International Conference on One Medicine One Science • April 24-27, 2016

Program & Abstracts Book

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UNIVERSITY OF MINNESOTA
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THE SCIENCE BEHIND ONE HEALTH

iCOMOS™

International Conference on One Medicine One Science

2nd International Conference on One Medicine One Science
April 24-27, 2016
University of Minnesota, Minneapolis, USA

The Science Behind One Health, at the Interface of Humans, Animals and the Environment

UNIVERSITY OF MINNESOTA

Office of the President

202 Morrill Hall
100 Church Street S.E.
Minneapolis, MN 55455-0110

612-626-1616
Fax: 612-625-3875

April 24, 2016

Dear iCOMOS Participants,

Welcome to the Twin Cities and the University of Minnesota. I am pleased to greet delegates from across the United States and from nearly 30 countries from around the world.

After a highly acclaimed and successful conference in 2014, we are proud to present the 2nd International Conference on One Medicine One Science. As part of the Global One Health Initiative, the University of Minnesota, with more than 50 multidisciplinary programs, is at the forefront of addressing pressing societal challenges at the intersection of animals, humans, and the environment.

These challenges are enormous: growing populations, emerging diseases, preservation of the environment, feeding a global population, and the health and well being of humans and animals. All of us are affected by these societal challenges, and we want to be a part of the solution.

This iCOMOS conference brings us together to explore the science behind One Health. Over the next three days you will experience wide-ranging presentations, networking opportunities with colleagues and funding stakeholders, and workshop involvement for hands-on training. The issues will require a collaboration of partners in business, industry, government, non-governmental organizations, and other academic institutions.

I hope that you will also take time during your stay to familiarize yourself with our University, our resources, and our expertise, and that you will develop and advance partnerships with our faculty and students. On behalf of the entire University of Minnesota community, thank you for visiting our campus, and have a wonderful time!

Sincerely,

Eric W. Kaler
President

iCOMOS

International Conference on One Medicine One Science

University of Minnesota
1365 Gortner Ave. 440 VMC
St. Paul, MN 55108
Office: *612-624-2744*
Fax: *612-624-5100*
Email: comos@umn.edu

Dear Colleagues and Guests,

On behalf of the Organizing Committee we are delighted to welcome you to Minneapolis/St Paul, Minnesota, USA, for the 2nd International Conference on One Medicine One Science (**iCOMOS 2016**), at The Commons Hotel from April 24th to 27th, 2016.

The iCOMOS is organized by the College of Veterinary Medicine in partnership with other University of Minnesota colleges and centers as well as allied local, national and international agencies. It serves as a global One Health forum for: communicating the importance of science in solving pressing issues at the interface of animals, humans and the environment; facilitating increased international collaboration against emerging zoonotic pathogens, food- and water-borne diseases, and environmental health threats; and informing governmental policy development for managing complex needs in food safety/production, in environmental protection, and in animal and human health.

In its second meeting, iCOMOS 2016 is focused on the balance between personalized/precision medicine and public health; the impacts of air quality on health; the multidimensional role of water in economic welfare and health of humans and animals; and the role of science in development of health policies at local and global levels. Workshops on Wednesday will help you engage in and develop an in-depth understanding of: the role of team science in physician-scientist training; One Health policy related to global food security; and the role of 'big data' in addressing animal, human and plant health. Also, experts will show how canines and humans can serve as mutually beneficial comparative models for better epilepsy treatments and cures.

iCOMOS 2016 is packed with exciting, informative presentations, panel discussions, and workshops delivered by world-renowned bench, translational and applied scientists. As such, we hope you use this gathering to meet old and new colleagues to expand on existing networks and to build new partnerships. The deliberations of this meeting, attended by human health-care professionals, animal health-care veterinarians, public health specialists, economists and policy experts in health, environmental affairs, and economic development, and representing nearly 30 countries will be critically important in not only understanding the current status, but also in advancing the SCIENCE behind One Health, and finding viable and sustainable solutions to societal grand challenges throughout the world.

Finally, the twin cities of Minneapolis and St. Paul are one of the most vibrant and multicultural urban settings in United States. You have extensive access to musical and theater events, spectator and participatory sports, and a cornucopia of food choices. It blends a rich and diverse scientific community with major industries ranging from high tech medical devices, information technology, and agricultural business to leisure and pleasure. We hope you will take advantage of the many opportunities to enjoy the cities, their surroundings, and all they have to offer.

Sincerely,
Srirama Rao, Ph.D., Professor and Associate Dean
Michael Murtaugh, Ph.D., Professor
The Organizing Committee Co-Chairs

We greatly acknowledge the sponsorship of our Institutional Partners

UNIVERSITY OF MINNESOTA
College of Veterinary Medicine

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Academic Health Center

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GENERAL INFORMATION

Location

The International Conference on One Medicine One Science is at the **The Commons Hotel**, **April 24-27, 2016.**

Registration, session, poster sessions, and refreshment breaks will be held:
The Commons Hotel on the University of Minnesota's East Bank campus
Mezzanine Level
615 Washington Ave SE
Minneapolis, MN 5541 4
www.commonshotel.com
Monday evening social event will be held:
McNamara Alumni Center
200 Oak Street
Minneapolis, MN 55414

Parking

The University of Minnesota is an urban campus. There is public parking on campus for a charge, but the space is limited. If you are driving locally, daily parking is available in various public parking lots/ramps on the East Bank campus. The least expensive parking is in Flat Lot 37 on 5th Street SE ($4.00 per day). Parking is also available in the University Avenue Ramp next to the McNamara Alumni Center ($12 per day) or the Washington Avenue Ramp next to the The Commons Hotel ($12 per day).

Registration Desk Hours

University of Minnesota staff will be at the registration desk during the times listed below. Information about Minneapolis and Saint Paul is available near the registration desk area.
Sunday, April 24, 2016 3:00-7:30 p.m.
Monday, April 25, 2016 7:00 a.m.-6:00 p.m.
Tuesday, April 26, 2016 7:30 a.m.-4:00 p.m.
Wednesday, April 27, 2016 7:30 a.m.-12:30 p.m.

Program Changes

All program changes or cancellations will be reflected in the Guidebook mobile app.

Name Badge

Your name badge is your entrance ticket to all sessions, poster sessions, and social events. Participants are asked to wear name badges at all times.

Meals and Refreshment Breaks

We will provide refreshment breaks throughout the conference. These items are available in the Meridian Foyer & Summit. We will also provide the following meals:

Sunday, April 24, 2016 Opening reception and networking hors d'oeuvres
Monday, April 25, 2016 Continental breakfast, lunch, social hour and dinner
Tuesday, April 26, 2016 Continental breakfast, lunch
Wednesday, April 27, 2016 Continental breakfast, lunch

Poster Session

The poster session is scheduled from 4:00-5:45 p.m. on Monday, April 25, in the Summit and Meridian Foyer at The Commons Hotel. Each poster presenter will have a 4x4 foot area for the poster. Posters may be attached by using t-pins, masking and clear packing tape. Pins and tape will be provided. The posters are numbered, and each board space includes a sign with the poster number. A list of all posters is included in the program in this book.

Posters can be set up anytime beginning at 7:00 a.m. on Monday, April 25, 2016, and should be in place by 10:30 a.m., Monday. Posters will remain on display for the entire poster session, and through Tuesday afternoon. Presenters must have all posters removed by 5:00 p.m. on Tuesday, April 26, 2016. Posters not removed by 5:30 p.m. on Tuesday will be recycled.

Continuing Education Units

This conference and workshops will provide continuing education credit hours for veterinarians. The University of Minnesota will award the following CE hours for full event attendance for veterinarians:

Scientific conference (Sunday-Tuesday): 16.2 hours
Workshop 1 - Team Science: 6.9 hours
Workshop 2 - Risk-Global Food Security: 8.5 hours
Workshop 3 - Big Data: 6.9 hours
Satellite symposium 4 - Epilepsy: 6.4 hours

Cell Phones, Mobile, and Tablet Devices

Please mute your cell phones, mobile and tablet devices while in all meeting rooms. Also, please turn the sound on your laptops to mute.

Time Zone

The time zone in Minneapolis is Central Daylight Time (CST).

Internet Access Instructions

PASSWORD: iCOMOS

Open wireless networks on your device.
Select Commons Convention network.
Open a web browser. This will take you to The Commons log in page.
Input Password: iCOMOS
Launch a new webpage.

Mobile App

iCOMOS has gone mobile and utilizes the Guidebook mobile application! Attendees can plan their days with a personalized schedule, view program and workshop information, get speaker details, access venue maps, add conference photos, and glimpse at country flags.

The app is compatible with iPhone, iPad, iPod Touch, and Android devices. Windows Phone 7 and Blackberry users can access the same information via a mobile site: http://guidebook.com/guide/60678

To get the guide, for iOS and Android users: Download ‘Guidebook‘ from the Apple App Store or the Android Marketplace. Scan the following image with your mobile phone’s QR Code reader.

Social Media

#iCOMOS2016

We invite you to join the conversation about the 2nd International Conference on One Medicine One Science by tweeting or posting updates to your Twitter, LinkedIn, and Facebook pages. The hashtag is #icomos2016: include this hashtag in your tweets/posts to continue the conference "backchannel"; you may also search Twitter for this hashtag to view related tweets. These social media efforts will help participants network and meet new colleagues prior to and during the symposium.

Watch for future iCOMOS meetings!

2017 in Thailand (dates tbd)
April 22-25, 2018 in Minneapolis, Minnesota

Safety/Medical Information

Campus Safety Information
University Police (non-emergency) 612-624-2677
Free campus escort service 612-624-9255
Motorist assistance 612-626-7275

Medical Care

Emergency medical care: 911

Boynton Health Service: 612-625-8400
University of Minnesota Minneapolis campus
410 Church Street SE
Minneapolis, MN 55455

Fairview-University Hospital: 612-273-3000
University of Minnesota Minneapolis campus
500 Harvard Street SE
Minneapolis, MN 55455

For assistance while you are in the hotel, please dial “0” from a house telephone.

Recap and Highlights of the Inaugural International Conference on One Medicine One Science (iCOMOS 2014)

The inaugural iCOMOS 2014 in Minneapolis, MN, USA, from April 27 to 30, 2014, welcomed over 300 participants from throughout the U.S. and 13 countries to learn about and discuss critical global One Health scientific issues in animals and humans. The conference was focused around four topics, including the science of disease recognition at the human-animal-environment interface; evolving solutions to the changing infectious disease horizon; the grand challenges of food production; and the grand challenges of food safety. The Science behind One Health was further explored in heavily attended workshops on grantsmanship in a changing environment; the reality of One Health partnerships on the ground; a vision for safe food systems from local to global, and the question if it is possible to predict the next outbreak threat.

iCOMOS 2014 provided an interdisciplinary forum for exchange of knowledge in basic and applied sciences and medicine that included Nobel Laureate Peter Agre, the leadership from NIH, NIFA, USDA, USAID, Bill & Melinda Gates Foundation, and the United Nations, as well as scientists, health professionals, key sponsors and policy experts from various national and international organizations. It was revealed that relevant case studies of monkeypox, influenza A, tuberculosis and HIV can be used to guide strategies for anticipating and responding to new disease threats such as Ebola, Chickungunya and influenza viruses, as well as improve programs to control existing zoonotic diseases, including tuberculosis. The wicked problem of safely feeding the world while preserving the environment and avoiding divisive issues such as antibiotic resistance in animals and humans was shown to benefit from cooperative scientific problem solving. Food poisoning outbreaks resulting from Salmonella growing in vegetables showed the need for knowledge of pathogen evolution and adaptation in developing appropriate countermeasures for prevention and policy development. Similarly, pesticide use for efficient crop production must take into consideration bee population declines that threaten availability of two-thirds of human foods that are dependent on pollination.

Speakers weighed in on the objective merits of competing health priorities and identifying gaps in knowledge that threaten health security. Opportunities for major public policy implications were discussed and decided with an emphasis on an underlying platform of facts. There was general consensus that characterizing the health consequences of interactions among animals, humans and the environment in the face of climatic change, environmental disturbance, and expanding human populations is a critical global challenge in today's world.

Meeting participants left the Twin Cities with a renewed appreciation for the commonalities in human and animal health, and the underlying principles shared by animals and humans. Importantly, the critical role of environment, shared by all species, means that health and development policies meant to achieve individual goals will have broad impacts, so multidisciplinary discussion and analysis is critical to maintaining health of humans, animals and the environment. It was concluded that solutions to global One Health challenges can best emerge through convergence of expert views at iCOMOS and related colloquia and the communication of these views to the society at large.

Meeting themes and outcomes have been detailed in the following publications:

Advancing One Health policy and implementation through the concept of One Medicine One Science. Cardona, C., D.A. Travis, K. Berger, G. Coat, S. Kennedy, C.J. Steer, M.P. Murtaugh, and P. Sriramarao. *Glob Adv Health Med*. 4:50-54, 2015.

One Medicine One Science and policy. Sriramarao, P., M.P. Murtaugh, K. Berger, D. Travis, S. Kennedy, C.J. Steer, and C. Cardona. *Science* 347:242. 2015.

One Medicine One Science: a framework for exploring challenges at the intersection of animals, humans and the environment. Travis, D.A., P. Sriramarao, C. Cardona, C.J. Steer, S. Kennedy, S. Sreevatsan, and M.P. Murtaugh. *Ann. N.Y. Acad. Sci*. 1334:26–44, 2014.

CONFERENCE COMMITTEES

EXECUTIVE COMMITTEE

Brian Herman, PhD, Vice-President for Research, University of Minnesota
Brooks Jackson, MD, MBA, Vice-President for Health Sciences and Dean of the Medical School, University of Minnesota
Srirama Rao, PhD, Associate Dean for Research, College of Veterinary Medicine, University of Minnesota
Trevor Ames, DVM, Dean, College of Veterinary Medicine, University of Minnesota

ORGANIZING COMMITTEE

Srirama Rao, PhD Co-Chair, Professor and Associate Dean for Research, Department of Veterinary and Biomedical Sciences, College of Veterinary Medicine, and Department of Medicine, Medical School, University of Minnesota
Michael Murtaugh, PhD Co-Chair, Professor, Department of Veterinary and Biomedical Sciences, College of Veterinary Medicine, and Institute for Molecular Virology, University of Minnesota
Andres Perez, DVM, PhD, Associate Professor, Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota
Carol Cardona, DVM, PhD, Ben Pomeroy Chair in Avian Medicine, Department of Veterinary and Biomedical Sciences, College of Veterinary Medicine, University of Minnesota
Claudia Neuhauser, PhD, Director, Informatics Institute, and Professor, Department of Ecology, Evolution, and Behavior, College of Biological Sciences, University of Minnesota
Clifford J. Steer, MD, Associate Dean for Faculty Affairs; Professor of Medicine and Genetics, Cell Biology & Development; Director, Molecular Gastroenterology Program; and Director, Physician-Scientist Training Program, Medical School, University of Minnesota
Hortencia Hornbeak, PhD, Associate Director of Scientific Review and Policy, National Institute of Allergy and Infectious Diseases, National Institutes of Health
Lewis Gilbert, PhD, Associate Director, Institute on the Environment, University of Minnesota
Ned Patterson, DVM, PhD, Associate Professor, Veterinary Clinical Sciences, College of Veterinary Medicine, University of Minnesota
Peter Jackson, PhD, Chief, AIDS Research Review Branch, Scientific Review Program, Division of Extramural Activities, National Institute of Allergy and Infectious Diseases, National Institutes of Health
Shaun Kennedy, BS, Associate Professor, Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota
Srinand Sreevatsan, BVSc., MPH, PhD, Professor, Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota
Amy McMillen, BA, Partnerships and Outreach Coordinator, Liaison Office for North America, Food and Agriculture Organization of the United Nations (FAO)
Ajay Markanday, MS, Director, Liaison Office for North America, Food and Agriculture Organization of the United Nations (FAO)

ADMINISTRATIVE COMMITTEE

Eugene Anderson, PhD, Program Director, College of Continuing Education, University of Minnesota
Laurie Brickley, Director of Communications, College of Veterinary Medicine, University of Minnesota
Paula Buchner, Chief Operating Officer, College of Veterinary Medicine, University of Minnesota
Nathan Pasch, Graphic Designer/Webmaster, College of Veterinary Medicine, University of Minnesota
Jessica Raines-Jones, Project Specialist, Office of the Associate Dean for Research, College of Veterinary Medicine, University of Minnesota
Kersten Warren, Research Administrator, Office of the Associate Dean for Research, College of Veterinary Medicine, University of Minnesota
Marie Villano, Program Administrative Specialist, College of Continuing Education, University of Minnesota
Helen Weber, Program Associate, College of Continuing Education, University of Minnesota

