

**Rachel L. Graham, Ph.D.**

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**Education:**

- 2006 Doctor of Philosophy in Microbiology and Immunology  
 Vanderbilt University, Nashville, TN  
 Dissertation: "Papain-Like Proteinase Mediated Processing and the Role of Intermediate and Mature Replicase Proteins in Coronavirus Replication"
- 2001 Bachelor of Science in Biology, Summa Cum Laude  
 University of Kentucky, Lexington, KY

**Professional Experience:**

- 2015-present Research Assistant Professor in the laboratory of Ralph S. Baric, Ph.D.
- 2014-present Project Manager for NIH U19 grant "Characterization of Novel Genes Encoded by RNA and DNA viruses" – Ralph S. Baric, Ph.D., Principal Investigator
- 2013-present Research Associate in the laboratory of Ralph S. Baric, Ph.D.
- 2007-2013 Determinants of pathogenesis of SARS coronavirus  
 University of North Carolina at Chapel Hill  
 Advisor: Ralph S. Baric, Ph.D.
- 2006-2007 Determinants of replication complex formation and the regulation of viral replication in the coronaviruses murine hepatitis virus and SARS coronavirus  
 Vanderbilt University Medical Center  
 Advisor: Mark R. Denison, M.D.

**Honors:**

- 2008-2011 Ruth L. Kirschstein National Research Service Award (Postdoctoral Fellowship)
- 2002-2006 Microbes and Defense Academic Society  
 Department of Microbiology and Immunology, Vanderbilt University
- 2002-2004 Training Grant in Cellular, Biochemical, and Molecular Sciences, Vanderbilt University Medical Center
- 2001-2002 Training Grant for the Interdisciplinary Graduate Program, Vanderbilt University Medical Center
- 1997-2001 Otis A. Singletary Scholarship, University of Kentucky

**Memberships**

- 2019-present Member, Institutional Biosafety Committee, University of North Carolina at Chapel Hill
- 2013-present Board Member, North Carolina Science Fair Foundation
- 2002-2006 Microbes and Defense Academic Society, Vanderbilt University School of Medicine

**Bibliography and Products of Scholarship*****Ph.D. Dissertation:***

**R.L. Graham.** *Papain-like proteinase-mediated processing and the role of intermediate and mature replicase proteins in coronavirus replication.* 2006. Vanderbilt University. Ph.D. Advisor: Mark R. Denison, M.D.

***Publications:***

**R.L. Graham**, E.J. Fritch, W. Sanders, A.C. Sims, L.E. Herring, A.A. Schepmoes, E.M. Zink, K.K. Weitz, K.J. Bloodsworth, J.E. Kyle, K.E. Burnum-Johnson, K.G. Stratton, B.-J.M. Webb-Robertson, L.M. Bramer, J.R. Texier, D.P. Dittmer, L.M. Graves, R.D. Smith, T.O. Metz, K.M. Waters, N.J. Moorman, and R.S. Baric. *Metagenomics analysis reveals a novel transcriptional and translational landscape during Middle East respiratory syndrome coronavirus infection*. 2020. Ready for submission.

D. Alzhanova, K. Corcoran, A. Bailey, K. Long, S. Taft-Benz, **R. Graham**, M. Heise, G. Neumann, Y. Kawaoka, P. Halfmann, R. Baric, B. Damania, D.P. Dittmer. Novel modulators of p53-signaling encoded by unknown genes of emerging viruses. 2002. In review.

C.E. Edwards, B.L. Yount, **R.L. Graham**, S.R. Leist, K.H. Dinnon, A.C. Sims, J.A. Swanstrom, K. Gully, T. Scobey, M.R. Cooley, C.G. Currie, S.H. Randell, and R.S. Baric. *Broad species specificity of swine acute diarrhea syndrome coronavirus reveals human threat potential*. 2020. In review.

