

VIRUS-LIKE PARTICLE & NANO-PARTICLE VACCINES

4-6 June 2014, Salk Institute for Biological Studies, La Jolla, California, USA

FINAL ORAL PROGRAMME & POSTER PROGRAMME VLPNPV 2014

SCIENTIFIC ADVISORY PANEL

Local Organisers: John Young and Greg Lemke (Salk Institute, La Jolla, California, USA)

Martin Bachmann (University of Zurich, Zurich, Switzerland)
 Bryce Chackerian (University of New Mexico, Albuquerque, New Mexico, USA)
 Marc-Andre D'Aoust (Medicago Inc., Quebec, Canada)
 Greg Glenn (Novavax Inc., Rockville, Maryland, USA)
 Melissa M. Herbst-Kralovetz (University of Arizona, Phoenix, Arizona, USA)
 George Lomonosoff (John Innes Centre, Norwich, UK)
 Marianne Manchester (University of California, San Diego, California, USA)
 Ann Meyers (University of Cape Town, South Africa)
 Peter Pushko (Medigen Inc., Frederick, Maryland, USA)
 Charles Richardson (Takeda Vaccines, Bozeman, Montana, USA)

Ted Ross (Vaccine & Gene Therapy Institute of Florida, Port Saint Lucie, Florida, USA)
 Polly Roy (London School of Hygiene & Tropical Medicine, London, UK)
 Geert Vanden Bossche (UNIVAC LLC, Seattle, Washington, USA)
 Brian Ward (McGill University, Montreal, Quebec, Canada)
 Vidadi Yusibov (Fraunhofer USA, Newark, Delaware, USA)
 Richard Compans (Emory University, Atlanta, Georgia, USA)
 Adriana Baz Morelli (CSL Limited, Parkville, Victoria, Australia)
 Alan Shaw (Vedantira Corporation, Cambridge Massachusetts, USA)
 Trudy Morrison (University of Massachusetts, Worcester, Massachusetts, USA)



08.00 onwards

Registration

09.30-09.40

Welcome to the Salk Institute & Opening Remarks

Greg Lemke (*Salk Institute, La Jolla, California, USA*)

SESSION 1: OPENING PLENARY I

Moderator: Richard W. Compans (*Emory University, Atlanta, Georgia, USA*)

09.40-10.20

'The background and development of rotavirus and norovirus VLP vaccines for prevention of gastroenteritis in children'

Timo Vesikari (*University of Tampere, Tampere, Finland*)

10.20-10.50

'Primary and secondary B cell responses induced by VLPs'

Martin Bachmann

(*University of Oxford, Oxford, UK/University of Zurich, Zurich, Switzerland*)

10.50-11.20

Coffee Break & Poster Set-Up

SESSION 2: PLENARY II

Moderator: George P. Lomonosoff

(*John Innes Centre, Colney, Norwich, UK*)

11.20-11.50

'Designing Ebola VLP vaccines to avoid immune subversion'

Richard W. Compans (*Emory University, Atlanta, Georgia, USA*)

11.50-12.20

'RSV fusion (F) nanoparticle immunogenicity in man: A new approach to vaccines?'

Greg Glenn (*Novavax Inc., Gaithersburg, Maryland, USA*)

12.20-12.50

'Plant-produced influenza VLP vaccines and beyond'

Marc-Andre D'Aoust (*Medicago, Quebec City, Quebec, Canada*)

12.50-14.00

Lunch Break & Posters

SESSION 3: IMMUNE RESPONSES

Moderator: Bryce Chackerian

(*University of New Mexico, Albuquerque, New Mexico, USA*)

14.00-14.25

'Impact of virus-like particle associated glycoprotein structure on immune responses'

Madelyn R. Schmidt, Lori W. McGinnes, Sarah Kenward, Robert Woodland and Trudy G. Morrison

(*University of Massachusetts Medical School, Worcester, Massachusetts, USA*)

14.25-14.50

'Generating optimal VLP-specific antibody responses using mucosal delivery routes and formulations'

Melissa Herbst-Kralovetz (*University of Arizona, Phoenix, Arizona, USA*)

14.50-15.15

'Anti-glycan immunity from virus-like particle platforms'

