A. Klu

1977 Kansas State Univ., Manhattan, KA (XXIX) T.T. Dunagan
A.J. MacInnis, Snails, Dollars, DNA and Worms.
PO=W.D. Lindquist, ST=W.H. Coil,
H=M. Fletcher, L=L. Smurro, L=J. Ketchum

1978 Indiana Central Univ., Indianapolis, IN (XXX) E.J. Huggghins
J.P. Dubey, Recent Advances in Feline and Canine Coccidia and Related
Organisms.
PO=M. Brandt, ST=W.H. Coil,
H=D. McNair, L=G.L. Hendrickson

1979 Loyola Univ., Chicago, IL (XXXI) D.E. Gilbertson
E. Foor, Basic Studies in Reproduction (in Nematodes).
PO=B.J. Jaskowski, ST=W.H. Coil,
H=G. Plorin, H=D. Minchella, L=M. Fletcher

1980 Eastern Michigan Univ., Ypsilanti, MI (XXXII) A.D. Johnson
J.R. Williams, Tropical Parasitology at the Junction of the White and
Blue Nile Rivers.
PO=E. Waffle, ST=G. Garoian,
H=C.L. Williams, L=M. Goldman, L=R. Gamble,
S=Functional Morphology of Acanthocephala

1981 Eastern Illinois Univ., Charleston, IL (XXXIII) D.M. Miller
PO=B.T. Ridgeway, ST=G. Garoian,
H=J.M. Holy, L=B.N. Tuggle,
S=Immunity to Protozoan Parasites

1982 Western Illinois Univ., Macomb, IL (XXXIV) D.G. Myer
J.D. Briggs, Biological Control of Invertebrates in International Programs.
PO=P.M. Nollen, ST=G. Garoian,
H=D.E. Snyder, L=C.L. Williams,
S=Biological Control of Organisms

1983 Univ. of Illinois, Urbana, IL (XXXV) C.M. Vaughn
H.M. Moon, Speculations on the Pathogenesis of Cryptosporidiosis with
Comparisons to Other Enteric Infections.
PO=K.S. Todd, Jr, ST=G. Garoian,  
H=K.J. Hamann, L=K.W. Bafundo,  
S=Intestinal Protozoa  

1984  
Univ. of Iowa, Iowa City, IA (XXXVI)  
W.H. Coil  
J. Donelson, Genetic Rearrangement and the Basis of Antigenic Variation in  
African Trypanosomes.  
PO=G.D. Cain, ST=G. Garoian,  
H=K.F. Forton, L=D. Woodmansee,  
S=Helminth Immunology  

1985  
Ohio State Univ., Columbus, OH (XXXVII)  
B.T. Ridgeway  
K.D. Murrell, Epidemiology of Swine Trichinosis: Could Both Zenker  
and Leuckart be Right?,  
PO=P.W. Pappas, ST=G. Garoian,  
H=R.L. Lavy, L=H.K. Forton,  
S=Physiological Ecology of Parasites  

1986  
Univ. of Missouri, Columbia, MO (XXXVIII)  
G.D. Cain  
R.C. Tinsley, Correlation of Host Biology in Polynematid Monogenea.  
PO=L. Uhazy, ST=D.M. Miller  
H=M.C. Lewis, H=I.G. Welsford, L=D.A. Leiby,  
S=Gene Expression in Helminth Development  

1987  
Southern Illinois Univ., Edwardsville, IL (XXXIX)  
P.M. Nollen  
K. Kazacos, *Baylisascaris* Nematodes-Their Biology and Role in  
Larva Migrans Disease.  
PO=D. Myer, ST=D.M. Miller,  
H=D.A. Leiby, L=V.A. Connors,  
S=Modern Systematics in Parasitology  

1988  
Purdue University, West Lafayette, IN (XL)  
G. Garoian  
W.H. Coil, Forty Years of AMCOP, Laying a Foundation.  
PO=K. Kazacos & D. Minchella, ST=D.M. Miller,  
H=R.A. Bautz, L=R.R. Mitchler,  
S=Host Parasite Genetics  

1989  
Miami Univ., Oxford, OH (XLI)  
A.E. Duwe  
G. Castro, A Physiological View of Host-parasite Interactions.  
PO=R.A. Grassmick, ST=D.M. Miller,  
H=S.R. Morris, S=Parasites in the Immune Suppressed  

1990  
Univ. Illinois, Urbana, IL (XLII)  
J. H. Hubschman  
G. Cross, Phosphatidylinositol Membrane Anchor and/or Transfection of Protozoa.  
PO=G. McLaughlin, ST=D.M. Miller,  
H=L.D. Morton, L=S.R. Morris,  
S=Defining the Limits of Integrated Pest and Disease Management  

1991  
University of South Dakota, Vermillion, SD, (XLIII)  
K. R. Kazacos  
M. Dryden, What You Always Wanted to Know About Fleas on  
Fluffy and Fido but were Afraid to Ask.  
PO=A. D. Johnson, ST=D.M Miller,  
H=D. Royal, L=R. Clopton,  
S= Host Specificity
1992  Univ. Wisconsin-Eau Claire, WI, (XLIV) ..........  Omer Larson
PO= D. Wittrock, ST=D.M. Miller,
H=S. Storan, L=D.K. Howe,
S=Teaching of Parasitology-New Methods