T.P. Sheahan, A.C. Sims, S. Zhou, **R.L. Graham**, C.S. Hill, S.R. Leist, A. Schäfer, K.H. Dinnon, S.A. Montgomery, M.L. Agostini, A.J. Pruijssers, J.D. Chapell, A.J. Brown, G.R. Bluemling, M.G. Natchus, M. Saindane, A.A. Kolykhalov, G. Painter, J. Harcourt, A. Tamin, N.J. Thornburg, R. Swanstrom, M.R. Denison, and R.S. Baric. *An orally bioavailable broad-spectrum antiviral inhibits SARS-CoV-2 and multiple endemic, epidemic and bat coronaviruses*. 2020. *Science Translational Medicine* (in press).

L.V. Tse, R.M. Meganck, **R.L. Graham**, R.S. Baric. The current and future state of vaccines, antivirals and gene therapies against emerging coronaviruses. 2020. *Frontiers Microbiology* (in press).

Y. Wan, J. Shang, **R.L. Graham**, R.S. Baric, and F. Li. *Receptor recognition by the novel coronavirus from Wuhan: an analysis based on decade-long structural studies of SARS coronavirus*. 2020. *Journal of Virology* 94:e00127.

V.D. Menachery, K.H. Dinnon III, B.L. Yount Jr., E.T. McAnarney, L.E. Gralinski, A. Hale, **R.L. Graham**, T. Scobey, S.J. Anthony, D. Corti, B. Graham, W.I. Lipkin, R.S. Baric. *Trypsin treatment unlocks barrier for zoonotic coronavirus infection*. 2020. *Journal of Virology* 14:e01774.

A.J. Brown, J. Won, **R.L. Graham**, K.H. Dinnon III, A.C. Sims, J.Y. Feng, T. Cihlar, M.R. Denison, R.S. Baric, T.P. Sheahan. *Broad spectrum antiviral remdesivir inhibits human endemic and zoonotic coronavirus with the most divergent RNA dependent RNA polymerase known*. 2019. *Antiviral Research* 169:104541.

M.L. Mallory, L.C. Lindesmith, **R.L. Graham**, R.S. Baric. *GII.4 human norovirus: Surveying the antigenic landscape*. 2019. *Viruses* 11:E177.

**R.L. Graham**, D.J. Deming, M.E. Deming, B.L. Yount, and R.S. Baric. *Evaluation of a recombination-resistant coronavirus as a broadly applicable, rapidly implementable vaccine platform*. 2018. *Communications Biology* 1:179.

E.N. Gallichotte, T.J. Baric, U. Nivarthi, **R.L. Graham**, D.G. Widman, B.L. Yount, A. Durbin, S. Whitehead, A.M. de Silva, and R.S. Baric. *Genetic variation between dengue virus type 4 strains impacts human antibody binding and neutralization*. 2018. *Cell Reports* 25:1214.

L.C. Lindesmith, P.D. Brewer-Jensen, M.L. Mallory, B. Yount, M.H. Collins, K. Debbink, **R.L. Graham**, R.S. Baric. *Human norovirus epitope D plasticity allows escape from antibody immunity without loss of capacity for binding cellular ligands*. 2019. *Journal of Virology* 93:e01813.

A.S. Cockrell, J.C. Johnson, I.N. Moore, D.X. Liu, K.W. Bock, M.G. Douglas, **R.L. Graham**, J. Solomon, L. Torzewski, C. Bartos, R. Hart, R.S. Baric, R.F. Johnson. *A spike-modified Middle East respiratory syndrome coronavirus (MERS-CoV) infectious clone elicits mild respiratory disease in infected rhesus macaques*. 2018. *Science Reports* 8:10727.

V.D. Menachery, L.E. Gralinski, H.D. Mitchell, K.D. Dinnon III, S.R. Leist, B.L. Yount Jr., E.T. McAnarney, **R.L. Graham**, K.M. Waters, R.S. Baric. *Combination attenuation offers strategy for live attenuated coronavirus vaccines*. 2018. *Journal of Virology* 92:e00710.