M.G. Finn, Zinaida Polonskaya, Marta Comellas-Aragones, Katarzyna Kaczanowska, Lisa Kain, Shenglou Deng, Paul Savage and Luc Teyton (*The Scripps Research Institute and Georgia Institute of Technology, Atlanta, Georgia, USA*)

15.15-15.40

'Virus-like particle immunization of peripheral blood lymphocyte engrafted humanized mice for the analysis of human immune responses'

Madelyn R. Schmidt, Trudy G. Morrison, Sarah A. Kenward, Lori W. McGinnes, George K. Lewis, Dale Greiner and Robert T. Woodland (*University of Massachusetts medical School, Worcester, Massachusetts, USA*)

15.40-16.00

'Mannosylation enhances uptake of VLP by murine and human antigen presenting cells'

Vernon Ward, Farah Al-Barwani, Sarah Young, Margaret Baird and David Larsen (*University of Otago, Dunedin, New Zealand*)

16.00-16.20

'Immune humoral response in mice elicited by inoculation with native and recombinant Triatoma Virus-VLPs'

Diego M.A. Guerin, Jailson F.B. Querido, Ruben Sanchez-Eugenia, Gerardo A. Marti, Jose F. Rodriguez and Marcelo Sousa Silva (*The University of the Basque Country, Bizkaia, Spain*)

16.20-16.35

Tea Break & Posters

SESSION 4: NANOPARTICLE VACCINES

Moderator: Trudy G. Morrison

(*University of Massachusetts Medical School, Worcester, Massachusetts, USA*)

16.35-16.55

'Mechanisms of inflammatory cell targeting by viral nanoparticles'

Marianne Manchester

(*University of California at San Diego, San Diego, California, USA*)

16.55-17.15

'Self-assembly of influenza antigens into nanoclusters as candidate universal vaccines'

Baozhong Wang, Li Wang, Annie Hess, Julie A. Champion*, Richard W. Compans (*Emory University School of Medicine and *Georgia Institute of Technology, Atlanta, Georgia, USA*)

17.15-17.35

'A broadly multivalent next generation PRINT nanoparticle pneumococcal vaccine induces potent B- and T-cell responses'

Shyam Rele, Anton Beletskii, Camille Bernasconi, Jinny Conley, Meredith Earl, Gabe Fawcett, Jeremy Hansen, Lara Kelly, Marquita Lily, Frank Malinoski, Joseph Marchand, Nicole Meyer, RiLee Robeson, Michele Stone, Ben Yerxa, Jeff Maisonneuve and Mark Alderson (*Liquidia Technologies, Morrisville, North Carolina, USA*)

17.35-17.55

'Immune-tolerant elastin-like polypeptide (iTEP) nanoparticles promote peptide vaccine presentation by dendritic cells'

Mingnan Chen, Shuyun Dong and Scott Cho (*University of Utah, Salt Lake City, Utah, USA*)

* This provisional programme is correct at the time of printing. However the organizers reserve the right to make any alterations that may be required in the interests and integrity of the final conference programme. A final programme with timings will be available in May 2014.

**SESSION 5:
PLANT-BASED PRODUCTION**

Moderator: Marc-Andre D'Aoust (*Medicago, Quebec City, Quebec, Canada*)

09.00-09.30

'Plants as an efficient system for the production of virus-like particles for vaccine and nanotechnology purposes'

George P. Lomonosoff, Keith Saunders, Y. Meshcheriakova, J. Marsian, Eva C. Thuenemann, Hadrein Peyret, P. Saxena, and N. Montague (*John Innes Centre, Colney, Norwich, UK*)

09.30-09.55

'Molecular farming and engineering of a HER2 cancer vaccine'

Sourabh Shukla and Nicole F. Steinmetz (*Case Western Reserve University, Cleveland, Ohio, USA*)

09.55-10.20

'Optimization and characterization of an HIV vaccine using replicating vaccinia virus and plant-produced Gag and dgp41 virus-like particles'

Lydia R. Meador, Sarah A. Kessans, Jacquelyn Kilbourne, Karen L. Denzler, Karen V. Kibler, Joseph N. Blattman, Bertram L. Jacobs and Tsafir S. Mor (*Arizona State University, Tempe, Arizona, USA*)

