



XIVth International Nidovirus Symposium
Kansas City, June 4-9, 2017



NIDO2017 SCIENTIFIC PROGRAM

Sunday, June 4th, 2017	
Workshop: Translating NidoResearch into Field Applications	
Session 1: New Targets and Approaches for Antivirals	
Moderators: Frank van Kuppeveld & Bob Rowland	
08:15 – 08:25	Workshop opening remarks
08:25 – 08:50	W1. O-01 State of the art presentation From Bench to Clinical Trial: microRNA 122 as an Antiviral Target for Hepatitis C Virus Peter Sarnow* Stanford University, CA, USA
08:50 – 09:10	W1. O-02 Discovery & Development of Coronavirus Protease Inhibitors as Potential Therapeutics Andrew Mesecar* Purdue University, IN, USA
09:10 – 09:30	W1. O-03 A Protease Inhibitor as a Potential Therapeutic for Feline Coronavirus Yunjeong Kim* Kansas State University, KS, USA
09:30 – 09:45	W1. O-04 Broad-spectrum antiviral GS-5734 inhibits both epidemic and zoonotic coronaviruses Timothy P. Sheahan¹, Amy C. Sims¹, Rachel L. Graham¹, Vineet D. Menachery¹, Lisa E. Gralinski¹, James B. Case⁴, Sarah R. Leist¹, Krzysztof Pyrc⁵, Joy Y. Feng², Iva Trantcheva², Roy Bannister², Yeojin Park², Darius Babusis², Michael O. Clarke², Richard L. Mackman², Jamie E. Spahn², Christopher A. Palmiotti², Dustin Siegel², Adrian S. Ray², Tomas Cihlar², Robert Jordan², Mark R. Denison³, Ralph S. Baric¹ ¹ University of North Carolina at Chapel Hill, Chapel Hill, NC ² Gilead Sciences, Inc., Foster City, CA, ³⁻⁴ Vanderbilt University Medical Center, Nashville, TN, ⁵ Jagiellonian University, Krakow, Poland
09:45 – 10:00	W1. O-05 Utilizing yeast as a platform to identify therapeutics and

	<p>genetic interactors for SARS and MERS-CoV Stuart Weston, Krystal Matthews, Matthew Frieman University of Maryland, MD, USA</p>
10:00 – 10:30	Coffee Break
<p>Session 2: Opportunities for Nidovirus Vaccines Moderators: Scott McVey & Pravina Kitikoon</p>	
10:30 – 10:50	<p>W2. O-01 State of the art presentation: Overcoming Technical and IP Hurdles, from Concept to Product Jay Calvert* Zoetis Inc., USA</p>
10:50 – 11:10	<p>W2. O-02 Challenges in PRRS vaccine development and application in the developing world Shishan Yuan* Boehringer Ingelheim</p>
11:10 – 11:30	<p>W2. O-03 PRRSV vaccine development and application in China Kegong Tian* Pulike Inc. P. R. China</p>
11:30 – 11:45	<p>W2. O-04 Development of rationally attenuated live vaccines for effective control of infectious bronchitis Erica Bickerton, Sarah Keep, Paul Britton The Pirbright Institute, UK</p>
11:45 – 12:00	<p>W2. O-05 Protection against MERS-CoV infection by immunization with genetically engineered live-attenuated viruses Javier Gutiérrez-Álvarez¹, Carlos Castaño-Rodríguez¹, Jose M. Honrubia¹, Raul Fernandez-Delgado¹, Sonia Zuñiga¹, Paul McCray², Stanley Perlman², Isabel Sola¹, Luis Enjuanes¹ ¹National Center for Biotechnology (CNB-CSIC) Campus Universidad Autónoma de Madrid, Spain, ²University of Iowa, USA</p>
12:00 – 13:30	<p>Lunch roundtable session with industry and academic professionals Chairs: Kyoung-Jin Yoon and Megan Niederwerder</p>
<p>Session 3: Host Genomics and Viral Infection Moderators: Udeni Balasuria & Qiu Hong Wang</p>	
13:30 – 13:55	<p>W3. O-01 State of the art presentation: Genetic Engineering to answer basic questions about viral infection Randall Prather* University of Missouri, MO, USA</p>
13:55 – 14:15	<p>W3. O-02 Using animal breeding and genetic selection to combat infectious disease Jack Dekkers* Iowa State University, IA, USA</p>
14:15 – 14:35	<p>W3. O-03 Development of an Arterivirus RNA-based Platform Expression System</p>