- J.F. Kocher, L.C. Lindesmith, K. Debbink, A. Beall, M.L. Mallory, B.L. Yount, **R.L. Graham**, J. Huynh, J.E. Gates, E.F. Donaldson, R.S. Baric. *Bat caliciviruses and human noroviruses are antigenically similar and have overlapping histo-blood group antigen binding profiles*. 2018. *MBio*. 9:e00869.
- M.L. Agostini, E.L. Andres, A.C. Sims, **R.L. Graham**, T.P. Sheahan, X. Lu, E.C. Smith, J.B. Case, J.Y. Feng, R. Jordan, A.S. Ray, T. Cihlar, D. Siegel, R.L. Mackman, M.O. Clarke, R.S. Baric, and M.R. Denison. *Coronavirus susceptibility to the antiviral remdesivir (GS-5734) is mediated by the viral polymerase and the proofreading exoribonuclease*. 2018. *MBio* 9:e00221.
- L.C. Lindesmith, M.L. Mallory, K. Debbink, E.F. Donaldson, P.D. Brewer-Jensen, E.W. Swann, T.P. Sheahan, **R.L. Graham**, M. Beltramello, D. Corti, A. Lanzavecchia, and R.S. Baric. *Conformational occlusion of blockade antibody epitopes, a novel mechanism of GII.4 human norovirus immune evasion*. 2018. *mSphere* 3:e00518.
- B.A. Johnston, **R.L. Graham**, and V.D. Menachery. *Viral metagenomics, protein structure, and reverse genetics: key strategies for investigating coronaviruses*. 2017. *Virology* 17:30414.
- V.D. Menachery, L.E. Gralinski, H.D. Mitchell, K.H. Dinnon III, S.R. Leist, B.L. Yount Jr, **R.L. Graham**, E.T. McAnarney, K.G. Stratton, A.S. Cockrell, K. Debbink, A.C. Sims, K.M. Waters, and R.S. Baric. *Middle east respiratory syndrome coronavirus nonstructural protein 16 is necessary for interferon resistance and viral pathogenesis*. 2017. *mSphere* 2:e00346.
- H. Di, J.C. Madden Jr., E.K. Morantz, H.Y. Tang, **R.L. Graham**, R.S. Baric, and M.A. Brinton. *Expanded subgenomic mRNA transcriptome and coding capacity of a nidovirus*. 2017. *Proceedings of the National Academy of Sciences* 114:E8895.
- V.D. Menachery, H.D. Mitchell, A.S. Cockrell, L. Gralinski, B. Yount, **R.L. Graham**, E.T. McAnarney, M.G. Douglas, T.D. Scobey, A. Beall, K. Dinnon, J.F. Kocher, A.E. Hale, K.G. Stratton, K.M. Waters, R.S. Baric. *MERS-CoV accessory ORFs play key role for infection and pathogenesis* 2017. *mBio*. 8:e00665.
- T.P. Sheahan, A.C. Sims, **R.L. Graham**, V.D. Menachery, L.E. Gralinski, J.B. Case, S.R. Leist, K. Pyrc, J.Y. Feng, I. Trantcheva, R. Bannister, Y. Park, D. Babusis, M.O. Clarke, R.L. Mackman, J.E. Spahn, C.A. Palmiotti, D. Siegel, A.S. Ray, T. Cihlar, R. Jordan, M.R. Denison, R.S. Baric. *Broad-spectrum antiviral GS-5734 inhibits both epidemic and zoonotic coronaviruses*. 2017. *Science Translational Medicine* 9:ea3653.
- V.D. Menachery, **R.L. Graham**, R.S. Baric. *Jumping species: A mechanism for coronavirus persistence and survival*. 2017. *Curr. Op. Virol* 23:1-7.
- V.D. Menachery, B.L. Yount Jr., A.C. Sims, K. Debbink, S.S. Agnihothram, L.E. Gralinski, **R.L. Graham**, T. Scobey, J.A. Plante, S.R. Royal, J. Swanstrom, T.P. Sheahan, R.J. Pickles, D. Corti, S.H. Randell, A. Lanzavecchia, W.A. Marasco, R.S. Baric. *SARS-like WIV1-CoV poised for human emergence*. 2016. *Proceedings of the National Academy of Sciences* 113:3048-53.
- V.D. Menachery, B.L. Yount Jr, K. Debbink, S. Agnihothram, L.E. Gralinski, J.A. Plante, **R.L. Graham**, T. Scobey, X.Y. Ge, E.F. Donaldson, S.H. Randell, A. Lanzavecchia, W.A. Marasco, Z.L. Shi, R.S. Baric. *A SARS-like cluster of circulating bat coronaviruses shows potential for human emergence*. 2015. *Nature Medicine* Nov 9. doi: 10.1038/nm.3985.
- X.C. Tang, S.S. Agnihothram, Y. Jiao, J. Stanhope, **R.L. Graham**, E. Peterson, Y. Avnir, J. Sheehan, Q. Zhu, R.S. Baric, and W.A. Marasco. *Identification of Human Neutralizing Antibodies against MERS-CoV and Their Role in Virus Adaptive Evolution*. 2014. *Proceedings of the National Academy of Sciences* 111:E2018-26.
- M.C. Freeman, **R.L. Graham**, X.T. Lu, C.T. Peek, and M.R. Denison. *Coronavirus Replicase-Reporter Fusions Provide Quantitative Analysis of Replication and Replication Complex Formation*. 2014. *Journal of Virology* 88:5319-5327.
- S.S. Agnihothram, B.L. Yount, E.F. Donaldson, J. Huynh, V.D. Menachery, L.E. Gralinski, **R.L. Graham**, M.M. Becker, S. Tomar, T.D. Scobey, H.L. Osswald, A. Whitmore, R. Gopal, A.K. Ghosh, A. Mesecar, M. Zambon, M. Heise, M.R. Denison, and R.S. Baric. *A Mouse Model for Betacoronavirus Subgroup 2 Using a Bat Coronavirus Strain HKU5 Variant*. 2014. *MBio* 5:e00047-14.
- S.S. Agnihothram, R. Gopal, B.L. Yount, E.F. Donaldson, V.D. Menachery, **R.L. Graham**, T. Scobey, L.E. Gralinski, M.R. Denison, M. Zambon, and R.S. Baric. *Evaluation of Serologic and Antigenic Relationships between Middle Eastern Respiratory*