1993  St. Mary's, Notre Dame, IN, (XLV) ..........  R. A. Grassmick
J. Crites, AMCOP Peragraphe Anni, Homines, Exitus
PO=T.R Platt, ST=D.M. Miller,
H=M. S. Schoen, L=B. J. Davids,
S="Ain't Misbehavin'": Ethology, Phylogeny and Parasitology

1994  Murray State Univ. Murray, KY (XLVI) ..........  Gary Uglem
E. Christiansen, Come out, come out, we know you are in there.
PO=L. Duobinis-Gray, ST=D. J. Minchella,
Dynamics

1995  Univ. of Wisconsin-Milwaukee (XLVII) ..........  Darwin Wittrock
E.S. Loker, Schistosomiasis in Kenya: a Copernican point of view
PO= J. Coggins, ST=D.J. Minchella;
H=J. Curtis; L=M. Dwinnell
S=Water-borne Diseases

1996  Northeast MO State Univ., Kirksville, MO (XLVIII)  Daniel Snyder
PO=L. C. Twining, ST=D.J. Minchella,
H=V. G. Mehta, L=H. Yoder,
S=Immune Aspects of Protozoan Infections: Malaria and Amoebiasis

1997  Butler University, Indianapolis, IN, (XLIX) ..........  Joe Camp
R. Hengst, Paleoparasitology,
PO=D. Daniell; ST=D.J. Minchella;
H=A. Bierberich, L=S. Kappe, S=Molecular Biology in Solving
Problems in Parasitology

1998  Indiana State University, Terre Haute, IN (L).........  Jim Coggins
W. Coil, J. Crites, & T. Dunagan, AMCOP 50 - Fifty Years Revisited;
PO=F. Monroy & D. Dusanic; ST=D. Wittrock;
H=M. Bolek; L=K. Page
S=Cytokines and Parasitic Diseases; Visit by ASP President John Oaks

1999  Wilmington College, Wilmington OH (LI) ..........  Dennis Minchella
P. LoVerde, Molecular Biology of Schistosomes,
PO= D. Woodmansee, ST=D. Wittrock;
H=J.B. Green; L=J. Curtis;
S=Parasite Biochemistry by J.D. Bangs and C.F. Fioravanti.

2000  University of Notre Dame, Notre Dame, IN (LII)....  Peter Pappas
J.A. Oaks – Zen and the Art of Tapeworms
PO= J. H. Adams; ST= D. Wittrock;
H=A. Epper; L= M. Bolek; HM= C. Dresden-Osborne & K. VanBuskirk
S=Life Style Choices of Parasitic Protozoans by T. Sinai and J. Lebowitz

2001  Eastern Illinois University, Charleston, IL (LIII)....  Lin Twining
R.D. Smith - Environmental contamination with Cryptosporidium parvum from a
dairy herd.
PO= J. Laursen; ST= D. Wittrock;
H= B. Foulk; L= M. Michalski; HM= M. Gillilland III; B. Balu and P. Blair
S= Use of Molecular Data in Parasite Systematics by M. Mort and M. Siddall
2002 Millikin University, Decatur, IL (LIV) .......... David Williams
P. Brindley – Mobile genetic elements in the schistosome genome
PO= Tom McQuistion; ST= D. Wittrock;
H= Stacy Pfluger; L= Greg Sandland;
HM= Kelly VanBuskirk and Michelle Steinauer
S= Parasite Transmission and Control in Domesticated Animals
by M. McAllister and L. McDougald
2003 Michigan State University, East Lansing (LV) ........ Tom Platt
Robert Pennock – Darwin and the Parasitic Wasp: Teaching Evolutionary
Design;
PO= Pat Muzzall; ST= Darwin Wittrock;
H= Luis Gondim; L= Michelle Steinauer; HM= Shawna Cook and Ahmed Sayed;
C= Katie Reif; S= Vector Borne Diseases of Michigan and Adjacent States by Ned
Walker and Hans Klompen
2004 Minnesota State University, Mankato, MN (LVI) .. Patrick Muzzall
Richard Clopton – Publishing with pain: The editor doesn’t really hate you.
PO= Robert Sorensen, ST= Darwin Wittrock
H= Rebecca LaBorde; L= Maria Castillo;
HM= Angie Kuntz and Laura Duclos; C= Jenna Rodgers
S= Molecular phylogenetics of parasites by Vasyl Tkach and Ramon Carreno
2005 Wabash College, Crawfordsville, IN (LVII). .... Douglas Woodmansee
John Adams - In a changing world of malaria research, can an old dog learn new
tricks?
PO= Eric Wetzel, ST= Darwin Wittrock
H= Amy McHenry; L= Laura Duclos;
HM= Jillian Detwiler and Julie Clennon; C= Kristin Giglietti;
S= Molecular Phylogenies in Nematoda by Virginia Ferris and
Microbial Community Ecology of Tick-borne Human Pathogens by Keith Clay
2006 Winona State University, Winona, MN (LVIII)....... Thomas McQuistion
Matthew Bolek - Amphibian parasites: The cool, the bad and the ugly.
PO= Kim Bates; ST= Doug Woodmansee;
H= Andrew Claxton; L= Kristin Herrmann; C= Lindsey Stillson;
HM= Brenda Pracheil, Kristin Giglietti;
S= Parasites of Wildlife of the Midwest by Rebecca Cole and Darwin Wittrock
2007 University of Wisconsin-Oshkosh, Oshkosh, WI (LIX) Jason Curtis
David Williams – The Genomics Revolution in Parasitology.
PO= Shelly Michalski, ST= Doug Woodmansee;
H= Christine Hsiao; L= Shriver Dangoudoubiyam
HM= Peter Ziniel, Nathan Peterson; C= Emily Doucette,
S= Tropical Disease by Gary Weil and Peter Fischer
2008 University of Illinois at Urbana-Champaign (LX) .. Robert Sorensen
Dennis Minchella – P.C. (Post Cable) Parasitology at Purdue.
PO= Milton McAllister, ST= Doug Woodmansee;
H= Nathan Peterson; L= Erica Mize
HM= Apichat Vitta, Jillian Detweiler; C= Kyle Luth,
S= Parasitic Protists by Laura Knoll and Alexa Rosypal.