	Kurt Kamrud* , Martina Felderman, Nancy Choi, Nathaniel Wang, Jessica Sparks, Lyn'Al Nosaka, Carolina Carpenter, Rebecca Mazahreh, Jason DeHart, Win Maung, Magda Barbu, Heather Gouvis, Belyn Hubby Synthetic Genomics Vaccines, Inc. CA, USA
14:35 – 14:50	W3. O-04 Parainfluenza Virus 5 (PIV5) As A Vaccine Vector: MERS-CoV Vaccine Development Zhuo Li¹, Kun Li², Paul McCray², Biao He¹ ¹ University of Georgia, GA; ² University of Iowa, IA, USA
14:50 – 15:20	Coffee Break
Session 4: Evolution & Diagnostics of Nidoviruses Moderators: Hanchun Yang & DJ Rezac	
15:20 – 15:40	W4. O-01 Translational outcomes of research into the biology of equine arteritis virus in advancing the diagnosis and control of viral arteritis Udeni Balasuriya* University of Kentucky, USA
15:40 – 16:00	W4. O-02 PRRSV evolution and challenges for diagnostics and epidemiology Tomaz Stadejek* Warsaw University of Life Sciences, Poland
16:00 – 16:15	W4. O-03 Rapid disease diagnostics and surveillance using a broad-spectrum microbial detection array C.J. Jaing¹, J.B. Thissen¹, K.S. McLoughlin², M.C. Niederwerder³, R. R.R. Rowland³ ^{1,2} Lawrence Livermore National Laboratory, Livermore, CA, ³ Kansas State University, Manhattan, KS, USA
16:15 – 16:30	W4. O-04 VSV pseudotype and monoclonal antibody-based assays for determining MERS coronavirus neutralizing antibody responses Shuetsu Fukushi¹, Aiko Fukuma¹, Hideki Tani¹, Takeshi Kurosu¹, Satoshi Taniguchi¹, Kazutaka Egawa¹, Shumpei Watanabe¹, Masayuki Shimojima¹, Kazuya Shirato², Shutoku Matsuyama², Hanako Sekimukai³, Naoko Iwata-Yoshikawa³, Noriyo Nagata³, Kazuo Ohnishi⁴, Manabu Ato⁴, Hiroshi Sentsui⁵, and Masayuki Saijo¹ ¹⁻⁴ National Institute of Infectious Diseases and ⁵ Department of Veterinary Medicine, Nihon University, Japan.
*Invited Speakers	
18:00 – 18:15 Symposium opening remarks	
18:15 – 19:00 Keynote presentation	
New Insights into Zika Virus Pathogenesis, Immune Response and Vaccine Protection Michael Diamond*	

Washington University School of Medicine
St. Louis, Missouri, USA

19:00 – 22:00 Welcome Gala in the Marriott Hotel Barney Allis Historic Lobby

Monday, June 5th 2017	
SESSION 1: Gymnastics of Viral Entry	
Moderators: Tom Gallagher & Barney Graham	
08:30 – 08:50	S1. O-01 Structural biology of betacoronavirus spike proteins Andrew Ward* The Scripps Research Institute, USA
08:50 – 09:10	S1. O-02 Structures and functions of coronavirus spike proteins: what lessons can we learn? Berend-Jan Bosch* Utrecht University, The Netherlands
09:10 – 09:25	S1. O-03 Structural studies of coronavirus spike proteins Alexandra C. Walls¹, M.Alejandra Tortorici^{2,3}, Brandon Frenz¹, Joost Snijder¹, Wentao Li⁴, Peter Rottier⁴, Frank DiMaio¹, Berend-Jan Bosch⁴, Félix A. Rey^{2,3}, David Veessler¹ ¹ University of Washington, Seattle, Washington, USA; ² Institut Pasteur, Unité de Virologie Structurale, Paris, France; ³ CNRS UMR 3569 Virologie, Paris, France; ⁴ Utrecht University, The Netherlands
09:25 – 09:40	S1. O-04 Entry of human coronaviruses Aleksandra Milewska^{1,2}, Paulina Nowak^{1,2}, Katarzyna Kosowicz^{1,2}, Artur Szczepanski^{1,2}, Krzysztof Pyrc^{1,2} ¹⁻² Jagiellonian University, Krakow, Poland
09:40 – 09:55	S1. O-05 Receptor engagement of the porcine epidemic diarrhea virus Wentao Li, Frank J.M. van Kuppeveld, Peter J.M. Rottier, Berend-Jan Bosch Utrecht University, The Netherlands
09:55 – 10:10	S1. O-06 Structural insights into the SARS Spike-ACE2 receptor complex Robert N. Kirchdoerfer¹, Nianshuang Wang², Jesper Pallesen¹, Daniel Wrapp², Hannah L. Turner¹, Christopher A. Cottrell¹, Kizzmekia S. Corbett³, Barney S. Graham³, Jason S. McLellan², Andrew B. Ward¹ ¹ The Scripps Research Institute; ² Geisel School of Medicine at Dartmouth; ³ National Institute of Allergy and Infectious Disease, USA
10:10 – 10:40	Coffee Break
Moderators: David Veessler & Berend-Jan Bosch	
10:40 – 10:55	S1. O-07 The fusion peptide of the coronavirus spike protein has a novel bipartite organization and acts in a calcium-dependent manner Alex L. Lai¹, Jean K. Millet², Jack H. Freed¹, Susan Daniel³, Gary R. Whittaker² ¹⁻³ Cornell University, Ithaca NY 14853, USA
10:55 – 11:10	S1. O-08 Molecular cloning of porcine Siglec-3, Siglec-5 and Siglec-10 and identification of Siglec-10 as an alternative receptor for porcine reproductive and respiratory syndrome virus (PRRSV) Jiexiong Xie, Isaura Christiaens, Bo Yang, Wander Van Breedam, Tingting Cui, Hans J. Nauwynck Ghent University, Belgium