10.20-10.50

Coffee Break & Posters

**SESSION 6:
DEVELOPMENT & CHARACTERIZATION**

Moderator: Marianne Manchester

(*University of California at San Diego, San Diego, California, USA*)

10.50-11.20

'Protection of mice against live rotavirus challenge induced by rotavirus VP6 vaccine in dl2/6-VLP or tubular formulation'

Suvi Lappalainen, Ana Ruth Pastor, Maria Malm, Vanessa Lopez-Guerrero, Fernando Esquivel-Guadarrama, Laura A. Palomares, Timo Vesikari and Vesna Blazevic (*University of Tampere, Tampere, Finland*)

11.20-11.45

'In-vivo characterization of microneedle-based delivery of VLP and nanoparticle vaccine formulation'

Mark A. Tomai, L. Niu, L. Chu, J. Panyam and Kris J. Hansen (*3M Company, St. Paul, Minnesota, USA*)

11.45-12.05

'Development and characterization of MS2 virus-like particles displaying N-terminal peptide libraries'

Jayne M. Christen, Bryce Chackerian and David S. Peabody (*University of New Mexico, Albuquerque, New Mexico, USA*)

12.05-12.25

'Using VLPs and camelid nanobodies to create an antigen scaffold for vaccine production purposes: The gene jockey experience'

Hadrien Peyret, Eva C. Thuenemann and George P. Lomonosoff (*John Innes Centre, Colney, Norwich, UK*)

12.25-12.50

'Challenges in the development of an insect cell-derived influenza A(H7N9) VLP vaccine: From gene to man'

Gale Smith (*Novavax Inc., Gaithersburg, Maryland, USA*)

12.50-14.00

Lunch Break & Posters

**SESSION 7:
RESPIRATORY**

Moderator: T.M. Ross

(*Vaccine and Gene Therapy Institute of Florida, St Lucie, Florida, USA*)

14.00-14.25

'Immune history shapes specificity of pandemic H1N1 influenza antibody responses'

D.M. Carter, C.J. Crevar, Y. Li, J. Wrarmert, S. Esposito, R. Ahmed, P.C. Wilson, S.E. Hensley and T.M. Ross (*Vaccine and Gene Therapy Institute of Florida, St Lucie, Florida, USA*)

14.25-14.45

'Optimization of influenza virus-like particles (VLPs) in eukaryotic cells'

Peter Pushko, Rachmat Hidajat and Irina Tretyakova (*Medigen Inc., Frederick, Maryland, USA*)

14.45-15.05

'A novel *Escherchia coli* derived pandemic influenza vaccine that induces neutralizing antibodies and potent CD4+ T-helper type-1 responses'

David A.G. Skibinski, Brendon J. Hanson, Wu Xue Lin, Hoang Truong Long, Yufang Lin, Veronika von Messling, Andrea Jegerlehner, Jason Boon Sern Tee, De Hoe Chye, Steven K.K. Wong, Amanda A.P. Ng, Hui Yin Lee, Bijin Au, Nivashini Kaliaperumal, Bennett T.K. Lee, Lucia Santosa, Veronica Diermayr, Michael Poidinger, Anna-Marie Fairhurst, Alex Matter, Martin Hibberd, Martin F. Bachmann, Philippe Saudan and John E. Connolly (*A*Star, Agency for Science, Technology and Research, Singapore*)

15.05-15.25

'M2e-coated gold nanoparticle-based intranasal vaccine provides heterosubtypic protection against influenza A challenge'

Harvinder Singh Gill, Wenqian Tao, Bart Tarbet and Silke Paust (*Texas Tech University, Lubbock, Texas, USA*)

15.25-15.45

'Computationally optimized broadly reactive antigens (COBRA): Developing broadly reactive VLP vaccines against emerging and seasonal influenza'

Corey J. Crevar, Donald M. Carter and Ted M. Ross (*Vaccine & Gene Therapy Institute of Florida, Port St. Lucie, Florida, USA*)

15.45-16.15

Tea Break & Posters

**SESSION 8:
VACCINES I**

Moderator: Melissa Herbst-Kralovetz (*University of Arizona, Phoenix, Arizona, USA*)