- Syndrome Coronavirus and Other Coronaviruses to Develop Vaccine Platforms for the Rapid Response to Emerging Coronaviruses. 2014. *Journal of Infectious Diseases* 209:995-1006.
- R.L. Graham**, E.F. Donaldson, and R.S. Baric. A Decade After SARS: Strategies for Controlling Emerging Coronaviruses. 2013. *Nature Reviews Microbiology* 11:836-848.
- T. Scobey, B.L. Yount, A.C. Sims, E.F. Donaldson, S.S. Agnihothram, V.D. Menachery, **R.L. Graham**, J. Swanstrom, P.F. Bove, J.D. Kim, S. Grego, S.H. Randell, and R.S. Baric. Reverse Genetics with a Full-Length Infectious cDNA of the Middle East Respiratory Syndrome Coronavirus. 2013. *Proceedings of the National Academy of Sciences* 110:16157-16162.
- L. Josset, V.D. Menachery, L.E. Gralinski, S.S. Agnihothram, P. Sova, V.S. Carter, B.L. Yount, **R.L. Graham**, R.S. Baric, and M.G. Katze. Cell Host Response to Infection with Novel Human Coronavirus EMC Predicts Potential Antivirals and Important Differences with SARS Coronavirus. 2013. *MBio* 4:e00165-13.
- R.L. Graham**, M.M. Becker, L.D. Eckerle, M. Bolles, M.R. Denison, and R.S. Baric. A Live, Impaired-Fidelity Coronavirus Vaccine Protects In an Aged, Immunocompromised Mouse Model of Lethal Disease. 2012. *Nature Medicine* 18:1820-1826.
- M.R. Denison, **R.L. Graham**, E.F. Donaldson, L.D. Eckerle, and R.S. Baric. Coronaviruses: An RNA Proofreading Machine Regulates Replication. 2011. *RNA Biology* 8:270-279.
- L.D. Eckerle, M.M. Becker, R.S. Halpin, K. Li, E. Venter, X. Lu, S. Scherbakova, **R.L. Graham**, R.S. Baric, T.B. Stockwell, D.J. Spiro, and M.R. Denison. Infidelity of SARS-CoV nsp14-Exonuclease Mutant Virus Replication Is Revealed by Complete Genome Sequencing. 2010. *PLoS Pathogens*. 6:e1000896.
- R.L. Graham** and R.S. Baric. Recombination, Reservoirs, and the Modular Spike: Mechanisms of Coronavirus Cross-Species Transmission. 2010. *Journal of Virology* 84:3134-3146.
- M.M. Becker and **R.L. Graham** (co-first authors), E.F. Donaldson, B.H. Rockx, A.C. Sims, T.P. Sheahan, R.J. Pickles, D. Corti, R.E. Johnston, R.S. Baric, and M.R. Denison. 2008. Synthetic Recombinant Bat SARS-like Coronavirus Is Infectious in Cultured Cells and in Mice. *Proceedings of the National Academy of Sciences* 105:19944-19949.
- M.J. Gadlage, **R.L. Graham**, and M.R. Denison. Murine Coronaviruses Encoding nsp2 at Different Genomic Loci Have Altered Replication, Protein Expression, and Localization. 2008. *Journal of Virology* 82:11964-11969.
- R.L. Graham**, J.S. Sparks, L.D. Eckerle, A.C. Sims, and M.R. Denison. SARS Coronavirus Replicase Proteins in Pathogenesis. 2008. *Virus Research* 133:88-100.
- D.J. Deming, **R.L. Graham**, M.R. Denison, and R.S. Baric. Processing of Open Reading Frame 1a Replicase Proteins nsp7 to nsp10 in Murine Hepatitis Virus Strain A59 Replication. 2007. *Journal of Virology* 81:10280-10291.
- E.F. Donaldson, **R.L. Graham**, A.C. Sims, M.R. Denison, and R.S. Baric. Analysis of Murine Hepatitis Virus Strain A59 Temperature Sensitive Mutant TS-LA6 Suggests That nsp10 Plays a Critical Role In Polyprotein Processing. 2007. *Journal of Virology* 81:7086-7095.
- E.F. Donaldson, A.C. Sims, **R.L. Graham**, M.R. Denison, and R.S. Baric. Murine Hepatitis Virus Replicase Protein nsp10 is a Critical Regulator of Viral RNA Synthesis. 2007. *Journal of Virology* 81:6356-6368.
- R.L. Graham** and M.R. Denison. Replication of Murine Hepatitis Virus is Regulated by Papain-Like Proteinase 1 Processing of Nonstructural Proteins 1, 2, and 3. 2006. *Journal of Virology* 80:11610-11620.
- R.L. Graham**, A.C. Sims, S.M. Brockway, R.S. Baric, and M.R. Denison. The nsp2 Replicase Proteins of Murine Hepatitis Virus and Severe Acute Respiratory Syndrome Coronavirus Are Dispensable for Viral Replication. 2005. *Journal of Virology* 79:13399-13411.