11:10 – 11:25	<p>S1. O-09 A tetraspanin protein promotes coronavirus infection by linking cell receptors and proteases James T Earnest¹, Michael P Hantak¹, Kun Li², Paul B McCray Jr², Stanley Perlman^{2,3}, <u>Tom Gallagher¹</u> ¹Loyola University Medical Center, Maywood, IL; ²⁻³University of Iowa, Iowa City, IA, USA</p>
11:25 – 11:40	<p>S1. O-10 Wild type human coronaviruses prefer cell surface TMPRSS2 to endosomal cathepsins for cell entry <u>Kazuya Shirato¹</u>, Kazuhiko Kanou², Miyuki Kawase¹, Shutoku Matsuyama¹ ¹National Institute of Infectious Diseases, Tokyo, Japan; ²Infectious Disease Surveillance Center, National Institute of Infectious Diseases, Tokyo, Japan</p>
11:40 – 11:55	<p>S1. O-11 Utilizing a glycan shield for epitope masking in HCoV-NL63 spike proteins <u>Alexandra C. Walls¹</u>, M.Alejandra Tortorici^{2,3}, Brandon Frenz¹, Joost Snijder¹, Wentao Li⁴, Félix A. Rey^{2,3}, Frank DiMaio¹, Berend-Jan Bosch⁴, David Veesler¹ ¹University of Washington, Seattle, Washington, USA; ²Institut Pasteur, Paris, France; ³CNRS UMR 3569 Virologie, Paris, France; ⁴Utrecht University, Utrecht, The Netherlands</p>
12:00 – 13:30	<p>Lunch Roundtable session: Young Scientists Career Chair: Joan Lunney</p>
SESSION 2: From Omics to Function	
Moderators: Brenda Hogue & Raoul de Groot	
13:30 – 13:40	Women in Science Awards
13:40 – 14:00	<p>S2. O-01 Applying Systems Biology to Viral Pathogenesis Ralph Baric* UNC Chapel Hill, North Carolina, USA</p>
14:00 – 14:20	<p>S2. O-02 Comparative Genomics and RNA Virus Gene Expression <u>Andrew E. Firth*¹</u>, Sawsan Naphthine¹, Roger Ling¹, Nerea Irigoyen¹, Betty YW. Chung², John F. Atkins³, Ian Brierley¹ ¹⁻³University of Cambridge, UK</p>
14:20 – 14:35	<p>S2. O-03 The viral predictome: partnering RNA structure and high-throughput analyses to predict novel coronavirus functional domains <u>Rachel L. Graham¹</u>, Wes Sanders², Heather A. Vincent², Jordan Texier², Nat Moorman², Dirk P. Dittmer², Ralph S. Baric^{1,2} ¹⁻²The University of North Carolina at Chapel Hill, Chapel Hill, NC, USA</p>
14:35 – 14:50	<p>S2. O-04 Identification of functional transcription regulatory sequences (TRS) in the SHFV genome by next generation sequencing <u>Han Di¹</u>, Joseph C. Madden¹, Esther K. Morantz¹, Rachel Graham², Ralph S. Baric^{2,3}, M. A. Brinton¹ ¹Georgia State University, Atlanta, GA; ²⁻³University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA</p>

14:50 – 15:20	Coffee Break
Moderators: Eric Snijder & Mark Denison	
15:20 – 15:35	S2. O-05 Coronavirus nsp14 modulates the innate immune response Martina Becares, Alejandro Pascual-Iglesias, Isabel Sola, Luis Enjuanes, <u>Sonia Zuñiga</u> National Center of Biotechnology (CNB-CSIC), Madrid, Spain
15:35 – 15:50	S2. O-07 The 5'-terminal stem-loop 2 is a structurally and functionally conserved <i>cis</i>-acting RNA element in coronavirus genomes Ramakanth Madhugiri, Nadja Karl, Daniel Petersen, <u>John Ziebuhr</u> Justus Liebig University Giessen, Germany
15:50 – 16:05	S2. O-08 Activation of NF-κB by PRRSV is mediated by nucleocapsid protein binding to PIAS1 Hanzhong Ke, <u>Dongwan Yoo</u> University of Illinois at Urbana-Champaign, Urbana, IL, USA
16:05 – 16:20	S2. O-09 Structure and kinetics of a core MERS papain-like protease with utility for structure-based drug design <u>Jozlyn Clasman</u>¹, Yahira M. Báez-Santos^{1,2}, Robert C. Mettelman³, Amornrat O'Brien³, Susan C. Baker³, Andrew D. Mesecar^{1,4,5,6} ^{1-2,4-5} Purdue University, West Lafayette, IN; ³ Loyola University Chicago, Stritch School of Medicine, Maywood, IL, USA
16:20 – 16:35	S2. O-10 Potent and selective inhibition of Middle East respiratory syndrome coronavirus papain-like protease by ubiquitin variants Robert C. M. Knaap¹, Wei Zhang², Ben A. Bailey-Elkin³, Baldeep Khare³, Tim J. Dalebout¹, Garrett G. Johnson³, Puck B. van Kasteren¹, Nigel J. McLeish³, Jun Gu², Wenguang He³, Brian L. Mark³, Sachdev S. Sidhu², <u>Marjolein Kikkert</u>¹ ¹ Leiden University Medical Center, The Netherlands; ² University of Toronto, Toronto, Canada; ³ University of Manitoba, Winnipeg, Canada
17:00 – 19:00	Poster Session #1. Please put up posters on Mon AM, presenters should be at their posters from 17:00 – 19:00, posters stay up until Tuesday evening.
Tuesday, June 6th, 2017	
SESSION 3: How Viruses Take Over	
Moderators: Volker Thiel & Marjolein Kikkert	
08:30 – 08:50	S3. O-01 Common themes in the biogenesis and structure of nidovirus replication organelles Eric J. Snijder* Leiden University Medical Center, The Netherlands
08:50 – 09:10	S3. O-02 Tunneling nanotubes provide a unique conduit for intercellular spread of PRRSV infection: A novel pathways for nidovirus transmission Ying Fang* Kansas State University, USA
	S3. O-03 Proofreading-deficient coronaviruses evolve increased nucleotide selectivity over long-term passage