16.15-16.35

'A HIV-1-VLP vaccine expressing pure native Env trimers elicits potent neutralizing antibodies directed to a quarternary, glycan-sensitive epitope'

James M. Binley, Ema T. Crooks, Bimal Chakrabarti, Keiko Osawa, Kristen Narayan, Janelle Muranaka, Sean X. Du, Tommy Tong, Robert Whalen and Richard Wyatt (*San Diego Biomedical Research Institute, San Diego, California, USA*)

16.35-16.55

'A VLP-based malaria vaccine candidate based on an epitope of the *Plasmodium falciparum* RH5 protein'

Bryce Chackerian, David S. Peabody, Amy Noe, Gabriel Gutierrez and Cheryl A. Lobo (*University of New Mexico, Albuquerque, New Mexico, USA*)

16.55-17.15

'Development of a recombinant dengue vaccine targeting E domain III'

Sean P. McBurney, William F. Sutton, William B. Messer and Nancy L. Haigwood (*Oregon Health Sciences University, Beaverton, Oregon, USA*)

17.15-17.35

'Virus-like particles as vaccine for paramyxoviruses: Protective efficacy of RSV-VLPs'

Pramila Walpita, Lisa M. Johns and Brian Gilbert (*University of Hawaii at Manoa, Hawaii*)

SESSION 9: DELIVERY PLATFORMS

Moderator: Charles Richardson (*Takeda Vaccines Inc., Bozeman, Montana, USA*)

09.00-09.25

'The synthetic virus-like particle platform: A new approach to antigen delivery'

Arin Ghasparian (*Virometix AG, Zurich, Switzerland*)

09.25-09.45

'Fast and efficient assembly platform for enveloped virus-like particles and their use as novel vaccines'

Christian Mittelholzer, Simon Bredl, Corinne John and Sabine Wellnitz (*Redbiotec AG, Schlieren, Switzerland*)

09.45-10.05

'Nanoemulsions with advanced surface functionality as therapeutic and prophylactic delivery vehicles'

Frank Sainsbury, Bijun Zeng, Ranjany Thomas and Anto P.J. Middelberg (*The University of Queensland, Lucia, Queensland, Australia*)

10.05-10.25

'Potentiation of neutralizing antibody responses following DNA vaccination with electroporation'

Kate E. Broderick, Karuppiyah Muthumani, Laurent Humeau, David B. Weiner and Niranjana Y. Sardesai (*Inovio Inc., Blue Bell, Pennsylvania, USA*)

10.25-11.15

Coffee Break & Posters

SESSION 10: TECHNOLOGY

Moderator: Peter Pushko (*Medigen Inc., Frederick, Maryland, USA*)

11.15-11.35

'Rapid total particle quantification: Accelerating the pace of research, development and production'

Mark Rehse and Michael Artinger (*ViroCyt, LLC, Boulder, Colorado, USA*)

11.35-11.55

'The Whc-VLP: An ideal platform raise high-titer antibody to targeted epitopes, both linear and structured'

David Whitacre, Amy Tucker, Cory Peters, Joyce Jones, Darrell Peterson and David Milich (*VLP Biotech Inc., San Diego, California, USA*)

11.55-12.15

'Flu titer on Chip: A rapid, cost-saving alternative to SRID'

Kathy Rowlen (*InDevR Inc., Boulder, Colorado, USA*)

12.15-12.35

'Development of alternative purification steps for virus-like particles using high-throughput experimentation'

Christopher Ladd Effio, Lukas Wenger, Ozan Oetes, Stefan A. Oelmeier and Jurgen Hubbuch (*Karlsruhe Institute of Technology, Karlsruhe, Germany*)

12.35-13.00

'Qualitative and quantitative characterization of VLP and nanoparticle samples using electron microscopy and automated image analyses'

Musa Sani (*Vironova AB, Stockholm, Sweden*)

13.00-14.00

Lunch Break & Posters

SESSION 11: VACCINES II

Moderator: Greg Glenn (*Novavax Inc., Rockville, Maryland, USA*)

14.00-14.25

'Progress in the development of a norovirus VLP vaccine'

Charles Richardson (*Takeda Vaccines Inc., Bozeman, Montana, USA*)

14.25-14.50

'Generation of a cholesterol-lowering vaccine that targets PCSK9'

