I. Highlighted Achievements

1. Dr. Daniel Perez joined the Department of Population Health, College of Veterinary Medicine, as its new Georgia Research Alliance Distinguished Investigator and the holder of the Caswell Eidson Chair in Poultry Medicine. He also conducted the first Highly Pathogenic Avian Influenza (HPAI) study at the CVM Animal Health Research Center (AHRC), November 2015.

2. Dr. Lois Zitzow joined the POPH faculty in our Lab Animal division. She is the new Director of University Research Animal Resources (URAR).

3. Dr. Mark Ruder was hired as an Assistant Research Scientist in the Southeastern Cooperative Wildlife Disease Study (SCWDS).

4. Dr. Margie Lee was appointed to the National Advisory Committee on Microbiological Criteria for Foods for a 2-year term (2015-2017) by U.S. Agricultural Secretary Tom Vilsack. Dr. Lee was also appointed as the new Clinical Head of the PDRC Diagnostic Laboratory as Dr. Charles Hofacre’s successor.

5. The successful graduation of MAMs Alexis Kiers and Samantha Pohl, who received a posthumous degree.

6. Dr. Charles Hofacre moved the Master of Avian Health and Medicine (MAHM) program to a fully UGA supported program and gained University approval to teach all classes involved as UGA classes after the University of Melbourne ended the joint teaching agreement.

7. The Department of Population Health faculty assisted and trained 144 visiting scholars and business industry representatives during 2015.

II. Accomplishments in Instruction

New Courses Offered:

1. POPH7050, 7051, and 7052- Avian histopathology practicum I, II and III. 1-3 Credit Hours. Course Descriptions: First year, 2nd year, and 3rd year Veterinary Pathology Residents respectively will interpret lesions and diagnosis of diseases of avian species by microscopic examination. Approved Feb 2015. Taught by Susan Williams.

2. VETM9000 - Doctoral Research (developed by Roberto Palomares)

3. VETM7000 - Master Research (developed by Roberto Palomares)

4. VETM 8900 - VBS Advances (developed by Roberto Palomares)

5. POPH5900 (CRN 24768) - Lab Animal Enrichment Seminar (Co-developers: Alworth LC, Harvey SB)

6. VETM5155 - Professional Skills and Attributes (Co-developers: Alworth LC, Smith J, Harvey SB)
7. POPH 5201 – Intro to Wildlife Diseases (developed and taught by Michael Yabsley)
8. POPH 5900 – Lab animal enrichment seminar (developed by Steve Harvey)
9. POPH 5155 – Professional Skills and Attributes (developed by Steve Harvey)

Number of and total funding for Instructional grants – include those applied for and those funded - None

Innovations in instruction –
David Hurley completed a total revision of IDIS (POPH) 3110 – Food Animal Infectious Diseases – Revised the course as a single instructor survey course of diseases with economic, social and political impact relative to food animal agriculture.
Lois Zitzow obtained a commitment from the Division of Laboratory Animal Medicine at Emory University to share resources with UGA. This will allow UGA Laboratory Animal Medicine residents to attend Laboratory Animal Classes offered through Emory via distance learning, and for residents at both institutions to spend time at the other location to augment their education (Emory utilizes nonhuman primates as research models while UGA does not, and UGA has laboratory animal pathologists, agricultural animals, and a variety of non-rodent species that Emory does not). While the details have yet to be finalized, she and the other institutional leaders involved have identified a source of funding, recruited the first resident, and anticipate the program starting in July 2016.

Teaching honors and awards received
1. Brent Credille and Emmanuel Rollin were recognized by the UGA Career Center as a faculty member that had a significant impact on the career course of students in the University of Georgia College of Veterinary Medicine Class of 2015, December 1, 2015.
2. Dr. Michael Yablsey received a UGA Career Center certificate, and he was nominated for a Richard B. Russell Award for Excellence in Undergraduate Teaching.
3. Students under Sonia Hernandez who received awards:
   1) Shannon Curry:
      I. Georgia Museum of Natural History Laerm Award, $750, November 2014
      III. Oconee Rivers Audubon Society Conservation Grant, $600, April 2015
      IV. Curry, S. E. Public perceptions of wild birds and bird feeding activity in Palm Beach County, Florida. Pending grant proposal, H. Branch Howe, Jr. Graduate Student Research Grant, Georgia Ornithological Society: $890.
      V. Curry, S. E. Are our cities good for birds? Using stable isotopes to investigate White Ibis (Eudocimus albus) diet and its effect on ibis health in urban Florida. Joshua Laerm Academic Support Fund, Georgia Museum of Natural History: $750.
   2) Sebastian Ortiz:
      I. Warnell School of Forestry and Natural Resources. Young Alumni Scholarship for Leadership and Training. Spring 2015. $500
      II. Graduate School Travel Grant. Spring 2015. $1000
3) Jennifer Bloodgood:
   I. Robert W. & June C. Porterfield Memorial Scholarship for married graduate students in Warnell, $2000, March 2015
   II. UGA Graduate School Dean’s Award in the Social Sciences, $1500, January 2015

4) Catharine Welch:
   4. Rebecca Welch, a student under Chris King, received the American Society of Laboratory Animal Practitioners (ASLAP) student award.

**Number of faculty serving as DVM student mentors (including faculty that served as Vet student research advisors or with their curriculum advisement)** –11
   Alworth, Credille, Fenton, Hernandez, Hurley, Jones, Lee, Palomares, Rollin, Williams (also on DVM-MPH Advisory Committee), Yabsley

**Number of faculty serving on graduate committees, or as resident advisors (including faculty that served as MS/PhD student advisors)** –21
   Berghaus, Brindley, Collett, Corn, Credille, Ferguson-Noel, Franca, Garcia, Hofacre, Jackwood, Jones, Jordan, Hernandez, Hurley, Lee, Mead, Maurer, Palomares, Perez, Rollin, Ruder, Sellers, Stallknecht, Williams, Yabsley

**Number of faculty serving on new faculty advisory/mentoring committees** –
   Susan Williams – Mentor committee for Heather Fenton
   Roy Berghaus – Chair of the Third year review committee for Dr. Roberto Palomares
   David Hurley – Faculty Advisory Committee for Roberto Palomares and Lee Jones; also part of third year review committee for Roberto Palomares
   Daniel Mead - Promotion and Tenure Mentoring Committee (Melinda Brindley), ID and POPH, CVM
   Promotion and Tenure Mentoring Committee (Courtney Murdock), ID CVM and Ecology

**Editor or reviewer of an instructional journal** -

**Development and participation in extracurricular learning opportunities**
   1. Leanne Alworth was a Faculty advisor for UGA CVM Animal Welfare Club (2007-present).
   2. Leanne Alworth was a Faculty advisor for UGA CVM VOICE (diversity committee).
   3. Leanne Alworth served as Co-liaison/Faculty Advisor for the American Society of Laboratory Animal Practitioners Student Chapter (ASLAP) at UGA CVM.
   4. Brent Credille was a Faculty Co-Advisor for the AABP Student Chapter.
   5. Brent Credille was the Moderator and Chief Judge for 2015 University of Georgia College of Veterinary Medicine Science of Veterinary Medicine Symposium (Judge for 5 graduate student presentations and 4 posters)
7. Brent Credille led a tour of Rose Creek Farm for approximately 50 high school students.
8. Brent Credille participated in Duke TIP @ UGA – Duke University Talent Identification Program (2009-2013, 2015), in which he (1) led small groups in exploration of rumen anatomy and function, and (2) presented seminar on opportunities in production medicine.
9. Brent Credille facilitated and led a tour of UGA VTH for 50 students and 1 faculty from North Carolina State University College of Veterinary Medicine.
10. Monique Franca served as a judge for UGA Veterinary and Graduate Student Poster Presentations – Science of Veterinary Medicine Symposium (SVM). October 8, 2015.
12. Sonia Hernandez served as Faculty advisor for the following:
   - Zoological Medicine Club, College of Veterinary Medicine
   - Student Chapter of Wildlife Disease Association; new student chapter which is co-hosted by the College of Veterinary Medicine and WSFNR
   - Warnell Pre-Vet Club
14. Steve Roney was a guest speaker and faculty advisor for SwAP (swine, aquaculture and poultry) club at UGA Vet School.
15. Susan Williams was a Phi Zeta Advisory Committee Member. (Population Health representative)
16. Susan Williams was a Faculty Co-Advisor for Veterinary Students One in Ethnicity and Color (VOICE).
17. Susan Williams was a Faculty Co-Advisor for Christian Veterinary Fellowship (CVF).

Other noteworthy achievements in instruction
1. Drs. Charles Hofacre and Samantha Pohl were featured in an episode of Vets on Call on Poultry Health Today. They visited a broiler farm to examine a flock’s response to a vaccine and to confirm the absence of Salmonella bacteria.

III. Accomplishments in Research

Number of publications – refereed journals in print – 90
Lateral Saphenous Vein for Microfilaria Counts in Mongolian Gerbils (Meriones unguiculatus) Infected with Brugia pahangi. Comparative medicine, 65(6), 492-498.


10. Brown, Justin D.; Patricia Dunn; Eva Wallner-Pendleton; Subhashinie Kariyawasam; Timothy Schriner; Charles Hofacre; Joshua Johnson; Robert Boyd. Surveillance for Pasteurella multocida in Ring-necked Pheasants (Phasianus colchicus) after an outbreak of avian cholera and apparently successful antibiotic treatment. Avian Dis. 2015. (Accepted)


79. Sikes RS, Bryan II, JA. Institutional Animal Care and Use Committee considerations for the use of wildlife in research and education. ILAR J. (Peer-reviewed).