S.M. Sperry, L. Kazi, **R.L. Graham**, R.S. Baric, S.R. Weiss, and M.R. Denison. Single-Amino-Acid Substitutions in Open Reading Frame (ORF) 1b-nsp14 and ORF 2a Proteins of the Coronavirus Mouse Hepatitis Virus Are Attenuating in Mice. 2005. *Journal of Virology* 79:3391-3400.

M.R. Denison, B. Yount, S.M. Brockway, **R.L. Graham**, A.C. Sims, X.T. Lu, and R.S. Baric. Cleavage between Replicase Proteins p28 and p65 of Mouse Hepatitis Virus Is Not Required for Virus Replication. 2004. *Journal of Virology* 78:5957-5965.

**Oral Presentations and Abstracts:**

**R.L. Graham**, W. Sanders, H.A. Vincent, J. Texier, N.J. Moorman, D.P. Dittmer, and R.S. Baric. The viral predictome: partnering RNA structure and high-throughput analyses to predict novel coronavirus functional domains. 2017. *XIV<sup>th</sup> International Symposium of Nidoviruses*. Kansas City, MO, USA.

**R.L. Graham** and R.S. Baric. The viral predictome: Partnering RNA structure and high-throughput analysis to predict novel coronavirus functional domains. *Functional Genomics National Annual Meeting*. Beverly, MA, USA.

