BIOGRAPHICAL SKETCH

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NAME: Parcells, Mark S.

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POSITION TITLE: Professor, Molecular Virology

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Delaware, Newark DE	B.A.	06/1984	Biological Sciences
University of Delaware, Newark DE	Ph.D.	06/1994	Biological Sciences
University of Delaware, Newark DE	Postdoctoral	11/1996	Molecular Virology

A. Personal Statement

My research background is extensive in the fields of molecular virology, avian immunology and tumor virology. Over the course of my career, I have had a long commitment to the training and mentoring of graduate students, undergraduates and high school students in a safe, supportive and productive research environment. In my establishment of the UD Envision program, partnering with regional HBCUs, I have provided strong research and public outreach training to undergraduate students seeking degrees in numerous fields of the biological sciences. This was recognized in our recent renewal of this program for another five years of funding. During this time, I have also supported 3 – 4 undergraduate researchers in my laboratory each semester, providing important research experiences, independent projects, as well as direct and peer mentoring with my graduate students and technician. These have yielded undergraduates who have gone on to veterinary and graduate school, as well as those who have gone into government institutes (USDA, FDA) and private companies. The training experiences have varied according to project and span projects involving Marek's disease virus, Zika virus, and most recently, SARS-CoV-2.

The publications listed here represent my diverse expertise in the field of ***Molecular Virology***

a. Farkas T, Fey B, Hargitt E 3rd, **Parcells M**, Ladman B, Murgia M, Saif Y. 2012. Molecular detection of novel picornaviruses in chickens and turkeys. Virus Genes 44:262-72.
b. Morgan R, Anderson A, Bernberg E, Kamboj S, Huang E, Lagasse G, Isaacs G, **Parcells M**, Meyers BC, Green PJ, Burnside J. Sequence conservation and differential expression of Marek's disease virus microRNAs. 2008. J Virol. 82:12213-20
c. Dienglewicz RL, Parcells MS. 1999. Establishment of a lymphoblastoid cell line using a mutant MDV containing a green fluorescent protein expression cassette. Acta Virol. 43:106-12
d. Quinlin, BD, H. Mou, L. Zhang, Y. Guo, W. He, A. Ojha, M.S. Parcells, G. Luo, W. Li, G. Zhong, H. Choe and M. Farzan. 2020. The SARS-CoV-2 receptor-binding domain elicits a potent neutralizing response without antibody-dependent enhancement. bioRxiv 2020.04.10.036418; doi: https://doi.org/10.1101/2020.04.10.036418
e. Quinlan BD, He W, Mou H, Zhang L, Guo Y, Chang J, Peng S, Ojha A, Tavora R, Parcells MS, Luo G, Li W, Zhong G, Choe H, Farzan M. An engineered receptor-binding domain improves the immunogenicity of multivalent SARS-CoV-2 vaccines. bioRxiv [Preprint]. 2020 Nov 18:2020.11.18.388934. https://doi.org/10.1101/2020.11.18.388934

B. Positions and Honors

Positions and Employment

1984 – 1985	DuPont Company, Glasgow site, Immunodiagnostics, human TSH immunoassay
1985 – 1987	DuPont Company, Glenolden site, Immunopharmacology and signal transduction of IL-1
1987 – 1989	DuPont Company, Experimental Station, Development of a blood test for HIV-1 and -2
1989 – 1994	University of Delaware, Graduate Research Assistant, Dept. of Biology
1994 – 1996	University of Delaware, Post-doctoral Associate/Independent Researcher, Dept. of Animal Science and Agricultural Biochemistry
1996 – 2001	University of Arkansas, Assistant Professor, Dept. of Poultry Science
2001 – 2004	University of Arkansas, Associate Professor, Dept. of Poultry Science, Cell and Molecular Biology Faculty
2004 – 2010	University of Delaware, Associate Professor, Dept. of Animal and Food Sciences, Dept. of Biological Science (Joint Appt.)
2010 –>	University of Delaware, Professor, Dept. of Animal and Food Sciences, Dept. of Biological Sciences

Other Experience and Professional Memberships

Memberships

1992 – 2004	American Association for the Advancement of Science
1992 – 2004	American Society of Microbiology
1997 – 2004	Poultry Science Association
2004 – present	American Association of Avian Pathologists

