

CURRICULUM VITAE

Robert A. Heckert, BSc (Agr), DVM, PhD

Education:

<u>School</u>	<u>Field</u>	<u>Degree</u>	<u>Year</u>
The Ohio State University	Preventive Medicine	PhD	1990
University of Saskatchewan	Veterinary Medicine	DVM	1984
University of British Columbia	Agriculture	BSc (Agr)	1980

A. Positions held:

Owner of Robert Heckert Consulting, LLC 2007 - present

A private biosafety consulting firm specializing in providing biosafety advice to governments, industry and academia.

Fellow, Homeland Security Institute 2006-2007

Analytical Services, Arlington, VA

Participates in the Science and Technology Assessments Division by providing technical advice and guidance on Agriculture related threats to the Department of Homeland Security. Leads teams of analysts in evaluation of complex issues related to Agrosecurity and foreign animal disease preparedness.

National Program Leader, Animal Health 2002- 2006

United States Department of Agriculture

Agriculture Research Services, Beltsville, MD 20705

Serves as the focal point for national leadership and coordination of agricultural research programs relating to animal health. As the Agency's technical expert for animal health, advises ARS senior leadership on related technical and policy issues. Represents and speaks for ARS concerning animal health issues both nationally and internationally. Works with ARS scientists and line managers nationwide to assure that the animal health national research program reflects national priorities and policies, contains acceptable timetables for action, and correctly utilizes available human and physical resources.

Assistant Professor 1998 - 2002

Virginia-Maryland Regional College of Veterinary Medicine, University of Maryland, College Park, MD 20742

Duties involve developing and conducting a research program in infectious diseases of poultry. Providing leadership and guidance to graduate students enrolled in a MS or PhD program. Providing support, advice and help to the poultry industry with respect to avian infectious viral diseases.

Chief, Foreign Animal Disease Diagnosis 1997-1998
**Canadian Food Inspection Agency, Animal Diseases Research Institute,
Centre of Expertise Foreign Animal Diseases, Nepean, Ontario, Canada**
Duties were as below.

Acting Chief, Foreign Animal Disease Diagnosis 1994-1997
**Agriculture Canada, Animal Diseases Research Institute, Foreign Animal
Disease Section, Nepean, Ontario, Canada**
Responsible for all laboratory operations regarding diagnosis of foreign animal
disease viruses for Canada. Duties included operation of a biocontainment Level
II and III laboratory, supervision of 3 research scientists and 10 technicians in the
diagnosis and research of several viral animal diseases, teaching animal diseases
to other veterinarians, provision of scientific advice to regulatory officials in the
Animal Health Division of Agriculture Canada, representing Canada as a
scientific expert in court.

Veterinary Diagnostician, Foreign Animal Diseases 1992-1994
**Agriculture Canada, Animal Diseases Research Institute, Foreign Animal
Disease Section, Nepean, Ontario, Canada**
Responsible for research and diagnosis of viral diseases of animals. Duties
included reporting of results, development and validation of diagnostic tests and
basic research on the pathogenesis of several viral diseases (avian and
mammalian), teaching of foreign animal diseases to other veterinarians, provision
of scientific advice to regulatory officials in the Animal Health Division of
Agriculture Canada.

Head, Virology/Immunology 1990-1992
Agriculture Canada, Health of Animals Laboratory, Sackville, N.B. Canada
Responsible for research and diagnosis of retroviral diseases of small ruminants.
Duties included supervision of a diagnostic laboratory, reporting of results,
development and validation of diagnostic tests and basic research on the
pathogenesis of retroviral diseases.

Veterinarian 1984-1985
Avian and large animal practice, Vancouver, Canada
Duties involved the provision of veterinary service and advice to poultry and
swine farmers.

A. Publications

Articles in refereed journals

1. Saif LJ, **Heckert RA**, Miller KL, Tarek MM. Cell culture propagation of bovine coronavirus. J Tissue Culture Meth 11:139-146, 1988.
2. Saif LJ, Redman DR, Brock KV, Kohler EM, **Heckert RA**. Winter dysentery in adult dairy cattle: Detection of coronavirus in the feces. Vet Rec 123:300-301,

1988.