09:10 – 09:25	Kevin W. Graepel¹, Xiaotao Lu², James Brett Case¹, Everett Clinton Smith³, Mark R. Denison^{1,2} ¹⁻² Vanderbilt University Medical Center, Nashville, TN; ³ The University of the South, Sewanee, TN, USA
09:25 – 09:40	S3. O-04 Identification of sites of Infectious Bronchitis Virus RNA synthesis Nicole Doyle, Selma Rayon, Helena J Maier The Pirbright Institute, UK
09:40 – 09:55	S3. O-05 Role of MERS-CoV nonstructural protein 1 in virus replication Keisuke Nakagawa¹, Krishna Narayanan¹, Kumari G. Lokugamage¹, Masami Wada¹, Ralph S. Baric², Shinji Makino¹ ¹ University of Texas Medical Branch, Galveston, TX; ² University of North Carolina at Chapel Hill, NC, USA
09:55 – 10:25	Coffee Break
10:25 – 10:45	S3. O-06 Inhibition of Replication and Pathogenesis of Coronaviruses by Targeting Viral Methyltransferases Shilei Wang¹, Cong Zeng¹, Yi Wang¹, Ruangang Pan¹, Yu Chen¹, Deyin Guo*² ¹ Wuhan University, Wuhan, China; ² Sun Yat-sen University, Guangdong, China.
10:45 – 11:00	S3. O-07 The Epigenetic Landscape during Coronavirus Infection Alexandra Schäfer¹, Vineet D. Menachery¹, Katrina M. Waters², Amy C. Sims¹, Timothy P. Sheahan¹, Ralph S. Baric¹ ¹ University of North Carolina at Chapel Hill, Chapel Hill, NC; ² Pacific Northwest National Laboratory, Richland, WA, USA
11:00 – 11:15	S3. O-08 Composition of the subcellular molecular environment of coronavirus replicase complexes identified by proximity labelling. Philip V'kovski^{1,2}, Sophie Braga Lagache³, Cedric Simillion^{4,5}, Alexey Stukalov⁶, Andreas Pichlmair⁶, Manfred Heller³, Volker Thiel^{1,7} ^{1-5,7} University of Bern, Switzerland; ⁶ Max-Planck Institute of Biochemistry, Martinsried, Germany
11:15 – 11:30	S3. O-09 The MHV packaging signal promotes virulence and prevents a robust interferon response during infection Jeremiah Athmer, Anthony Fehr, Mathew Grunewald, Stanley Perlman University of Iowa, Iowa City, Iowa, USA
11:30 – 11:45	S3. O-10 Special presentation: National Bio and Agro-defense Facility (NBAF) Ron Trewyn, Kansas State University, Manhattan, KS, USA

11:45 – 13:00	Lunch
SESSION 4: Emerging & Evolving Viruses	
Moderators: John Ziebuhr & Alexander Gorbalenya	
13:00 – 13:20	S4. O-01 Origins and emergence of coronaviruses Christian Drosten* University of Bonn Medical Centre, Bonn, Germany
13:20 – 13:40	S4. O-02 The nsp14-exoribonuclease in coronavirus replication, pathogenesis and evolution Mark Denison* Vanderbilt University School of Medicine, Nashville, TN, USA
13:40 – 13:55	S4. O-03 Cooperation and competition among genome regions in macroevolution of nidoviruses Ivan A. Kuznetsov¹, Anastasia A. Gulyaeva², Svetlana Iarovenko¹, Chris Lauber^{2,3}, Andrey M. Leontovich⁴, Igor A. Sidorov², <u>Alexander E. Gorbalenya</u>^{1,2,4} ^{1,4} Lomonosov Moscow State University, Moscow, Russia; ² Leiden University Med. Center, Leiden, The Netherlands; ³ Technische Universität Dresden, Dresden, Germany
13:55 – 14:10	S4. O-04 Betacoronavirus adaptation to humans involved progressive loss of hemagglutinin-esterase lectin activity <u>Yifei Lang</u>¹, Mark J.G. Bakkers¹, Louris J. Feitsma², Ruben J.G. Hulswit¹, Stefanie A.H. de Poot¹, Arno L.W. van Vliet¹, Irina Margine¹, Jolanda D.F. de Groot-Mijnes³, Frank J.M. van Kuppeveld¹, Martijn A. Langereis¹, Eric G. Huizinga², Raoul J. de Groot¹ ¹⁻³ Utrecht University, The Netherlands
14:10 – 14:25	S4. O-05 Novel nido-like virus genomes associated with eukaryotic intracellular RNA pools <u>Benjamin W. Neuman</u>¹, Khulud Bukhari², Saad T. Mutlk², Hasan S. H. Alrashedi², Ban O. Abdulsattar², Guocheng Shu³, Lanying Zhao³, Jianping Jiang³, Leonid L. Moroz⁴, Federica di Palma⁵, Nadia Ayoub⁶, Jessica Garb⁷, Weilin Sun⁸, Barry Pittendrigh⁸ ¹ Texas A&M University–Texarkana, TX, USA; ² University of Reading, UK; ³ Chinese Academy of Sciences, Chengdu, China; ⁴ University of Florida, USA; ⁵ The Earlham Institute, Norwich, UK; ⁶ Washington & Lee University, Lexington, VA, USA; ⁷ University of Massachusetts-Lowell, MA, USA; ⁸ Michigan State University, East Lansing, MI, USA
14:25 – 14:40	S4. O-06 Examining the emergence potential of MERS-like CoV PDF-2180 <u>Menachery VD</u>¹, Yount, B.L², Scobey, T², Dinno, K.H^{2,3}, Anthony, S.J^{4,5,6}, Gilardi, K⁷, Goldstein, T⁷, Ssebide, B⁸, Mbabazi, R⁸, Navarrete-Macias, I⁴, Liang, E^{4,6}, Wells, H⁴, Hicks, A⁴, Petrosov, A⁴, Byarugaba, D.K^{9,10}, Debbink, K², Randell, S.H¹¹, Cranfield⁷, M, Johnson, C.K⁷, Lipkin, W.I^{4,5}, Mazet, J.A.K⁷, Baric, R.S^{2,3} ¹ University of Texas Medical Branch, Galveston, Texas; ^{2-3,11} University of North Carolina; ⁴ Mailman School of Public Health, Columbia University,