CONFERENCE SCIENTIFIC PROGRAM

Sunday, April 24, 2016

3:00 p.m.	Registration opens	**Mezzanine Level**
5:00−8:45	**Opening Session**	**Meridian Ballroom**
5:00-5:10	**Conference Welcome and Introductions** *Srirama Rao,* Chair, iCOMOS Organizing Committee, University of Minnesota	
5:10−5:15	**University Welcome** *Brian Herman*, Vice President for Research, University of Minnesota	
5:15-5:45	**Turning Science into Policy; Minimizing Chaos and Maximizing Impact** *Michael Osterholm*, Regent's Professor, University of Minnesota	
5:45−7:15	**Panel Vignettes and Discussion: Global Challenges at the Interface of Animals, Humans, and the Environment, the Role of Science and Medicine in the Pursuit of One Health** Moderator: *Kerri Miller*, Minnesota Public Radio Session Panelists: *C. Arden Pope*, Professor*,* Brigham Young University *Sally Rockey*, Director*,* Foundation for Food and Agriculture Research (formerly at the National Institutes of Health) *Liz Neeley*, Executive Director, The Story Collider *Adam Berger*, Senior Fellow, US Department of Health and Human Services *Andy Morse*, Professor, University of Liverpool, England	
7:15−8:45	Opening Reception and Networking	**Meridian Foyer**

Monday, April 25, 2016
Session I: Role of Science in Solving Emerging Health Threats

7:00−8:00 a.m.	Continental Breakfast	**Meridian Foyer**
8:00−8:15	**Welcome to the Conference** *Eric Kaler*, President, University of Minnesota	**Meridian Ballroom**
8:15−8:20	**Welcome to the Scientific Session Day 1** *Brooks Jackson*, Vice President, Academic Health Sciences, University of Minnesota	
8:20−12:00 p.m.	**Session I: Topic 1: Balancing Personalized/Precision Medicine and Public Health in a Changing Environment**	
8:20-8:30	Session Chairs: *Ned Patterson and Clifford Steer*, University of Minnesota	

Session summary: The biological revolution linking genotypic variation to health and disease has created vast potential for tending to the health of individuals based on personal health risks, drug sensitivities, nutritional needs, and yet-to-be-discovered variables. Individualized medicine

requires large investments and resource commitment to address individual needs. Public health, based on scientific knowledge of generalized health risks and rewards, requires investments and commitments to population and health impacts of local and global environments. Given a fixed set of resources, maximizing the potential of both is challenging at best. Here we highlight scientific complexities of individual and population health in animals and humans as impacted by environment.

8:30-9:00 **Ethical and Legal Challenges of Translating Genomic Research into Public Health Benefit**
Susan Wolf, Professor, University of Minnesota

9:00−9:30 **Ethics of Personalized Medicine versus Public Health**
Art Caplan, Professor, New York University

9:30−10:00 **The Science Behind Personalized Medicine: Mapping Complex Traits and Diseases**
Elaine Ostrander, Distinguished Investigator, National Institutes of Health

10:00-10:30 Networking Break

10:30−11:00 **Vaccines - Opportunities and Challenges in Meeting Global Expectations**
Mark Feinberg, President, International AIDS Vaccine Initiative

11:00−11:30 **President's Precision Medicine Initiative-Health and Human Services Overview**
Adam Berger, Senior Fellow, US Department of Health and Human Services

11:30−noon **Panel Discussion**

Noon−1:00 p.m. Lunch **Pinnacle Ballroom**

1:00−4:00 **Session I: Topic 2: Air Quality, Environmental Exposures and Health**
Meridian Ballroom

1:00-1:05 Session Chairs: *Steve Hecht* and *Anne Joseph*, University of Minnesota
Session summary: The health of air-breathers is inextricably linked to the quality and composition of air. Human, animal, and plant health is therefore linked in the need to effectively manage air quality. To know what this means, it is essential to unravel the impact of human activities, animal metabolism, and plant biology on air quality, as well as the detrimental impact of specific air constituents on health. Here we will examine what air is in today's world, the science behind major air-related diseases and overall health, and the human and economic costs resulting from these diseases.

1:05−1:35 **Air Pollution, Health and Policy**
C. Arden Pope, Professor, Brigham Young University

1:35−2:05 **Air Pollution and Environmental Justice: Can We Address Both?**
Julian Marshall, Professor, University of Washington

2:05−2:35 **Household Air Pollution Due to Cooking Practices**
Sumi Mehta, Senior Director, United Nations Foundation

2:35−3:00 Networking Break

3:00−3:30 **Health Effects of Air Pollution**
Paolo Boffetta, Professor, Mount Sinai School of Medicine, New York

3:30-4:00 **Air Pollution and Cancer**
Jonathan Samet, Professor, University of Southern California

4:00−5:45 Poster Presentations **Summit and Meridian Foyer**

6:00−6:30 Social Hour **McNamara Alumni Center**

6:30−7:30 Dinner **McNamara Alumni Center**

7:30−8:15 **Transforming Agriculture and Health: The Foundation for Food and Agriculture Research and the Importance of Public-Private Partnerships**
Introduction: *Karen Hanson*, Senior Vice President for Academic Affairs and Provost, University of Minnesota
Sally Rockey, Executive Director, Foundation for Food and Agriculture Research

Tuesday, April 26, 2016
Session II: Science Informing Public Policy and Economics of Health

7:30−8:25 a.m. Continental Breakfast **Meridian Foyer**

8:00−8:10 **Welcome to Scientific Session Day 2**
Brian Herman, Vice President for Research, University of Minnesota
Meridian Ballroom

8:25−12:00 pm **Session II: Topic 1: Water at the Interface of Health, Economics and Environment**
Session Chairs: *Raj Rajan*, Ecolab; *Jessica Hellman*, University of Minnesota

Session summary: The fundamental need for water of quality and quantity to sustain health becomes increasingly difficult to fulfill as populations grow, human land use expands, and water patterns shift due to climate change. The problem facing policymakers is compounded by the fact that human, animal, and environmental health must be considered in making water policy but each are measured by different standards. Economic and social values vary across the globe and tend to compound rather than simplify issues at the local up to global levels. All of this means data to adequately inform policy is often hard to come by, and putting one use of water above and out of balance with all the other uses has already led to unintended and undesirable consequences.

8:10-8:40 **Status and Challenges of Environment and Health in China**
Yinlong Jin, Professor, China Center for Disease Control

8:40−9:10 **Environmental Pollution Impacts on Fish and Humans**
Levent Bat, Professor, Sinop University, Turkey

9:10−9:40 **Pharmaceutical Waste in Water: Examples from Sweden of Trying to Reduce Emissions from Use and Manufacturing**
Marie-Louise Ovesjö, Senior Consultant, Stockholm County Council, Sweden

9:40-10:20 Networking Break

10:20−10:50 **Influence of a Natural Water Flow System in the Epidemiology of Anthrax at a Human-Wildlife-Livestock Interface: A Case of Queen Elizabeth National Park**
Margaret Driciru, Principal Warden/Wildlife Veterinarian Uganda Wildlife Authority, Uganda

10:50−11:20 **The Use of Climate Models in the Prediction of Vector Borne Diseases**
Andy Morse, Professor, University of Liverpool, England

11:20−11:50 **Water—The Greatest Threat to Achieving Global Food and Nutrition Security**
Ajay Markanday, Director FAO Liaison Office, North America

11:50-12:00 **Break and Lunch Set-up**

12:00−1:30 p.m. **Lunch and Featured Speaker** **Meridian Ballroom**

To the Ends of the Earth: Initiatives To Not Only Educate but Reshape How People and Communities Think About Water
Ann Bancroft, Educator, Explorer and Team Leader, Bancroft Arnesen Explore

1:30-5:00 **Session II: Topic 2: Role of Science in Formulation of Local and Global Health Policy**
Session Chairs: *Ajay Markanday*, Food and Agricultural Organization; *Shaun Kennedy*, Food Science Institute/University of Minnesota

Session summary: Government regulation in the interest of health in the U.S. began around 1848 to ensure quality of imported drug products, with the role of animal health in protecting human health firmly established 1862 with the early Department of Agriculture. Publication of Silent Spring in 1962 dramatically raised awareness of the impact of environment on human and animal health. Today, industrial expansion in China and India, etc., reminds us of the interaction of environment and health. Health policies that establish national and international social priorities are often influenced more by near-term economics and public emotion than by science.

Unfortunately, compartmentalized science often misses crucial interactions, and science often is not effectively introduced into the policy debate. To ensure that science serves its appropriate role in the development of enlightened public policies for sustaining human, animal, and environmental health, the science needs to be integrated and articulated so that it is impartial, useful, and accepted

1:35-2:05 **Role of Science in Water Management Policy Development**
Deborah Swackhamer, Professor, University of Minnesota

2:05−2:35 **Storytelling for Effective Science Communication and Policy**
Liz Neeley, Executive Director, The Story Collider

2:35−3:05 **Animal Welfare: A Case Study in Translating Science into Policy**
David Fraser, Professor, University of British Columbia, Canada

3:05-3:30 Networking Break

3:30−4:00 **Linking Science and Policy: The Foodborne Disease Consideration**
Jorgen Schlundt, Professor, Nanyang Technological University, Singapore

4:00−4:30 **Minnesota Effect and Evidence-Based Policy in Global Health**
Juhwan Oh, Professor, *S*eoul National University*,* South Korea

4:30-5:00 **The Successes and Challenges of Bringing Science to Global Food Safety Policy through CODEX Alimentarius**

Samuel Godefroy, Professor, University Laval, Quebec, Canada; Senior Food Regulatory Advisor, United Nations Industrial Development Organization

5:00-5:10 **Closing Remarks and Perspective for the Future**
Michael Murtaugh, Co-Chair, Organizing Committee, University of Minnesota

5:10-5:15 **Conference Closing**
Trevor Ames, Dean, College of Veterinary Medicine, University of Minnesota

Workshop One: Tomorrow's Health Science Workforce: Physician-Scientists and Team Science
Coordinators: *Clifford Steer,* University of Minnesota and *Hortencia Hornbeak, Peter Jackson*, National Institutes of Health

Overview: Gaps in our knowledge about complex biomedical and environmental problems limit our ability to develop durable solutions in the spirit of OMOS. Teams of experts who understand the OMOS vision are critical for developing these durable solutions.

Physician Scientists trained in a broad, nonlinear, cross-disciplinary manner are, and will be, essential members of those teams.

Program: **Meridian Ballroom 3**

8:30–8:45 a.m. **Introduction: Workshop Theme**
Clifford J. Steer, University of Minnesota

8:45−9:00 **Physician Scientists of the Future**
Brooks Jackson, University of Minnesota

9:00-9:15 **The Minnesota Experience**
Erik J. Peterson, University of Minnesota

9:15−9:45 **Team Science Approaches to Bring the Bench and Bedside Closer**
Michael O'Rourke, Michigan State University

9:45−10:00 Break

10:00–11:30 **Panel Discussion—Challenges to Physician-Scientist Development and the Practice of Team Science**
Moderator: *Gregory Vercellotti,* University of Minnesota

Panelists:
Jaime Modiano, University of Minnesota
Peter Igarashi, University of Minnesota
Connie Delaney, University of Minnesota
Mark Herzberg, University of Minnesota
Bin He, University of Minnesota

11:30−noon **Creating a Cohesive Workforce Model Across All of the Health Professions: The Intersection of Physician-Scientists and Team Science**
Lauren Trepanier, University of Wisconsin

Noon−1:30 p.m. Lunch **Pinnacle Ballroom**

1:30−3:30 **Team Science Tools for Developing Effective Teams of Physician-Scientist and Other Experts**
Moderators: *Hortencia Hornbeak and Peter Jackson*, National Institutes of Health, National Institute of Allergy and Infectious Diseases

- 1:30 Identifying potential team members—Open-source software to identify the institutional workforce, their capabilities and activities.
  Griffin Weber, Harvard University

- 2:00 Breaking the Ice—Tools for Facilitating Understanding Across Diverse Experts
  Michael O'Rourke, Michigan State University

- 2:30 Facilitating Collaboration While Protecting Your Interests—Team Science Planning Tools
  Gaetano Lotrecchiano, George Washington University

- 3:00 Federal Funding Sources for Physician-Scientist Training
  Peter Jackson, National Institutes of Health, National Institute of Allergy and Infectious Diseases

- 3:15 People Awards/Crowdsourcing Nontraditional Resources for Physician-Scientist
  Hortencia Hornbeak, National Institutes of Health, National Institute of Allergy and Infectious Diseases

3:30 **Wrap Up**
Gregory Vercellotti, University of Minnesota

4:00−6:00 **Individual Short meetings with Program Speakers and Organizers**

Workshop Two: **One Health One Policy:**
Managing Risk Enroute to Global Food Security

Coordinators: *Shaun Kennedy,* University of Minnesota; *Ajay Markanday,* Food and Agricultural Organization of the United Nations

Overview: CODEX Alimentarius and OIE are examples of countries coming together to establish global guidelines and scientific guidance to protect human and animal health. While very successful, they do not always achieve their goal of aligning national policies. In order to better achieve the goals of these and other global efforts to protect health through policy, there is a need to translate across these scientific and social drivers so that there is greater transparency in the trade-offs that come with the various choices. This workshop will initiate a framework for comparing across risk management paradigms that are grounded in science but end in different outcomes, each of which has positives and negatives, with a focus on the impact on least developed countries.

Program:

8:00−8:15 a.m. **Introduction and Logistics** **Meridian Ballroom 4**
Shaun Kennedy, University of Minnesota

8:15−8:30 **Opening Comments**
Ajay Markanday, Food and Agricultural Organization of the United Nations

8:30−9:15 **The Importance of Global Standards**
Samuel Godefroy, Université Laval, Canada

9:15−10:15 **Panel Discussion: What are the challenges in applying "One Medicine, One Science" to global standards?**

Developing global food safety and animal health guidelines, standards and scientific guidance are challenging processes given the need for consensus, differing national perspectives, data availability, and the effort required. As a result, the primary risk assessments tend to be informed more by developed world data and studies and less by the developing world. In addition, they are more focused on the specific risk and not the totality of the impacts any recommendations may have beyond that risk. Through discussion, the challenges that FAO and CODEX face in applying "One Medicine, One Science" will be explored.

Panelists:
Marsha Echols, Howard University
Samuel Godefroy, Université Laval, Canada
Markus Lipp, Food and Agricultural Organization of the United Nations
Jorgen Schlundt, Nanyang University, Singapore
Tongkorn Meeyam, Chiang Mai University, Thailand

10:15−10:35 Break

10:35−11:00 **Animal Health and Global Standards**
*Juan Lubroth***,** Food and Agricultural Organization of the United Nations

11:00−12:30 p.m. **How do Differing Risk Management Paradigms Make it Difficult to Align Around "One Medicine, One Science" Across Countries?**
Opening comments: *Ajay Markanday,* Food and Agricultural Organization of the

	Risk assessments focused on the specific risk within defined systems underpin global guidelines and standards. Application to national policies is in the context of other priorities and the uniqueness of the national food and agriculture systems. All new food and agriculture systems and technologies have some level of risk. Nations evaluate risks and effect policies based on their own paradigms, with genetically modified organisms, GMOs, being the highest profile example. This session will explore examples of the risk paradigm differences that drive national policy development..
12:30−1:30	**Lunch Presentation**: **The Challenges of Operating Globally Across Differing National Policies, an Industry Perspective** *Joe Scimeca*, Cargill
1:30−2:30	**Strategies for Bridging Across Risk Paradigm Differences** Small group discussions Using either 1−2 examples from the prior session or others more familiar to the small group, explore strategies that could enhance understanding of how the differing risk paradigms impact policy positions and global guidelines/standards.
2:30−3:00	**Reporting Back: Highlights from the Small Group Discussions**
3:00−3:20	Break
3:20−4:20	**Establishing Frameworks for One Medicine, One Science Policies Across Risk Management Paradigms** Small Group Discussions Given that a common single global risk management paradigm that addresses all national food and agriculture systems, stages of development, and priorities is unlikely, a framework that compares across the most common paradigms and makes the trade-offs more transparent may be more realistic. The options will be explored in separate groups on animal health and food safety frameworks.
4:20−4:45	**Reporting Back, Key Elements of One Medicine, One Science Based Animal Health and Food Safety Frameworks**
4:45−5:00	**Closing Comments and Next Steps Toward One Medicine, One Science Based Frameworks Supporting Global Policies** *Samuel Godefroy,* Université Laval, Canada *Shaun Kennedy,* University of Minnesota

Workshop Three: Big Data, the Language and Future of One Medicine One Science

Coordinators: *Andres Perez, Claudia Neuhauser, Srinand Sreevatsan, Greg Cuomo,* University of Minnesota

Overview: There is an urgent need for computational tools to mine the enormous quantity and complexity of data available to support health and food production, to enhance multidisciplinary team efficiencies, and to provide Science-based policy inputs. This workshop will set the stage for discussions around the challenges of development of biocomputational teams and tools tools applied in the analysis of big data in human, plant, and animal health, and their contribution to improve the efficiency of our food production systems.