3. **Heckert RA**, Saif LJ, Myers GW. Development of protein A-gold immunoelectron microscopy for detection of bovine coronavirus in calves: comparison with ELISA and direct immunofluorescence of nasal epithelial cells. Vet Microbiol 19:217-231, 1989.
4. **Heckert RA**, Saif LJ, Hoblet KH and Agnes AG. A longitudinal study of bovine coronavirus enteric and respiratory infections in dairy calves in two herds in Ohio. Vet Microbiol 22:187-201, 1990.
5. **Heckert RA**, Saif LJ, Mengel JP and Myers GW. Isotype specific antibody responses to bovine coronavirus structural proteins in serum, feces, and mucosal secretions from experimentally challenge-exposed colostrum-deprived calves. Am J Vet Res 52:692-699, 1991.
6. **Heckert RA**, Saif LJ, Mengel JP, Myers GW and Agnes AG. Epidemiologic factors and isotype-specific antibody responses in serum and mucosal secretions of dairy calves with bovine coronavirus respiratory tract and enteric tract infections. Am J Vet Res 52:845-851, 1991.
7. **Heckert RA**, Saif LJ, Mengel JP and Myers GW. Mucosal and systemic antibody responses to bovine coronavirus structural proteins in experimentally challenge-exposed calves fed low or high amounts of colostrum antibodies. Am J Vet Res 52:700-708, 1991.
8. **Heckert RA**, Saif LJ, Mengel JP and Myers GW. Mucosal and systemic isotype-specific antibody responses to bovine coronavirus structural proteins in naturally infected dairy calves. Am J Vet Res 52:852-857, 1991.
9. **Heckert RA**, McNab WB, Richardson SM and Brisco MR. Evaluation of an enzyme-linked immunosorbent assay for the detection of antibodies to caprine arthritis-encephalitis virus in goat serum. Can J Vet Res 56:237-241, 1992.
10. **Heckert RA**, Power CA, Briscoe MR. Pestivirus is a common contaminant in Maedi-Visna and Caprine Arthritis-Encephalitis virus stocks. Can J Vet Res 56:370-372, 1992.
11. Nagy E, Krell PJ, **Heckert RA**, Derbyshire JB. Vaccination of chickens with a recombinant fowlpox virus containing the hemagglutinin-neuraminidase gene of Newcastle disease virus under the control of the fowlpox virus thymidine kinase promoter. Can J Vet Res 57:306-308, 1993.
12. Afshar A, Zhao X, **Heckert RA**, Trotter HC. Suitability of autoclaved tap water for preparation of ELISA reagents and washing buffer. J Virol Methods 46:275-278, 1994.
13. Zhou E-M, Afshar A, **Heckert RA**, Nielsen K. Anti-idiotypic antibodies

generated by sequential immunization detect the shared idiotypic on antibodies to pseudorabies virus antigens. J Virol Meth 48:301-313, 1994.

14. **Heckert RA**, Dubuc C, Briscoe MR, Ranger M. Prevalence of border disease virus infection in a small group of Canadian sheep. Can Vet J 35:379-381, 1994.
15. Deregt D, Bolin SR, **Heckert RA**, Loewen KG. Monoclonal antibodies to bovine viral diarrhoea virus: Cross-reactivities to field isolates and hog cholera virus strains. Can J Vet Res 58:71-74, 1994.
16. **Heckert RA**, Myers DJ, Afshar A, Riva J. Development and evaluation of an enzyme-linked immunosorbent assay for the detection of antibodies to avian pneumovirus. Avian Diseases 38:694-700, 1994.
17. Afshar A, **Heckert RA**, Dulac GC, Trotter HC. Application of a competitive ELISA for the detection of bluetongue virus antibodies in sera of Llamas and some wild ruminants. J Wildlife Diseases 31:327-330, 1995.
18. **Heckert RA**, Collins MS, Manvell RJ, Strong I, Pearson JE, Alexander DJ. Comparison of Newcastle disease viruses isolated from cormorants in Canada and the USA in 1975, 1990 and 1992. Can J Vet Res 60:50-54, 1996.
19. Smith RD, Tsunemitsu H, **Heckert RA**, Saif LJ. Evaluation of two antigen-capture ELISAs using polyclonal or monoclonal antibodies for the detection of bovine coronavirus. J Vet Diagn Invest 8:99-105, 1996.
20. Lin M, Zhou EM, **Heckert RA**. Induction of antibodies to the bluetongue virus core polypeptide VP7 in sheep by internal image rabbit anti-idiotypic antibodies. Viral Immunol 9:35-43, 1996.
21. **Heckert RA**, Riva J, Cook S, McMillen J, Schwartz RD. Onset of protective immunity in chicks after vaccination with a recombinant herpesvirus of turkeys vaccine expressing Newcastle disease virus fusion and hemagglutinin-neuraminidase antigens. Avian Diseases 40:770-777, 1996.
22. Harding MJ, Prud'homme I, Gradil CM, **Heckert RA**, Riva J, McLaurin R, Dulac GC, Vydelingum S. Evaluation of nucleic acid amplification methods for the detection of hog cholera virus. J Vet Diagn Invest 8:414-419, 1996.
23. Zarnke RL, Gamble R, **Heckert RA**, Ver Hoef J. Serologic survey for *Trichinella* spp. in grizzly bears from Alaska. J Wildlife Diseases 33:474-479, 1997
24. **Heckert RA**, Best M, Jordan LT, Dulac GC, Eddington DL and Sterritt WG. Efficacy of vaporized hydrogen peroxide against exotic animal viruses. Applied and Environmental Microbiology 63:3916-3918, 1997.