	New York, NY; ⁵ Mailman School of Public Health, Columbia University, New York, NY; ⁶ EcoHealth Alliance, NY, New York; ⁷ One Health Institute & Karen C. Drayer Wildlife Health Center, School of Veterinary Medicine, University of California Davis, CA; ⁸ Gorilla Doctors, c/o MGVP, Inc., Davis, CA; ⁹ Makerere University Walter Reed Project, Kampala, Uganda; ¹⁰ Makerere University, College of Veterinary Medicine, Kampala, Uganda
15:00 –	Scenic views of Kansas City Attendees sign up at the registration desk for a group tour of <u>Powell Gardens</u> or enjoy exploring KC on your own during the afternoon and evening.
Wednesday, June 7th, 2017	
SESSION 5: How the Host Responds to Viruses	
Moderators: Ralph Baric & Luis Enjuanes	
08:30 – 08:50	S5. O-01 Viral antagonists of innate immune responses Susan Baker* Loyola University Chicago, Stritch School of Medicine, USA
08:50 – 09:10	S5. O-02 OAS-RNase L: an antiviral and proapoptotic pathway Susan R. Weiss* University of Pennsylvania, USA
09:10 – 09:25	S5. O-03 TiPARP upregulation during CoV infection reveals potential activation of the aryl hydrocarbon receptor <u>Matthew Grunewald</u>, Anthony Fehr, Stanley Perlman University of Iowa Carver College of Medicine, USA
09:25 – 09:40	S5. O-04 The interleukin-1 pathway contributes to SARS-CoV pathogenesis and disease <u>Jacob Kocher</u>¹, Anne Beall¹, Kara Jensen¹, Jessica Plante¹, Lisa Gralinski¹, Vineet Menachery¹, Alexandra Schäfer¹, Timothy Sheahan¹, Trevor Scobey¹, Ralph Baric^{1,2} ¹⁻² University of North Carolina-Chapel Hill, Chapel Hill, NC, USA
09:40 – 09:55	S5. O-05 A naturally occurring recombinant enterovirus expresses torovirus protease <u>Pengcheng Shang</u>¹, Saurav Misra², Ben Hause¹, Ying Fang¹ ¹⁻² Kansas State University, Manhattan, KS, USA
09:55 – 10:10	S5. O-06 Middle East respiratory coronavirus accessory protein 4a inhibits PKR-mediated antiviral stress responses <u>Huib H. Rabouw</u>¹, Martijn A. Langereis¹, Robert C.M. Knaap², Tim J. Dalebout², Peter J. Bredenbeek², Marjolein Kikkert², Raoul J. de Groot¹, and Frank J.M. van Kuppeveld¹ ¹⁻² Utrecht University, The Netherlands
10:10 – 10:40	Coffee Break
Moderators: Susan Weiss & Dongwan Yoo	
10:40 – 10:55	S5. O-07 PARP-dependent ADP-ribosylation independently enhances the IFN response and represses coronavirus replication