Advisory Boards

1998 – 2002	Institutional Biosafety Committee, BIOMUNE, INC.
2014 – present	Arkion Life Sciences, LLC, Newcastle, DE
2012 – 2017	Global Advisory Board, Bayer Animal Health, Mannheim, Germany
2012 – 2017	Poultry Advisory Board, Bayer Animal Health, Shawnee Mission, KS

Editorial Boards

2002 – 2017	Medical Science Monitor
2004 – present	Avian Diseases
2008 – present	Poultry Science
2014 – present	BMC-Genomics

Grant Panel Service

1998	USDA-NRI, CGP
2003 – 2005	USDA-NRI, CGP
2007 – 2009	NSF – Ecology of Infectious Diseases
2014 – 2016, 2018	NIFA-AFRI (panelist)
2019, 2020	NIFA-AFRI (panel manager, Animal Health, panel B)

Peer Review (Journals)

Avian Diseases, Avian Pathology, BMC-Genomics, BMC-Veterinary Research, Cell, Gene, J. Clinical Microbiology, J. Gen. Virology, J. Infectious Diseases, J. Virology, Medical Science Monitor, PLoS-ONE, PLoS – Pathogens, PNAS – USA, Poultry Science, Veterinary Microbiology, Veterinary Research, Virology, Virology J., Virus Genes, Viruses (MDPI)

Honors

2002, 2004	University of Arkansas, Undergraduate Student Mentoring Award
2002	Hyline International Research Award
2004	Keynote Address, 5th International Symposium on Marek's Disease, St. Catherine's College, Oxford University, UK
2004	Presidential Citation, Distinguished Alumnus, University of Delaware
2007	Jozsef Marek Award, Hungarian Academy of Sciences, Veterinary Medical Research

Institute, Balatonfürad, Hungary

2007 Jozsef Marek Centennial Lecture, 15th Annual Derzsy Napok, Lake Balaton, Hungary 2007

2008 Invited Speaker, 8th International Symposium on Marek's Disease, James Cook University, Townsville, Australia

2012 Session chair, 10th International Symposium on Marek's Disease, Berlin, Germany

2016 Session chair, 11th International Symposium on Marek's Disease and Avian Herpesviruses, Tours, France

2018 Session chair, 12th International Syposium on Marek's Disease and Avian Herpesviruses, Yangzhou, China

C. Contributions to Science

1. ***Generation of First Oncogenic Recombinant Marek's Disease Virus.*** I have published seminal papers on the genetic analysis of Marek's disease through constructing the first recombinant MDVs that retained oncogenicity. Prior to this time, all recombinants were constructed using attenuated, cell-culture adapted, MDV strains. By generating these recombinants, we, and others have been able to functionally characterize the genes encoded by MDV as they relate to host-virus interactions such as pathogenicity, oncogenicity and immune evasion. Using this genetic approach, we were able to characterize the functions of several MDV genes important to replication and pathogenicity.
    a. **Parcells, MS,** Anderson, AS, and Morgan, RW. 1995. Retention of oncogenicity by a Marek's disease virus lacking six unique short region genes. J Virol. 69:7888-98.
    b. Anderson, AS, **Parcells, MS,** and Morgan RW. 1998. The glycoprotein D (US6) homolog is not essential for oncogenicity or horizontal transmission of Marek's disease virus. J. Virol. 72:2548-53.
    c. Hunt, HD, Lupiani B, Miller MM, Gimeno I, Lee LF, and **Parcells MS**. 2001. Marek's disease virus down-regulates surface expression of MHC (B complex) Class I (BF) glycoproteins during active, but not latent, infection of chicken cells. Virology 282:198-205.
    d. Trapp S, **Parcells MS,** Kamil JP, Schumacher D, Tischer BK, Kumar PM, Nair, VK, and Osterrieder N. 2006. A virus-encoded telomerase RNA promotes T cell lymphomagenesis. J. Exp. Med. 203: 1307-17.