Program:

8:30–8:45 a.m. **Introduction** **Meridian Ballroom 2**
Andres Perez, University of Minnesota
Sri Sreevatsan, University of Minnesota

8:45–9:45 **Keynote: Setting the Stage**
High Performance Computing Focused on Life Sciences
Gabriel Broner, Vice President and General Manager, Higher Performance Computing, SGI

9:45–10:00 Break

Session One: **Science in Action: Big Data Methods and Approaches**
Moderator: *Sri Sreevatsan,* University of Minnesota

10:00−10:30 **Molecules to Populations: Applications of Bayesian Approaches in Phylodynamics**
Rowland Kao, University of Glasgow

10:30−11:00 **Modeling Airborne Spread of Pests and Pathogens-A Big Data Approach**
Peter Durr, The Commonwealth Scientific and Industrial Research Organization, Australia

11:00−11:30 **Microbiomes and Health: Big Data Challenges**
Dan Knights, University of Minnesota

11:30−Noon **Questions From the Floor and Discussion**
Rowland Kao
Peter Durr
Dan Knights

Noon–1:30 p.m. Lunch **Pinnacle Ballroom**

Session Two: **Science in Action: Big Data Approaches on Food Systems**
Moderator: *Greg Cuomo,* University of Minnesota

1:30−2:00 **Animal Health: Big Data-Related Research**
Molly McCue, University of Minnesota

2:00−2:30 **Plant Health and Production: Big Data-Related Research at the UMN CFANS**
Phil Pardey, University of Minnesota

2:30−3:00 **Translating Big Data into Improved Crop Performance in Agricultural Systems**
Candice Hirsch, University of Minnesota

3:00−3:15 Break

3:15−4:15 **Round Table Discussion**

Topic: Big Data, One Health, Education, Capacity Building, and Development. Focused on Africa, Southeast Asia, and Latin America
Moderator: *Andres Perez,* University of Minnesota

Panel members:
Christiane Wolff, World Trade Organization (WTO)
Paula Caceres, World Animal Health Organization (OIE)
Marcelo D'Agostino and Victor del Rio, Pan American Health Organization (PAHO)
Adam Berger, US Department of Health and Human Services

The moderator introduces the topic (5 minutes). Panel members are given 5−10 minutes to provide remarks from their institutional perspectives on the keynote presentation/s and then take questions from the floor.

4:15−4:30 **Final Remarks**

Andres Perez, University of Minnesota
Sri Sreevatsan, University of Minnesota

Satellite Workshop Four: Canine and Human Epilepsy, a Model for Bidirectional Benefit
Coordinator: *Ned Patterson,* University of Minnesota
Co-sponsors: University of Minnesota, Mayo Clinic, National Institute of Health, Minnesota Epilepsy Foundation

Overview: This workshop will look at the current state and upcoming hope for the improved therapy of both human and canine epilepsy where in both species 30% of patients are refractory to two or more medications. Presentations will include promising novel drug and alternative therapies (including cannabidiol) and devices for epilepsy, both of which have and can be tested in dogs with naturally occurring epilepsy. The outcome will be two white papers with recommendations for future directions of epilepsy research including method for increased funding for and for improved patient support.

Program:

9:00−9:10 a.m. **Introduction** **Meridian Ballroom 1**
Ned Patterson, University of Minnesota

9:10−9:20 **Family Perspective**
Audrey Colasanti

9:20−9:30 **Dog Owner Perspective**
Eric Brendtro

Session One: Novel Drugs and Future Hopes

9:30−9:50 **Human Perspective**
Mike Rogawski, University of California, Davis

9:50−10:10 **Canine Perspective**
Mike Podell, MedVet Medical & Cancer Center for Pets

10:10−10:40 **Panel Discussion**

Panelists
James Cloyd, University of Minnesota
John Kehne, National Institute of Neurological Disorders and Stroke

10:40−11:00 Break

Session Two: Devices for Epilepsy and Future Hopes

11:00–11:20 **Canine and Human Perspectives**
Kent Leyde, Cascade Medical Devices LLC

11:20−11:40 **Translational Perspectives**
Tim Denison, Medtronic

11:40−12:10 p.m. **Panel Discussion**

Panelists
Tay Netoff, University of Minnesota
Greg Worrell, Mayo Clinic

12:10–1:10 Lunch **Pinnacle Ballroom**

Session Three:	**Cannabidiol for Epilepsy: What Do We Know, What Don't We Know?**
1:10−1:25	**Marijuana and Animals** *Mike Podell,* MedVet Medical & Cancer Center for Pets
1:25−1:40	**Cannabidiol and People with Epilepsy** *Ilo Leppik*, University of Minnesota College of Pharmacy, MINCEP Epilepsy Care
1:40−2:10	**Panel Discussion** *Greg Worrell,* Mayo Clinic *Andrew Bachman*, LeafLine Labs *Laura Bultman*, Minnesota Medical Solutions
2:10–2:30	Break
2:30−3:30	**Round Table Discussions-Research, Patients and Future Directions** *Greg Worrell, James Cloyd, Tay Netoff, John Kehne, Mike Podell*
3:30−3:40	**Patient/Owner Summary**
3:40−3:50	**Research Summary**
3:50−4:00	**Summary and Next Steps** *Ned Patterson, University of Minnesota*

SPEAKERS

Sunday Conference Opening

***Srirama Rao*, PhD: Conference Welcome and Introductions**
Dr. Rao is Professor and Associate Dean for Research in the College of Veterinary Medicine, University of Minnesota. Dr. Rao received his Ph.D. in allergy and immunology from the Indian Institute of Science in Bangalore, India, in 1989, after which he conducted post-doctoral studies at Pharmacia-Experimental Medicine in La Jolla, California. Prior to joining the University of Minnesota in 2007, Dr. Rao was Vice President of Research and Professor and Head of the Division of Vascular Biology at the La Jolla Institute for Molecular Medicine in San Diego, California. He is currently a Professor in the Department of Veterinary and Biomedical Sciences in the College of Veterinary Medicine, with a joint appointment in the Division of Pulmonary Allergy Critical Care & Sleep Medicine at the University of Minnesota Medical School. Dr. Rao's laboratory research focuses on understanding the pathogenesis of allergic inflammation including asthma and food allergy. Dr. Rao is currently the Chair of Council of Research Deans at the University of Minnesota. With his administrative and joint faculty appointment, he seeks to build on the strong interdisciplinary and cutting-edge research focus across the Academic Health Center and rest of the university to promote exciting new collaborative One Health research initiatives at the interface of animals, humans and the environment. Specifically, he leads a transdisciplinary effort of "One Medicine One Science" that aims to advance the Science behind One Health. In this capacity he has been the driving force behind the University of Minnesota's "International Conference on One Medicine One Science (iCOMOS)", a global forum dedicated to (i) communicating the importance of science in solving pressing health issues at the interface of humans, animals and the environment; (ii) facilitating interdisciplinary, international collaborations embracing health, science and economics; and (iii) providing information regarding the public policy development necessary for preserving human and animal health.

***Michael Osterholm*, PhD, MPH: Turning Science into Policy; Minimizing Chaos and Maximizing Impact**
Dr. Osterholm is Regents Professor, McKnight Presidential Endowed Chair in Public Health and Director of the Center for Infectious Disease Research and Policy at the University of Minnesota. He is a member of the National Academy of Medicine, the Council of Foreign Relations, and the National Science Advisory Board on Biosecurity. Previously, Dr. Osterholm was the Minnesota state epidemiologist; his team were leaders in infectious disease epidemiology, with numerous investigations of international importance, calling attention to the changing epidemiology of foodborne diseases, the association of tampons and toxic shock syndrome, hepatitis B transmission in healthcare settings, and HIV infection in healthcare workers. He is an international leader for preparedness before pandemics occur, and on the use of biological agents as catastrophic weapons targeting civilian populations, as detailed in his book, *Living Terrors: What America Needs to Know to Survive the Coming Bioterrorist Catastrophe*. He is the author of more than 315 papers and abstracts and a frequent consultant to the World Health Organization, the National Institutes of Health, the Food and Drug Administration, the Department of Defense, and the CDC. He has received numerous honors for his work, including an honorary doctorate from Luther College; the Pump Handle Award, CSTE; the Charles C. Shepard Science Award, CDC; the Harvey W. Wiley Medal, FDA; the Squibb Award, IDSA; and the Wade Hampton Frost Leadership Award, American Public Health Association. He also has been the recipient of six major research awards from the NIH and the CDC.

***Kerri Miller*: Moderator, Panel Vignettes and Discussion: Global Challenges at the Interface of Animals, Humans, and the Environment, the role of Science and Medicine in the Pursuit of One Health**
Ms. Miller is host of MPR News with Keri Miller, and host of Talking Volumes, a literary series at the Fitzgerald Theater, since 2004. Previously she was a political reporter for KARE11 television in Minneapolis-St. Paul.

***C. Arden Pope III*, PhD: Panel Member**
Dr. Pope is the Mary Lou Fulton Professor of Economics at Brigham Young University and was a Fellow at the Harvard School of Public Health. He has conducted research dealing with various natural resource and environmental issues. His cross-disciplinary research in environmental economics and air pollution epidemiology has resulted in seminal studies on the health effects and costs of air pollution, including key studies of human health effects of short- and long-term air pollution exposure. He is one of the world's most widely cited and recognized experts on the health effects of air pollution. His awards include the Thomas T. Mercer Joint Prize from the American Association for Aerosol Research and the International Society for Aerosols in Medicine, the Utah Governor's Medal for Science & Technology, Honorary Fellow of the American College of Chest Physicians, and International Society for Environmental Epidemiology Best Environmental Epidemiology Paper Award.

***Sally Rockey*, PhD: Panel Member**
Dr. Rockey is the inaugural Executive Director, Foundation for Food and Agriculture Research, USDA, starting September 2015. Previously, Dr. Rockey was a leader in Federal research, overseeing the operations of extramural programs in both agriculture and biomedicine. She spent 19 years with the U.S. Department of Agriculture in the Cooperative State Research, Education, and Extension Service as head of the competitive grants program, and later as the Chief Information Officer. She then served 11 years with the National Institutes of Health. As Deputy Director for Extramural Research, Dr. Rockey oversaw the operations of the largest Federal extramural research program and led groundbreaking initiatives and activities that have and will have a lasting positive impact on the research community. She has devoted her career to improving people's lives through research and will continue her mission by seeing FFAR become an essential component of the scientific enterprise.

***Liz Neeley*, MA: Panel Member**
Liz Neeley is the Executive Director of The Story Collider, which is dedicated to producing true, personal stories about science. She is a member of the Advisory Board to the CommsLab at MIT and has spent the past decade helping scientists tell more compelling stories about their work. She was previously the Assistant Director of Science Outreach for COMPASS, where she led media and social media trainings for researchers around the country. Before COMPASS, she worked in Fiji and Papua New Guinea, helping local scientists share their knowledge of coral reefs and conservation. She is active in international science policy around the trade of deep-sea corals and a related high-fashion campaign with Tiffany & Co. Her thinking is influenced by data-driven communication design, social network analysis, and her graduate research at Boston University on the evolution of vision and color patterns in tropical reef fishes.

***Adam Berger*, PhD: US President's Precision Medicine Initiative—HHS Overview**
Dr. Berger is a Senior Fellow in the Immediate Office of the Secretary of Health and Human Services. His primary interests focus on policy issues relating to translational medicine, including the development of drug, diagnostic, and clinical and public health applications. Dr. Berger has facilitated numerous public policy discussions and reports such as Genome-Based Diagnostics: Clarifying a Pathway to Clinical Use; Integrating Large-Scale Genomic Information into Clinical Practice; Genome-Based Therapeutics: Targeted Drug Discovery and Development; and The Value of Genetic and Genomic Technologies. Dr. Berger's scientific background is in biochemistry, cell and molecular biology, and molecular genetics. He is the recipient of the NIH Fellows Award for Research Excellence and a Ruth L. Kirschstein National Research Service Award.

***Andy Morse*, PhD: The Use of Climate Models in the Prediction of Vector Borne Diseases**
Dr. Morse is Professor of Climate Impacts, University of Liverpool, England. He works on applying current weather forecasts and climate projections information for humanitarian well being through the use of application models and methodologies. This is achieved through research and teaching. He is a member of the SSC of the Earth System Science Partnership's (ESSP) Joint Project on Global Environmental Change and Human Health and the World Climate Research Programme's

(WCRP) Working Group on Seasonal to Interannual Prediction (WGSIP), and is attached to the NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, University of Liverpool. He is a leader in quantitative climate and weather modeling to forecast disease patterns, including malaria, human plague, Japanese encephalitis, and Rift Valley Fever virus.
DAY 1: Role of Science in Solving Emerging Health Threats

***Eric Kaler*, PhD: Welcome to the Conference**
Eric Kaler is President of the University of Minnesota. As President since 2011, he has focused on core priorities of academic excellence, access for qualified students, diversity, stewardship of tuition and public dollars, a world-class research enterprise that aligns with the needs of the state of Minnesota and its industries, and a deep commitment to public engagement and outreach, locally and globally. He pioneered an innovative research partnership with the state of Minnesota, known as MnDRIVE, and greatly enhanced international collaborations and programs. Previously, he served as provost and senior vice president for academic affairs at Stony Brook University, New York, was dean of the University of Delaware's College of Engineering, and taught at the University of Washington. Dr. Kaler is one of the nation's foremost experts on "complex fluids," which have applications in drug delivery, food processing, pharmaceuticals, and manufacturing. He has been elected to the American Academy of Arts and Sciences for his work as a chemical engineer and as a higher education administrator, to the National Academy of Engineering, is a Charter Fellow of the National Academy of Inventors, and chairs the U.S. Department of Homeland Security Academic Advisory Council. He received the PhD degree in Chemical Engineering from the University of Minnesota.

SESSION TOPIC 1: Balancing Personalized/Precision Medicine and Public Health in a Changing Environment

Clifford J. Steer, MD: Session Co-Moderator
Dr. Steer is Associate Dean for Faculty Affairs at the University of Minnesota Medical School. He also is Professor of Medicine, Director of the Physician-Scientist Training Program, and holds joint appointments in the Department of Genetics, Cell Biology and Development, and in the Stem Cell Institute. His research program uses the Sleeping Beauty transposon system as a gene therapy vector to investigate liver, bone marrow and brain disorders. Another area of research is the use of ursodeoxycholic acid (UDCA), a hydrophilic bile acid, as a potent antiapoptotic agent to treat transgenic models of Huntington's disease and retinitis pigmentosa as well as acute stroke, spinal cord injury, myocardial infarction, and acute renal failure. Steer's lab also is actively characterizing the role of microRNAs in gene regulation for a number of different target organs and stem cell populations. In particular, they have identified specific microRNAs that may be involved in the cancer progression of colon polyps; as well as their role in the regenerating liver. The studies are both basic and translational in nature. They are also identifying specific microRNAs as biomarkers of disease that can be assayed in blood. Most notably, they have recently discovered a unique nuclear profile of mature microRNAs; and a subset of microRNAs in mitochondria that may act as a rheostat for the control of apoptosis. Dr. Steer received the MD degree and residency training at the University of Minnesota Medical School and conducted research in liver diseases for 14 years at the NIH.

Ned Patterson, DVM, PhD: Session Co-Moderator
Dr. Patterson is an associate professor of clinical veterinary medicine at the University of Minnesota. He is the director of the Canine Epilepsy Research Consortium. Dr. Patterson's instructional areas include genetics, seizure disorders, and molecular medicine. His recent research focuses on understanding and treating epilepsy in dogs and as a model for human epilepsy using novel drugs and novel devices. Additional clinical interests include clinical trials, endocrinology, and comparative medicine. He was awarded both the DVM and PhD degrees from the University of Minnesota.

***Susan Wolf*, JD: Ethical and Legal Challenges of Translating Genomic Research into Public Health Benefit**
Dr. Wolf is McKnight Presidential Professor of Law, Medicine & Public Policy; the Faegre Baker

Daniels Professor of Law; and Professor of Medicine at the University of Minnesota. She is Chair of the University's Consortium on Law and Values in Health, Environment & the Life Sciences; has served as principal investigator on a series of NIH- and Robert Wood Johnson Foundation-funded projects tackling ethical and policy issues raised by genomics; and has published widely in journals including *Science*,*the New England Journal of Medicine*, *JAMA*, and *Genetics in Medicine*.