80. Sikes, RS, Bryan II, JA. Response as wildlife experts to a scenario involving gunshot euthanasia of wildlife. Lab Animal.


Submitted for review, but not yet published – 40

2. Andrew B. Reeves, Rebecca L. Poulson, Denys Muzyka, Haruko Ogawa, Kunitoshi Imai, Vuong Nghia Bui, Jeffrey S. Hall, David E. Stallknecht, and Andrew M. Ramey. Lack of evidence for intercontinental dispersal of avian paramyxovirus serotype 4 by migratory birds. Infection, Genetics and Evolution


11. Gleim ER, Garrison LE, Vello MS, Savage MY, Lopez G, Berghaus RD, Yabsley MJ. Factors associated with tick infestation and pathogen prevalence in ticks parasitizing humans in Georgia, USA. Parasites and Vectors (Submitted).


16. Jarrett, C., Jarrett, T., Harvey, S., Alworth, L. The Female chinchilla has a uterus duplex bicollis, vagina simplex. *JAALAS. Accepted, publication expected March 2016.*


Popular Press – non-refereed publications and published conference proceedings — 73


2. Armour, NK and N Ferguson-Noel. Evaluating the egg transmission and pathogenicity of Mycoplasma gallisepticum isolates of the ts-11 genotype. XIXth Congress of the World


7. Credille BC. Antimicrobial Pharmacodynamics – Relationship to therapeutic success – University of Georgia Veterinary Diagnostic Laboratory e-Newsletter, Fall 2015.

8. Credille BC. Update on Antimicrobial and Non-Steroidal Anti-Inflammatory Drug Use in Ruminants – University of Georgia Veterinary Teaching Hospital e-Brief, October 2015.


18. Durairaj, V., E. Linnemann, V. Gauthiersloan, A. Icard and H.S. Sellers. Full length genotypic characterization of novel group 1 variant reoviruses from clinical cases of tenosynovitis in chickens. AVMA, AAAP annual convention, Boston, MA, July, 2015. (Published in conference proceedings)
27. Franca, M. Visualizing Infection Dynamics and Harborage Sites of Salmonella that Might Contribute to Contamination of Ground Chicken Meat. VMES report. 2015.
38. Jones L. Buyer Beware, Georgia Cattlemen’s Magazine, September, 2015, p 26
40. Jones L. How to get more than a preg-check from the vet’s preg-check visit. Beef Magazine, August 2015.
46. Jordan, B. J. (2015). Avian influenza outbreak is concern for poultry industry, not general public, UGA poultry expert says. UGA FACES.
51. Little S and MJ Yabsley. 2015. 2015 CAPC parasite forecast predicts ehrlichiosis is still a risk in many areas of the country. CAPC Expert Article Series. 1 page.
53. Nickerson, SC, Nace, EL, Hurley, DJ, Ely, LO, Kautz, FM, Chapman, JD, Zanzalari, KP. Innate Immunity and periparturient well-being of late gestation Holstein heifers fed Omnigen-AF. Dairy white paper – Prince Agri Products, Quincy, IL.
54. Palomares RA, Bittar JH, Hurley DJ, Woolums AR, Collins TA. Immune Response to Subcutaneous and Intranasal Vaccination in Young Beef Calves. The Veterinary Medical Experiment Station (VMES). Training the Next generation of Veterinary Scientist. 2015.
63. Sellers, H. S., V. Durairaj, E. Linnemann, V. Gauthiersloan, W. Dawe, L. Daniel, and T. Durham. Genetic diversity among reovirus field isolates from clinical cases of viral arthritis in commercial broilers. WVPAC, Capetown, South Africa, Septemeber 7-12, 2015. (Published in conference proceedings)
External competitive research grants (list number of and total funding)

Grants received:

PDRC and Food Animal:
-264 (Jordan) = 65,520
-280 (Perez) = 763,203
-281 (Sellers) = 12,213
-282 (Jordan) = 38,148
-283 (Jackwood) = 66,355
-284 (Perez) = 151,643
-285 (Perez) = 15,606
-286 (Jackwood) = 15,011
-287 (Hofacre) = 86,125
-288 (Franca) = 90,604
-289 (Jackwood) = 4,008.91
-290 (Jones) = 16,900
-291 (Perez) = 70,393.55
-292 (Franca) = 99,964
-293, 294, 295 (Jackwood w/ secondary investigators Drs. Ferguson and Garcia) = 150,514
-296 (Jackwood) = 94,535

Total PDRC/Food Animal = 16 grants, $1,740,743.46

SCWDS (see spreadsheet):
-Corn -> 228,000; 25,477; 100,000 = 353,477
-Corn/Yabsley -> 82,500
-Fischer -> 332,336; 131,500; 60,000; 563,344; 1,000 = 1,088,180
-Mead -> 37,950; 9,900; 8,000 = 55,850
-Stallknecht -> 680,973
-Yabsley -> 9,556; 22,308 = 31,864

Total SCWDS = 15 grants, $2,292,844

GRAND TOTAL = 31, for a total of $4,033,587.46

Internal competitive research grants (list number of and total funding for those applied for and those funded)

Total received: 0

Other research funding received (research gifts) – $277,734.86

Research awards and recognition
1. Dr. Holly Sellers received the AAAP Bruce W. Calnek Poultry Research Achievement Award.
2. Dr. Brian Jordan received the John M. Bowen Award for Excellence in Animal/Biomedical Research, April 9, 2015.
3. Dr. Monique Franca was awarded the Houghton Trust Travel Grant to attend the WVPA Congress in Cape Town, South Africa, 2015.
4. Eric Shepherd, a DVM student working with Drs. Jackwood and Jordan on IBV research and an incoming MAM student, received the AAAP L. Dwight Schwartz Travel Scholarship to present his work “Development of Real-Time Quantitative RT-PCR assays to detect GA07, GA08, and GA13 Infectious Bronchitis Virus.”
5. Dr. Silvia Carnaccini, a Post-Doctoral Research Scholar working with Dr. Daniel Perez, was awarded the 2015 AAAP Outstanding Field Case/Diagnostic Report Award.

Number of research/professional presentations, abstracts (published), and posters – 205


dynamics of infectious diseases in Alaskan brown bears (Ursus arctos). Warnell Graduate
Student Symposium. Athens, GA. (Oral presentation)
24. Coker, SM, WM Kistler, SE Curry, CN Welch, HW Barron, S Harsh, SM Hernandez, and
MJ Yabsley. 2015. A single haplotype of Haemoproteus is widespread in American White
Ibis (Eudocimus albus) from urban and rural sites in Southern Florida. International
Wildlife Disease Association Conference. Twin Waters, Sunshine Coast, Queensland,
Australia. (Oral presentation)
25. Coker, SM, WM KistlerGST, SE Curry, CN Welch, HW Barron, S Harsh, SM Hernandez,
and MJ Yabsley. 2015. A single haplotype of Haemoproteus is widespread in American
White Ibis (Eudocimus albus) from urban and rural sites in Southern Florida. Student
chapter of the Wildlife Disease Association, Athens, GA. (Oral presentation)
26. Coker, SM, WM KistlerGST, SE Curry, CN Welch, HW Barron, S Harsh, SM Hernandez,
and MJ Yabsley. 2015. A single haplotype of Haemoproteus is widespread in American
White Ibis (Eudocimus albus) from urban and rural sites in Southern Florida. Southeastern
Society of Parasitologists. Blacksburg, VA. (Oral presentation)
single haplotype of Haemoproteus is widespread in American White Ibis (Eudocimus
albus) from urban and rural sites in Southern Florida. International Urban Wildlife
Conference, Chicago IL. (Oral presentation)
28. Coker, SM, WM Kistler, SE Curry, CN Welch, HW Barron, S Harsh, SM Hernandez, and
MJ Yabsley. 2015. A single haplotype of Haemoproteus is widespread in American White
Ibis (Eudocimus albus) from urban and rural sites in Southern Florida. Warnell Graduate
Student Symposium. Athens, GA. (Oral presentation)
Exposition, Atlanta, Georgia January 23, 2015. (Invited oral presentation)
Exposition, Atlanta, Georgia January 23, 2015. (Invited oral presentation)
31. Collett, S. R. Rearing Turkeys Drug Free in the US. Annual National Turkey Federation
Meeting. Keynote address. Caribe Hilton Hotel, 1 San Geromino Street, San Juan, Puerto
Rico. February 14, 2015. (Invited oral presentation)
Pennsylvania US. February 19, 2015. (Invited oral presentation)
33. Collett, S. R. Neonatal gastrointestinal Physiology Platinum Brooding Course – Poultry
Diagnostic and Research Center, March 17, 2015. (Invited oral presentation)
Infections. What are the Alternatives Alltech 30th Annual International Animal Health &
oral presentation)
(Invited oral presentation)
37. Cookson, K, J Schaeffer, J Dickson, C Hofacre, and G Mathis. Comparison of Poulvac®
ST colonization rates in commercial leghorns inoculated intranasally or via coarse spray on


43. Credille, B.C. Post-Partum Uterine Disease in Dairy Cattle. 2015 ACVIM Forum, Indianapolis, IN. June 3-6, 2015.


77. Fishman HJ, Palomares RA, Ferrer MS. Comparison of Monday-Friday 4-day versus 5-day Co-Synch + Controlled internal drug release (CIDR) + timed artificial insemination (TAI) protocols in beef heifers. Society for Theriogenology, Annual meeting and Symposium San Antonio, TX. Aug, 2015.