2009 Ohio Wesleyan University, Delaware, OH (LXI)            Daniel Howe
Eugene Lyons - Hookworms (*Unicaria* spp.) in Pinnipeds with Notes on the Biology of Northern Fur Seals.
PO= Ramon Carreno, ST= Doug Woodmansee;
H= Sriveny Dangoudoubiyam; L= Elizabeth Thiele, HM= Matthew Brewer;
C= Cailee Smith;
S= Ectoparasites by Susan C. Jones and Glen R. Needam

2010 Western Illinois University, Macomb, IL (LXII)          Jeffrey Laursen
Tim Yoshino - Frankenflukes: Parasitic GMO's.
PO= Shawm Meagher, ST= Doug Woodmansee;
H= Kathryn Coyne; L= Philip Scheibel; HM= Kathy Johnson; C= Bryan Rolfsen;
S= Can Parasitic worms treat autoimmune disorders? by David Elliott and John O. Fleming.

2011 Saint Mary’s College, Notre Dame IN (LXIII) ............. Shelly Michalski
Bruce Christensen – Programmes for control of lymphatic filariasis: perspectives from a vector biologist.
PO= Tom Platt, ST= Doug Woodmansee;
H= Daniela Cortese; L= Ablesh Gautam HM= Jenica Abrudan, Elizabeth Warburton; C= Markah Frost, Sarah Johnson; S= Parasitonomics by Mary Ann McDowell and Mike Ferdig.

2012 Truman State University, Kirksville, MO (LXIV) .. Shawn Meagher
Scott D. Snyder - Parasite Biodiversity: Reflections, Challenges and Opportunities.
PO= Lin Twining, ST= Doug Woodmansee
H= Utibe Bickham; L= Heather Stigge; C= Michael Lehrke; HM= Shelby Heistand;
S= The importance of the unimportant. & Understanding the histories of parasites of Galapagos birds.
by John Janovy and Patricia Parker.

2013 Purdue University, West Lafayette, IN (LXV) ............ Kimberly Bates
Agustin Jimenez - Biodiversity in the New World: "What is it?", still a relevant question.
PO= Joe Camp, ST= Doug Woodmansee
H= Heather Stigge; L= Elizabeth Warburton HM= Ablesh Gautam and Bhagya Wijayawardena; C= David Cordie;
S= DNA Barcoding in Parasitology Research by Sean Locke and Mark Forbes

2014 The University of Kentucky ................. Agustin Jimenez
PO= Daniel Howe ST= Robert Sorensen
H= ?; L= ? HM= ?; C= ?;
S= Parasite adaptation and anthelmintic resistance by Martin K. Nielsen and Craig R. Reinemeyer
New Account opened at Affinity Plus, Mankato MN $10.00
AMCOP Funds transferred from Woodmansee $7,854.63
Student Research Grant Refunded $500.00
Balance Available 4/2/2014 $8,364.63

Expenses

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Income

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<td>AMCOP 65 Surplus (Loss)</td>
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<td><strong>Total Income</strong></td>
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Operating Surplus (Loss) for 2014 -$390.73
Current Net Worth $7,973.90

Submitted By:

Robert E. Sorensen
Secretary/Treasurer
<table>
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<tr>
<th>Name</th>
<th>Institution</th>
<th>Email Address</th>
</tr>
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<tbody>
<tr>
<td>Tyler Achatz</td>
<td>MN State University, Mankato</td>
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<td>Erica Berg</td>
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<td>David Daniell</td>
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<tr>
<td>Sriveny Dangoudoubiyam</td>
<td>Purdue University</td>
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<tr>
<td>Ablesh Gautam</td>
<td>The University of Kentucky</td>
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</tr>
<tr>
<td>Daniel Howe</td>
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<td>Judith Humphries</td>
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<td>John Janovy</td>
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<tr>
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