***Arthur Caplan*, PhD: Ethics of Personalized Medicine Versus Public Health**
Dr. Caplan is the Drs. William F and Virginia Connolly Mitty Professor and founding head of the Division of Bioethics at New York University Langone Medical Center in New York City and the head of the ethics program in the Global Institute for Public Health at NYU. Previously, he created the Center for Bioethics and Department of Medical Ethics at the University of Pennsylvania Perelman School of Medicine and was the Sidney D. Caplan Professor of Bioethics. Earlier, Caplan founded the Center for Biomedical Ethics at the University of Minnesota. Caplan is the author or editor of 32 books and over 600 papers in peer-reviewed journals. His most recent book is *Replacement Parts: The Ethics of Procuring and Replacing Organs in Humans* (Georgetown University Press, 2015).

***Elaine Ostrander*, PhD: The Science behind Personalized Medicine: Mapping Complex Traits and Diseases**
Dr. Ostrander is chief of the Cancer Genetics and Comparative Genomics Branch at the National Human Genome Research Institute of NIH. At the Lawrence Berkeley National Labs, she and collaborators began the canine genome project, and built canine linkage and radiation hybrid maps. Dr. Ostrander's lab works in both human and canine genetics to identify prostate cancer susceptibility genes. She is best known, though, for studies of the domestic dog as a well-phenotyped species with an extensively documented population structure that offers unique opportunities for solving fundamental biological problems. Her lab developed key genomic mapping resources and was the first to map genes for canine epilepsy, Addison's disease, kidney, squamous cell and histiocytic cancers. All are now models for comparable human disorders. She has won multiple awards including the American Cancer Society Junior Faculty Award, Burroughs Welcome Award for Functional Genomics, Asa Mays Award, Lifetime Achievement Awards for both her prostate cancer and canine genetics work, and in the 2013 Genetics Society of America Medal.

***Mark Feinberg*, MD, PhD: Vaccines—Opportunities and Challenges in Meeting Global Expectations**
Dr. Feinberg is President and CEO of the International AIDS Vaccine Initiative (IAVI). He leads a global team of scientists, clinicians and advocates in the effort to ensure development of safe, effective, accessible, preventive HIV vaccines for use throughout the world. Previously he was Chief Public Health and Science Officer for Merck Vaccines, where he helped advance product development, medical and scientific policy efforts for innovative vaccines targeting rotavirus, human papillomavirus (HPV), shingles and HIV. At Merck, he partnered with the Wellcome Trust on the development of new and improved vaccines to address unmet needs in resource-limited countries. Among many previous activities, he served as a Project Officer for the Institute of Medicine's Committee on a National Strategy for AIDS and as Medical Officer in the Office of AIDS Research at the NIH. He served on the Scientific Advisory Boards of the HIV Vaccine Trials Network (HVTN) and the President's Emergency Plan for AIDS Relief (PEPFAR), and the Board of Directors of the African Comprehensive HIV/AIDS Partnerships Program (ACHAP). He is a Fellow of the American College of Physicians, and a member of the Association of American Physicians and the Council on Foreign Relations. He was a Fellow in the Advanced Leadership Initiative at Harvard University from 2012−2014, and is recipient of an Elizabeth Glaser Scientist Award.

***Adam Berger*, PhD: US President's Precision Medicine Initiative—HHS Overview**
Dr. Berger is a Senior Fellow in the Immediate Office of the Secretary of Health and Human Services. His primary interests focus on policy issues relating to translational medicine, including the development of drug, diagnostic, and clinical and public health applications. Dr. Berger has facilitated numerous public policy discussions and reports such as Genome-Based Diagnostics: Clarifying a Pathway to Clinical Use;

Integrating Large-Scale Genomic Information into Clinical Practice; Genome-Based Therapeutics: Targeted Drug Discovery and Development; and The Value of Genetic and Genomic Technologies. Dr. Berger's scientific background is in biochemistry, cell and molecular biology, and molecular genetics. He is the recipient of the NIH Fellows Award for Research Excellence and a Ruth L. Kirschstein National Research Service Award.

SESSION TOPIC 2: Air Quality, Environmental Exposures and Health
Stephen Hecht, PhD: Session Co-Moderator
Dr. Hecht is the Wallin Land Grant Professor of Cancer Prevention in the Department of Laboratory Medicine and Pathology at the University of Minnesota. The Hecht laboratory research goal is to understand mechanisms of metabolic activation and DNA modification by carcinogens in tobacco products and the human environment, and apply this knowledge to cancer prevention. Carcinogenic nitrosamines, polycyclic aromatic hydrocarbons, and aldehydes, their metabolites, and DNA adducts are studied and quantified in mice and humans. Identified biomarkers are applied in collaborative clinical and epidemiologic studies to investigate human carcinogen exposure, metabolism, and susceptibility to cancer. The effects of naturally occurring potentially cancer chemo-preventive compounds on carcinogen metabolism in humans are also investigated. His awards and recognition include election as an American Association for the Advancement of Science Fellow, Editor-in-Chief of Chemical Research in Toxicology, elected Fellow of the American Chemical Society, National Cancer Institute Merit Award, and the Joseph Cullen Award from the American Society of Preventive Oncology. Dr. Hecht earned the PhD degree in Organic Chemistry and obtaine postgraduate training at Massachusetts Institute of Technology.

Anne Joseph, MD, MPH: Session Co-Moderator
Dr. Joseph is the Wexler Professor of Medicine in the Division of General Internal Medicine and the Director of the Applied Clinical Research Program at the University of Minnesota. Her primary research interests are in tobacco control, focused on smoking cessation and smoking reduction interventions for special populations of smokers that experience unique barriers to delivery of tobacco treatment. Dr. Joseph is past president of the Society for Research on Nicotine and Tobacco, Co-Chair of the Medical School Promotion and Tenure Committee and a member of the University of Minnesota Women's Faculty Cabinet. She is a member of the American College of Physicians, and received the Under Secretary of Health for Veterans Affairs Special Service Award. She earned the MD degree from the University of Michigan and the MPH in Epidemiology from the University of Minnesota.

***C. Arden Pope III*, PhD: Air Pollution, Health and Policy**
Dr. Pope is the Mary Lou Fulton Professor of Economics at Brigham Young University and was a Fellow at the Harvard School of Public Health. He has conducted research dealing with various natural resource and environmental issues. His cross-disciplinary research in environmental economics and air pollution epidemiology has resulted in seminal studies on the health effects and costs of air pollution, including key studies of human health effects of short- and long-term air pollution exposure. He is one of the world's most widely cited and recognized experts on the health effects of air pollution. His awards include the Thomas T. Mercer Joint Prize from the American Association for Aerosol Research and the International Society for Aerosols in Medicine, the Utah Governor's Medal for Science & Technology, Honorary Fellow of the American College of Chest Physicians, and International Society for Environmental Epidemiology Best Environmental Epidemiology Paper Award.

***Julian Marshall*, PhD: Air Pollution and Environmental Justice: Can We Address Both?**
Dr. Marshall is Professor of environmental engineering at the University of Washington. Dr. Marshall studies exposure to air pollution. His areas of focus include relationships between urban design and air pollution; pollution and health impacts of alternative transportation fuels (e.g., biofuels) and modes (e.g., walking and biking); and measuring air pollution exposures in low-income countries. He holds courtesy appointments in Mechanical Engineering, Urban and Regional Planning, and Environmental Health Sciences. Dr. Marshall is a member of the Minnesota Population Center, a faculty scholar in the Center for Transportation Studies, and resident fellow at the Institute on the Environment.

He cofounded and codirects the Acara program, a series of classes and incubations on social entrepreneurship for environmental grand challenges in the US and India. He cofounded and codirects the Peace Corps Masters International program in environmental engineering at UMN. Marshall's honors include a McKnight Land-Grant professorship, the Joan M. Daisey Outstanding Young Scientist Award, and the Minnesota Young Civil Engineer of the Year Award. He earned a BSE in Chemical Engineering (High Honors) from Princeton, and a MS and PhD in Energy and Resources from UC Berkeley.

***Sumi Mehta*, MPH, PhD: Household Air Pollution Due to Cooking Practices**
Sumi Mehta is the Senior Director for Research and Evaluation for the Global Alliance for Clean Cookstoves. Prior to joining the Alliance, she was the scientific lead for the Health Effects Institute's Public Health and Air Pollution in Asia Program. She collaborated with Kirk Smith to produce the first estimates of the global burden of disease from HAP. Dr. Mehta has worked on assessing exposures to HAP in India, and evaluating the cost-effectiveness of interventions to promote environmental health. She coauthored chapters on exposure assessment and susceptibility in the latest WHO Global Air Quality Guidelines, and is a member of the WHO Expert Group for developing health-based guidelines for household air pollution.

***Paolo Boffetta*, MD, MPH: Health Effects of Air Pollution**
Dr. Boffetta is Professor of Medicine, Hematology and Medical Oncology, and the Bluhdorn Professor of International Community Medicine at Mount Sinai School of Medicine, New York City. He is an expert in the field of environmental factors for cancer other chronic diseases, where he contributed to the understanding of the role of occupation, environment, alcohol, smoking and nutrition in disease development. Born in Turin, Italy, Dr. Boffetta has been heavily involved in teaching in research at numerous institutions throughout Europe and the US. He has more than 1100 scientific articles published and is identified among the top 20 Italian scientists.

***Jonathan Samet,* MD, MS: Air Pollution and Cancer**
Dr. Samet, a pulmonary physician and epidemiologist, is the Distinguished Professor and Flora L. Thornton Chair for the Department of Preventive Medicine at the Keck School of Medicine, University of Southern California, and Director, USC Institute for Global Health. Previously, he was chair of the Department of Epidemiology of the Johns Hopkins Bloomberg School of Public Health. His research has focused on the health risks of inhaled pollutants—particles and ozone in outdoor air and indoor pollutants including secondhand smoke and radon. He has also investigated the occurrence and causes of cancer and respiratory diseases, emphasizing the risks of active and passive smoking.

Dinner Speaker

***Sally Rockey*, PhD: Transforming Agriculture and Health: The Foundation for Food and Agriculture Research and the Importance of Public-Private Partnerships**
Dr. Rockey is the inaugural Executive Director, Foundation for Food and Agriculture Research, USDA, starting September 2015. Previously, Dr. Rockey was a leader in Federal research, overseeing the operations of the extramural programs in both agriculture and biomedicine. She spent 19 years with the U.S. Department of Agriculture in the Cooperative State Research, Education, and Extension Service as head of the competitive grants program, and later as the Chief Information Officer. She then served 11 years with the National Institutes of Health. As Deputy Director for Extramural Research, Dr. Rockey oversaw the operations of the largest Federal extramural research program and led groundbreaking initiatives and activities that have and will have a lasting positive impact on the research community. She has devoted her career to improving people's lives through research and will continue her mission by seeing FFAR become an essential component of the scientific enterprise.
DAY 2: Science Informing Public Policy and Economics of Health

SESSION TOPIC 3: Water at the Interface of Health, Economics, and Environment

Raj Rajan, PhD: Session Co-Moderator
Dr. Rajan is the RD&E Vice President and Global Sustainability Technical Leader for Ecolab. In his current role, Dr. Rajan helps drive top-line growth for Ecolab and its customers by embedding sustainability thought leadership into the innovation process, environmental metricsin internal operations and sector-level standardization of sustainability metrics. Previously, he was Vice President of Engineering in the Water, Energy and Waste Division, and earlier he was at Ecovation, where he led process engineering focused on sustainable management of residues from the food and beverage industry, including all aspects of waste to renewable energy facilities development and operation. Prior to joining Ecovation, he worked for two decades in research, process engineering and environmental consulting firms, developing biodegrading solutions for challenging industrial wastewaters and bioremediation of legacy impacts from heavy industries. He sits on the board of directors of the non-profit Great River Greening that has worked to secure the legacy of Minnesota land and water through community-based restoration, stewardship and partnerships. He received a Ph.D. in Environmental Engineering from the University of Massachusetts.

Jessica Hellman, PhD: Session Co-Moderator
Dr. Hellmann is Director of the Institute on the Environment and the Russell M. and Elizabeth M. Bennett Chair in Excellence at the University of Minnesota. She provides overall strategic leadership for the Institute, an internationally recognized organization working to solve grand environmental challenges, while promoting interdisciplinary research, teaching and leadership across the university and engaging external partners and stakeholders. Her research focuses on global change ecology and climate adaptation. She was among the first to propose and study ways to reduce the impact of climate change through new techniques in conservation management. Hellmann led an important paradigm shift in ecology and natural resource management by showing that adaptation — living with climate change — is just as crucial to the future of humanity and Earth's ecosystems as slowing and stopping greenhouse gas emissions. Her group has shown that differences in the way populations respond to climate change are a key to predicting and managing their futures. Building upon her seminal findings in ecology, Hellmann has extended her work on climate change adaptation to human systems, including health, infrastructure, food and water. Previously, Hellmann was a professor at the University of Notre Dame directing the Notre Dame Global Adaptation Index, leading the climate change adaptation program at Notre Dame's Environmental Change Initiative, and directing GLOBES, an interdisciplinary graduate training program in environment and society. Hellmann earned the Ph.D. in Biology from Stanford University and served as a postdoctoral fellow at Stanford's Center for International Security and Cooperation and the University of British Columbia's Centre for Biodiversity Research.

***Yinglong Jin*, MD: Status and Challenges of Environment and Health in China**
Dr. Jin is Professor and Chairman of the Environment and Health Committee of the China Society of Health Inspection. He previously served as Director General in the Chinese Center for Disease control and Prevention, Associate Professor and Deputy Director in the Chinese Academy of Preventive Medicine, and as an Officer at the World Health Organization headquarters in Geneva, Switzerland. He is the recipient of numerous awards and honors from the Chinese Ministry of Health, the Chinese Society of Science and Technology, and the State Council of China. He has published extensively in the areas of trace elements and cognitive function, prenatal exposure and health, and climate change and human health. The underlying research has been funded by NIH, World Health Organization, National Basic Research Program of China, United Nations Development Programme, US Environmental Protection Agency, the World Bank, and other national and international organizations. Dr. Jin received the MD degree in Public Health from Shanghai Medical University.

***Levent Bat*, PhD: Environmental Pollution Impacts on Fish and Humans**
Dr. Bat is Professor Doctor of Fisheries, Sinop University, Turkey. He specializes in biology, ecology and pollution of marine environments. His work involves both ecological and ecotoxicological studies of heavy metal pollution impacts in the Black Sea on invertebrates, planktons, and fish. He has coordinated

many international projects supported by NATO Scientific Affairs Linkage Grant, NATO Science for Peace, the Scientific and Technical Research Council of Turkey, and the National Academy of Sciences of Ukraine on bioindicators of ecosystem recovery, ctenophore invader impacts, fishing stock distribution responses to nutritional and environmental forces. He has authored numerous publications of Black Sea Commission and the Turkish Marine Research Foundation.

***Marie-Louise Ovesjö*, MD, PhD: Pharmaceutical Waste in Water: Examples from Sweden of Trying to Reduce Emissions from Use and Manufacturing**
Dr. Ovesjö is senior consultant on Clinical Pharmacology, Stockholm South General Hospital Sweden. She is Chair of the Wise List committee and member of the Drug and Therapeutics Committee in Stockholm. She participates in regional and national groups working to reduce the environmental impact of pharmaceuticals.

***Margaret Driciru*, MS: Influence of a Natural Water Flow System in the Epidemiology of Anthrax at a Human-Wildlife-Livestock Interface: A Case of Queen Elizabeth National Park**
Dr. Driciru is senior warden and wildlife veterinarian at the Uganda Wildlife Authority where she oversees programs for monitoring and reducing threats to wildlife populations and protected areas. Her initial work on lions in Uganda has led to the establishment of a long term lion research program that is investigating changes in lion populations, health and conflicts with communities. Her work is recognized by the African Wildlife Foundation and she has received the Women in Conservation Leadership Program award, which celebrates outstanding women involved in conservation in Uganda. She is an expert in wildlife health and management with an MS from Makerere University, Uganda. Her thesis on the use of lions and leopards by people was featured in the book *The Trouble with Lions: A Glasgow Vet in Africa*.