**R.L. Graham**, A.E. Beall, J. Texier, D. Yang, M.K. Sanders, D.P. Dittmer, and R.S. Baric. 2015. Transcriptomic analysis of Betacoronavirus infection. *American Society for Virology 34<sup>th</sup> Annual Conference*. London, ON, Canada.

**R.L. Graham**, S.S. Agnihothram, B.L. Yount, E.F. Donaldson, J. Huynh, V.D. Menachery, L.E. Gralinski, M.M. Becker, T. Scobey, A. Whitmore, R. Gopal, M. Zambon, M.T. Heise, M.R. Denison, and R.S. Baric. 2014. Development of Virulent Mouse Models for HKU3 and HKU5 Pathogenesis. *XIII<sup>th</sup> International Symposium of Nidoviruses*. Salamanca, Spain.

**R.L. Graham**, D.J. Deming, M. Bolles, B.L. Yount, and R.S. Baric. 2013. Stabilization of a Recombination- and Reversion-Resistant Live-Attenuated Coronavirus Vaccine. *American Society for Virology 32<sup>nd</sup> Annual Conference*. State College, PA, USA.

**R.L. Graham** and R.S. Baric. 2012. Recombination- and Reversion-Proof Coronaviruses: Altering Genome Fidelity and Infrastructure to Promote Stability in a Vaccine Candidate. *American Society for Virology 31<sup>st</sup> Annual Conference*. Madison, WI, USA.

**R.L. Graham**, M.M. Becker, L.D. Eckerle, M.R. Denison, and R.S. Baric. 2012. Reversion-Proof Coronavirus Vaccine Design: Balancing on the Fulcrum of Fidelity and Pathogenesis. *National Regional Centers of Excellence Annual Meeting*. Amelia Island, FL, USA.

**R.L. Graham**, L.D. Eckerle, M.M. Becker, M.R. Denison, and R.S. Baric. 2011. Reversion-Proof Coronavirus Vaccine Design: Balancing on the Fulcrum of Fidelity and Pathogenesis. *XII<sup>th</sup> International Symposium of Nidoviruses*. Acme, MI, USA.

**R.L. Graham**, M.B. Frieman, L.D. Eckerle, M.M. Becker, M.R. Denison, and R.S. Baric. 2010. Infection of aged and immune-compromised mouse models with mouse-adapted SARS-CoV strains culminates in an escalating ARDS-like pulmonary disease independent of virus replication. *American Society for Virology 29<sup>th</sup> Annual Conference*. Bozeman, MT, USA.

**R.L. Graham** and R.S. Baric. The pathology of ARDS-like pulmonary disease in aged and immune compromised models of SARS-CoV infection. 2010. *The Elizabeth B. Lamb Center 20<sup>th</sup> Anniversary Symposium*. Vanderbilt University, Nashville, TN, USA.

**R.L. Graham**, D.J. Deming, B.L. Yount, B.H. Rockx, L.D. Eckerle, M.M. Becker, M.R. Denison, and R.S. Baric. 2009. Design of a recombination- and reversion-resistant self-attenuating coronavirus live-vaccine platform. *American Society for Virology 28<sup>th</sup> Annual Conference*. Vancouver, B.C., Canada.

**R.L. Graham**, M.M. Becker, E.F. Donaldson, A.C. Sims, B.H. Rockx, M.R. Denison, and R.S. Baric. 2008. A synthetically generated bat SARS-like coronavirus containing a chimeric receptor-binding domain with a single amino acid substitution replicates in vivo. *XI<sup>th</sup> International Symposium of Nidoviruses*. Oxford, England.

**R.L. Graham** and M.R. Denison. 2007. Recombinant murine hepatitis and SARS coronaviruses expressing reporter molecules within ORF1a enhance detection of intracellular replication events. *American Society for Virology 26<sup>th</sup> Annual Conference*. Corvallis, OR, USA.

**R.L. Graham** and M.R. Denison. 2006. Inactivation of mouse hepatitis virus papain-like proteinase 1 results in virus with multiple adaptive mutations but no cleavage of nsp1 or nsp2. *American Society for Virology 25<sup>th</sup> Annual Conference*. Madison, WI, USA.