25. **Heckert RA**, Brocchi E, Berlinzani A, Mackay DKJ. An international comparative analysis of a competitive ELISA for the detection of antibodies to swine vesicular disease virus. J Vet Diag Invest 10: 295-297, 1998.
26. Vydelingum S, Tao T, Balazsi K, **Heckert RA**. Comparison of a reverse transcription-polymerase chain reaction assay with virus isolation for the detection of hog cholera virus. OIE, Scientific and Technical Review. 17:674-681, 1998.
27. Clavijo A, Zhou E-M, Vydelingum S, **Heckert RA**. Development and evaluation of a novel antigen capture assay for the detection of classical swine fever virus antigens. Vet Microbiol 60: 155-168, 1998.
28. Zhou E-M, Chan M, **Heckert RA**, Riva J, Cantin M-F. Evaluation of a competitive ELISA for detection of antibodies against avian influenza virus nucleoprotein. Avian Diseases, 42: 517-522, 1998.
29. Zhou E-M, Chan M., McIsaac M, **Heckert RA**. Evaluation of antibody responses of emus (*Dromaius novaehollandiae*) to avian influenza virus infection. Avian Diseases 42:757-761, 1998.
30. Kuiken T, Leighton FA, Wobeser G, Danesik KL, Lassard L, Riva J, **Heckert RA**. An epidemic of Newcastle disease in double-crested cormorants (*Phalacrocorax auritus*) in Saskatchewan, 1995: Clinical signs, mortality, virus isolation, and serology. J Wildlife Diseases, 34:457-471, 1998.
31. Kuiken T, **Heckert RA**, Riva J, Leighton FA, Wobeser G. Excretion of pathogenic Newcastle disease virus by double-crested cormorants (*Phalacrocorax auritus*) in absence of mortality or clinical signs. Avian Pathol. 27:541-546, 1998.
32. Kuiken T, Wobeser G, Leighton FA, Haines DM, Chelack B, Bogdan J, Hassard L, **Heckert RA**, Riva J, Pathology of Newcastle disease in double-crested cormorants from Saskatchewan, with comparison of diagnostic methods. J Wildlife Diseases 35:8-23, 1999.
33. **Heckert RA**, Nagy E. Evaluation of the hemagglutination-inhibition assay using a baculovirus expressed hemagglutinin-neuraminidase protein for detection of Newcastle disease virus antibodies. J Vet Diag Invest, 11:99-102, 1999.
34. **Heckert RA**, McIsaac M, Chan M, Zhou E-M. Experimental infection of emus (*Dromaius novaehollandiae*) with avian influenza viruses of varying virulence: Clinical signs, virus shedding and serology. Avian Pathol 28:13-16, 1999.
35. Clavijo A, **Heckert RA**, Dulac GC, Afshar A. Isolation and identification of bluetongue virus. J Vir Meth 87:13-23, 2000.
36. **Heckert RA**, Elankumaran S, Milani A., Baya A. Detection of a new

Mycobacterium species in wild Striped Bass in the Chesapeake Bay. J Clin Microbiol 39:710-715, 2001.

37. Brandt M, Yao K, Liu M, **Heckert RA**, Vakharia VN. Molecular determinants of virulence, cell tropism, and pathogenic phenotype of infectious bursal disease virus. J Virology 75:11974-11982, 2001.
38. **Heckert RA**, Estevez I, Russek-Cohen E, Pettit-Riley R. Effects of density, heat stress and perch availability on the immune status of broilers. J Poultry Science 81:451-457, 2002.
39. Elankumaran S, **Heckert RA**, Moura L. Persistence and tissue distribution of a variant strain of infectious bursal disease virus in commercial broiler chickens. Avian Dis. 46:169-176, 2002.
40. Bautista DA, Elankumaran S, Arking JA, **Heckert RA**. Evaluation of an immunochromatography strip assay for the detection of *Salmonella* sp. from poultry. J Vet Diag Invest 14:427-430, 2002
41. **Heckert RA**, Elankumaran S, Oshop GL, Vakharia VN. A novel transcutaneous plasmid-dimethylsulfoxide delivery technique for avian nucleic acid immunization. Vet Immunol Immunopathology 89: 67-81, 2002.
42. Oshop GL, **Heckert RA**, Elankumaran S. DNA vaccination in the avian. Vet Immunol Immunopathology, 89:1-12, 2002.
43. Babu US, Scott M, Myers MJ, Okamura M, Gaines D, Yancy HF, Lillehoj H, **Heckert RA**, Raybourne RB. Effects of live attenuated and killed salmonella vaccine on T-lymphocyte mediated immunity in laying hens. Vet Immunol Immunopathol 91:39-44, 2003.
44. Oshop GL, Elankumaran S, Vakharia VN, **Heckert RA**. *In ovo* delivery of DNA to the avian embryo. Vaccine 21:1275-1281, 2003.
45. Xie H, Raybourne RB, Babu US, Lillehoj HS, **Heckert RA**. CpG-induced immunomodulation and intracellular bacterial killing in a chicken macrophage cell line. Develop and Comp Immuno 27:823-834, 2003.
46. Okamura, M, Lillehoj HS, Raybourne RB, Babu, US, **Heckert, RA**. Antigen-specific lymphocyte proliferation and interleukin production in chickens immunized with killed *Salmonella enteritidis* vaccine or experimental subunit vaccines. Avian Diseases 47:1331-1338, 2003.
47. Sheela RR, Babu US, Mu J, Elankumaran S, Bautista DA, Raybourne RB, **Heckert RA**, Song W. Immune responses against *Salmonella enterica* serovar enteritidis infection in virally immunosuppressed chickens Clin Diag Lab Immunol 10:670-679, 2003.