79. França, M., Maurer, J. Visualizing Infection Dynamics and Harborage Sites of Salmonella that Contribute to Contamination of Ground Chicken Meat. XIXth World Veterinary Poultry Association Congress, Cape Town, South Africa. September, 2015. (Abstract)


85. Gonzalez-Astudillo V; Hernandez SM; Yabsley MJ; Mead DG; Keel MK; Munk B; Fischer JR; Ruder M; Brown JD; Peters V. 2015. Mortality of passerines and relatives submitted to a wildlife diagnostic laboratory (Southeastern Cooperative Wildlife Disease Study, USA): a 36-year retrospective analysis. November 4, 2015. University of Queensland School of Veterinary Science Research Conference, (Conference), Event location: Queensland, Australia. Scope: University (Oral presentation)


89. Harvey, S. B. (2015). Husbandry, Medical Care, and Research Applications for Microtus species. In District 4 AALAS Meeting, Raleigh, NC. (Oral presentation)
91. Harvey, S. B. (2015). Avoiding common animal use proposal pitfalls and problems.. In PDRC & Population Health Spring Semester Seminar. (Keynote speaker)
95. Hernandez, SM. Buin Zoo, Chile, Invited Seminar Series, June, 2015. 5, 60-min talks, 1, 2 hr workshop: Problems with Wildlife Disease Investigation; Urbanization and Wildlife Health; Global Emergent Diseases; Update on White Nose Syndrome; What Wildlife Vets can Learn from Disease Ecology; Chemical Immobilization of Wildlife (workshop). Scope: International, Invited (Invited oral presentation)
103. Hurley, DJ. Inflammation, Immunity and Dairy Cow, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, Belgium, 24 April 2015 (Invited Presentation)
111. Jones, L. Challenges of Eradicating BVD in Georgia Beef and Dairy Herds, March National Institute of Animal Agriculture, March 27, 2015, Indianapolis, IN.
112. Jones, L. Results of BVD Surveillance in Georgia and Florida Dairies. Southern Woods Veterinary Retreat, November 19, 2015, Sylvester, GA.
120. Jude, RL and N Ferguson-Noel. Optimal Sample Processing for Diagnostic Avian Mycoplasma Real-time PCR. American Veterinary Medical Association (AVMA) Annual Convention, Boston, MA Jul 11-14, 2015. (Poster)


126. Lewis M, KL Bailey, TC Washburn, SM Hernandez, JS Ortez, CA Cleveland, and MJ Yabsley. 2015. Babesia spp. in raccoons: efforts to understand the natural history of these apparently ubiquitous parasites. Young Scholars Program Symposium. Athens GA. (Oral presentation)


146. Peltier S, MJ Yabsley, JD Brown, M Tement. 2015. Mange in black bears (Ursus americanus) in Pennsylvania: Etiologic agents(s), diagnostic assays, and environmental persistence of mites. Student chapter of the Wildlife Disease Association, Athens, GA. (Oral presentation)


148. Peltier S, MJ Yabsley, JD Brown, M Tement. 2015. Mange in black bears (Ursus americanus) in Pennsylvania: Etiologic agents(s), diagnostic assays, and environmental
persistence of mites. Warnell Graduate Student Symposium. Athens, GA. (Oral presentation)


158. Roney, CS, Diagnostic Case Reports. Emerald Coast Veterinary Conference (ECVC) Poultry Session. 6, June 2015. Sandestin, FL.


infections in wild chimpanzees. Student chapter of the Wildlife Disease Association, Athens, GA. (Oral presentation)


166. Sapp, SGH, S Weinstein, and MJ Yabsley. 2015. Comparison of Baylisascaris procyonis infection dynamics and host competence in two Peromyscus species. Student chapter of the Wildlife Disease Association, Athens, GA. (Oral presentation)

167. Sapp, SGH, LN Rascoe, P Wilkins, S Handali, EB Gray, M Eberhard, DM Woodhall, SP Montgomery, and MJ Yabsley. 2015. Detection of antibodies to raccoon roundworm (Baylisascaris procyonis) and risk factors for exposure in wildlife rehabilitators from the United States and Canada. Student chapter of the Wildlife Disease Association, Athens, GA. (Oral presentation)


195. Williams, S. M. Histologic Lesions found in the Reproductive Tract from Cases submitted to PDRC. Poster session presented at the meeting of AAAP/ AVMA Annual Meeting in Boston MA. July 2015. (Poster)

196. Williams, S. M., Yabsley, M. J., Williams, R. J., & Gogal, R. M. Acute Mortality Due To A Parasitic Infection in A Roller Pigeon. Poster session presented at the meeting of World Veterinary Poultry Association Congress, Cape Town South Africa. September 7-11, 2015. (Poster)


List bibliography of continuing education or lay presentations: – 94


14. Credille, BC. 2015 University of Georgia SCAVMA Educational Affairs Committee Seminar – Antimicrobial Use in Large Animals.

15. Credille, BC. 2015 University of Georgia Pre-Veterinary Club Seminar – Opportunities in Food Animal Medicine.


18. Credille, BC. 2015 University of Georgia Internal Medicine Club Internal Medicine Mondays – The Case of the Comatose Calf.


50. Jones L. Is there a Rural Veterinary Shortage? GA Farm Bureau Program, Nov 12, 2015, Dalton, GA.

51. Jones L. Beef Herd Diseases: Treatment and Prevention, Oct 27, 2015, Moultrie, GA
52. Jones L. Herd Health: Common Diseases in Beef Herds, YCC GA Cattlemen’s, Oct 24, 2015, Tifton, GA.
53. Jones L. How to assist in Dystocia, Sunbelt Expo, Oct 20-22, 2015, Moultrie, GA.
57. Jones L. Herd Health, Tift County Cattlemen’s, Tifton, GA August 20, 2015
65. Jones L. Beef Quality Assurance training, Wiregrass Cattlemen’s, Quitman, GA, February 26, 2015
66. Lee, MD. My Journey to Science, University of Arkansas Medical Center graduate recruiting, May 7, 2015
67. Lee, MD. Microbiology Careers, University of Arkansas Medical Center Career Day, October 22, 2015
81. Roney, CS, Necropsy Techniques and Instruction. 2015 UGA International Poultry Short Course. Athens, 1 Feb. 2015. Athens, GA.
82. Roney, CS, Enteric Diseases and the Immune System of the Chicken. UGA Int'l Poultry Short Course, 1 Feb., 2015. Athens, GA.
83. Roney, CS, Coccidiosis and Lesion Identification of the Chicken. UGA Int'l Short Course. 1 Feb. 2015, Athens, GA.
85. Ruder, MG. 2015. Wildlife Disease Rounds. Student Chapter of the Wildlife Disease Association, University of Georgia, Athens, GA.
86. Sellers, H.S. Emergence of variant reoviruses in clinical cases of tenosynovitis. Elanco Full Value Poultry Symposium, Cancun, Mexico, 2015. 1 hour/50 attendees.
94. Protecting Individuals Working with Laboratory Animals: From A (allergens) to Z (zoonoses). 2-hour webinar presented for the California Biomedical Research Association on February 25, 2015.
Number of faculty serving as editor of book or research journal – 11
2. Leanne Alworth served on the AALAS Editorial Review Board for journals JAALAS and Comparative Medicine.
3. Roy Berghaus served on the Preventive Veterinary Medicine Editorial Board for the Elsevier organization.
5. Maricarmen Garcia served on the Editorial Board of Avian Diseases.
6. Sonia Hernandez was one of 6 editors for a Special Issue of the Journal of Wildlife Diseases entitled Advances and Improvements in Wildlife Health and Welfare currently In Press; online version in January 2016 and printed version in April, 2016.
8. Sonia Hernandez served as Associate Editor for both the Journal of Zoo and Wildlife Medicine and also the Wildlife Society Bulletin.
9. Mark Jackwood - Member, Editorial Advisory Board of Avian Diseases, Published by; The American Association of Avian Pathologists, University of Pennsylvania, New Bolton Center, Kennett Square, PA 19348-1692. 1990-present.