	<u>Anthony R. Fehr</u> ¹ , Gytis Jankevicius ² , Craig Fett ¹ , Ivan Ahel ² , Stanley Perlman ¹ ¹ University of Iowa, Iowa City, IA; ² University of Oxford, UK
10:55 – 11:10	S5. O-08 Infectious bronchitis virus (IBV) accessory protein 4b and stress granules <u>Ross Hall</u> ¹ , Julian A. Hiscox ² , Paul Britton ¹ , Helena J. Maier ¹ ¹ The Pirbright Institute, UK; ² Institute of Infection and Global Health, University of Liverpool, Liverpool, UK
11:10 – 11:25	S5. O-09 Type I interferons and alveolar macrophages protect hDPP4 KI mice from mouse-adapted strain of MERS-CoV infection <u>Rudragouda Channappanavar</u> ¹ , Anthony R Fehr ¹ , Kun Li ² , Paul B McCray ^{2,1} and Stanley Perlman ^{1,2} ¹⁻² University of Iowa, Iowa City, USA
11:25 – 11:40	S5. O-10 DPP4-mediated immunity during MERS-CoV infection: implication for development of medical countermeasure <u>Algaissi AA</u> ^{1,6} , Agrawal AS ¹ , Han S ² , Chan TS ¹ , Peng B-H ³ , Couch RB ⁴ , Tseng CTK ^{1,5} ¹⁻⁵ University of Texas Medical Branch at Galveston, TX; ⁶ Jazan University, Saudi Arabia
11:40 – 11:55	S5. O-11 The unfolded protein response induced by porcine reproductive and respiratory syndrome virus infection of alveolar macrophages is involved in immune dysregulation <u>W.Y. Chen</u> , W.M. Schnitzlein, G. Calzada-Nova, F.A. Zuckermann University of Illinois at Urbana-Champaign. Urbana, IL, USA
12:00 – 13:30	Lunch
SESSION 6: Insights into Viral Pathogenesis	
Moderators: Wen-hai Feng & Isobel Sola	
13:30 – 13:50	S6. O-01 Historical context and biological enigma of rhinovirus C Ann Palmenberg* University of Wisconsin-Madison, USA
13:50 – 14:10	S6. O-02 Illuminating the coronavirus replicase: from pathogenicity to molecular function Volker Thiel* , University of Bern, Switzerland
14:10 – 14:25	S6. O-03 Characterization of virus - host interaction dynamics within the respiratory epithelium <u>Ronald Dijkman</u> ^{1,2} , Hulda R. Jonsdottir ^{1,2} , Volker Thiel ^{1,2} ¹⁻² University of Bern, Switzerland
14:25 – 14:40	S6. O-04 Coronavirus deubiquitinase modulates type I IFN response in infected macrophages and promotes infection <i>in vivo</i> <u>Xufang Deng</u> ¹ , Anna M Mielech ¹ , Yafang Chen ² , Robert C Mettelman ¹ , Matthew Hackbart ¹ , Amornrat O'Brien ¹ , Andrew D Mesecar ² , Susan C Baker ¹ ¹ Loyola University Chicago Stritch School of Medicine, Maywood, IL;

	² Purdue University, West Lafayette, IN, USA
14:40 – 14:55	<p>S6. O-05 CXCL16 gene variants regulate equine arteritis virus infection in stallions <u>Sanjay Sarkar</u>¹, Ernest Bailey¹, Yun Young Go^{1,2}, R. Frank Cook¹, Ted Kalbfleisch³, John Eberth¹, R. Lakshman Chelvarajan¹, Kathleen M. Shuck¹, Sergey Artiushin¹, Peter J. Timoney¹, Udeni B. R. Balasuriya¹ ¹University of Kentucky, Lexington, KY 40546, USA; ²Korea Research Institute of Chemical Technology, Daejeon, South Korea; and ³University of Louisville, Louisville, KY, USA</p>
14:55 – 15:25	Coffee Break
15:25 – 15:45	<p>S6. O-06 Pathogenesis of Emerging Coronavirus Vincent Munster* NIH/NIAID/Rocky Mountain Laboratories, USA</p>
15:45 – 16:00	<p>S6. O-07 Mutations in a nidoviral trans-membrane replicase subunit confer resistance towards the cyclophilin inhibitor cyclosporin A Adriaan de Wilde¹, Jessika Zevenhoven-Dobbe¹, Corrine Beugeling¹, Linda Boomaars-van der Zanden¹, Montserrat Bárcena², Eric Snijder¹, Clara Posthuma¹ Leiden University Medical Center, The Netherlands</p>
16:00 – 16:15	<p>S6. O-08 Critical amino acids in nsp9 and nsp10 determining the fatal virulence of Chinese highly PRRSV <u>Lei Xu</u>, Lei Zhou, Weifeng Sun, Pingping Zhang, Xinna Ge, Xin Guo, Jun Han, Hanchun Yang College of Veterinary Medicine, China Agricultural University</p>
16:15 – 16:30	<p>S6. O-09 Coronavirus Gene Expression and Cellular Differential Expression Analyses by RNA Sequencing and Ribosome Profiling <u>Nerea Irigoyen</u>¹, Andrew E. Firth¹, Adam M. Dinan¹, Krzysztof Franaszek¹, Joshua D. Jones¹, Betty YW. Chung², Stuart G. Siddell³, Ian Brierley¹ ¹⁻²University of Cambridge, UK; ³University of Bristol, UK</p>
16:30 – 16:45	<p>S6. O-10 Structural and biochemical insights into the interaction of coronavirus papain-like proteases and interferon-stimulated-gene-product 15 from different species <u>Courtney M. Daczkowski</u>¹, John Dzimianski¹, Nick J. Mank¹, Phani Das², Kay Faaberg², Scott D. Pegan¹ ¹University of Georgia, Athens, Georgia, ²National Animal Disease Center, ARS, USDA, Ames, IA, USA</p>
17:00 – 19:00	Poster Session #2. Please put up posters on Wed AM, presenters should be at their posters from 17:00 – 19:00, posters stay up until Thursday afternoon.
20:00 – 22:00	ICTV Arterivirus and Coronavirus Study Group Meetings