48. Okamura M, Lillehoj HS, Raybourne RB, Babu US, **Heckert RA**. Cell-mediated immune responses to a killed *Salmonella* enteritidis vaccine: Lymphocyte proliferation, T-cell changes and interleukin-6 (IL-6), IL-1, IL-2 and IFN- γ production. Comp Immunol Microbiol Infect Dis 27:255-272, 2004.
49. Bautista DA, Elankumaran S, **Heckert RA** Effect of a variant infectious bursal disease virus (E-Del) on *Salmonella typhimurium* infection in commercial broiler chickens. Avian Diseases 48:361-369, 2004
50. Babu U, Dalloul RA, Okamura M, Lillehoj HS, Xie H, Raybourne RB, Gaines D, **Heckert RA**. *Salmonella* enteritidis clearance and immune responses in chickens following *Salmonella* vaccination and challenge. Veterinary Immunol Immunopathol 101:251-257, 2004.
51. Dalloul RA, Lillehoj HS, Okamura M, Xie H, Min W, Ding X, **Heckert RA**. In vivo effects of CpG oligodeoxynucleotide on *Eimeria* infection in chickens. Avian Diseases 48:733-740, 2004.
52. Dalloul RA, Lillehoj HS, Klinman DM, Ding X, Min W, **Heckert RA**, Lillehoj EP. In ovo administration of CpG oligodeoxynucleotides and the recombinant microneme protein MIC2 protects against *Eimeria* infections. Vaccine. 23:3108-113, 2005.
53. Okamura M, Lillehoj HS, Raybourne RB, Babu US, **Heckert RA**, Tani H, Sasai K, Baba E, Lillehoj EP. Differential responses of macrophages to *Salmonella enterica* serovars Enteritidis and Typhimurium. Vet Immunol Immunopath. 107:327-335, 2005.
54. Myint MS, Johnson YJ, Tablante NL, **Heckert RA**. The effect of pre-enrichment protocol on the sensitivity and specificity of PCR for detection of naturally contaminated *Salmonella* in raw poultry compared to conventional culture. Food Microbiology 23:599-604, 2006.
55. Kitching P, Hammond J, Jeggo M, Charleston B, Paton D, Rodriguez L, **Heckert RA**, Global FMD control – Is it an option?, Vaccine 25: 5660-5664, 2007.
56. **Heckert RA**., Kozlovac JP. Biosafety levels for animal agriculture pathogens. Applied Biosafety 12:168-174, 2007.
57. Lee SH., Lillehoj HS, **Heckert RA**, Cho SM, Tuo W, Lillehoj EP, Chun HK, Park HJ. Immune enhancing properties of Safflower leaf (*Carthamus tinctorius*) on chicken lymphocytes and macrophages. Poultry Science. 45:147-151, 2008.

Books, chapter in books

1. Saif LJ, **Heckert RA**. Enteric coronaviruses. In: Saif LJ, Theil KW eds. Viral

Diarrheas of Man and Animals. Boca Raton Florida, CRC Press, 1990.

2. **Heckert RA**, Kiley MP, Kozlovac JP. Special consideration for agriculture pathogen biosafety. In: Fleming DO, Hunt DL eds. Biological Safety – Principles and Practices, 4th Ed, American Society for Microbiology, Washington, DC, 2006.
3. Leighton FA, **Heckert RA**. Newcastle Disease and Related Avian Paramyxoviruses. In: Thomas NJ, Hunter BD, Atkinson CT eds. Infectious Diseases of Wild Birds, Blackwell Publishing, Ames IA, 2007.
4. **Heckert RA**. Agriculture Pathogen Biosafety. In: Biosafety in Microbiological and Biomedical Laboratories, 5th Ed. US Government Printing Office, Washington DC, 2008.

Dissertation

Heckert RA. Bovine coronavirus in calves: Epidemiology, diagnosis and antibody isotype responses to structural viral proteins, 1990

Abstracts and other professional papers presented

1. **Heckert RA**, LJ Saif and KH Hoblet. A field survey for bovine coronavirus infections in calves: detection of fecal and infected nasal epithelial cell shedding, seroconversion and clinical signs. Proc. Conference of Research Workers in Animal Diseases, Chicago, IL. Abstract #115, 1986.
2. **Heckert RA** and LJ Saif. Development of protein A-gold immunoelectron microscopy for detection of rectal and nasal shedding of bovine coronavirus (BCV) in calves. Proc. Conference of Research Workers in Animal Diseases, Chicago, IL. Abstract #81, 1987.
3. **Heckert RA** and LJ Saif. Bovine coronavirus: Pathogenesis, diagnosis, epidemiology and prevention. 125th annual meeting of the American Veterinary Medical Association. Portland Org., 1988.
4. **Heckert RA**, Saif LJ, Tarek MM, Myers GW. Epidemiology of respiratory bovine coronavirus infections detected by nasal cell immunofluorescence. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #391, 1988.
5. Saif LJ, Redman DR, Brock KV, **Heckert RA**, Kohler EM. Detection and characterization of a coronavirus from an outbreak of winter dysentery in dairy cattle. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #118, 1988.