***Andy Morse*, PhD: The Use of Climate Models in the Prediction of Vector Borne Diseases**
Dr. Morse is Professor of Climate Impacts, University of Liverpool, England. He works on applying current weather forecasts and climate projections information for humanitarian well being through the use of application models and methodologies. This is achieved through research and teaching. He is a member of the SSC of the Earth System Science Partnership's (ESSP) Joint Project on Global Environmental Change and Human Health and the World Climate Research Programme's (WCRP) Working Group on Seasonal to Interannual Prediction (WGSIP), and is attached to the NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, University of Liverpool. He is a leader in quantitative climate and weather modeling to forecast disease patterns, including malaria, human plague, Japanese encephalitis, and Rift Valley Fever virus.

***Ajay Markanday*, MS: Water—The Greatest Threat to Achieving Global Food and Nutrition Security**
Ajay Markanday is Director of the Food and Agriculture Organization (FAO) of the United Nations Liaison Office for North America. Trained in agricultural economics, he has over 33 years of agricultural development experience in Asia, the Pacific and Africa with a variety of international development organizations and research institutions. He joined FAO as an economist in the Economics and Trade Division and was later transferred to the Investment Centre Division as Senior Economist. He served as the FAO Representative in Cambodia, where the Prime Minister and Royal Government of Cambodia honored him in recognition for services to the country by FAO, a first for the UN. He has served as Senior Advisor to the FAO Deputy Director-General Knowledge, as Chief of the Donor Liaison and Resource Mobilization Service, and as FAO Representative to the World Bank in Washington DC.

TUESDAY LUNCH FEATURED SPEAKER

***Ann Bancroft*: To the Ends of the Earth: Initiatives to Not Only Educate but Reshape How People and Communities Think About Water**
Ann Bancroft, a Minnesota-born native, is one of the world's preeminent polar explorers and an internationally recognized leader. Through her various roles as an explorer, educator, sought-after speaker and philanthropist, Ann believes that by sharing stories related to her dreams of outdoor adventure, she

can help inspire a global audience to pursue their individual dreams. Her teamwork and leadership skills have undergone severe tests during her polar expeditions and provided her with opportunities to shatter female stereotypes. The tenacity and courage that define her character have earned Ann worldwide recognition as one of today's most influential role models for women and girls. She has been named among Glamour magazine's "Women of the Year" (2001); featured in the book Remarkable Women of the Twentieth Century (1998); inducted into the National Women's Hall of Fame (1995); named Ms. magazine's "Woman of the Year" (1987); and honored with numerous other awards for her accomplishments. Ann Bancroft is the first known woman in history to cross the ice to both the North and South Poles. Here, she will take the audience from the top to the bottom of the world. Exploring not only the polar icecaps, but the evolution of discovering the power of expeditions that have passion and purpose. From the Arctic three decades ago; an expedition sadly a thing of the past due to global warming, to several Antarctic expeditions leading to the present - Access Water. A seven continent multi-year initiative exploring the challenges and solutions with young people around the globe. Having just returned from the first in the series, Ann will share experiences in India where she and her team traveled the length of the Ganges River, from its source to the sea, with a focus on fresh water issues. Ann Bancroft is team leader of Bancroft Arnesen Explore.

SESSION TOPIC 4: Role of Science in Formulation of Local and Global Health Policy

Ajay Markanday, MS: Session co-Moderator
Ajay Markanday is Director of the Food and Agriculture Organization (FAO) of the United Nations Liaison Office for North America. Trained in agricultural economics, he has over 33 years of agricultural development experience in Asia, the Pacific and Africa with a variety of international development organizations and research institutions. He joined FAO as an economist in the Economics and Trade Division and was later transferred to the Investment Centre Division as Senior Economist. He served as the FAO Representative in Cambodia, where the Prime Minister and Royal Government of Cambodia honored him in recognition for services to the country by FAO, a first for the UN. He has served as Senior Advisor to the FAO Deputy Director-General Knowledge, as Chief of the Donor Liaison and Resource Mobilization Service, and as FAO Representative to the World Bank in Washington DC.

Shaun Kennedy, BCE: Session Co-Moderator
Shaun Kennedy created and leads the Food System Institute, LLC, and is an Associate Professor in the Department of Veterinary Population Medicine at the University of Minnesota (adjunct). Previously, he directed the National Center for Food Protection and Defense (NCFPD), a Department of Homeland Security Center of Excellence, and the Associate Director for the Center for Animal Health and Food Safety. Shaun's research focuses on food system bio-security, food safety and food defense and he has authored leading articles and book chapters on both. Professor Kennedy is the past chair of the International Association for Food Protection Food Defense professional development group, serves on the US Pharmacopeia Intentional Adulterants Expert Panel and is a scientific advisor to food firms, national laboratories and regulatory authorities. Shaun provided the inaugural lecture in the FDA's Chief Scientist Lecture series and received the FDA Commissioner's Special Citation for advancing food defense.

***Deborah Swackhamer,* PhD: Role of Science in Water Management Policy Development**
Dr. Swackhamer is Professor Emeritus of Science Technology & Environmental Policy and Environmental Health Sciences, and Codirector of the Water Resources Center, University of Minnesota. is a Professor of Environmental Health Sciences in the School of Public Health. She studies the processes affecting the behavior of, and exposures to, toxic chemicals in the environment and works on policies to address these potential risks. Dr. Swackhamer recently served as Chair of the Science Advisory Board of the U.S. Environmental Protection Agency, and currently is a member of the Science Advisory Board of the International Joint Commission of the U.S. and Canada, and the National Research Council, National Academy of Sciences committee addressing Sustainability Linkages in the Federal Government. She is a Governor appointee on the Minnesota Clean Water Council, and was President of the National Institutes of Water Resources. She is a Fellow in the Royal Society of Chemistry in the UK. In 2009 she received

the Founders Award from the Society of Environmental Toxicology and Chemistry for lifetime achievement in environmental sciences.

***Liz Neeley*, MA: Science Does Not Inform Policy Because Science Does Not Inform the Public**
Liz Neeley is the Executive Director of The Story Collider. They host regular shows in London, New York, DC, Boston, and LA, and produce a weekly podcast, that has more than 3.5 million downloads. The Story Collider is dedicated to the idea that true personal stories, told live, are a powerful format for science engagement. Liz previously worked as the Assistant Director of Science Outreach for COMPASS, where she specialized in journalism and social media trainings for scientists. She is a marine biologist by training, beginning her career at Boston University on the evolution of color patterns in tropical reef fishes, before going on to work on international policies on the management and trade of coral.

***David Fraser*, CM, PhD: Role of Science in Animal Welfare: Definitions, Priorities, and Human Implications**
Dr. Fraser is the NSERC Industrial Research Chair and Professor in Animal Welfare, University of British Columbia, Canada. Trained in psychology and zoology, he studies farm animal behavior and welfare. He is an original member of the Animal Welfare Working Group of the World Organisation for Animal Health (Paris) which develops global animal welfare standards for 180 member nations, and chaired the expert committee on animal welfare of the UN Food and Agriculture Organization. In Canada he is on the National Farm Animal Health and Welfare Council and led development of a national strategy for farm animal welfare. He serves on advisory committees for Institut National de la Recherche Agronomique, and the Centre for Zoo Animal Welfare. He was appointed Member of the Order of Canada in 2005 for his work as "a pioneer in the field of animal welfare science".

***Jørgen Schlundt*, PhD: Linking Science and Policy: The Foodborne Disease Consideration**
Dr. Schlundt is Professor of Food Science and Technology and Director-Designate, Nanyang Technological University, Singapore. Trained at Copenhagen University, Denmark, he has worked in Denmark, Zimbabwe, Switzerland, USA, and Singapore, including 11 years as Director of the Department for Food Safety and Zoonoses in the World Health Organization. Dr. Schlundt has participated in developing the food safety risk analysis principles and the One Health concept and has overseen the initiation of the first-ever World Health Organization estimation of the global burden of foodborne diseases. He chairs Global Microbial Identifier, an international initiative suggesting a global database of DNA-sequences of all microorganisms.

***Juhwan Oh*, MD, MPH, DrPH: Minnesota Effect and Evidence-Based Policy in Global Health**
Dr. Oh is Professor of International Health Policy and Management, and Chief of Education, Research, and Policy at the Lee Jong-wook Center for Global Medicine, Seoul National University, South Korea. He is an expert on international health and his work is centered on improving the health of underserved populations in resource-limited countries through Korea's Official Development Aid in Health. His research addresses issues of national health insurance and maternal and child health.

***Samuel Godefroy*, PhD: The Successes and Challenges of Bringing Science to Global Food Safety Policy through CODEX Alimentarius**
Dr. Godefroy is Full Professor of Food Risk Analysis and Regulatory Systems at Université Laval, Québec City Canada, and Senior Food Regulator with the World Bank's Global Food Safety Partnership, in charge of strategic development and engagement. Previously, he was the Director General of Health Canada's Food Directorate, the Federal food standard setting organization in Canada. During Dr. Godefroy's tenure as Vice Chair of the Codex Alimentarius Commission, he led the adoption by consensus of the organisation's strategic plan for setting international food standards for 2014−19. He now serves as a scientific and food regulatory expert domestically and internationally, including on the International Advisory Committee of the China Centre for Food Safety Risk Assessment (CFSA) and on the Ministerial Advisory Board for Canada's Food Inspection Agency (CFIA). He is an expert in analytical chemistry, biochemistry and chemical engineering, has authored over 65 scientific publications

and book chapters, serves on a number of international editorial boards of scientific journals related to food safety and nutrition and acts as an instructor on food risk analysis and food regulatory measures in a number of universities.

***Michael Murtaugh*, PhD: Closing Remarks and Perspective for the Future**
Dr. Murtaugh is a Professor of Veterinary and Biomedical Sciences at the University of Minnesota. He was recipient of the American Association of Immunologists Veterinary Immunologist of the Year 2012 Award, has more than 200 peer-reviewed publications and is an inventor on four patents. He is co-organizer of the iCOMOS conferences and a leader in graduate education in the College of Veterinary Medicine. The Murtaugh laboratory seeks a comprehensive understanding of porcine immune responses to infectious pathogens, primarily viral diseases that limit production and welfare. His lab uses functional genomic, molecular biologic, proteomic, and immunologic approaches to help elucidate biochemical and molecular mechanisms of immune resistance that can guide future development of novel approaches for treatment and prevention of disease. The scientific goal is to elucidate the initiating molecular and cellular responses that are crucial in determining the outcome of infection. Dr. Murtaugh received the PhD degree in Entomology from Ohio State University and served as a postdoctoral fellow in cell and molecular biology at the University of Texas Health Science Center in Houston.

Trevor Ames, DVM, MS, DACVIM: Conference Closing
Trevor Ames is Dean of the College of Veterinary Medicine at the University of Minnesota. As Dean, he oversees national and international centers of excellence: the Center for Animal Health and Food Safety and its programs including the Global Initiative for Food Systems Leadership and the World Health Organization for Animals capacity building programs, the Academic Health Center's Food Protection and Defense Institute, Veterinary Public Health Collaborations with the School of Public Health that include the joint DVM/MPH program, and the Public Health Institute, the DVM-PhD Combined Degree Program, the USAID One Health Workforce component of the Emerging Pandemic Threats Program, and the Veterinary Diagnostic Laboratory for national and global livestock and wildlife disease diagnostic testing. He served previously as Chair of the Department of Veterinary Population Medicine and was principal investigator of numerous projects studying bacterial and viral pathogenesis of bovine respiratory disease complex and other infectious diseases of horses and cattle. He was awarded the DVM degree from the University of Saskatchewan and the MS degree from the University of Minnesota. He is a Diplomate of the American College of Veterinary Internal Medicine.

WORKSHOP SPEAKERS

Workshop 1: Tomorrow's Health Science Workforce: Physician-Scientists and Team Science

***Clifford Steer*, MD: Workshop Co-Chair**
Dr. Steer is Associate Dean for Faculty Affairs at the University of Minnesota Medical School. He also is Professor of Medicine, Director of the Physician-Scientist Training Program, and holds joint appointments in the Department of Genetics, Cell Biology and Development, and in the Stem Cell Institute. His research program uses the Sleeping Beauty transposon system as a gene therapy vector to investigate liver, bone marrow and brain disorders. Another area of research is the use of ursodeoxycholic acid (UDCA), a hydrophilic bile acid, as a potent antiapoptotic agent to treat transgenic models of Huntington's disease and retinitis pigmentosa as well as acute stroke, spinal cord injury, myocardial infarction, and acute renal failure. Steer's lab also is actively characterizing the role of microRNAs in gene regulation for a number of different target organs and stem cell populations. In particular, they have identified specific microRNAs that may be involved in the cancer progression of colon polyps; as well as their role in the regenerating liver. The studies are both basic and translational in nature. They are also identifying specific microRNAs as biomarkers of disease that can be assayed in blood. Most notably, they have recently discovered a unique nuclear profile of mature microRNAs; and a subset of microRNAs in mitochondria that may act as a rheostat for the control of apoptosis. Dr. Steer received the MD degree and residency training at the University of Minnesota Medical School and conducted research in liver diseases for 14 years at the NIH.

***Hortencia Hornbeak*, PhD: Workshop Co-Chair, Session Moderator, Speaker**
Dr. Hornbeak is an Associate Director for Scientific Review and Policy at the National Institute of Allergy and Infectious Diseases (NIAID), NIH. After a post-doctoral fellowship at the NIAID/NIH, Dr. Hornbeak assumed the position of Assistant Professor at the University of Alabama, School of Medicine, Mobile, AL where she taught medical students and conducted independent research in virology for five years. She then returned to the NIH where she began her career in Health Science Administration. Dr. Hornbeak has authored peer-reviewed publications and chapters on research career development and securing research funds. She has had extensive communication and outreach efforts with the extramural scientific community including: serving as a U.S. expert consultant to the Global Fund for AIDS, Tuberculosis & Malaria (GFAMT) for the establishment and management of the first GFAMT review of grant applications; a representative of the State Department team that reviewed "Baltic Science and Technology" in Latvia, Estonia and Lithuania. This effort resulted in the initiation of collaborative research among the U.S. scientists and their counterparts in the Baltic countries. Dr. Hornbeak has been integrally involvement in restructuring of the AIDS clinical trial networks including outreach workshops in several countries (i.e. Argentina, Colombia, Brazil, Thailand, South Africa and the U.S.) over the last 20 years. She earned a Certificate in Public Leadership from The Brookings Executive Education, and participated in the training of scientists and administrators at the NIH and the Brookings Institute. Trainees at the Brookings Institute included Senior Executive Service candidates from federal agencies and executives from private sector. Dr. Hornbeak continues to serve as a leader and mentor to Health Scientists Administrators at NIH and the scientific community. Dr. Hornbeak obtained a BA in Biology and Chemistry from Skidmore College and her Ph.D. in Medical Microbiology from Georgetown University.

***Peter Jackson*, PhD: Workshop Co-Chair, Session Moderator, Speaker**
Dr. Jackson is Chief, AIDS Research Review Branch, Scientific Review Program, NIAID. He has over 25 years of experience in the scientific and technical peer review of basic through applied research grant applications and contract proposals in HIV/AIDS, other Infectious Diseases, and Immunology at the NIAID, NIH. He is familiar with NIH policies and procedures for developing and evaluating grant applications and contract proposals from US and non-US investigators. In addition to his peer reviewed scientific papers, Dr. Jackson authored peer-reviewed several book chapters on developing a competitive research career, identifying research funding opportunities, and submitting successful grant applications.

He has provided NIH grantsmanship training to researchers worldwide, including an extended period in 2009 when he served as a US Embassy Science Fellow in Croatia. Dr. Jackson's training is in Infectious Diseases. His PhD is from Rice University, and his Postdoctoral Fellowships were at the University of Massachusetts and the Walter Reed Army Institute of Research (WRAIR). After serving as a Research Microbiologist at the WRAIR, he joined the American Institute of Biological Sciences and helped manage the peer review of USAID supported Malaria Vaccine Research Program grant applications. His NIAID, NIH career began in 1990.

***Brooks Jackson*, MD, MBA: Physician-Scientists of the Future**
Dr. Jackson is Vice President for Health Sciences and Dean of the Medical School at the University of Minnesota. He previously served as Director of Pathology for 12 years at Johns Hopkins University School of Medicine, where it became first nationwide in NIH funding. He is an internationally recognized researcher in HIV diagnostics, prevention and treatment; and his team has revolutionized HIV prevention in developing countries through research in the United States, Uganda, and China. He is the principal investigator of the $500 million NIH-funded International Maternal Pediatric Adolescent AIDS Clinical Trials (IMPAACT) Network. Jackson's work resulted in new drug development and a project to prevent neonatal HIV transmission. The method has saved thousands of infants from starting life with HIV infection. His work has been recognized by the Global Strategies for HIV Prevention Special Recognition Award and the HIV Prevention Trials Network Service Award. Dr. Jackson earned his MD from Dartmouth Medical School and his MBA at Dartmouth College. He served his residency in clinical pathology at the University of Minnesota Hospitals, where he was a blood bank fellow in the hospitals' department of laboratory medicine and pathology.