2. ***Evolution of MDV Virulence.*** My laboratory was the first to identify mutations in the principal oncogene of MDV, *meq*, that correlated with the evolution of field strains of higher virulence in the US. In addition, we identified a mutation in the signal peptide of glycoprotein L, that has been apparently selected via the use of vaccines in hosts of a particular MHC-I haplotype (B^{21}), common to commercial breeds of chickens.
    a. Shamblin, C.E., N. Greene, V. Arumugaswami, R. L. Dienglewicz, and **M. S. Parcells.** 2004. Comparative Analysis of Marek's Disease Virus (MDV) Glycoprotein-, Lytic Antigen pp38- and Transformation Antigen Meq-encoding Genes: Association of Meq Mutations with MDVs of High Virulence. Vet. Microbiol. **102:**147-167.
    b. Tavlarides-Hontz, P., P. M. Kumar, J. R. Amortegui, N. Osterrieder, and M**. S. Parcells.** 2009. A deletion within glycoprotein L of Marek's disease virus (MDV) field isolates correlates with a decrease in bivalent MDV vaccine efficacy in contact-exposed chickens. Avian Dis.53:287-296.
    c. Shaikh, S. A. R., U. K. Katneni, H. Dong, S. Gaddamanugu, P. Tavlarides-Hontz, K. W. Jarosinski, N. Osterrieder, and **M. S. Parcells.** 2013. A Deletion in the Glycoprotein L (gL) Gene of U.S. Marek's Disease Virus (MDV) Field Strains Is Insufficient to Confer Increased Pathogenicity to the Bacterial Artificial Chromosome (BAC)–Based Strain, RB-1B. Avian Dis 57:509-18.
    d. Padhi, A. and **M.S. Parcells.** 2016. Positive Selection Drives Rapid Evolution of the *meq* Oncogene of Marek's Disease Virus. PLoS-ONE doi: 10.1371/journal.pone.0162180.
    e. Conradie AM, Bertzbach LD, Trimpert J, Patria JN, Murata S, **Parcells MS**, Kaufer BB. Distinct polymorphisms in a single herpesvirus gene are capable of enhancing virulence and mediating vaccinal resistance. PLoS Pathog. 2020 Dec 11;16(12):e1009104. doi: 10.1371/journal.ppat.1009104. PMID: 33306739.

3. ***Functional Analysis of the Meq Oncoprotein of MDV.*** A main focus of my laboratory has been on the oncoprotein of MDV, meq, and its splice variants. Meq is a basic leucine zipper protein (bZIP) that is expressed from an unspliced mRNA during early virus replication in vivo, but is expressed as unspliced and splice variant-derived forms during latency and the transformation of T-cells. We have identified

changes in mobility associated with these splice variant-derived forms, which have increased affinity for the C-terminal binding protein (CtBP-1) and cell cycle/apoptosis regulatory protein, Bmi-1. The significance of this work is that similar pathways have been identified in Epstein-Barr Virus (EBV)-associated malignancies, and hence, MDV appears to be a very tractable model for Hodgkin's lymphoma.

a. Anobile JM, Arumugaswami V, Downs D, Czymmek K, **Parcells MS** and Schmidt C. 2006. Nuclear localization and dynamic properties of the Marek's disease virus oncogene products Meq and Meq/vIL8. J. Virol. 80:1160-6.
b. Levy AM, Izumiya Y, Brunovskis P, Xia L, **Parcells MS**, Reddy SM, Lee LF, Chen HW, Kung HJ. 2003. Characterization of the chromosomal binding sites and dimerization partners of the viral oncoprotein Meq in Marek's disease virus-transformed T cells. J. Virol. 77:12841-51.
c. Burgess SC, Young JR, Baaten BJ, Hunt L, Ross LN, **Parcells MS**, Kumar PM, Tregaskes CA, Lee LF, and Davison TF. 2004. Marek's disease is a natural model for lymphomas overexpressing Hodgkin's disease antigen (CD30). Proc. Natl. Acad. Sci USA 101: 13879-84.
d. **Parcells MS**, Burnside J, Morgan RW. 2012. Marek's disease virus-induced T-Cell lymphomas *Current Cancer Research*. 8: 307-335. DOI: 10.1007/978-1-4614-0016-5_13