6. **Heckert RA**, Saif LJ. Isotype specific antibody responses to bovine coronavirus (BCV) proteins in serum, nasal secretions and feces of infected calves as determined by immunoblotting. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #187, 1988.
7. Saif LJ, Redman DR, Brock KV, **Heckert RA**, Kohler EM. Characterization of a coronavirus associated with an outbreak of winter dysentery in dairy cattle. 126th annual meeting of the American Veterinary Medical Association. Orlando FL., 1989.
8. **Heckert RA**, Saif LJ, Mengel JP, Myers GW. Antibody responses to bovine coronavirus proteins in serum, feces and mucosal secretions of inoculated calves fed high or low levels of maternal antibodies. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #134, 1989.
9. **Heckert RA**, Zarnke RL. A seroprevalence survey for antibodies to *Trichinella* in Grizzly and Black bear by enzyme-linked immunosorbent assay. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #172, 1990.
10. **Heckert RA**, Power CA, Briscoe MR. Detection of pestivirus contaminants in laboratory virus stocks by a fixed-cell immunoperoxidase assay. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #210, 1991.
11. Cook SM, Villegas P, Sharma J, **Heckert RA**, Carter D, Schwartz RD. A novel HVT recombinant vaccine: Protection against NDV and MDV. American Association of Avian Pathologists, 1993.
12. Afshar A, **Heckert RA**, Dulac GC, Trotter HC, Myers DJ. Application of competitive ELISA for detection of bluetongue virus antibodies in wild ruminant sera. Proc. Conference of Research Workers in Animal Diseases, Chicago IL, Abst. #181, 1993.
13. Dulac GC, **Heckert RA**, Afshar A, Bosse J, White W, Tores A, House JA, Ferris NP, Dubuc C and Alonso A. Application of the double antibody sandwich ELISA for the diagnosis of vesicular disease viruses. Proc. Ninety-Seventh Annual Meeting of the United States Animal Health Association, LasVegas, Nevada, USA, Oct 29th, 1993.
14. **Heckert RA**, Riva J and Dulac. Pathotyping of Newcastle disease viruses isolated from commercial poultry and feral birds in Canada from 1991 to 1993. Proc. Ninety-Seventh Annual Meeting of the United States Animal Health Association, LasVegas, Nevada, USA, Oct 29th, 1993.
15. **Heckert RA**, Collins MS, Manvell RJ, Strong I, Pearson JE, Alexander DJ. Comparison of Newcastle disease viruses isolated from cormorants in Canada and the USA in 1975, 1990 and 1992. Proc. Conference of Research Workers in

Animal Diseases, Chicago IL, Abst. #190, 1994.

16. Zhou EM, Afshar A, **Heckert RA**, Nielsen K. Anti-idotypic antibodies generated by sequential immunization detect the shared idiotype on antibodies to pseudorabies virus antigens. Proc. Conference of the Canadian Society for Immunology, Sainte-Adele, Quebec, 1994.
17. **Heckert RA**, Vydelingum S, Riva J. Application of the indirect immunoperoxidase technique for identification of foreign animal disease viruses. Proc. Thirty-Ninth Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians, Little Rock Arkansas, USA, Oct 12-18, 1996.
18. Zhou E-M, Chan M, **Heckert RA**, Riva J, Cantin M-F. A competitive ELISA for avian influenza serologic surveillance. Proc. Fourth International Symposium on Avian Influenza, Athens Georgia, USA, May 28-31, 1997.
19. Kuiken T, Leighton FA, Wobeser G, Riva J, **Heckert RA**. The epidemiology of Newcastle disease in a breeding colony of double-crested cormorants on Dore lake, Saskatchewan, 1994-1996. Proc. 47th Annual Wildlife Disease Association Conference, St. Petersburg, Florida, USA, August 11-14, 1997.
20. **Heckert RA**. Future of Diagnostic Tools for the Poultry Industry. Proc. 33rd. National Meeting on Poultry Health & Processing, Ocean City, MD, USA, October 14-16th, 1998.
21. Elankumaran S, **Heckert RA**, Jacobs J, Ahmed R, Coakley B, Weedon C, Pieper L, Roscher K, Driscoll C, Poulis C, Baya A. Detection and characterization of a new *Mycobacterium* species in wild striped bass from the Chesapeake bay. Proc. 26th Annual Eastern Fish Health Workshop, Shepherdstown, West Virginia, April 23-26 2000.
22. Brandt M, Yao K, Liu M. **Heckert RA**, Vakharia VN. Virulence and pathogenic markers of infectious bursal disease virus reside in VP2. Proc. 19th Annual Meeting of the American Society for Virology, Fort Collins, Colorado, July 8-12 2000, W 40-1.
23. Brandt M, Yao K, Liu M. **Heckert RA**, Vakharia VN. Virulence and pathotype markers of infectious bursal disease virus reside in the VP2 protein. Proc. 136th Annual Meeting of the American Association of Avian Pathologists, Salt Lake City, Utah, July 22-26 2000.
24. Bautista DA., Elankumaran S, Arking EJ, **Heckert RA**. Evaluation of an immunochromatography strip assay kit for the detection of Salmonella species. Proceedings of the 72nd. Northeastern Conference on Avian Diseases, Newark Delaware, June 2000.
25. Oshop GL, Elankumaran S, **Heckert RA**. *In ovo* delivery of plasmid DNA results in protein production in chicken embryos. Proceedings of the 72nd.