Number of faculty serving as scientific reviewer of research journal – 28
1. Leanne Alworth – Column editor for Lab Animal; Ad Hoc Reviewer for the Journal of Zoo and Wildlife Medicine, and JAALAS
2. Roy Berghaus – Ad Hoc Reviewer for the Journal of Veterinary Diagnostic Investigation and Preventative Veterinary Medicine
3. John Bryan, II – Ad Hoc Reviewer for the Journal of Wildlife Diseases (Special supplement on Welfare)
5. Steve Collett – Ad Hoc Reviewer of the Journal of Applied Poultry Research, and Avian Diseases
6. Joseph Corn- Ad Hoc Reviewer for various journals (specifics unlisted)
9. Naola Ferguson-Noel – Ad Hoc Reviewer for Avian Diseases
12. Steve Harvey – Ad Hoc Reviewer for Journal of Visualized Experiments, for Journal of the American Association for Laboratory Animal Science, and Comparative Medicine
16. Lee Jones – Ad Hoc Reviewer for the Bovine Practitioner
17. Brian Jordan – Ad Hoc Reviewer for Avian Pathology
18. Margie Lee – Ad Hoc Reviewer of Avian Diseases, Emerging Infectious Diseases, FEMS Microbiology and Ecology, Zoonosis and Public Health, Poultry Science, Plos, and Archives of Microbiology
19. John Maurer – Ad Hoc Reviewer for International Journal of Food Microbiology; PLOS One, Avian Diseases, Emerging Infectious Diseases, Journal of Clinical Microbiology, and Agriculture
21. Roberto Palomares - Ad Hoc Reviewer for Theriogenology
23. Emmanuel Rollin – Ad Hoc Reviewer for The Bovine Practitioner
24. Mark Ruder – Ad Hoc Reviewer for Journal of Medical Entomology
25. Holly Sellers – Ad Hoc Reviewer for Avian Pathology, Veterinary Microbiology, and Virus Genes
26. David Stallknecht – Reported providing editorial service to 15-20 journals (unlisted)
27. Susan Williams - Ad Hoc Reviewer for Avian Diseases; Avian Pathology; Plos One; Virology; Infection, Genetics and Evolution; Journal of General Virology; and Virus Genes
Number of faculty serving on grant review panels – 6

1. Roy Berghaus reviewed for both (1) USDA ARS NP 108 Poultry Production & Processing and (2) UGA CVM Love of the Horse Equine Program
2. Melinda Brindley - NSF-CAREER grant, October 10, 2015 - October 23, 2015; Assessment type: Summative; Number of applications assessed: 1; Scope: National
4. David Hurley served on the National Pork Board’s grants program (Immunology Section).
5. Daniel Mead served on (1) Natural Sciences and Engineering Research Council of Canada, Discovery Grants Program and (2) NIH National Institute of General Medical Sciences, IDeA Network of Biomedical Research Excellence Competitive Grant Program.
6. David Stallknecht reported serving on at least 3 grant review panels (unlisted).

Other noteworthy achievements in research

2. Dr. Holly Sellers was involved in the creation of 3 patents:
   (1) US Patent WO2015116778-A1
       06 Aug 2015
       New isolated avian reoviruses
   (2) US Nonprovisional Patent Application No. 14/808,225
       Attenuation of Infectious bronchitis virus variant GA-13
   (3) US Patent Application Serial No. 14/612,495
       Chicken astrovirus responsible for runting stunting syndrome
3. Dr. Sonia Hernandez (SCWDS faculty with joint appointment at Warnell) was featured in UGA Columns for her research in wildlife diseases at the Hernandez Wildlife Disease Lab. She has also been profiled in the North American Veterinary Conference’s “Profiles of Leadership,” had two stories written about her research in the Athens Banner Herald. Additionally, her research regarding white ibis has been featured on NPR “All Things Considered” and in the UGA Red & Black newspaper.
4. Dr. Monique Franca was interviewed about current Avian Influenza research in her PDRC laboratory for Georgia Health News, April 2015.
5. Drs. Maurer and Hernandez’ were involved with NIH-funded Salmonella study (see journal article reference “Diversity and persistence of Salmonella enterica…” by Dr. Maurer et al above) that spawned a press release that was picked up by two news based web sites and several university and government web sites including World Health Organization. Dr. Maurer also received a letter from UGA President Jere Morehead commending their work.
IV. Accomplishments in Service

Referring and consulting veterinarian satisfaction - N/A

Client or customer satisfaction
PDRC:
# of Poultry Industry calls = 134
Birds seen = 10,660,000

Food Animal:
# of Industry calls = 281
Dairy Cows seen = 344,700
Beef Cows seen = 31,796
Swine seen = 200
Alligators seen = 0
Total (non-poultry) = 376,696

Revenue generated from clinical services provided:
January 1 – December 31, 2015 = $1,277,101.68

Clinical Test Summary (January 1 – December 31, 2015):

<table>
<thead>
<tr>
<th>2015</th>
<th>Accessions</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteriology</td>
<td>4,029</td>
<td>$88,885.17</td>
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<tr>
<td>Serology</td>
<td>73,442</td>
<td>$226,500.82</td>
</tr>
<tr>
<td>Mycoplasma</td>
<td>4,740</td>
<td>$120,783.66</td>
</tr>
<tr>
<td>Histopathology</td>
<td>3,390</td>
<td>$42,229.52</td>
</tr>
<tr>
<td>Virology</td>
<td>7,630</td>
<td>$760,086.82</td>
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<tr>
<td>Miscellaneous</td>
<td>3,541</td>
<td>$38,615.69</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>96,772</strong></td>
<td><strong>$1,277,101.68</strong></td>
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Number of continuing education courses offered – 14
1. NPIP Diagnostic Workshops -1 Mycoplasma and 1 Avian Influenza- held in March and May 2015, respectively. PDRC faculty and staff work with the USDA NPIP coordinators to hold certification workshops for labs all over the world.
2. UGA Food Animal Drug Use Seminar was sponsored by Boehringer Ingelheim Vetmedica; held on July 16, 2015.
3. John Bryan, II, organized the Instruction of the SCWDS Controlled Substance Information and Policy Course; January 8 and November 5, 2015.
PDRC for 28 industry veterinarians from 17 countries (spanning South America, North America, Europe and Asia), September 28 – October 1, 2015. Several PDRC faculty also lectured for this course.

6. Joseph Corn was Co-Chair of the Wildlife Seminar for Emergency Animal Disease Preparedness. This seminar is jointly sponsored by USDA-APHIS and the Southeastern Cooperative Wildlife Disease Study. The course is attended by state and federal veterinarians and wildlife biologists each year. (3.5 days, 29 participants)

7. Monique Franca participated in Basic Ultrastructure and Ultrastructural Pathology, a 2-day course for 24 veterinary pathologists and veterinary pathology residents. Lecture Title: Identification of Infectious Agents. UGA, Athens, GA, April 2015.

8. Sonia Hernandez helped organize and teach the Iberica Improve Course for Veterinarians. Two day workshop in Madrid, Spain on Wildlife Medicine; May, 2015, 40 participants

9. Sonia Hernandez helped organize and teach the Veterinary Information Network, Continuing Education for veterinarians, Wildlife Medicine Online Course, 2015; 173 participants

10. Charles Hofacre organized and taught Platinum Brooding Conference, March 17, 2015, 1 day, 32 attendees

11. Brian Jordan helped to organize and lectured in the 2015 International Poultry Short Course (3 day course). Several other PDRC faculty also lectured for this course. Athens, GA. February 1, 2015. 48 students.

12. Lee Jones was Moderator and Coordinator of the 2015 Georgia Food Animal Veterinary Conference, March 21-22, 2015, Tifton, GA.

13. Lee Jones assisted in coordinating the South Georgia VMA Conferences (Jan, Feb, March and Sept.)

14. Steve Roney conducted a continuous economic development project with commercial layer operation in poor areas of Northern Cambodia, including 3 informal seminars to villages on the transmission and dangers of Avian Influenza and Exotic Newcastle Disease.

Number of textbook chapters - 11

1. Alworth, LC. LATG Manual. To be published fall 2016 by AALAS. I submitted a solicited chapter section regarding the environmental impact of research animal facilities.


Books authored – 1


Book Reviews

Leadership roles in specialty organizations

1. Leanne Alworth served as Chair of the Wet Lab Coordination for 2016 SEAALAS Conference.

2. Leanne Alworth served as Assistant Director of University Research Animal Resources (URAR).

3. Roy Berghaus served as Chair of the American College of Veterinary Preventative Medicine (ACVPM) Examination Committee.