4. ***Role of Exosomes in Marek's disease virus-induced immune suppression and vaccine-induced systemic protection.*** An important recent project, for which we have received seed funding and are awaiting federal support, is the compositional analysis of exosomes in relation to Marek's disease virus infection and those expressed by tumor cell lines established from MDVs of different virulence levels. To these ends, we have published several recent works and have two additional manuscripts under current review addressing the composition (proteomic and transcriptomic) of serum exosomes from vaccinated and protected chickens versus those having disseminated lymphomas, and cell line supernatant medium-derived exosomes from cell lines established from virulent (MDCC-CU12, CU47), very virulent (MDCC-UD34, UD36, UD39, UD40), and very virulent plus (MDCC-UD31, UA53) MDVs.
    a. Neerukonda, S.N., N. A. Egan, and **M.S. Parcells**. 2017. Exosomal Communication during Infection, Inflammation and Virus-Associated Pathology. J. Cancer and Therap. Science. 1:1 -13.
    b. Neerukonda S.N., Egan N.A,. Patria J., Assakhi I., Tavlarides-Hontz P., Modla S., Muñoz E.R., Hudson M.B., **Parcells M.S.** Comparison of exosomes purified via ultracentrifugation (UC) and Total Exosome Isolation (TEI) reagent from the serum of Marek's disease virus (MDV)-vaccinated and tumor-bearing chickens. 2018. J Virol. Methods. 263:1-9.
    c. Neerukonda SN, Tavlarides-Hontz P, McCarthy F, Pendarvis K, Parcells MS. Comparison of the Transcriptomes and Proteomes of Serum Exosomes from Marek's Disease Virus-Vaccinated and Protected and Lymphoma-Bearing Chickens. Genes (Basel). 2019 Feb 5;10(2). pii: E116. doi:10.3390/genes10020116.
    d. Neerukonda SN, Katneni UK, Bhandari N, **Parcells MS.** Transcriptional Analyses of Innate and Acquired Immune Patterning Elicited by Marek's Disease Virus Vaccine Strains: Turkey Herpesvirus (HVT), Marek's Disease Virus 2 (strain SB1), and Bivalent Vaccines (HVT/SB1 and HVT-LT/SB1). *Avian Dis*. 2019;63(4):670-680. doi:10.1637/aviandiseases-D-19-00117
    e. Neerukonda SN, Egan NA, Patria J, Assakhi I, Tavlarides-Hontz P, Modla S, Muñoz ER, Hudson MB, **Parcells MS**. A comparison of exosome purification methods using serum of Marek's disease virus (MDV)-vaccinated and -tumor-bearing chickens. Heliyon. 2020 Dec 11;6(12):e05669. doi: 10.1016/j.heliyon.2020.e05669. PMID: 33336096; PMCID: PMC7734234.

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/mark.parcells.1/bibliography/50113607/public/?sort=date&direction=ascending

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support
Agency: USDA NIFA-AFRI A1221
Award# 19A00082 Parcells (MPI) 7/1/19 – 6/30/22
The Role of Exosomes in Marek's disease virus Pathogenesis and Immunity

The goal of this projects was to determine the role of serum exosomes from tumor-bearing chickens on driving systemic immune suppression during Marek's disease. In addition, we are examining the role of serum exosomes in patterning the immune response during vaccination to lead to systemic anti-tumor immunity.
Role: MPI Total Award: $480,000

Agency: NIH
Award# R21HD096309A Schwarz/Parcells (Co-PI) 7/31/20 – 7/30/22
Effects of Zika virus (ZIKV) on prenatal neurological development in a rat model
The goal of this projects was to provide ZIKAV stocks for the infection of pregnant rats as well as to develop more rat neuroinvasive ZIKA strains using a human isolate (PRVABC059).
Role: Co-PI Total Award: $431,450 (Dr. Jaclyn Schwarz, MPI, Parcells sub-award: $78,000)

Agency: USDA NIFA-AFRI REEU
Award # 2020-67037-31077 Parcells (MPI) 8/1/20 – 7/31/24
The UD ENVISION Program: Undergraduate Research, Education and Extension Exploring One Health and Food Sustainability. This is the renewal and expansion of the original program (Envision) to include Cheyney State University and Wesley college. In addition, faculty participation in this program has expanded to include faculty in plant and soil sciences (PLSC) and entomology and wildlife ecology (ENWE). This is a (5) year program to increase minority participation in the Agricultural Sciences with strong independent researcher mentoring, videography training and public outreach.
Role: MPI Total Award: $500,000

Completed Research Support
Agency: USDA NIFA-AFRI REEU
Award # 2017-67032-26009 Parcells (MPI) 6/1/17 – 8/31/19
(NCE through 7/31/21)
Undergraduate Research and Education Exploring One Health: Protecting our food supply, animal health, and the environment (Envision Program)
The goal of this projects was to establish a regional program for increasing the participation of underrepresented groups in the Agricultural Sciences. This was initially with Lincoln University and Delaware State University as partners and was expanded to include the University of Maryland, Eastern Shore. This program would bring 10 – 13 undergraduate students on UD campus each summer for a 10-week program of research development, videography training and cohort-building activities to have students *Envision* themselves as scientists.
Role: MPI Total Award: $283,000