***Erik Peterson*, MD: The Minnesota Experience**
Dr. Peterson is an Associate Professor of Medicine in the Division of Rheumatic and Autoimmune Diseases in the Department of Medicine, University of Minnesota Medical School. He is a member of the interdisciplinary Center for Immunology and its Autoimmunity Program, as well as a member of the Cancer Center. He is an immunologist with a scientific interest in those molecules that regulate the development and function of the immune system and prevent or promote the development of autoimmunity. He practices general rheumatology and participates in Resident and Fellow teaching. He received the MD degree from the University of Minnesota, completed residency training in internal medicine at the University of Colorado, and completed a fellowship in rheumatology at the University of Iowa Hospital and Clinics.

***Michael O'Rourke*, PhD: Team Science Approaches to Bring the Bench and Bedside Closer**
Michael O'Rourke is Professor of Philosophy and faculty in AgBioResearch at Michigan State University. His research interests include environmental philosophy, the nature of epistemic integration and communication in collaborative, cross-disciplinary research, and the nature of linguistic communication between intelligent agents. He is Director of the Toolbox Project, an NSF-sponsored research initiative that investigates philosophical approaches to facilitating interdisciplinary research (http://www.cals.uidaho.edu/toolbox/). He has published extensively on the topics of communication, interdisciplinary theory and practice, and robotic agent design. He has been a co-principal investigator or collaborator on funded projects involving environmental science education, facilitating cross-disciplinary communication, biodiversity conservation, sustainable agriculture, resilience in environmental systems, and autonomous underwater vehicles. He co-founded and served as co-director of the Inland Northwest Philosophy Conference, an interdisciplinary conference on philosophical themes, and as co-editor of the Topics in Contemporary Philosophy series published by MIT Press.

***Gregory Vercellotti*, MD: Moderator, Challenges to Physician Scientist Development and the Practice of Team Science**
Dr. Vercellotti is professor of medicine at the University of Minnesota with a strong laboratory interest in vascular biology, inflammation, and sickle cell disease. Clinically, he cares for benign hematology patients and attends on the Bone Marrow Transplant Service. He is a dedicated medical educator and clinician, and has been honored as a U.S. News & World Report 2012 Top Doctor, Minnesota Monthly

"Best Doctors" (2014), Mpls. St. Paul Magazine "Top Doctor" (2008-2014), and other awards. He received the MD degree from the University of Illinois.

***Jaime Modiano*, DVM, PhD: Panelist, Challenges to Physician Scientist Development and the Practice of Team Science**
Dr. Modiano is the Al and June Perlman Endowed Chair of Comparative Oncology and Director of the Animal Cancer Care and Research Program at the University of Minnesota. He is a partner at Veterinary Research Associates, LLP, a company focused on development and implementation of diagnostics for veterinary medicine, and he is a founder/scientist at ApopLogic Pharmaceuticals, a biotechnology company developing cancer therapeutics. He was awarded both DVM and PhD degrees at the University of Pennsylvania, and completed a residency in veterinary clinical pathology at Colorado State University, and a post-doctoral fellowship at the National Jewish Medical and Research Center in Denver. Previously, Dr. Modiano was assistant professor of veterinary pathobiology at Texas A & M University, scientist and senior scientist at the AMC Cancer Research Center, and associate professor of immunology at the School of Medicine, University of Colorado, Denver. He also served as director of cancer immunology and immunotherapy for the Donald Monk Cancer Research Foundation.

***Peter Igarashi*, MD: Panelist, Challenges to Physician Scientist Development and the Practice of Team Science**
Dr. Igarashi is Nesbitt Chair and Head of the Department of Medicine, University of Minnesota. He is a physician-scientist, nephrologist, and an expert in kidney development, transcriptional regulation, and polycystic kidney disease (PKD). Dr. Igarashi studied Biomedical Sciences in a joint program between the University of California, Riverside, UCLA, and earned MD from UCLA. He completed a nephrology fellowship at Yale University School of Medicine. Previously, he was the Robert Tucker Hayes Distinguished Chair in Nephrology at the University of Texas Southwest Medical Center and taught at Yale University School of Medicine.

***Connie Delaney*, PhD, RN: Panelist, Challenges to Physician Scientist Development and the Practice of Team Science**
Dr. Delaney is Professor and Dean at the University of Minnesota School of Nursing. She is the first dean of nursing in the country with a record of achievement in health informatics recognized through her election as a fellow in the American College of Medical Informatics. She is a fellow of the American Academy of Nursing and was inducted into the National Academies of Practice as a distinguished scholar in 2013. Dr. Delaney has served on boards of the American Association of Colleges of Nursing, LifeScience Alley, and the American Medical Informatics Association. She is an active leader, researcher and writer in the areas of national standards for electronic health record and outcomes/safety data. She received a BS in Nursing from Viterbo University and PhDs in educational administration and computer applications from the University of Iowa. After postdoctoral study in nursing and medical informatics at the University of Utah, she served as a professor of medicine and nursing at the University of Iceland with a focus in health informatics. Previously, Dr. Delaney was professor and director of Health & Nursing Informatics at the University of Iowa College of Nursing.

***Mark Herzberg*, DDS, PhD: Panelist, Challenges to Physician Scientist Development and the Practice of Team Science**
Dr. Herzberg is Professor of Dental Surgery and Director of the Mucosal and Vaccine Research Center in the School of Dentistry at the University of Minnesota. He is renowned as a teacher and mentor, while his discovery of a link between bacterially induced platelet aggregation and coronary thrombosis was announced in the *New York Times*. He studies the antimicrobial mechanism of calprotectin in oral epithelial cells that line the mouth and throat and its role in defending mucous membranes against infection, including HIV-1. Dr. Herzberg led the University of Minnesota Dentist-Scientist Training Program (MinnCResT) for 14 years, and has served as associate director of the Clinical and Translational Science Institute. He was editor of the *Journal for Dental Research* for 11 years. He is consulted broadly and is a prolific investigator and writer, with pages and pages of citations for books, book chapters,

monographs, abstracts and articles, many of them published in the very same journals he shelved during his high school job in the library, where he first became interested in dentistry.

***Bin He*, PhD: Panelist, Challenges to Physician Scientist Development and the Practice of Team Science**

Bin He is a Distinguished McKnight University Professor of Biomedical Engineering, Medtronic-Bakken Endowed Chair for Engineering in Medicine, director of the Institute for Engineering in Medicine, director of the Center for Neuroengineering at the University of Minnesota. He received his BS from Zhejiang University, PhD from Tokyo Institute of Technology, and completed his postdoctoral fellowship at the Harvard – MIT Division of Health Sciences and Technology. Dr. He has made significant research contributions to the fields of neuroengineering and functional biomedical imaging related to human neuroscience. Dr. He has received a number of awards including the Academic Career Achievement Award from the IEEE Engineering in Medicine and Biology Society. He served as a Past President of the IEEE Engineering in Medicine and Biology Society (EMBS), and is a Member of the NIH BRAIN Multi-Council Working Group. Dr. He serves as the Editor-in-Chief of IEEE Transactions on Biomedical Engineering, and is Chair-Elect of the International Academy of Medical and Biological Engineering.

***Lauren Trepanier*, DVM, PhD: Creating a Cohesive Workforce Model Across All of the Health Professions: The Intersection of Physician Scientists and Team Science**

Dr. Trepanier is a Professor of Medicine at the University of Wisconsin School of Veterinary Medicine. She is Board Certified by the American College of Veterinary Internal Medicine and the American College of Veterinary Clinical Pharmacology. She hA clinical expertise in Internal Medicine and Clinical Pharmacology. Dr. Trepanier has 16 years of experience as an NIH-funded PI, conducting research in pharmacogenetics and xenobiotic detoxification pathways. As the Director of Clinical Research at the UW-SVM, she develops initiatives to increase the number of veterinarians engaged in translational research. She also is the Director of Clinician Scientist Training Programs and Director of the Small Animal Internal Medicine Residency training program at the University of Wisconsin. She received both DVM and PhD in pharmacology degrees from Cornell University.

***Griffin Weber*, MD, PhD: Identifying Potential Team Members–Open-source Software to Identify the Institutional Workforce, Their Capabilities and Activities**

Dr. Weber is an Assistant Professor of Medicine and Head of the Knowledge Discovery & Management Group in the Department of Biomedical Informatics at Harvard Medical School. One of Dr. Weber's research areas is in expertise mining and social network analysis. In his previous role as Chief Technology Officer of Harvard Medical School, he invented an open source social networking website for scientists called Profiles RNS, which is used at dozens of institutions across the country. Dr. Weber is funded by NIH and NSF grants to study these networks to learn how scientific teams form and to determine the role of cross-disciplinary collaborations in biomedical research. Dr. Weber received his MD and PhD in computer science from Harvard University

***Gaetano (Guy) Lotrecchiano*, EdD,PhD: Facilitating Collaboration While Protecting Your Interests–Team Science Planning Tools**

Dr. Lotrecchiano is an assistant professor of Clinical Research and Leadership and of Pediatrics at the George Washington University School of Medicine and Health Sciences. His research interests include complexity leadership, transdisciplinary team science, and organizational change. Dr. Lotrecchiano's recent published material is in the Maternal and Child Health Journal, International Journal of Transdisciplinary Research, VINE: The Journal of Information and Knowledge Management Systems, Clinical Translational Research, Integral Leadership Review, and he is the associate editor of the Journal of Collaborative Healthcare and Translational Medicine. Dr. Lotrecchiano is a Morton A. Bender awardee for teaching excellence and Chair of the George Washington University Society of Distinguished Teachers. He was awarded the PhD degree by the University of Maryland, College Park.
2: One Health One Policy: Managing Risk En Route to Global Food Security

***Shaun Kennedy*, BCE: Workshop coordinator**
Shaun Kennedy created and leads the Food System Institute, LLC, and is an Associate Professor in the Department of Veterinary Population Medicine at the University of Minnesota (adjunct). Previously, he directed the National Center for Food Protection and Defense (NCFPD), a Department of Homeland Security Center of Excellence, and the Associate Director for the Center for Animal Health and Food Safety. Shaun's research focuses on food system bio-security, food safety and food defense and he has authored leading articles and book chapters on both. Professor Kennedy is the past chair of the International Association for Food Protection Food Defense professional development group, serves on the US Pharmacopeia Intentional Adulterants Expert Panel and is a scientific advisor to food firms, national laboratories and regulatory authorities. Shaun provided the inaugural lecture in the FDA's Chief Scientist Lecture series and received the FDA Commissioner's Special Citation for advancing food defense.

***Ajay Markanday*, MS: Workshop Coordinator**
Ajay Markanday is Director of the Food and Agriculture Organization (FAO) of the United Nations Liaison Office for North America. Trained in agricultural economics, he has over 33 years of agricultural development experience in Asia, the Pacific and Africa with a variety of international development organizations and research institutions. He joined FAO as an economist in the Economics and Trade Division and was later transferred to the Investment Centre Division as Senior Economist. He served as the FAO Representative in Cambodia, where the Prime Minister and Royal Government of Cambodia honored him in recognition for services to the country by FAO, a first for the UN. He has served as Senior Advisor to the FAO Deputy Director-General Knowledge, as Chief of the Donor Liaison and Resource Mobilization Service, and as FAO Representative to the World Bank in Washington DC.

***Samuel Godefroy*, PhD: The Importance of Global Standards**
Dr. Godefroy is Full Professor of Food Risk Analysis and Regulatory Systems at Université Laval, Québec City Canada, and Senior Food Regulator with the World Bank's Global Food Safety Partnership, in charge of strategic development and engagement. Previously, he was the Director General of Health Canada's Food Directorate, the Federal food standard setting organization in Canada. During Dr. Godefroy's tenure as Vice Chair of the Codex Alimentarius Commission, he led the adoption by consensus of the organisation's strategic plan for setting international food standards for 2014−19. He now serves as a scientific and food regulatory expert domestically and internationally, including on the International Advisory Committee of the China Centre for Food Safety Risk Assessment (CFSA) and on the Ministerial Advisory Board for Canada's Food Inspection Agency (CFIA). He is an expert in analytical chemistry, biochemistry and chemical engineering, has authored over 65 scientific publications and book chapters, serves on a number of international editorial boards of scientific journals related to food safety and nutrition and acts as an instructor on food risk analysis and food regulatory measures in a number of universities.

***Marsha Echols*, JD, LLM, JSD: Panel Member: What are the challenges in applying "One Medicine, One Science"to global standards?**
Dr. Echols is Professor of Law and Director of The World Food Law Institute at Howard University. She is a recognized expert in the fields of international food regulation, international trade and dispute settlement. She has served as a Member of the United Nations Administrative Tribunal and as a Panelist in a World Trade Organization dispute between India and the European Union, among other activities. She is the Vice Chair of the International Dispute Resolution Committee on the DC Bar. She is the author of *Food Safety and the WTO: The Interplay of Culture, Science and Technology and Geographical Indications for Food Products: International Legal and Regulatory Perspectives* and of several law journal articles about international food regulation. Professor Echols has studied, worked and taught in Geneva, Beijing, Shenyang (China), Brussels, Paris, Nantes (France) and Mozambique. She has served as an international trade negotiator for the U.S. Department of Agriculture and specialized in international agribusiness transactions while engaged in the private practice of law. She is a member of the Council on Foreign Relations and the Secretary of State's Advisory Committee on Private International Law and is the Liaison to UNIDROIT for the ABA Section of International Law.

***Markus Lipp*, PhD: Panel Member: What are the challenges in applying"One Medicine, One Science"to global standards?**
Dr. Lipp is Senior Food Safety Officer at FAO, Rome, Italy. He has first hand experience working internationally in food safety and food science positions in food companies, regulators, trade associations, and standard-developing organizations, built on a strong background in food science, food fraud/adulteration, food quality and safety, biotechnology and analytical chemistry and profound knowledge in molecular biology, clinical chemistry, toxicology and radiochemistry. He has appeared frequently in print, radio and video media and has over 70 contributions to journals, conferences, and member working groups on standardization of food safety rules. He received the PhD in Analytical Chemistry from Karlsruhe Institute of Technology.

***Jørgen Schlundt*, PhD: Panel Member: What are the challenges in applying"One Medicine, One Science"to global standards?**
Dr. Schlundt is Professor of Food Science and Technology and Director-Designate, Nanyang Technological University, Singapore. Trained at Copenhagen University, Denmark, he has worked in Denmark, Zimbabwe, Switzerland, USA, and Singapore, including 11 years as Director of the Department for Food Safety and Zoonoses in the World Health Organization. Dr. Schlundt has participated in developing the food safety risk analysis principles and the One Health concept and has overseen the initiation of the first-ever World Health Organization estimation of the global burden of foodborne diseases. He chairs Global Microbial Identifier, an international initiative suggesting a global database of DNA-sequences of all microorganisms.

***Tongkorn Meeyam*, DVM, MSc, DMV: Panel Member: What are the challenges in applying "One Medicine, One Science"to global standards?**
Dr. Meeyam is Professor of Veterinary Public Health at Chiang Mai University, Thailand, and Director of the Veterinary Public Health Centre for Asia Pacific (VPHCAP). The VPHCAP is the center for information and collaboration regarding the safety of food originating from animals, animal diseases, and cross-border issues. In addition, she is a project coordinator of the EcoHealth-One Health Resource Centre of Chiang Mai University. Her academic focus is on Veterinary public Health, particularly food safety and quality assurance for food of animal origin. She received her DVM degree from Chulalongkorn University in 2001 and the MS in Health Science from Chiang Mai University in 2003. She was at the Institute of Meat Hygiene, Faculty of Veterinary Medicine, Freie Universität Berlin, Germany, completing her Doctoral program in 2010.

***Patrick Webb*, DVM: Animal Health and Global Standards**
Dr. Webb is Director of Swine Health Programs, Science & Technology at the U.S. National Pork Board. He is responsible for Pork Checkoff efforts in animal disease traceability and foreign animal disease awareness, preparedness, response and recovery. Webb, a veterinarian most recently working as a private consultant, has extensive experience in emergency preparedness and response planning. He will be responsible for the Pork Checkoff's efforts in animal identification and domestic and foreign animal disease surveillance and response. Dr. Webb previously worked with the United States Department of Agriculture Animal Plant Health Inspection Service on developing a facilities manual for highly contagious animal diseases for the dairy industry, a hazard specific plan for food security for the state of South Carolina, and producer biosecurity programs and county and local agro-terrorism training for state emergency responders. He developed an emergency preparedness plan for animal disease disasters for the state of Iowa was subsequently used as a model for other animal diseases. Dr. Webb obtained the DVM degree from Iowa State University.