4. Roy Berghaus served as the Field Services Section Head for the UGA Veterinary Teaching Hospital.

5. Roy Berghaus served as Graduate Coordinator for the Master of Food Animal Medicine (MFAM) program (since 2012).

6. Steve Collett was the 2015 Chairman of the American College of Poultry Veterinarians (ACPV) Exam Committee.
7. Brent Credille served as Chair of the UGA Veterinary College Farm Resources Committee.
8. Brent Credille served as Assistant Chair of the American College of Veterinary Internal Medicine (ACVIM) Food Animal Program Committee.
10. Joseph Corn served as Chair for the Feral Swine Subcommittee on Pseudorabies and Brucellosis (2011-2015)
11. Heather Fenton served as the state agency liaison for herpetological diseases.
12. Naola Ferguson-Noel served as the Chair of the Mycoplasma Subcommittee (2008-present) for the NPIP Technical Advisory Committee.
14. Steve Harvey served as Chair of the BSL-3 Users Committee.
15. Sonia Hernandez was Vice-President of the American Association of Wildlife Veterinarians, 2013-present.
16. Sonia Hernandez was a Board member of the American Association of Zoo Veterinarians (2013-present) as well as Co-Chair of its Committee on Wildlife Health (2013-present).
17. Sonia Hernandez was Chair of the Wildlife Section of the North American Veterinary Conference.
18. Sonia Hernandez was a Board Member of Living Fossil Productions, a non-profit organization dedicated to creating awareness of and providing solutions for conservation problems facing earth's wild species and environments through the integration of science and fine art. Ithaca, NY (2004-present).
19. Charles Hofacre served as the Secretary/Treasurer of the American Association of Avian Pathologists (AAAP).
20. Charles Hofacre served as Chair of the Ad Hoc Disciplinary Committee in the UGA College of Veterinary Medicine.
21. Charles Hofacre served as the Editor of Aerosols, the official newsletter of the World Veterinary Poultry Association (WVPA).
22. David Hurley was Chair of the University Libraries Committee (2009-2015).
23. David Hurley was Chair of the Health and Clinical Sciences Panel, Promotion and Tenure Review Committee.
24. David Hurley was Vice-Chair of the Educational Resource Center & Information Technology Advisory Committee.
25. Mark Jackwood served as Secretary Treasurer of the Southern Conference on Avian Diseases.
26. Mark Jackwood served as Chair of the AAAP Respiratory Disease Committee.
27. Mark Jackwood served on the Avian Diseases Advisory Board, American Association of Avian Pathologists.
28. Chris King served as a Board Member of the Council on Accreditation, Association for the Assessment and Accreditation of Laboratory Animal Care, International (AAALAC). (Reelected to second 3 year term effective September 2014)
29. Chris King served as Chair of the Selection Committee for Ad Hoc Consultants, Association for assessment and Accreditation of Laboratory Animal Care, International (AAALAC).
30. Lee Jones served on the Georgia Beef Board, BQA Advisory Committee.
31. Lee Jones served as Secretary/Treasurer of the South Georgia Veterinary Medical Association (SGVMA).
32. Lee Jones was the Cattle Health Co-Chair for the Georgia Cattlemen’s Association.
33. Brian Jordan served as President of the Southern Conference on Avian Diseases.
34. Margie Lee was on the National Science Advisory Board for Biosecurity, National Institutes of Health.
35. Margie Lee was the Scientific Advisor for the U.S.-U.K. Researchers and Funders Workshop (June 1-3, 2015).
36. Daniel Mead was an Advisory Board Member of the Biological Emergency Preparedness and Response Program, Southeast Regional Center of Excellence for Emerging Infections and Biodefense.
37. Daniel Mead was Chair of the AHRC Users Committee (CVM, UGA).
38. Mark Ruder served as Chair of the Membership and Promotions Committee in the Wildlife Disease Association.
39. David Stallknecht served as Co-chair 9th International Symposium on Avian Influenza Athens GA, April 2015 Scientific Advisory Committee, Emory University Center of Excellence for Influenza Research and Surveillance NIH. 2015.
41. Susan Williams served on the Advisory Board Member for Tri-County Technical College (South Carolina) for Pre-Veterinary Medicine. (CVM representative)
42. Susan Williams was the President of the National Society of Phi Zeta (2013-2015).
43. Susan Williams served as Secretary of the Sandy Creek Nature Center in Athens, GA (2013-2015) and has been a member of the Board since 2012.
44. Michael Yabsley served on the Board of Directors of the Companion Animal Parasite Council (CAPC).
45. Michael Yabsley served as a Board Member for the American Association of Veterinary Parasitologists.
46. Lois Zitzow served as Chair of the American College of Laboratory Animal Medicine (ACLAM) Certification Oversight Committee. She also served as the liaison coordinating the new contact between ACLAM Board of Directors and the Exam Consulting firm that will host the examination database, manage the certification examination process, and provide statistical analysis.

Service honors and awards received
1. Sonia Hernandez was nominated for the UGA Women’s Leadership Initiative by Warnell Dean.
Other noteworthy achievements in service

1. Dr. Leanne Alworth, for her IACUC AUP Reviews as Attending Veterinarian and IACUC member, processed 126 new AUPs, 153 modifications and 248 annual renewals, and provided IACUC researcher consulting services for the entire university.
2. Dr. Leanne Alworth assessed 256 sentinels for health surveillance and quarantine.
3. As a member if the UGA Green Labs Task Force, Dr. Leanne Alworth developed a proposal for a university wide approach to ecologically sound research waste handling methods.
4. Dr. Steve Collett continues to be editor and publisher of the Poultry Informed Professional (PIP), a bi-monthly PDRC electronic newsletter with worldwide readership of over 900 people.
5. PDRC Clinicians Steve Collett, Charles Hofacre, and Steve Roney organized 134 field trips for over 180 students to combine student teaching with industry service. They provided clinical services for farms throughout the US, with a total of over 10,660,000 birds.
6. Food Animal Clinicians Brent Credille, Lee Jones, Roberto Palomares, and Emmanuel Rollin organized 281 field trips for over 500 students to combine student teaching with industry service. They provided clinical services for farms throughout the US, with a total of 31,796 beef cows, 344,700 dairy cows, and 200 swine.
7. Dr. John Bryan, II, coordinated the purchase, organization, and record-keeping of United States Drug Enforcement Agency controlled substances at SCWDS under the licensure of Dr. John R. Fischer.
8. Dr. Steve Collett served on the Advisory Councils for the following companies, both national and international: Fieldale Farms, Astral Foods, Eastman Feeds, Jennie-O Turkey Store, Akey Nutrition, Provimi, Cargill, Alltech, NutriQuest, Rose Acre Farms, Peco Farms, and Epicore.
9. Dr. Steve Collett gave an invited keynote address at the World Poultry Veterinary Association Congress, Cape Town, South Africa, September 7-11, 2015.
10. Dr. Monique Franca served as President of the Southern Conference on Avian Diseases, which holds its annual meeting as part of the U.S. Poultry & Egg International Poultry Scientific Forum.
12. Dr. Joseph Corn provided consultations to over 75 wildlife and animal health professionals, as well as the media.
13. Dr. Brent Credille provided phone, electronic, and in-person consultations to 22 institutions throughout the southeast U.S.
14. Dr. Heather Fenton was the Program coordinator for the current (2015-2016) Chronic Wasting Disease surveillance program (USDA-APHIS program).
15. Dr. Heather Fenton was the Program coordinator for the current (2015-2016) White-nose syndrome surveillance program (also federally recognized).
16. Dr. Naola Ferguson-Noel provided mycoplasma testing assistance, technical support, and reagents/cultures for diagnostic tests to 34 poultry institutions throughout the world.
17. Dr. Steve Harvey identified and eradicated 3 outbreaks at UGA related to infected mice (*Aspiculuris* sp, Mouse Parvovirus -MPV, and *Myocoptes* sp), including MPV at the new AHRC facility.
18. Dr. Lee Jones handled over 100 consultations for the Tifton Veterinary Diagnostic Lab.
19. Chris King completed consolidation of University Research Animal Resources (URAR), reorganizing the Life Sciences and Veterinary Medicine divisions into one consolidated unit. The consolidation of URAR allowed the reassignment of Dr. Leanne Alworth to the role of Director of OACU and University Attending Veterinarian. This for the first time places an experienced veterinarian in a fully committed oversight and leadership role for animal care and use compliance.
20. Chris King and Lois Zitzow completed the implementation of a basic Export Compliance Program at UGA, and also the new online system Click AnOps, which will allow researchers real-time access to animal inventories and animal care costs while providing an efficient interface for transferring and ordering animals and requesting services.
21. Daniel Mead hosted a delegation of veterinarians and veterinary diagnostic laboratory directors from Azerbaijan at the AHRC. The request came from the Georgia Council for International Visitors through the UGA Office of International Education.
22. Dr. Steve Roney conducted emergency investigations throughout the southeast U.S. of a new broiler disease “Huddling Syndrome,” and he served on the Biosecurity Task Force for MS outbreak for the Georgia Poultry Federation.
23. Dr. Steve Roney organized 61 field trips for 128 students to combine student teaching with industry service. He also handled 176 poultry necropsies for the PDRC Diagnostic Lab.
24. Dr. Holly Sellers’ Virology Lab processed over 1,000 submitted diagnostic cases.
25. David Stallknecht coordinated approximately 200 case submissions of bluetongue and epizootic hemorrhagic disease testing at SCWDS.
Projects:

**Monique Franca:**

**Title:** Visualizing Infection Dynamics and Harborage Sites of *Salmonella* that Might Contribute to Contamination of Ground Chicken Meat

**Account Number and/or Project Number:** Account number: 2926GR207002 VMES Animal Disease. Project number: 14 FRA

**Status:** (Progress or Termination): Termination

**Narrative:** (Please submit no more than one page per project)

Poultry products are the most frequently implicated sources of human *Salmonella* infections in the U.S with estimated 1 million illnesses and 380 deaths per year. *Salmonella* Typhimurium, *S. Enteritidis* and *S. Heidelberg* cause gastroenteritis and septicemia in humans and are the top serovars linked to foodborne salmonellosis worldwide. In poultry, infection and disease caused by *Salmonella* are dependent on a number of factors including age, immune status of the host, genetic susceptibility, environmental factors and stressful conditions. *Salmonella* may be transmitted vertically through contaminated eggs, horizontally by direct bird-to-bird contact or via contaminated environment, feed and water. *Salmonella* colonizes the ceca of poultry and are shed in feces for several weeks and months. Following intestinal invasion, *Salmonella* are taken up by phagocytic cells and are transported systemically via the bloodstream to various organs. Persistence in tissues is dependent on the *Salmonella* strain, age and immune status of the host.

Although numerous measures have been implemented to minimize surface contamination in poultry carcasses during processing, *Salmonella* are still frequently recovered from ground products. If systemic infection is responsible for *Salmonella* contamination in finished ground products, the identification of *Salmonella* harborage sites and the removal of these sites during processing may be the solution to prevent outbreaks of foodborne salmonellosis. While significant progress in the knowledge of *Salmonella* pathogenesis in mammalian hosts has been made in the past decade, there is still a paucity of information regarding the mechanisms of infection and systemic dissemination of different *Salmonella* serovars in avian species. Previous studies on *Salmonella* pathogenesis in poultry species were limited to in vitro assays and enumeration of recovered bacteria from tissues. In the present research we used a highly sensitive bioluminescence imaging (BLI) system to monitor specific body sites infected with bioluminescent *Salmonella* and the dynamics of bacterial colonization and clearance from these sites over time. Bacteria with chromosomal integration of the lux operon from *Photorrhhabdus luminescens* (luxCDABE) encode genes to synthesize luciferase, the substrate luciferin and are able to constitutively produce visible light.