Northeastern Conference on Avian Diseases, Newark Delaware, June 2000.

26. **Heckert RA**, Elankumaran S, Vakharia VN, Moura L, Oshop GL. Dermal delivery of DNA vaccine induces a systemic and mucosal antibody response in chickens against Newcastle disease virus and infectious bursal disease virus. Proc. of the 81st. Conference of Research Workers in Animal Diseases, Chicago IL, November 12-14th, 2000 Abst. #96.
27. **Heckert RA**, Elankumaran S, Oshop GL. An enhanced plasmid expression vector for avian DNA vaccination. Proceeding of the 21st World's Poultry Congress, Montreal Canada, August 2000.
28. Elankumaran S, **Heckert RA**, Moura L. Persistence and tissue distribution of a variant strain of infectious bursal disease virus in commercial broiler chickens. Proc. 2nd International symposium on infectious bursal diseases and chicken infectious anemia. Rauschholzhausen, Germany, June 2001.
29. Bautista DA, Elankumaran S, **Heckert RA**, Babu U, Sheela RR, Song W, Okamura M, Raybourne R, Lillehoj HS. Immune responses against *Salmonella enteritidis* PT4 in chickens vaccinated with live or inactivated *Salmonella* vaccines. 73rd. Northeastern Conference on Avian Diseases, College Park, Maryland, June 2001.
30. Oshop GL, **Heckert RA**, Elankumaran S. DNA and mRNA persistence and tissue distribution following topical delivery of a DNA vaccine in chickens. 73rd. Northeastern Conference on Avian Diseases, College Park, Maryland, June 2001.
31. Moura L, Elankumaran S, Oshop GL, Bautista DA, Wilson JD, **Heckert RA**. Determination of the most effective route for *in ovo* delivery of DNA vaccines. Proc. 138th American Veterinary Medical Association Meeting, Boston, MA, July 14-18, 2001.
32. Oshop GL, Elankumaran S, Vakharia VN, Wilson JD, Moura LC, Bautista DA, **Heckert RA**. *In ovo* nucleic acid immunization of the chicken against infectious bursal disease and Newcastle disease, Proc. 138th American Veterinary Medical Association Meeting, Boston, MA, July 14-18, 2001.
33. Bautista DA, Elankumaran S, **Heckert RA**, Oshop GL, Moura LC, Wilson JD. Interaction of *Salmonella typhimurium* and infectious bursal disease virus (IBDV) in broiler chickens. Proc. 138th American Veterinary Medical Association Meeting, Boston, MA, July 14-18, 2001.
34. **Heckert RA**, Federal role in poultry disease research: Implications for the future. Proc. 37th. National Meeting on Poultry Health & Processing, Ocean City, MD, USA, October 9-11th, 2002.
35. Xie H, Raybourne R, Babu U, Lillehoj H, **Heckert RA**. *In vitro* immunomodulatory effects of CpG motifs as potential vaccine adjuvants. 91th

- Annual Meeting of the Poultry Science Association. Poul. Sci. 81 (Suppl.1), 2002.
36. Xie H, Raybourne R, Babu U, Okamura M, Lillehoj H, **Heckert RA**. S. enteritidis and S. typhimurium have different pathogenic mechanisms in infected HD 11 cells. 91th Annual Meeting of the Poultry Science Association. Poul. Sci. 81 (Suppl.1), 2002.
 37. Xie H, Lillehoj H, **Heckert RA**. Comparison of in vivo effects of CpG treatment on E. acervulina infected SC and TK chicken lines. 91th Annual Meeting of the Poultry Science Association. Poul. Sci. 81 (Suppl.1), 2002.
 38. Babu U, Okamura M, Gaines D, Myers M, Raybourne R, Lillehoj H, **Heckert RA**. Effects of live attenuated and killed salmonella vaccines on cell-mediated immunity among young chickens. 91th Annual Meeting of the Poultry Science Association. Poul. Sci. 81 (Suppl.1), 2002.
 39. Okamura M, Lillehoj H, Raybourne R, **Heckert RA**, Babu U. Age difference in lymphocyte proliferation and IL-2 and IFN-gamma production following Salmonella enteritidis vaccination. 91th Annual Meeting of the Poultry Science Association. Poul. Sci. 81 (Suppl.1), 2002.
 40. Bautista DA, Sheela RR, Elankumaran S, Song W, **Heckert RA**. Long-term characterization of bacteriological and isotype-specific antibody parameters in chickens with early *Salmonella enterica* serovar *enteritidis* PT4 infection. Proc. 139th American Veterinary Medical Association Meeting, Nashville, TN, July 14-18, 2002.
 41. Babu U, Okamura M, Gaines D, Myers M, Raybourne R, Lillehoj H, **Heckert RA**. Live attenuated and killed salmonella vaccines cause an increase in cell-mediated immunity among laying hens. Proc. 139th American Veterinary Medical Association Meeting, Nashville, TN, July 14-18, 2002.
 42. Lillehoj H, Okamura M, Babu U, Raybourne R, **Heckert RA**. Cellular immune responses to *Salmonella enteritidis* vaccination. Proc. 139th American Veterinary Medical Association Meeting, Nashville, TN, July 14-18, 2002.
 43. Dalloul RA, Lillehoj HS, Babu US, Raybourne RB, Klinman DM, **Heckert RA**. In ovo immunomodulatory effects of CpG-containing oligodeoxynucleotides in *Eimeria*-infected chickens. 92nd Annual Meeting of the Poultry Science Association. Madison WI, July 6-9, 2003.
 44. Lillehoj H, Okamura M, Raybourne R, Babu U, **Heckert RA**. Antigen-specific lymphocyte proliferation, interleukin-6 (IL-6) and IL-2 production in chickens immunized with outer membrane protein of Salmonella enteritidis. Proc. 140th American Veterinary Medical Association Meeting, Denver, CO, July 19-23, 2003.