Bryce Chackerian, Erin Crossey, Marcelo Amar, David S. Peabody, John T. Schiller and Alan T. Remaley (*University of New Mexico, Albuquerque, New Mexico, USA*)

14.50-15.10

'Development of recombinant baculovirus for high yield production of enterovirus 71 virus-like particle vaccine'

Shih-Yeh Lin, Yao-Chi Chung and Yu-Chen Hu

(*National Tsing Hua University, Hsinchu City, Taiwan, R.O.C.*)

15.10-15.30

'A viral-like particle vaccine expressing Chikungunya Virus envelope protein induces protective immunity in mice against viral challenge'

Kar Muthumani, Colleen Tingey, Boa Huihui, Emma L. Reuscal, Peter Block, Sagar Kudchodkar, Nagarajan Muruganandam, Paluru Vijayachar, Kenneth E. Ugen, J. Joseph Kim, Niranjana Y. Sardesai and David B. Weiner (*University of Pennsylvania School of Medicine, Philadelphia, USA*)

15.30-15.50

'Advanced characterization of VLP particles on particle by particle basis using Tunable Resistive Pulse Sensing (TRPS) technology'

Subhash Kalluri (*IZON Inc., Cambridge, Massachusetts, USA*)

15.30

Closing Remarks & Departure

POSTER SESSION

Posters will be on display for the duration of the conference. Poster setup will be during the morning coffee break on Wednesday 4th June.

Poster 101

'Second generation COBRA vaccines against emerging influenza viruses'

Corey J. Crevar et al. (*Vaccine & Gene Therapy Institute of Florida, Port St. Lucie, Florida, USA*)

Poster 102

'Incorporation of conformation-stabilized Env into HIV VLPs induces enhanced immune responses'

Li Wang (*Emory University, Atlanta, Georgia, USA*)

Poster 103

'Production of LCMV glycoprotein virus-like particles in *Nicotiana benthamiana* as murine model of protective vaccination strategies for HIV'

Lydia R. Meador et al. (*Arizona State University, Tempe, Arizona, USA*)

Poster 104

'Whole *Pichia pastoris* yeast expressing measles virus nucleoprotein as a production and delivery system to multimerize *Plasmodium* antigens'

Daria Jacob et al. (*Institut Pasteur, Paris, France*)

Poster 105

'Purification of HIV-1 virus like particles by monoliths'

Petra Steppert and Alois Jungbauer (*BOKU, Vienna, Austria*)

Poster 106

'EBV-envelope protein virus-like particle based vaccine'

Javier Ogembo (*University of Massachusetts, Worcester, Massachusetts, USA*)

Poster 107

'Development, characterization and immunization studies of rabies VLPs'

Claudio Prieto et al. (*Ciudad Universitaria, Sante Fe, Argentina*)

Poster 108

'Immunogenic rabies VLPs produced in serum free medium'

Claudio Prieto et al. (*Ciudad Universitaria, Sante Fe, Argentina*)

Poster 109

'Save our salmon – developing a vaccine for fish'

Johanna Marsian (*John Innes Centre, Norwich, UK*)

Poster 110

'Immunogenic display of purified chemically crosslinked HIV-1 spikes'

Daniel Leaman (*The Scripps Research Institute, La Jolla, California, USA*)

Poster 111

'Genotype consideration for virus-like particle based bivalent norovirus vaccine composition'

Maria Malm et al. (*University of Tampere, Tampere, Finland*)

Poster 112

'Transient expression of African Horsesickness capsid proteins in *Nicotiana benthamiana* plants'

Daria A. Rutkowska et al. (*CSIR Biosciences, Pretoria, South Africa*)

Poster 113

'Construction, expression and purification of recombinant leucine zipper-neuraminidase of influenza virus, the protein produced in prokaryotic expression system'

Romanik Agnieszka et al. (*Institute of Biotechnology and Antibiotics, Warsaw, Poland*)

Poster 114

'Immunological evaluation of plant-based enveloped virus-like particles targeting yellow fever virus and respiratory syncytial virus'

Alex Prokhnovsky et al.

(*Fraunhofer USA Center for Molecular Biotechnology, Newark, Delaware, USA*)