***Joseph Simeca,* PhD: The Challenges of Operating Globally across Differing National Policies, an Industry Perspective**
Dr. Simeca currently holds the position of Vice President of Global Regulatory & Scientific Affairs, in the Corporate Food Safety, Quality and Regulatory department at Cargill, where he provides leadership for ensuring that company food/feed products are safe and compliant with relevant laws/regulations.

Before joining Cargill in 2004, he held a number of regulatory and scientific positions for Kraft, Pillsbury, and General Mills. He received his PhD in Pharmacology and Toxicology from the Medical College of Virginia, Virginia Commonwealth University in 1987.

3: Big Data, the Language and Future of One Medicine One Science

***Andres Perez*, DVM, PhD: Convenor. Big Data, the Language and Future of One Medicine One Science**

Dr. Perez is the Endowed Professor of Animal Health and Food Safety at the University of Minnesota. Dr. Perez is an expert in the field of veterinary spatial epidemiology and modeling. His research interests primarily include swine and other food animals. Over the past 10 years, he has led a number of educational activities on quantitative epidemiology in 20 countries. Previously, he was a researcher and Director of the University of California Center for Animal Disease Modeling and Surveillance. He is an advisor on epidemiology for the Argentine Animal Health Service and for the Foreign Animal Disease Research Unit of the USDA Agricultural Research Service. He is currently the lead expert for the Science, Technology, Engineering, and Mathematics for Minnesota Advancement (STEMMA) project. He received the DVM degree from the Universidad Nacional de Rosario, Argentina, and the PhD degree from Universidad de Buenos Aires, Argentina.

***Claudia Neuhauser*, PhD: Convenor. Big Data, the Language and Future of One Medicine One Science**

Claudia Neuhauser is the Director of Research Computing in the Office of the Vice President for Research, overseeing the University of Minnesota Informatics Institute (UMII) and the Minnesota Supercomputing Institute (MSI). UMII fosters and accelerates data-intensive research across all disciplines in the University and develops partnerships with industry. MSI provides high-performance computing resources to the University. Dr. Neuhauser's research is at the interface of mathematics and biology, and focuses on the analysis of ecological and evolutionary models and the development of statistical methods in biomedical applications. She has been the Director of Graduate Studies of the Biomedical Informatics and Computational Biology graduate program since 2008. She also has served as Vice Chancellor for Academic Affairs at the University of Minnesota Rochester (UMR). Previously, she was Professor and Head of the Department of Ecology, Evolution and Behavior at the University of Minnesota Twin Cities. She is a Distinguished McKnight University Professor, Howard Hughes Medical Institute Professor, and Morse-Alumni Distinguished Teaching Professor. She held faculty positions at the University of Southern California, the University of Wisconsin Madison, and the University of California Davis. She is currently a faculty member in the Department of Ecology, Evolution and Behavior, the Department of Biochemistry, Molecular Biology and Biophysics, and the Department of Computer Science and Engineering. She is a fellow of the American Association for the Advancement of Science (AAAS) and a fellow of the American Mathematical Society (AMS). Dr. Neuhauser was awarded the PhD degree in Mathematics from Cornell University and a Diploma in Mathematics from the Universität Heidelberg, Germany

***Srinand Sreevatsan*, PhD, MPH, MVSc: Convenor. Big Data, the Language and Future of One Medicine One Science**

Dr. Sreevatsan is a Professor of Infectious Disease and Director of the Veterinary Medicine Graduate Program at the University of Minnesota. The Sreevatsan laboratory focuses on microbe-host interactions with specific emphasis on the evolution of the pathogen and its adaptation to hosts. Dr. Sreevatsan is currently investigating the molecular diversity in mycobacteria, microbial population structure and functioning in pathogen induced environments, influenza virus ecology and evolution, and developing novel ligands and approaches toward new diagnostics and therapeutic modalities for infectious diseases. He received the MVSc degree from the University of Agricultural Sciences, Bangalore, India, and the PhD and MPH degrees from the University of Minnesota.

***Gregory Cuomo*, PhD, MPH: Convenor. Big Data, the Language and Future of One Medicine One Science**

Dr. Cuomo is Professor and Associate Dean for Research and Graduate Programs, College of Food, Agricultural and Natural Resource Sciences. He oversees the college's research portfolio and serves as Deputy Director of the Minnesota Agricultural Experiment Station. He facilitates research collaboration within the University of Minnesota and coordinates activities with other research institutions. Dr. Cuomo also provides strategic direction and leadership for CFANS Graduate Programs. His research interests are in agronomy with a specific interest in the grasses. Dr. Cuomo was awarded the PhD degree from the University of Nebraska.

***Gabriel Broner*, MBA: High Performance Computing Focused on Life Sciences**
Dr. Broner is Vice President and General Manager for High Performance Computing at SGI. Broner was awarded the MS degree in computer science from Universidad Simon Bolivar, Caracas, Venezuela, and completed PhD coursework in computer science at the University of Minnesota before entering industry, where he has held a variety of positions at Logiciel, Dataofis, CPT Corp, Cray Research, Silicon Graphics, and Microsoft. Most recently, he stimulated innovative design and product development as Head of Innovation at Ericsson, and in his current position.

***Rowland Kao*, PhD: Molecules to Populations: Applications of Bayesian Approaches in Phylodynamics**
Dr. Kao is Professor of Mathematical Population Biology and Director of the Boyd Orr Centre for Population and Ecosystem Health at the University of Glasgow. He studies infectious disease dynamics, mainly with respect to the role of demography in the spread and persistence of livestock diseases, such as foot-and-mouth disease, bovine tuberculosis, scrapie, BSE and avian influenza. He has developed theoretical models of disease transmission on social networks and applications to the transmission of livestock diseases using simple differential equation models, analysis of social networks, statistics and simulations. He is interested in the development of real-time parameter estimation techniques during the course of disease outbreaks and molecular epidemiology.

***Peter Durr*, PhD: Modeling Airborne Spread of Pests and Pathogens-A Big Data Approach**
Dr. Durr is a veterinary epidemiologist at the Australian Animal Health Laboratory (AAHL) which is Australia's exotic animal disease laboratory located in Geelong, near Melbourne. AAHL is the Australian government's high containment exotic animal disease (EAD) diagnostic laboratory. He leads a Bioinformatics and Epidemiology team, with a long term goal of developing a real-time molecular epidemiology system which could be used to assist in managing EAD outbreaks. He has extensive experience in animal disease surveillance and epidemiology, with a current focus on emerging zoonotic and exotic animal disease. Diseases of recent research include highly pathogenic avian influenza, bluetongue, MERS and Hendra virus infection. Dr. Durr received the PhD in agro-ecology from James Cook University.

***Dan Knights*, PhD: Microbiomes and Health: Big Data Challenges**
Dr. Knights is an assistant professor in the Department of Computer Science and Engineering and the Biotechnology Institute at the University of Minnesota. Dr. Knights research combines expertise in data mining and biology to study gut microbes and disease in children, adults, and non-human primates. In 2015 he was named a McKnight Land-Grant Professor by the University of Minnesota. He will be discussing his research into solving computational challenges in analyzing microbiome data. He received his PhD in Computer Science from the University of Colorado, and followed it with a post-doctoral fellowship at Harvard Medical School.

***Molly McCue*, DVM, PhD: Animal Health: Big Data-Related Research**
Dr. McCue is an associate professor of veterinary population medicine at the University of Minnesota, and is a Diplomate of the American College of Veterinary Internal Medicine, Large Animal. He research group uses molecular genetics and genomics tools to study complex genetic disease, physiological variation and genetic diversity in equine populations. The goals are to improve equine health through the understanding of complex genetic disease, allowing veterinarians to better predict, diagnose, and treat genetic disease, and to improve human health through the use of the horse as a biomedical model.

Diseases include equine metabolic syndrome, polysaccharide storage myopathy, recurrent exertional rhabdodyolysis, and melanoma susceptibility. Her group also studies equine genetic diversity and the impact of selective breeding practices on equine health and disease susceptibility. She was awarded the DVM degree from Kansas State University and the PhD degree from the University of Minnesota.

***Philip Pardey*, PhD: Plant Health and Production: Big Data-Related Research at the UMN CFANS**
Dr. Pardey is Professor of Science and Technology Policy in the University of Minnesota Department of Applied Economics, and Director of Global Research Strategy for the College of Food Agricultural and Natural Resource Sciences and the Minnesota Agricultural Experiment Station. He also serves as director of the International Science and Technology Practice and Policy (InSTePP) center. His research deals with productivity measurement and assessment, the finance and conduct of R&D globally, methods for assessing the economic impacts of research, and the economic and policy, especially intellectual property, aspects of genetic resources and the biosciences. Dr. Pardey was awarded the MAS degree from the University of Adelaide, Australia, and the PhD degree from the University of Minnesota.

***Candice Hirsch*, PhD: Translating Big Data into Improved Crop Performance in Agricultural Systems**
Dr. Hirsch is an assistant professor at the University of Minnesota in the Department of Agronomy and Plant Genetics. Her research program focuses on translational genomics in maize. Dr. Hirsch is a member of the Crop Science Society of America and the American Society of Plant Biologists. She received her PhD degree from the University of Wisconsin-Madison in Plant Breeding and Plant Genomics and was a research fellow at Michigan State University in plant genomics.

***Christiane Wolff*, MS: Round Table Panel Member**
Ms. Wolff is Counselor, Agriculture and Commodities Division of the World Trade Organization. Ms. Wolff is an expert in international trade and development. She previously worked at KfW, a German governmental bank with a public mission to finance and promote development in developing and transition governments. She holds the MS in agriculture, resource and managerial economics from Cornell University and the BA in economics and development studies from the University of California, Berkeley.

***Paula Caceres*, MS, MSc: Round Table Panel Member**
Dr. Caceres is Head of the World Organization for Animal Health (OIE) Animal Health Information Department. Dr. Caceres is a veterinary epidemiologist who previously served as a lecturer at the Universidad Viña del Mar, Chile, and practiced veterinary medicine in Chile. Dr. Caceres was awarded the MS and MSc degrees in Epidemiology and Animal Science from the Universidad de Chile.

***Marcelo D'Agostino*, MS, AD: Round Table Panel Member**
Dr. D'Agostino is the Senior Advisor in Knowledge Management, Big Data, at the Pan American Health Organization, officed in Washington DC. He has expertise in the planning, design and delivery of innovative, evidence-based and cost-effective, high-performance solutions and programs in support of political, technical and worldwide leaders with budget responsibilities up to US$ 40 million annually. He maintains a vision focused on country needs with the ability to establish strategic networks of relations, communities of practices and alliances with local, national, regional, sub-regional and global partners and groups. He received the MS degree in direction of information and knowledge management from the Universidad Abierta de Cataluña, Spain, and an Associate's Degree in diplomacy from DiploFoundation.

***Victor del Rio*, DVM, PhD: Round Table Panel Member**
Dr. del Rio is a veterinary public health adviser within the Pan American Health Organization (PAHO), based in Rio de Janeiro (Brazil) with regional responsibilities. He advises Ministries and Departments of Health on epidemiology, surveillance and control measures for a number of diseases such as rabies, leishmaniasis, hidatidosis, and on existing and emerging zoonotic programmatic issues across the region. He has previously worked in Uzbekistan implementing the Biological Threat Reduction Program (Defense Threat Reduction Agency, US Department of Defense), and as veterinary advisor and

epidemiologist for the United Kingdom´s Department for Environment, Food and Rural Affairs (Defra) and the Veterinary Laboratories Agency, respectively. He sits at the Board of Directors of the International Society for Disease Surveillance (ISDS) and co-chairs its Global Outreach committee. He received the DVM degree from the University of Santiago de Compostela Spain, and the PhD degree from Royal Veterinary College, London.

***Adam Berger,* PhD: Round Table Panel Member**
Dr. Berger is a Senior Fellow in the Immediate Office of the Secretary of Health and Human Services. His primary interests focus on policy issues relating to translational medicine, including the development of drug, diagnostic, and clinical and public health applications. Dr. Berger has facilitated numerous public policy discussions and reports such as Genome-Based Diagnostics: Clarifying a Pathway to Clinical Use; Integrating Large-Scale Genomic Information into Clinical Practice; Genome-Based Therapeutics: Targeted Drug Discovery and Development; and The Value of Genetic and Genomic Technologies. Dr. Berger's scientific background is in biochemistry, cell and molecular biology, and molecular genetics. He is the recipient of the NIH Fellows Award for Research Excellence and a Ruth L. Kirschstein National Research Service Award.

4: Canine and Human Epilepsy, a Model for Bidirectional Benefit

***Ned Patterson*, DVM, PhD: Organizer and Convenor**
Dr. Patterson is Associate Professor of Small Animal Medicine and Genetics at the University of Minnesota. He is a Founding Member and Director of the Canine Epilepsy Research Consortium, the Vice Chair of Shelter Medicine in the Department of Veterinary Clinical Sciences, The Small Animal Medicine Residency Director, and a member of the Institute for Engineering in Medicine. Dr. Patterson's instructional areas include genetics, seizure disorders, and molecular medicine. His recent research focuses on understanding and treating epilepsy in dogs and as a model for human epilepsy using novel drugs and novel devices. Additional clinical interests include clinical trials, endocrinology, and comparative medicine. He was awarded both the DVM and PhD degrees from the University of Minnesota.

***Mike Rogawski*, MD, PhD: Novel Drugs and Future Hopes; Human Perspective**
Dr. Rogawski is professor and chair emeritus of the Department of Neurology and a member of the Center for Neuroscience at the University of California, Davis. Previously, he was senior investigator and chief of the Epilepsy Research Section at the National Institute of Neurological Disorders and Stroke. Dr. Rogawski's research encompasses cellular neurophysiological studies of ion channels with a focus on the mechanisms of action of antiepileptic drugs in animal models of epilepsy, migraine, and nerve agent intoxication. He conducts clinical studies on new treatments for seizures, epilepsy, migraine, traumatic brain injury, and neurodevelopmental disorders. His laboratory studies on AMPA receptors and neurosteroids have led to new treatment approaches for seizures and epilepsy. Dr. Rogawski has received the NIH Director's Award, the Epilepsy Research Award for Contributions to the Pharmacology of Antiepileptic Drugs from the American Society for Pharmacology and Experimental Therapeutics, and the American Academy of Neurology 2015 Neuroendocrine Research Award. He presented the British Pharmacological Society Lecture, the Killam Lecture of the Montreal Neurological Institute, and the American Epilepsy Society's William G. Lennox Lecture. He is a founder and was co-chief editor of Epilepsy Curents, the journal of the American Epilepsy Society, and has served on the board of directors of the American Epilepsy Society. He has been a member of advisory panels to the National Institutes of Health, and he serves in an advisory capacity as a special government employee to the Food and Drug Administration. He is past president of the American Society for Experimental NeuroTherapeutics. Dr. Rogawski received the MD and PhD (pharmacology) degrees from Yale University, served a postdoctoral fellow in the Laboratory of Neurophysiology, NINDS, and completed residency training in neurology at Johns Hopkins.

***Michael Podell*, DVM, MSc: Novel Drugs and Future Hopes; Canine Perspective**
Dr. Podell, a Diplomate of the American College of Veterinary Internal Medicine, is a veterinary

neurologist specializing in the treatment of medical and surgical neurological problems in small animals at the MedVet Clinic in Chicago, IL. His clinic provides on-site MRI scanning as the most accurate imaging for the rapid diagnosis and treatment of all neurological diseases in a 24-hour critical care hospital setting.

***James Cloyd*, Pharm D: Novel Drugs and Future Hopes; Panel Discussant**
Dr. Cloyd is the Morse Alumni Distinguished Teaching Professor, the Lawrence C. Weaver Endowed Chair in Orphan Drug Development, and Director of the Center for Orphan Drug Research at the University of Minnesota College of Pharmacy. Dr. Cloyd co-authored the orphan drug application for diazepam rectal gel (Diastat) and was a leader in the development of the product. His research interests include orphan drugs, clinical neuropharmacology, antiepileptic drugs, and rare pediatric neurological disorders. He received the PharmD degree from the University of Kentucky and completed a postdoctoral fellowship in clinical pharmacokinetics at the University of Washington.