Thursday, June 8th, 2017	
SESSION 6: Insights into Viral Pathogenesis	
Moderators: Kay Faaberg & Bart Haagmans	
08:30 – 08:50	S6. O-11 Human Coronavirus Virulence Motifs and Virulence Luis Enjuanes* Centro Nacional de Biotecnología, CNB-CSIC, Madrid, Spain
08:50 – 09:05	S6. O-12 Interplay between coronavirus and nonsense-mediated mRNA decay pathway Masami Wada, Kumari G. Lokugamage, Krishna Narayanan, <u>Shinji Makino</u> The University of Texas Medical Branch, Galveston, Texas, USA
09:05 – 09:20	S6. O-13 Inhibition of cytosolic phospholipase A2α impairs coronavirus replication by interfering with virus-induced replicative organelle formation <u>Christin Müller</u>¹, Martin Hardt², Dominik Schwudke³, Benjamin W. Neuman⁴, Stephan Pleschka¹, John Ziebuhr^{1*} ¹⁻² Justus Liebig University Giessen, Germany; ³ Research Center Borstel, Leibniz Center for Medicine and Bioscience, Borstel, Germany; ⁴ Texas A&M University, Texarkana, TX, USA
09:20 – 09:35	S6. O-14 Double-stranded viral RNA as a potential mediator for the persistence of porcine reproductive and respiratory syndrome virus <u>Rui Guo</u>, Xinyu Yan, Pengcheng Shang, Tao Wang, Ying Fang Kansas State University, Manhattan, KS, USA
09:35 – 09:50	S6. O-15 Confined DPP4 expression in the respiratory tract of macaques is associated with restricted MERS-CoV replication <u>W. Widagdo</u>¹, Lidewij C.M. Wiersma¹, Debby Schipper¹, V. Stalin Raj¹, Albert D.M.E. Osterhaus², Judith M.A. van den Brand¹, Bart L. Haagmans¹ ¹ Erasmus Medical Center, Rotterdam, The Netherlands; ² University of Veterinary Medicine, Hannover, Germany. *The authors contributed equally to this work.
09:50 – 10:05	S6. O-16 SARS-CoV-encoded small RNAs contribute to infection-associated lung pathology Lucía Morales¹, Juan Carlos Oliveros², Raúl Fernandez-Delgado¹, Benjamin Robert tenOever³, Luis Enjuanes¹, <u>Isabel Sola</u>¹ ¹⁻² National Center of Biotechnology (CNB-CSIC), Madrid, Spain; ³ Icahn School of Medicine at Mount Sinai, New York, USA
10:05 – 10:35	Coffee Break
SESSION 7: Host Genomes and Animal Model Systems	
Moderators: Linda Saif & Gary Whittaker	
10:35 – 10:55	S7. O-01 Animal Coronaviruses: Interspecies transmission, virulence and cell tropism determinants Linda Saif*

	The Ohio State University, USA
10:55 – 11:15	S7. O-02 Pigs, PRRSV, host genomics and CRISPR Raymond Rowland* Kansas State University, USA
11:15 – 11:30	S7. O-03 A mouse adapted MERS-Coronavirus causes lethal lung disease in human DPP4 knock-in mice Kun Li¹, Christine L. Wohlford-Lenane¹, Rudragouda Channappanavar², Jung-Eun Park³, James T. Earnest³, Thomas B. Bair⁴, Amber M. Bates⁵, Kim A. Brogden⁵, Heather A. Flaherty⁷, Tom Gallagher³, David K. Meyerholz⁶, Stanley Perlman^{1,2}, Paul B. McCray, Jr.^{1,2} ^{1-2,4-7} University of Iowa, Iowa City, IA; ³ Loyola University Chicago, Maywood, IL, USA
11:30 – 11:45	S7. O-04 Acute respiratory infection in human dipeptidyl peptidase 4 transgenic mice infected with Middle East respiratory syndrome coronavirus Naoko Iwata-Yoshikawa¹, Tadashi Okamura^{1,2}, Yukiko Shimizu², Hanako Sekimukai^{1,3}, Shuetsu Fukushi¹, Tadaki Suzuki¹, Yuko Sato¹, Makoto Takeda¹, Masato Tashiro¹, Hideki Hasegawa¹, Noriyo Nagata¹ ¹ National Institute of Infectious Diseases, Tokyo, Japan; ² National Center for Global Health and Medicine Tokyo, Japan; ³ Tokyo University of Agriculture and Technology, Tokyo, Japan
11:45 – 12:00	S7. O-05 Development of a New Human DPP4 Transgenic Mice Model for Studying Lung Pathogenesis of MERS-CoV Infection Anurodh S. Agrawal¹, Abdullah Algaissi¹, Maki Wakamiya², Bi-Hung Peng³, Teh-Sheng Chan¹, Robert B. Couch⁴, Chien-Te K. Tseng^{1,5} ¹⁻⁵ University of Texas Medical Branch, Galveston, Texas, USA
12:00 – 13:30	Lunch session-TWiV: This Week in Virology with Vincent Racaniello
SESSION 8: Counter measures to Disease	
Moderators: Margo Brinton & Shinji Makino	
13:30 – 13:50	S8. O-01 Role of T cell responses in Coronavirus Clearance and Protection Stanley Perlman* University of Iowa, USA
13:50 – 14:10	S8. O-02 Challenges of controlling porcine reproductive and respiratory syndrome by vaccination Hans Nauwynck* Gent University, Belgium
	S8. O-03 Evaluation of stabilized prefusion MERS-CoV spike trimers as vaccine candidates Kizzmekia S. Corbett¹, Joan Ngwuta¹, Benjamin I. Cabrera¹, Nianshuang Wang², Jesper Pallesen³, Daniel Wrapp², Lingshu Wang¹, Wei Shi¹, Yi Zhang¹, Syed Moin¹, Robert N. Kirchdoerfer³, Hannah L. Turner³, Christopher A. Cottrell³, Timothy Sheahan⁴, Adam Cockrell⁴, Andrew B.