The goal of this project was to reveal harborage sites for *Salmonella* that might contribute to contamination of ground chicken meat. One-day-old specific pathogen free (SPF) chicks were randomly divided into two challenge groups and one control group. The chicks in the challenged groups were inoculated with $10^8$ CFU/0.1 ml of bioluminescent *S. Typhimurium* or *S. Heidelberg* via oral route, while the chicks in the control group were inoculated with 0.1 ml of inoculation...
broth. The chickens were evaluated daily for clinical signs and euthanized on different time points up to 42 days for sample collection. Blood, neck skin, drumstick with lymphatics and tibiotarsus were aseptically removed for BLI, bacteriology and immunohistochemistry. Samples of caeca, liver/spleen were also collected to confirm intestinal and systemic infections, respectively.

The results of this study showed that *S. Typhimurium* and *S. Heidelberg* can be detected in neck skin until 42 days post inoculation by BLI, bacteriology and immunohistochemistry, and that epidermal keratin is likely a harborage site for *Salmonella* in poultry skin. Small numbers of *Salmonella* were also detected in some muscle samples by immunohistochemistry in different time points post inoculation and until day 42. Low levels of bioluminescent *Salmonella* were detected in samples of tibiotarsus, blood and drumstick mainly in the first 2 weeks post inoculation by bacteriology. Immunohistochemistry revealed *Salmonella* in bone marrow only in the first week post inoculation.

Overall the results of this study indicate that neck skin, tibiotarsus, drumstick and blood from infected chickens are some possible sources of contamination in ground poultry meat. Systemic infection would explain the detection of *Salmonella* from blood, tibiotarsus and drumstick, while the presence of *Salmonella* in neck skin suggests surface contamination by fecal material. The results of this study suggest that neck skin with *Salmonella* attachment to epidermal keratin is likely a more significant source of contamination in ground poultry meat than bone, blood and skeletal muscle.

**Naola Ferguson-Noel**

**Title:** A Novel, Translational, Multidisciplinary Approach to Control Poultry Respiratory Diseases in the United States.

**2.1.3. Co-infection of broiler chickens with Mycoplasma synoviae (MS), NDV, IBV and ILTV to reproduce airsacculitis and mortality reported with MS infections in the field**

**PI:** Ferguson-Noel N.

**Account Number and/or Project Number:** 10-21-R188-294

**Status:** Progress

**Narrative:**

The overall objective of this research is to investigate the multifactorial etiology involving poultry respiratory diseases. *Mycoplasma synoviae* (MS), is a poultry pathogen of worldwide prevalence that may result in respiratory disease ranging in severity from a subclinical upper respiratory infection to more severe disease, involving airsacculitis as well as synovitis. MS strains have been shown to vary widely in their virulence and in some instances MS infection is perceived to have little clinical impact on commercial poultry production and MS control is lower priority. This perception can be misleading as the clinical presentation of MS may be greatly exacerbated by concurrent respiratory virus or *E. coli* infection. In this project we will inoculate broiler chickens with recent MS strains and combinations of NDV, IBV or ILTV. We have previously completed bird trials with co-infections of IBV and MS, also completed a trial with MS and ILTV in this year of the project (Evaluation of Infectious Laryngotracheitis CEO Vaccine in Mycoplasma synoviae positive Broilers). Our goal in this trial was to evaluate the impact of a commercial ILT CEO vaccine in MS infected commercial broilers.
Groups of broilers were inoculated with a recent MS field isolate via intra-tracheal and intra-airsac routes, a week later broilers were administered a commercial ILT CEO vaccine via eye drop. Clinical respiratory signs were scored at 3 and 5 days post ILT vaccination. The groups were grossly assessed for severity of airsacculitis at necropsy (at 7 and 14 days post ILT vaccination); tracheal and lung lesions were evaluated by histopathology. The degree of infection and replication of MS and ILT was determined by qPCR assays. The severity and appearance of clinical signs were markedly different in birds infected with both MS and ILT, as opposed to the groups infected with one pathogen.

Charles Hofacre:

Title: Poultry On-Farm National Antimicrobial Resistance Monitoring System (NARMS)
Account Number and/or Project Number: 59-0204-3-002
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project): See attached copy of Progress Report

Poultry On-Farm National Antimicrobial Resistance Monitoring System (NARMS)

A Progress Report
Charles L. Hofacre\(^A\), Randall Singer\(^B\), Roy Berghaus\(^A\), and Patrick McDermott\(^C\)

\(^A\)The University of Georgia, \(^B\)The University of Minnesota, \(^C\)The U. S. Food and Drug Administration

Summary. There is not a clear understanding of the link between antimicrobial resistance in the potential food borne pathogens for humans from poultry (\textit{Salmonella} sp. and \textit{Campylobacter} sp.). What is even more difficult to ascertain is whether there is an effect of antimicrobial resistance of these foodborne pathogens and the level of antimicrobial resistance in the human commensal bacteria population. To date we have enrolled more than 60% of the annual U. S. broiler and turkey production. In broilers 62.5\% of the bootsocks were \textit{Salmonella} positive and 36.9\% \textit{Campylobacter} sp. positive. Turkeys were 21.8\% \textit{Salmonella} and only 1 \textit{Campylobacter} isolate to date. Using the NARMS Sensititre panel, in broilers the greatest antimicrobial resistance in \textit{Salmonella} sp. was to tetracyclines followed by sulfisoxazole, streptomycin and gentamicin. The broiler \textit{Campylobacter} sp. isolates antimicrobial resistance was greatest to the tetracyclines, ciprofloxacin and macrolide, azithromycin. Antibiotic usage information was also collected from a survey completed by the production managers or veterinarians. The goal for the on farm NARMS is to not look at each year in isolation but to be able to follow trends in antimicrobial resistance and usage year after year. Results will not be written in this paper but will be presented at the meeting due to agreement with poultry company cooperators.

Introduction. Resistance to antibiotics is considered to be one of the greatest threats to the health of both animals and humans. The Food and Drug Administration (FDA) began a program in cooperation with the U. S. Department of Agriculture (USDA) to monitor the level of resistance to many of the medically important antimicrobial agents in \textit{Salmonella} sp. and \textit{Campylobacter} sp. that were isolated from poultry (chickens and turkeys) in processing plants in
1996. Also during this same time the poultry industry was implementing programs to lower *Salmonella* on the final products thus lowering the number of isolates of *Salmonella* available to USDA for the NARMS program. Therefore, in 2012, FDA and USDA collaborated with The University of Georgia and The University of Minnesota to perform a pilot to environmentally sample broiler and turkey farms at processing age and culture for *Salmonella* sp. and *Campylobacter* sp. These isolates were sent to FDA for antimicrobial sensitivity testing using the Sensititre NARMS panel and serotyping of *Salmonella* and speciation of *Campylobacter*. This program was very successful and has since been expanded from the original 400 bootsocks to the current pilot projection for 1,536 samples. Also, as more and more consumer/media groups put pressure for antibiotic use information (2), the pilot was expanded to include a survey of antimicrobial growth promotion, prevention and therapeutic use on these sampled farms.

Materials and Methods

**Sampling approach.** The sampling plan is based on the number of slaughter plants for each broiler and turkey company with the goal to be between 60 and 80% of the annual broiler chicken and turkey production. Farms within each complex for each enrolled company are selected at random by the production management from the farms that were within 1 week of slaughter. Four bootsock samples were collected from 1 house on each farm with 8 farms sampled at each complex (32 weekly bootsock samples). The sampling kits containing sampling instructions, sterile pre-moistened bootsocks (Solar Biologicals, Inc.) and survey were mailed to each complex. The completed antimicrobial usage survey and bootsock swabs were then overnight shipped in coolers with ice packs to either The University of Georgia or The University of Minnesota laboratory for culture. Upon arrival at the laboratory all samples had buffered peptone water (BPW) added.

*Salmonella Culture.* Following addition of BPW samples were incubated at 42 °C for 24 hours in Hajna tetrathionate broth (Oxoid Ltd.) and then struck onto XLT 4 agar plates (Remel Diagnostics) and incubated at 37 °C for 24 hours. Delayed secondary enrichment was performed for all samples negative on the first enrichment. Isolates were serogrouped and then inoculated into DNAase/RNAase free water to have serovar determined by intergenic sequence ribotyping (ISR) as per the method of Guard et al (1).

*Campylobacter Culture.* Following the addition of BPW to the bootsocks, 1.5 ml sample was placed into 13.5 ml Bolton’s broth (Oxoid Ltd.) and incubated at 42 °C for 24 hours then struck to Campy-Cefex agar (Remel Diagnostics) and incubated with Campy gas at 42 °C for 48 hours. Biochemical testing (Oxydose, indoxyl acetate and gram stain) was used to confirm identification as *Campylobacter*. Isolates were inoculated into DNAase/RNAase free water for speciation by PCR using the Rapid Finder™ *Campylobacter* Multiplex Assay beads according to manufacturer’s recommendations (Life Technologies).