45. Okamura M, Lillehoj H, Raybourne R, Babu U, **Heckert RA**. Antigen-specific lymphocyte proliferation, interleukin-6 (IL-6) and IL-2 production in chickens immunized with outer membrane protein of Salmonella enteritidis. Proc. Congress of the World Veterinary Poultry Association, Denver, CO, July 19-23, 2003.
46. Dalloul R, Lillehoj H, **Heckert RA**. In vivo effects Of CpG-ODN on Eimeria acervulina-infected SC and TK chickens. Proc. 140th American Veterinary Medical Association Meeting, Denver, CO, July 19-23, 2003.
47. Babu US, Okamura M, Raybourne RB, Dalloul RA, Xie H, Gaines D, Lillehoj HS, **Heckert RA**. Cellular and humoral immune responses and Salmonella enteritidis clearance in young broiler chickens following Salmonella vaccination and challenge. Proc. Conference of Research Workers in Animal Diseases, Chicago, IL, Nov 9-11, 2003.
48. Dalloul RA, Lillehoj HS, Babu US, Raybourne RB, **Heckert RA**. CpG-containing oligodeoxynucleotides protect chickens against *Eimeria* infections, American Association of Immunologists 2004 Annual Meeting, Washington DC, April 17-21, 2004.
49. Dalloul R, Lillehoj H, Ding X, Min W, **Heckert RA**, Klinman DM. CpG oligonucleotides as vaccine adjuvants to Eimeria in chickens. Proc. 141st American Veterinary Medical Association Meeting, Philadelphia, PA, July 24-28, 2004.
50. Okamura M, Lillehoj HS, Raybourne RB, Babu US, **Heckert RA**, Avian macrophage response against salmonellosis and the effects of IFN-gamma and CpG motif on the intracellular survival of salmonella. 8th Avian Immunology Research Group Meeting, Munich, Germany, September 4-7th 2004.
51. R. A. Dalloul, H. S. Lillehoj, D. M. Klinman, X. Ding, W. Min, **R. A. Heckert**, E. P. Lillehoj. CpG oligodeoxynucleotides co-administered with the microneme protein MIC2 protect against Eimeria infections. 8th Annual Conference on Vaccine Research, Baltimore, MD, May 9-11, 2005.

Other, Unrefereed publications

1. **Heckert RA** and LJ Saif. Detection of bovine coronavirus infection in dairy calves by nasal cell immunofluorescence. Dairy Day Report, OARDC, 1987.
2. Saif, LJ and **Heckert RA**. Bovine coronavirus infections. Ohio Veterinary Newsletter, 1987.
3. **Heckert RA**. Newcastle disease in cormorants. Can Vet J, 34:184, 1993.

4. **Heckert RA**, Myers DJ. Absence of antibodies to avian pneumovirus in Canadian poultry. *Vet Rec* 132:172, 1993.
5. Rapid Spread of Infections Puts Wildlife at Risk in *Science News*, March 3, Vol 159, No. 9, p. 132, 2001

B. Other creative and scholarly activities:

1. Special recognition and achievements

Recognized designated expert on classical swine fever virus by the Office International des Epizooties (OIE), 1996-1997

2. Contracts and grants, gifts

Development of an improved avian cell expression vector; \$3,500; University of Maryland, General Research Board; 1998-1999

Effects of a variety of Stress factors on the immune system of poultry and subsequent infection of shell eggs by *Salmonella enteritidis*, \$120,000 Joint Institute for Food Safety and Applied Nutrition, Co-PI, 1998-2001.

Rapid DNA-based Diagnostic Technique for detection of a new *Mycobacterium* species in wild Striped bass, \$20,000, Maryland Agricultural Experiment Station, 1999-2000.