14:10 – 14:25	<p>Ward³, Jason S. McLellan², Wing-Pui Kong¹, Ralph Baric⁴, Barney S. Graham¹ ¹National Institutes of Health; ²Geisel School of Medicine at Dartmouth; ³The Scripps Research Institute; ⁴University of North Carolina-Chapel Hill, USA</p>
14:25 – 14:40	<p>S8. O-04 Protective efficacy of a simian adenovirus vaccine against MERS-CoV challenge in a transgenic human-DPP4 mouse model <u>Michael Letko¹</u>, Vincent J. Munster¹, Daniel Wells², Teresa Lambe², Robert J. Fischer¹, Trenton Bushmaker¹, Greg Saturday³, Neeltje van Doremalen¹, Sarah C. Gilbert², Emmie de Wit¹, George M. Warimwe^{2,4,5} ^{1,3}NIH Rocky Mountain Laboratories, Hamilton, Montana, USA; ²The Jenner Institute, University of Oxford, UK; ⁴The Pirbright Institute, Woking, UK; ⁵KEMRI-Wellcome Trust Research Programme, Kilifi, Kenya</p>
14:40 – 14:55	<p>S8. O-05 Identification of MERS-CoV neutralizing nanobodies by direct cloning from a bone marrow cDNA library <u>V. Stalin Raj¹</u>, Nisreen Okba¹, Javier Gutierrez-Alvarez², Dubravka Drabek³, Widagdo Widagdo¹, Mart M. Lamers¹, Isabel Sola², Albert Moise Bensaid⁴, Joaquim Segalés i Coma⁴, Berend Jan Bosh⁵, Marion Koopmans¹, Gerd Sutter⁶, Albert D.M.E. Osterhaus⁷, Luis Enjuanes², Bart L. Haagmans¹ ^{1,3}Erasmus Medical Center, Rotterdam, the Netherlands; ²Department of Molecular and Cell Biology, CNB-CSIC, Madrid, Spain; ⁴Centre de Recerca en Sanitat Animal (CRESA), Barcelona, Spain; ⁵Utrecht University, The Netherlands; ⁶Institute for Infectious Diseases and Zoonoses, University of Munich, Germany; ⁷Center for Infection Medicine and Zoonoses Research, University of Veterinary Medicine, Hannover, Germany</p>
14:55 – 15:25	Coffee Break
Moderators: Stanley Perlman & Hans Nauwynck	
15:25 – 15:40	<p>S8. O-06 Neutralizing mAbs targeting distinct domains of MERS-CoV Spike and their roles in viral neutralization <u>Lingshu Wang¹</u>, Wei Shi¹, M. Gordon Joyce¹, Yi Zhang¹, Masaru Kanekiyo¹, James D. Chappell², Michelle M. Becker², Misook Choe¹, Rosemarie D. Mason¹, Tongqing Zhou¹, Kevin O. Saunders¹, Kathleen M. Tatti³, Lia M. Haynes³, Mark R. Denison², Kayvon Modjarad⁴, Wing-Pui Kong¹, John R. Mascola¹, Barney S. Graham¹ ¹National Institutes of Health, Bethesda, MD; ²Vanderbilt University Medical Center, Nashville, TN; ³Centers for Disease Control and Prevention, Atlanta, GA; ⁴Walter Reed Army Institute of Research, Silver Spring, MD</p>
15:40 – 15:55	<p>S8. O-07 Protection from MERS-CoV-induced pulmonary disease with neutralizing antibody depends on virus dose and intervention timing <u>Adam S. Cockrell¹</u>, Madeline Douglas¹, Trevor Scobey¹, Davide Corti³, Ralph S. Baric^{1,2} ^{1,2}University of North Carolina-Chapel Hill, North Carolina, USA; ³Humabs BioMed SA, Bellinzona, Switzerland</p>
	S8. O-08 Nonstructural Protein 2 and Papain-like Protease 2 Chimeras

15:55 – 16:10	<p>between Highly-Pathogenic JXwn06 and Ingelvac PRRS® MLV Strains of Porcine Reproductive and Respiratory Syndrome Virus <u>Fengxue Wang</u>¹, Nicholas Otis¹, Jude Chenge², Stephanie Bester², Scott D. Pegan², Kay S. Faaberg¹ ¹National Animal Disease Center, ARS, USDA, Ames, IA, USA and ²University of Georgia, Athens, Georgia, USA</p>
16:10 – 16:25	<p>S8. O-09 Targeting proteases and interferon antagonists for coronavirus therapeutics <u>Robert C. Mettelman</u>¹, Xufang Deng¹, Sarah E. St. John², Gary R. Whittaker³, Andrew D. Mesecar², Susan C. Baker¹ ¹Loyola University Chicago, Stritch School of Medicine, Maywood, IL; ²Purdue University, West Lafayette, IN; ³Cornell University, Ithaca, NY, USA</p>
16:25 – 16:40	<p>S8. O-10 Synthetic vector-mediated IgG generated in vivo confers protective immunity against viral infection <u>Kar Muthumani</u> The Wistar Institute, Philadelphia, PA, USA</p>
16:40 – 16:55	<p>ICTV meeting report <u>Alexander Gorbalenya</u> Leiden University Med. Center, Leiden, The Netherlands</p>
18:00 – 23:00	Gala Dinner and Concert in The Grand Hall at Power & Light
Friday, June 9th, 2017	
Departure	