References:


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**David Hurley:**

**Title:** Staphylococcal bacteria from maternal cells impact neonatal immune development

**Account Number and/or Project Number** GEOV-0533

**Status:** (Progress or Termination) Progress

**Narrative:** (Please submit no more than one page per project)

**Non-Technical Summary**

Staphylococcal bacteria are pathogens of cattle, and can be isolated from dairy cows beginning soon after birth and throughout their lifetime. Staphylococcal bacteria have been associated with a number of disease problems and may form biofilms on tissues. Staphylococcal bacteria may present as occult colonization or cause overt disease problems. Published studies have demonstrated that bacteria are transferred in association with cells from human mothers to their neonates in colostrum and milk. It has also been shown that immune activating and modulating bacterial toxin production is a feature of a large number of staphylococcal bacteria isolated from human neonates. At this time it is not clear if staphylococcal organisms are transferred with maternal cells in colostrum and milk in cattle, or if these bacteria impact the development of the dairy calf. In this study, we intend to monitor the cells from prepartum mammary secretion, colostrum and early milk from the dam, to culture several sites on body of calves (nasal, vaginal, and mammary associated skin surfaces, and in fecal samples) for the presence of staphylococcal species through about 12 weeks of age, and to monitor the level of circulating antibody in serum, mucosal antibody to protect body surfaces in nasal secretion, and the capacity of white blood cells to respond to a standard *S. aureus* antigen over six months. The pattern of staphylococcal isolates and progression of anti-staphylococcal immunity will be assessed to attempt to establish the ecological relationship that dairy heifers have with these bacteria.

**Accomplishments**

**Major goals of the project**

The goals of this project are: 1) to determine if staphylococcal bacteria can be isolated from the cells in pre-delivery mammary secretion, colostrum and early milk (up to 14 days post-delivery), 2) to survey the nose, vagina, teat skin, feces, and rectal mucus of 90 calves monthly from 1 month to 12 months of age for the presence and quantity of staphylococcal bacteria, and

3) to determine the serum IgG and nasal, vaginal, and rectal mucus IgG and IgA titers, and the capacity of mononuclear cells from these calves to proliferate against local staphylococcal strain antigens over the same period to provide a basic survey of the relationship between staphylococcal bacteria and the calf for 90 cow-heifer calf pairs over a three-year period.
The hypothesis of this study is that dairy calves are exposed to staphylococcal bacteria transferred at birth with cells from colostrum and milk that colonize the GI tract, which enhances GI function and impacts immune development over the first year.

What was accomplished under these goals?
Cells from the colostrum and second and tenth day milk of 20 additional cows were cultured and staphylococcal isolated were preserved. A sampling of these isolates were identified to the species level. While a small fraction of the isolates were Staphylococcus aureus, most were coagulase negative staphylococcal strains. Most represented two genus (S. hyicus and S. xylosis) that are not routinely isolated from the farm environment, only from dairy cows. In addition, isolates from mouth, rectum, nose, skin and vagina of 10 calves housed in individual hutches yielded a similar pattern of recovered staphylococcal organisms. Samples collected during the first week showed universal colonization of mouth, skin and rectum. Samples collected week 2 to week 6 from these calves yielded staphylococcal isolates from all sites swabbed. The principal staphylococcal organisms isolated from these calves were S. xylosis and S. hyicus, but there were a number of staphylococcal species recovered. Further, an assessment of the response to S. aureus and S. hyicus antigen by these calves demonstrated strong production of IL-17 and week production of interferon-gamma by stimulated mononuclear cells during the first two weeks of life, with the opposite true as the animal became older. By six weeks of age, production of interferon-gamma was the dominant response to in vitro stimulation with staphylococcal antigen. In addition, the cells activated in vitro by staphylococcal antigen in animal during the first week of life as indicated by CD25 expression, were about 60-70% gamma-delta T lymphocytes in the mononuclear cells from peripheral blood. By 4 weeks of age, CD4 and CD8 positive T lymphocytes from peripheral blood also expressed CD25 after staphylococcal stimulation in culture.

These finding suggest that staphylococcal bacteria may be transferred from the dam to the neonate with colostrum and colonization with these staphylococcal bacteria may impact the development of adaptive immune responses to bacteria in the calf.

Roberto Palomares:

1-Title: Characterization of the serum, uterine and vaginal mucosal antibody response (IgG and IgA) against *Tritrichomonas foetus* after immunization with a commercial vaccine (TrichGuard) in beef cows.

Account Number and/or Project Number: 1011RX208068 Project 13-PAL (startup package) and 1025GR188000 project AVYAB Provost, Summer Research Faculty Support

Status: Progress or Termination (Choose one): Progress

Narrative: (Please submit no more than one page per project:

After receiving the purified antigen contained in the commercial vaccine against *Tritrichomonas foetus* (TrichGuard) from Boehringer Ingelheim, we started developing an ELISA tests to determine the levels of IgG and IgA against *T. foetus* in serum, uterine and vaginal mucosal after immunization with a commercial vaccine (TrichGuard®) in beef cows.
Unfortunately, the preliminary results revealed high levels of antibody against whole killed protozoa in both vaccinated and control cows, which is likely due to nonspecific antigen – antibody binding. Samples were analyzed using the specific antigen TF1.17 in Dr. Lynette Corbeil’ lab at the University of California in San Diego to determine specific immune response against this *Trichomonas* antigen. An abstract will be submitted to the Society for Theriogenology Meeting and a manuscript is being prepared for submission in Theriogenology.

2-Title: Effect of injectable trace minerals (zinc, manganese, selenium, and copper) on the humoral and cell-mediated immune responses to vaccine antigens following administration of a modified-live viral vaccine in dairy calves.

**Account Number and/or Project Number:** 1011RX208068 Project 13-PAL/1021RR208083FA-RAP

**Status:** Progress or Termination (Choose one): Termination

**Narrative:** (Please submit no more than one page per project)

This study was financed through a gift provided by Multimin USA. The objective of this study was to determine the effect of injectable trace minerals (ITM) on cell mediated immune (CMI) response to vaccine antigens in dairy calves receiving a modified-live virus (MLV) vaccine and an attenuated bacterin. Administration of ITM concurrently with MLV vaccination resulted in higher GM antibody titers to BVDV-1 on day 28 post prime vaccination compared to the control group (*P* = 0.03). A remarkable PBMC proliferation was observed in both groups upon BVDV stimulation on different days post vaccination relative to day 0 (*P* < 0.05). Interestingly, a significant increase in PBMC stimulation index to BVDV1 occurred earlier in the ITM group (day 14) compared to the control group (day 28). Therefore, at day 14 post priming vaccination, the PBMC proliferation response was numerically higher in the ITM group than the control group (*P*=0.08). Both groups showed an increased PBMC proliferation response over time upon BHV-1 stimulation compared to day 0 (*P* <0.05). Despite there were no significant differences between groups, the ITM group had a stronger and earlier increment in PBMC proliferation response to BHV-1 than the control group. Administration of ITM resulted in a more consistent PBMC proliferation response to BRSV following MLV vaccination over the experimental period than the saline injected calves. Moreover, calved that received ITM showed a significantly higher PBMC proliferation upon BRSV recall on day 7 post prime vaccination compared to the control group (*P* = 0.01; Figure 8). The abstract entitled: “Effect of injectable trace minerals (Zn, Mn, Cu & Se) on the humoral and cell mediated immune response to vaccine antigens following administration of a modified-live virus vaccine in dairy calves” was presented as a poster at the annual meeting of the American Association of Bovine Practitioners in New Orleans, LA in September 2015. A manuscript will be submitted on January 2016 for publication at Journal of Animal Science.
3-Title: Effect of injectable trace minerals on immune response and protection from bovine viral diarrhea virus (BVDV) acute infection elicited by a MLV vaccine in dairy calves experimentally challenged with non-cytopathic BVDV.
Account Number and/or Project Number: 1021RR208083FA-RAP
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project)
A second phase of the previous research project was performed from July 2014 to January 2015 to evaluate the effect of injectable trace minerals on protection elicited by a MLV vaccine from acute and persistent testicular infection following experimental challenge with BVDV in dairy calves. Samples were collected and laboratory analysis (virus isolation, IHC and PCR) are being currently performed. This project represents the first study developed by the graduate student João Bittar.

4-Title: Comparison of 4-day vs 5-day Co-Synch + Controlled Internal Drug Release (CIDR) + Timed Artificial Insemination (TAI) Protocols in Beef Heifers.
Account Number and/or Project Number: 1021RR208083FA-RAP.
Status: Progress or Termination (Choose one): Termination
Narrative: (Please submit no more than one page per project)
We performed the study at Milton Stewart’s farm in Calhoun GA in November 2014. The application of the 4-day Co-Synch+CIDR protocol in beef heifers resulted in adequate pregnancy rate (50.0%) similar to that of the 5-day Co-Synch+CIDR protocol (56.0 %). An abstract derived from this study was presented orally at the Annual Conference and Symposium of the Society for Theriogenology at San Antonio Texas in August 2015 by Dr. Heidi Fishman (graduate student). We are in the phase of manuscript preparation.