Viral immunosuppression and the infection of shell eggs by *Salmonella enteritidis*, \$80,000 Joint Institute for Food Safety and Applied Nutrition, 2000-2001

Salmonella immunobiology and intervention strategies. \$596,408 USDA, National Food Safety Initiative, 2000-2003.

3. Reviewer

1992-1997. Office International des Epizooties (OIE). Manual of standards for diagnostic tests and vaccines

1992-1997. Canadian Veterinary Journal

1992-2001. Canadian Journal of Veterinary Research

1992-2006. Journal of Veterinary Diagnostic Investigation

1998 Journal of Wildlife Diseases

2000 Veterinary Research Communications

2000 - 2001 Vaccine

2002 Nature

2003. Editorial Advisory Board, Encyclopaedia of Animal Science,
Marcel Dekker

2004 Avian Diseases, Infection and Immunity

2005 - Infection and Immunity

2000 – 2015 – Applied Biosafety

C. Instruction:

1. Courses taught:

Ohio State University

Enteric diseases (VPM 201), Team member, 1987

University of Maryland

- Animal Science 412 – Diseases of Animals, 1999
- Animal Science 412 – Diseases of Animals, Team member, 2000-2001
- VMED 699 – Independent Research, Fall 1998, Spring 1999
- Animal Science 211 - Anatomy of Domestic Animals, Team member, Fall 2000
- VMSC 688J - Infectious Disease Diagnosis and Interpretation, Spring 2001

VA-MD Regional College of Veterinary Medicine

- Disease of Poultry 4024, Team member, 1999
- Advanced Poultry Disease 5574, Team member, 1999
- Infectious Disease Diagnosis and Interpretation, VMSC 688J, Spring 2001, Spring 2003
- Emerging Infectious Diseases, VMSC 688I/VM9084/VMS5004, 2000-2004
- Veterinary Anatomy ANSC 211, Team member, 2000

2. Undergraduate advising

Participant in the “Advise-5” program at the University of Maryland
1998-2000

Participant in the “Undergraduate Assistantship Program” at the University of Maryland, 1999-2001.

3. Supervision of student research

Major Advisor (MS Degree)

2001 - Gretchen Oshop, BS
2002 - Daniel Bautista, DVM

Major Advisor (PhD Degree)

2003 - Rowena Watson, BA

External Examiner (PhD Degree)

1996 - Alfonso Clavijo, DVM (The University of Guelph)

Member, Graduate Advisement Committee (MS Degree):

1999 - Joseph Hsiao, BS

Member, Graduate Advisement Committee (PhD Degree):

2002 – Zhuhui Huang, BVSc, MS
2004 – Micheal Quinn, MS

Member, Graduate Advisement Committee (Epidemiology Residency/MS Degree)

2001 – Domonic Travis, DVM

Member, Graduate Advisement Committee (Epidemiology Residency/MS Degree)

2004 – Maung Myint, MS

D. Extension

Member, Mid-Atlantic Cooperative Extension, Poultry Health and Management Unit

Chairman, Avian Influenza Working Group

President, 73rd North-eastern Conference on Avian Diseases, 2001

E. Service

1. Professional, public

a. Organization memberships:

American Veterinary Medical Association
United States Animal Health Association
American Association of Veterinary Laboratory Diagnosticians
American Biological Safety Association
Conference of Research Workers in Animal Diseases

b. Ad hoc reviewing activities for agencies:

Proposal Reviewer, National Research Council of Canada, 1994

Scientific Advisor, North American Foot and Mouth Disease
Vaccine Bank, 1994-1997

Grant proposal reviewer, U.S. Agency for International
Development, Animal Science Panel, 1998

Grant proposal reviewer, USDA, Animal Health Panel, 1999-
2000

Grant proposal reviewer, USDA, CSREES, Small Business
Innovation Research Program

Member, USAHA Committee on Transmissible Diseases of
Poultry and Other Avian Species

Member, USAHA Committee on Foreign Animal Diseases

Technical reviewer for the import risk analysis of avian
paramyxovirus type 1 in hens' hatching eggs for the Ministry of
Agriculture and Forestry of New Zealand

Member Animal Health review panel for Binational Agriculture
Research and Development Fund grants, 2004

Reviewer of Department of Homeland Security Science and
Technology programs, 2004, 2005, 2006

2. University

Member, Graduate Education Committee, (ANSC) 1989-1999

Department of Agriculture and Natural Resources,
University of Maryland

Member, Animal Care and Use Committee, 1989-2001
University of Maryland

Member, Institutional Biosafety Committee, 1999-2003
University of Maryland

3. Awards and Honours

American College of Veterinary Microbiology, 1st place award for best abstract and presentation, Conf. Res. Workers in Animal Diseases, Chicago, IL., 1986.

American Veterinary Medical Association fellowship for presentation of a paper in Research Medicine at the AVMA annual meeting, Portland, OR., 1988.

American Association of Veterinary Immunologists, 2nd place award for best abstract and presentation, Conf. Res. Workers in Animal Diseases, Chicago, IL., 1988

Recognized by the University of Maryland, Office of Research and Graduate Studies as among the top 100 in securing grant support

Recognized by the University of Maryland, Office of Technology Commercialization as a finalist for Invention of the Year