**R.L. Graham** and M.R. Denison. 2006. Adaptive evolution of a coronavirus reveals insights into potential RNA-protein interactions. *Southeast Regional Virology Conference*. Atlanta, GA, USA.

**R.L. Graham**. The coronavirus ORF1 protein nsp2 is dispensable for replication. 2005. *Department of Microbiology and Immunology Research in Progress Seminar Series*. Vanderbilt University School of Medicine, Nashville, TN, USA.

**R.L. Graham**, A.C. Sims, S.M. Brockway, R.S. Baric, and M.R. Denison. 2005. Engineering and characterization of viable nsp2 replicase protein mutants of MHV and SARS-CoV. *The X<sup>th</sup> International Symposium of Nidoviruses*. Colorado Springs, CO, USA.

**R.L. Graham**, X. Lu, S.M. Brockway, B. Yount, A.C. Sims, R.S. Baric, and M.R. Denison. 2004. Poster. Mouse Hepatitis Virus Replicates in the Absence of Cleavage of Replicase Proteins p28 and p65. *The Seventh International Symposium on Positive-Strand RNA Viruses*. San Francisco, CA, USA.

**R.L. Graham**. 2004. A coronavirus replicase protein has multiple roles in viral replication. *Department of Microbiology and Immunology Research in Progress Seminar Series*. Vanderbilt University School of Medicine, Nashville, TN, USA.

**R.L. Graham**, X. Lu, S.M. Brockway, B. Yount, A.C. Sims, R.S. Baric, and M.R. Denison. 2004. Mouse hepatitis virus replicates in the absence of p28 and p65 cleavage. *Southeast Regional Virology Conference*. Atlanta, GA, USA.

**R.L. Graham**, B. Yount, S.M. Brockway, X. Lu, and M.R. Denison. 2003. PLP1 mediated cleavage of mouse hepatitis virus replicase proteins p28 and p65 is not necessary for viral replication. *The IX<sup>th</sup> International Symposium of Nidoviruses*. Egmond aan Zee, The Netherlands.

## Teaching Activities

2016-2017	Guest Lecturer, Virology, MCRO 630
2013-2017	Guest Lecturer, Intro to Viruses, EPID 751
2008-2012	Lecturer/Discussion Facilitator, Responsible Conduct in Research, Biological and Biomedical Sciences Program, University of North Carolina at Chapel Hill
2007	Flextime Facilitator, Microbial Pathogenesis, Interdisciplinary Graduate Program, Vanderbilt University School of Medicine
2005	Flextime Director, Microbial Pathogenesis, Interdisciplinary Graduate Program, Vanderbilt University School of Medicine
2005-2006	Head Teaching Assistant, Medical Microbiology Laboratory, Vanderbilt University School of Medicine
2004-2005	Teaching Assistant, Medical Microbiology Laboratory, Vanderbilt University School of Medicine
2001	Facilitator, Enrichment Section, Introduction to Biology, University of Kentucky

## Mentoring Activities

2017-present	Facilitating the Coronavirus Molecular Virology working group in the Baric Lab
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## Grants

2008-2011	Source: National Institute of Allergy and Infectious Diseases, National Institutes of Health Type: F32 Ruth L. Kirschstein National Research Service Award Title: SARS-CoV Transcription Network Remodeling and the Attenuation of Pathogenesis Role: Principal Investigator (Post-doctoral Fellowship) Duration: 06/01/08-05/31/11 Total Funding Amount: \$153,822 (including three-year salary stipend)
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## Professional/Volunteer Service

2020-present Peer reviewer, Science  
2020-present Peer reviewer, Frontiers Public Health  
2020-present Peer reviewer, Frontiers of Medicine  
2020-present Peer reviewer, Frontiers Microbiology  
2015-present Peer reviewer, Molecular Biology and Evolution  
2015-present Peer reviewer, Computational Biology and Chemistry  
2013-present Board Member, North Carolina State Science Fair Foundation 2012-present  
2012-present Peer reviewer, Journal of Virology  
2011-present Co-Chair, State Scientific Review Committee, North Carolina State Science and  
Engineering Fair  
2009-present Member, State Scientific Review Committee, North Carolina State Science and  
Engineering Fair  
2008-present Judge, North Carolina State Science and Engineering Fair