5-Title: Immune response to subcutaneous and intranasal vaccination in young beef calves.
Account Number and/or Project Number: 1021RR208280 # 15PAL
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project)
The objective was to compare the serum neutralizing (SN) titers to BHV-1 and BRSV, and mucosal BHV-1-specific IgG and IgA in nasal secretions following administration of intranasal (IN) or subcutaneous (SC) modified-live virus (MLV) booster 60 days after priming calves with IN vaccine between 1-3 weeks of age. Twenty beef calves were administered 2mL of a MLV vaccine containing BHV-1, BRSV, and PI3 IN between 1-3 weeks of age. Calves were randomly assigned to one of two groups: 1.IN-MLV (n=10): Calves received 2mL of the same MLV vaccine used in priming vaccination IN 60 days after priming. 2.SC-MLV (n=10): Calves received 2mL of the same MLV vaccine SC 60 days after priming. Serum and nasal secretion samples were collected on days -14, 0, 14, 21, 30, and 60 relative to the day of booster for determination of total serum IgG and SN antibody titers against BHV-1 and BRSV as well as total mucosal IgA and BHV-1-specific mucosal IgG and IgA concentrations, respectively. The
field and laboratory stages have been completed. This study is currently in the stage of data interpretation and manuscript writing. The abstract entitled: *Comparison of the immune response to subcutaneous or intranasal modified-live virus booster vaccination in young beef calves that were primed with intranasal vaccine*” was presented at the Conference of Research Workers in Animal Diseases. Chicago Illinois, December 2015. This project represents the second study developed by the graduate student Dr. Joao Bittar. A second phase of the research project was initiated during October 2015 in the Double Bridge UGA beef farm to determine the effect route of booster vaccination on the systemic and mucosal antibody response following administration of two different commercial vaccines to prevent respiratory disease in beef calves. This experiment represents the third study developed by the graduate student Dr. Joao Bittar. The field stage of this study will be completed by March 2016.

6-Title: Assessment of Timing of Ovulation and Pregnancy Outcomes in Dairy Heifers treated with a Monday-Friday 4-day Co-Synch + CIDR + Timed Artificial Insemination (TAI) Protocol
Account Number and/or Project Number: 1021RR208083FA-RAP
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project)
The initial part of the experiment was conducted for the evaluation of ovulation synchronization + timed artificial insemination protocols in dairy heifers. Experiment 1 was aimed to assess timing of ovulation of heifers treated with 4-day Co-Synch+CIDR and will help to improve pregnancy outcomes in experiment 2 which will be conducted in a larger scale (n=1000 heifers) in a commercial dairy farm. The field stage of experiment 1 was completed and laboratory analysis for determination of hormonal levels is pending. This project represents the second study developed by the graduate student Dr. Heidi Fishman.

7-Title: Effect of sperm-bound anti-sperm antibodies (ASA) on function of bovine spermatozoa: Sperm-oocyte interactions.
Account Number and/or Project Number:
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project)
In this study we determined the effect of sperm-bound IgG and IgA on the ability of bovine spermatozoa to bind to the zona pellucida in vitro. Cryopreserved semen samples from four *Bos Taurus* Aberdeen Angus bulls were used. Bulls were immunized with autologous spermatozoa and adjuvants to induce formation of ASAs. Bovine ovaries were collected from a local slaughterhouse and antral follicles were aspirated to recover the cumulus-oocyte complexes (COCs). COCs were incubated with spermatozoa (1x10^4 sperm/oocyte in a 50 ul droplet) for 2 h at 38 °C in 5% CO2. Loosely bound sperm were removed and the oocyte-sperm complexes were evaluated under fluorescence microscopy and the number of spermatozoa bound to the zona pellucida of each oocyte (binding index) was counted. This project is in the phase of data interpretation and statistical analysis.
Joseph Corn:

In Progress


Completed


Title: SOUTHEASTERN COOPERATIVE WILDLIFE DISEASE STUDY VARIOUS OTHER STATES
Account Number and/or Project Number: - 1021RR694173
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project:

University, under general supervision of the Southeastern Association of Fish and Wildlife Agencies or any duly constituted committee empowered to act for or in behalf of this organization, shall use reasonable professional efforts to perform scientific research having the following objectives:

a. Determine the cause or causes of morbidity and mortality among wild birds, mammals, and other wildlife in the southeastern U.S.

b. Determine the population impacts of diseases and parasites on wild birds, mammals, and other wildlife in the southeastern U.S.

c. Investigate disease interactions between wildlife and domestic livestock and poultry. Conduct research into the diseases of wild birds, mammals, and other wildlife with special emphasis on problems possibly associated with public or domestic animal health.

d. Devise appropriate control measures where feasible.

e. Upon request, University shall perform chronic wasting disease (CWD) tests and analyze samples from publicly-owned, free-ranging cervids submitted by the Agency. If Agency has requested CWD testing, the Budget shall include a set number of samples to be tested.

Title: RELATIONSHIPS INVOLVING WILDLIFE, LIVESTOCK, AND POULTRY; EXOTIC ARTHOPOD SURVEILLANCE; AND NATIONAL FERAL SWINE MAPPING SYSTEM Account Number and/or Project Number: 1031RE694179
Status: Progress or Termination (Choose one): Progress
Narrative: (Please submit no more than one page per project:

The following is a list of priorities for this agreement for FY 2014. These priorities are ongoing and are discussed in detail in the Quarterly Reports and Annual Reports provided.
2. Wildlife Seminar for Emergency Animal Disease Preparedness
3. Emergency Management Response System
4. Wildlife Mortality Investigations
5. Avian Influenza Cooperative Surveillance and Research
6. West Nile Virus Surveillance
7. Hemorrhagic Disease Surveillance
8. *Culicoides* Surveillance
9. Exotic Arthropod Surveillance
10. Feral Swine Studies
11. Chronic Wasting Disease Surveillance
12. CWD Program Development
13. Service on National and International Working Groups
14. Leadership to the USAHA & AFWA
15. Quarterly Newsletter
16. Informational Services to Conservation Officials and Animal Health Officials
17. Liaison Activities between Wildlife and Agricultural Interest Groups

Melinda Brindley:

**Title:** Characterization of the Arenavirus Glycoprotein Complex and Mechanism of Fusion  
**Account Number:** 1021RR211444  
**Status:** Progress  
**Narrative:** (Please submit no more than one page per project)

**Specific Aim 1 – Examine the flexibility in six helix bundle formation during arenavirus fusion.**
We produced a small library of cysteine mutants, making 10 mutants with cysteine residues engineered in the region between the transmembrane domain and the heptad-repeat region B (HR-B). Upon biochemical characterization, the mutants displayed a defect in protein cleavage between the GP1 and GP2 subunits. Cleavage between GP1 and GP2 is a necessary step in arenavirus glycoprotein fusion. The lack of cleavage suggests that the arenavirus glycoprotein is very sensitive to mutations in this region, and the changes were significantly altering the overall conformation of the protein preventing necessary cleavage and trafficking of the mutants. Unfortunately, GPC’s sensitivity to mutations in this region prevented the comparative analysis between arenavirus GPC and the measles virus fusion protein as planned.

**Specific Aim 2 – Identify the receptor binding site within GP1.**
We have made the most progress in defining necessary regions within the GP1 subunit of the LASV GPC. We have produced a large library of mutants and completed biochemical characterization and cell-to-cell fusion assay. The mutants that retain >75% GP1-GP2 cleavage efficiency as compared to parental, are undergoing further testing in VSV-pseudotyping transduction assay and receptor binding experiments. Mutant library: (125 sequenced confirmed GPC mutant constructs have been created)
HA tag insertional mutagenesis – 30 mutants; 8 mutants display high cleavage efficiency and are presently undergoing further testing

GP1

- ΔCHO mutants – 7 mutants removing the naturally occurring glycans on GP1; 5 mutants display high cleavage efficiency and are presently undergoing further testing
- CHO shielding mutants – 7 mutants contain additional glycosylation sites in order to perturb receptor binding; 5 mutants display high cleavage efficiency and are undergoing further testing
- Charged residue mutants – 15 mutants replacing a charge amino acid with alanine; 14 mutants display high cleavage efficiency and are presently undergoing further testing
- Hydrophobic residue mutants – 16 mutants replacing hydrophobic residues with alanine; 7 mutants display high cleavage efficiency and are presently undergoing further testing
- Di-sulfide bonds mutants – 8 mutants containing additional cysteine residues to the GP1 subunit – mutants are presently undergoing initial biochemical characterization

We have several mutants from the library that may contribute to receptor binding. Since initial submission of the project, a second cellular receptor has been identified to interact with LASV GPC. Alpha-dystroglycan (DAG1) is thought to initiate virus binding at the cell surface and induce endocytosis, but once the cell matures the endosome, dropping the pH a receptor switch occurs. The low-pH environment no longer favors the GPC-DAG1 interaction, but now enables a GPC-LAMP1 (lysosomal associated membrane protein 1) interaction (Jae LT et al Science 2014). In light of this new information, we are examining both the DAG1-GPC and LAMP1-GPC interactions. In addition a low-pH crystal structure of LASV GP1 was published (Cohen-Dvashi H J Virol 2015). This structure gives us an additional framework to model our mutagenesis results.

Specific Aim 3 – Determine the geometry of Lassa glycoprotein in situ by cryo-electron tomography of purified virus-like particles.

We can routinely produce high titers of LASV pseudotyped VSV particles (>10^7 without any concentration). When examining the protein found in the particles, the amount of GPC compared to the VSV matrix (M), is relatively low. This means that although the particles retain infectivity, the amount of GPC on the particles is just above biochemical detection. We are working on increasing the amount of GPC on the particles for future visualization. We are experimenting with producing the particles in different cell lines as well as altering the level of GPC transfected during pseudotype production. In addition we are trying to concentrate the particles with an IP step to specifically recover particles containing GPC during the purification procedure.