***John Kehne*, PhD: Novel Drugs and Future Hopes; Panel Discussant**
Dr. Kehne is Program Director at the National Institute of Neurological Disorders and Stroke, NIH. He has 25 years of pharmaceutical industry experience in the discovery and development of drugs for treating a range of central nervous system disorders, including depression, anxiety, schizophrenia, epilepsy, Parkinson's disease, Alzheimer's disease, pain, sleep disorders, and obesity. On the drug discovery side, he directed the in vivo pharmacological evaluation of compounds, many of which advanced to clinical candidate status, and has contributed to product development teams spanning from early stage activities to drug application submission. Previously, he was a scientist in the Pharmacology Department of Merrell Dow Pharmaceuticals, then joined the CNS biotech company Neurogen, where he rose to the level of Executive Director of Pharmacology. Recently, Dr. Kehne has worked as a consultant partnering with scientific teams to advance compounds through discovery and development. Dr. Kehne has more than 80 scientific publications and numerous patents and presentations at scientific meetings. Dr. Kehne was awarded a PhD in Psychology by the University of Massachusetts and he completed a postdoctoral fellowship in Biological Psychiatry at Yale University School of Medicine.

***Kent Leyde*, BSEE, MSEE: Devices for Epilepsy and Future Hopes; Canine and Human Perspectives**
Mr. Leyde is owner and managing member of Cascade Medical Devices LLC, where he provides support for investor groups needing technology assessment, development of engineering policies and procedures, development of device specifications, and medical device design. Previously, he was Vice President of Engineering at Ventec Life Systems, and Chief Technology Officer of NeuroVista. He has more than 25 years of experience in the medical device and electronics industry, where he has developed broad technical expertise in medical device development, implantable systems, analog and digital electronics, digital signal processing, software design, and working with US and international technical standards and specifications. He led the product development programs at Northstar Neuroscience, Inc., a Seattle-based medical device company seeking to improve neurological recovery following stroke through targeted electrical stimulation of the brain, and he led multi-disciplinary engineering teams at Heartstream (now Philips Medical Systems), a Seattle-based company that revolutionized the treatment of sudden cardiac arrest with uniquely designed defibrillators that make the deployment of these devices practical in a variety of settings. Kent’s team designed and launched the company's initial series of innovative automated external defibrillators. He also has held engineering and management positions with Physio-Control and Hewlett-Packard. Mr. Leyde is an inventor on numerous patents relating to medical devices. He received both a BS and MS in electrical engineering from Washington State University.

***Tim Denison*, PhD: Devices for Epilepsy and Future Hopes; Translational Perspectives**
Dr. Denison is Senior Principal Design Engineer and the IC Technology Manager in the Neuromodulation Division of Medtronic. He is an adjunct professor at Brown University, serves as an assistant editor for the IEEE Transactions on Biomedical Circuits and Systems and is on the editorial board of the Journal of Neural Engineering. He oversees the design of next generation neural interface and algorithm technologies for the treatment of neurological disease. The group he manages addresses the major issues

of building circuits for neuromodulation technology, from sensing to enabling control algorithms to tissue stimulation. His designs for micropower analog circuits won him the Medtronic "Technical Contributer of the Year" award in 2007, and he shared the Best Evening Session award for the "Circuits for Life" symposia at ISSCC 2007. He received the PhD degree from MIT in Electrical Engineering. He was awarded membership to the Bakken Society. He explores artistic design as a board member and treasurer of FOCI glass studio, Minnesota's center for glass arts.

***Tay Netoff*, PhD: Devices for Epilepsy and Future Hopes; Panel Member Discussant**
Dr. Netoff is an Associate Professor in the Department of Biomedical Engineering at the University of Minnesota. The goal of his epilepsy and neuroengineering research laboratory is to better understand how seizures are generated. The lab is particularly interested in how inhibitory neurons play a role in seizure activity. Much epilepsy research has focused on the excitatory cells because the large amount of activation of neurons during a seizure. Their research leads suggests that inhibitory cells may play a significant role in the onset of seizures. They study seizures in slices of brain tissue using patch-clamp recording and dynamic clamp techniques as well as optical imaging. It is supplemented with experiments modeling large networks of neurons to test hypotheses in a controlled experimental condition. He was awarded a PhD in neuroscience from George Washington University and was a Postdoctoral Fellow in the Center for BioDynamics, Boston University.

***Greg Worrell*, MD, PhD: Devices for Epilepsy and Future Hopes; Round Table Discussant**
Dr. Worrell is an Associate Professor of Neurology in the Division of Epilepsy and Electroencephalography at the Mayo Clinic, Rochester, MN. He divides his time between clinical care of patients with epilepsy, and clinical trials investigating implantable devices for epilepsy. His research is focused on electrophysiological signatures of epileptogenic brain and the transition from normal brain activity to seizures. He is certified by the American Board of Psychiatry and Neurology. Originally educated in physics, Dr. Worrell received the PhD in Condensed Matter Theory at Case Western Reserve University and the MD from University of Texas Galveston Medical Branch.

***Michael Podell*, DVM, MSc: Marijuana and Animals**
Dr. Podell, a Diplomate of the American College of Veterinary Internal Medicine, is a veterinary neurologist specializing in the treatment of medical and surgical neurological problems in small animals at the MedVet Clinic in Chicago, IL. His clinic provides on-site MRI scanning as the most accurate imaging for the rapid diagnosis and treatment of all neurological diseases in a 24-hour critical care hospital setting.

***Ilo Leppik*, MD: Cannabidiol and People with Epilepsy**
Dr. Leppik is Professor of Pharmacy and adjunct Professor of Neurology at the University of Minnesota, and the Director of Research at MINCEP Epilepsy Care Center in Minneapolis, MN, where he has been since 1976. He serves as the Scientific and Medical Advisor of Sierra Neuropharmaceuticals Inc. and is a member of the Medical Advisory Board for Accordant Health Services. He is a leader in the field of antiepileptic medication research and treatment and sees adults and children. He trained in epilepsy at the Montreal Neurological Institute and the University of Wisconsin. Dr. Leppik serves as the President of the American Epilepsy Society and is the Chairman of the Professional Advisory Board of the Epilepsy Foundation of America.

iCOMOS ORGANIZING COMMITTEE

Srirama Rao

Dr. Rao is Professor and Associate Dean for Research since 2007 in the College of Veterinary Medicine, University of Minnesota. Dr. Rao received his Ph.D. in allergy and immunology from the Indian Institute of Science in Bangalore, India, in 1989, after which he conducted post-doctoral studies at Pharmacia-Experimental Medicine in La Jolla, California. Prior to joining the University of Minnesota in 2007, Dr. Rao was Vice President of Research and Professor and Head of the Division of Vascular Biology at the La Jolla Institute for Molecular Medicine in San Diego, California. He is currently a Professor in the Department of Veterinary and Biomedical Sciences in the College of Veterinary Medicine, with a joint appointment in the Division of Pulmonary Allergy Critical Care & Sleep Medicine at the University of Minnesota Medical School. Dr. Rao's laboratory research focuses on understanding the pathogenesis of allergic inflammation including asthma and food allergy. Dr. Rao is currently the Chair of Council of Research Deans at the University of Minnesota. With his administrative and joint faculty appointment, he seeks to build on the strong interdisciplinary and cutting-edge research focus across the Academic Health Center and rest of the university to promote exciting new collaborative One Health research initiatives at the interface of animals, humans and the environment. Specifically, he leads a transdisciplinary effort of "One Medicine One Science" that aims to advance the Science behind One Health. In this capacity he has been the driving force behind the University of Minnesota's "International Conference on One Medicine One Science (iCOMOS)", a global forum dedicated to (i) communicating the importance of science in solving pressing health issues at the interface of humans, animals and the environment; (ii) facilitating interdisciplinary, international collaborations embracing health, science and economics; and (iii) providing information regarding the public policy development necessary for preserving human and animal health.

Michael Murtaugh

Dr. Murtaugh is a Professor of Veterinary and Biomedical Sciences at the University of Minnesota. He was recipient of the American Association of Immunologists Veterinary Immunologist of the Year 2012 Award, has more than 200 peer-reviewed publications and is an inventor on four patents. He is co-organizer of the iCOMOS conferences and a leader in graduate education in the College of Veterinary Medicine. The Murtaugh laboratory seeks a comprehensive understanding of porcine immune responses to infectious pathogens, primarily viral diseases that limit production and welfare. His lab uses functional genomic, molecular biologic, proteomic, and immunologic approaches to help elucidate biochemical and molecular mechanisms of immune resistance that can guide future development of novel approaches for treatment and prevention of disease. The scientific goal is to elucidate the initiating molecular and cellular responses that are crucial in determining the outcome of infection. Dr. Murtaugh received the PhD degree in Entomology from Ohio State University and served as a postdoctoral fellow in cell and molecular biology at the University of Texas Health Science Center in Houston.

Andres Perez

Dr. Perez is the Endowed Professor of Animal Health and Food Safety at the University of Minnesota. Dr. Perez is an expert in the field of veterinary spatial epidemiology and modeling. His research interests primarily include swine and other food animals. Over the past 10 years, he has led a number of educational activities on quantitative epidemiology in 20 countries. Previously, he was a researcher and Director of the University of California Center for Animal Disease Modeling and Surveillance. He is an advisor on epidemiology for the Argentine Animal Health Service and for the Foreign Animal Disease Research Unit of the USDA Agricultural Research Service. He is currently the lead expert for the Science, Technology, Engineering, and Mathematics for Minnesota Advancement (STEMMA) project. He received the DVM degree from the Universidad Nacional de Rosario, Argentina, and the PhD degree from Universidad de Buenos Aires, Argentina.

Carol Cardona

Carol Cardona is the Ben Pomeroy Chair in Avian Health at the University of Minnesota. She is an expert in surveillance for and detection of avian influenza in domestic poultry, as well as in zoonoses (infectious

diseases that are transmitted between animals and humans) and the role that poultry play in human health and wellbeing, especially in developing countries. She has served as co-director of the Minnesota Center of Excellence for Influenza Research and Surveillance and works with large and small poultry producers to develop detection and prevention strategies. Her laboratory focuses on the broad field of viral disease pathogenesis in domestic poultry species, more specifically on diseases that modulate host responses. Her group is interested in the viral and host factors that determine transmissibility and viral adaptation particularly in how that relates to interspecies transmission of emerging and zoonotic diseases. As Pomeroy Chair, Dr. Cardona also works with partners and faculty in large-scale issues for food animals, gut health, respiratory health, and animal welfare. Dr. Cardona was awarded the PhD in Pathology at Michigan State University, the DVM at Purdue University, and DACPV and Avian Disease Specialist Residency at Cornell University.

Claudia Neuhauser

Claudia Neuhauser is the Director of Research Computing in the Office of the Vice President for Research, overseeing the University of Minnesota Informatics Institute (UMII) and the Minnesota Supercomputing Institute (MSI). UMII fosters and accelerates data-intensive research across all disciplines in the University and develops partnerships with industry. MSI provides high-performance computing resources to the University. Dr. Neuhauser's research is at the interface of mathematics and biology, and focuses on the analysis of ecological and evolutionary models and the development of statistical methods in biomedical applications. She has been the Director of Graduate Studies of the Biomedical Informatics and Computational Biology graduate program since 2008. She also has served as Vice Chancellor for Academic Affairs at the University of Minnesota Rochester (UMR). Previously, she was Professor and Head of the Department of Ecology, Evolution and Behavior at the University of Minnesota Twin Cities. She is a Distinguished McKnight University Professor, Howard Hughes Medical Institute Professor, and Morse-Alumni Distinguished Teaching Professor. She held faculty positions at the University of Southern California, the University of Wisconsin Madison, and the University of California Davis. She is currently a faculty member in the Department of Ecology, Evolution and Behavior, the Department of Biochemistry, Molecular Biology and Biophysics, and the Department of Computer Science and Engineering. She is a fellow of the American Association for the Advancement of Science (AAAS) and a fellow of the American Mathematical Society (AMS). Dr. Neuhauser was awarded the PhD degree in Mathematics from Cornell University and a Diploma in Mathematics from the Universität Heidelberg, Germany.

Clifford Steer

Dr. Steer is Associate Dean for Faculty Affairs at the University of Minnesota Medical School. He also is Professor of Medicine, Director of the Physician-Scientist Training Program, and holds joint appointments in the Department of Genetics, Cell Biology and Development, and in the Stem Cell Institute. His research program uses the Sleeping Beauty transposon system as a gene therapy vector to investigate liver, bone marrow and brain disorders. Another area of research is the use of ursodeoxycholic acid (UDCA), a hydrophilic bile acid, as a potent antiapoptotic agent to treat transgenic models of Huntington's disease and retinitis pigmentosa as well as acute stroke, spinal cord injury, myocardial infarction, and acute renal failure. Steer's lab also is actively characterizing the role of microRNAs in gene regulation for a number of different target organs and stem cell populations. In particular, they have identified specific microRNAs that may be involved in the cancer progression of colon polyps; as well as their role in the regenerating liver. The studies are both basic and translational in nature. They are also identifying specific microRNAs as biomarkers of disease that can be assayed in blood. Most notably, they have recently discovered a unique nuclear profile of mature microRNAs; and a subset of microRNAs in mitochondria that may act as a rheostat for the control of apoptosis. Dr. Steer received the MD degree and residency training at the University of Minnesota Medical School and conducted research in liver diseases for 14 years at the NIH.

Hortencia Hornbeak

Dr. Hornbeak is Associate Director for Scientific Review and Policy at the National Institute of Allergy and Infectious Diseases (NIAID), NIH. After her post-doctoral fellowship at the NIAID/NIH, Dr. Hornbeak assumed the position of Assistant Professor at the University of Alabama, School of Medicine, Mobile, AL. She taught medical students and conducted independent research in virology for five years

and then returned to the NIH where she began her career in Health Science Administration. Dr. Hornbeak has authored peer-reviewed publications and chapters on research career development and succeeding in grantsmanship. She has extensive communication and outreach with extramural scientific community, including the U.S. expert consultant to the Global Fund for AIDS, Tuberculosis & Malaria (GFAMT) for the establishment and management of the GFAMT review of grant applications; a representative of the State Department team that reviewed "Baltic Science and Technology" in Latvia, Estonia and Lithuania, resulting in the initiation of collaborative research among the U.S. scientists and their counterparts in the Baltic countries; and integrally involvement in restructuring of the AIDS clinical trial networks including outreach workshops in several continents (i.e. Argentina, Colombia, Brazil, Thailand, South Africa and the U.S.) over the last 20 years. Dr. Hornbeak earned a Certificate in Public Leadership from The Brookings Executive Education, and serves on the NIH faculty for Health Scientists Administrators and the Brookings Institute training programs. Brookings Institution trainees included Senior Executive Service candidates from federal agencies and the private sector. Dr. Hornbeak continues to serve as a leader and mentor to HSAs at NIH and the scientific community Dr. Hornbeak obtained a BA in Biology and Chemistry from Skidmore College and her Ph.D. in Medical Microbiology from Georgetown University.

Lewis Gilbert

Lewis Gilbert is Managing Director and Chief Operating Officer with the Institute on the Environment at the University of Minnesota. He represents the Institute at senior levels in University governance and to the public. Gilbert is responsible for inspiring collaboration among existing IonE programs and creating new endeavors that advance the Institute's mission. He also oversees the operational aspects of IonE's facilitator role across the whole of the University of Minnesota. Gilbert is an academic entrepreneur focused on the design, implementation and management of complex interdisciplinary activities in large research universities. He was a key architect in the creation of the Earth Institute at Columbia University and a central figure in the revitalization of the Nelson Institute at the University of Wisconsin-Madison. Among the major activities he has worked on are: creation of the International Research Institute for climate prediction, integration of CIESIN into the Earth Institute, creation of the Wisconsin Initiative on Climate Change Impacts, and evolution of the Wildlife Data Integration Network. He has also served as a consultant to Arizona State University, CINCS LLC and the Twycross Zoo. Gilbert has taught regularly in the MPA program at Columbia and in the Business School at the University of Wisconsin. He has also designed undergraduate curricula. His courses and lectures focus on the human role in the evolution of Earth and on the inherent complexity of natural and human systems.

Ned Patterson

Dr. Patterson is an associate professor of clinical veterinary medicine at the University of Minnesota. He is the director of the Canine Epilepsy Research Consortium. Dr. Patterson's instructional areas include genetics, seizure disorders, and molecular medicine. His recent research focuses on understanding and treating epilepsy in dogs and as a model for human epilepsy using novel drugs and novel devices. Additional clinical interests include clinical trials, endocrinology, and comparative medicine. He was awarded both the DVM and PhD degrees from the University of Minnesota.

Peter Jackson

Dr. Jackson is Chief, AIDS Research Review Branch, Scientific Review Program, NIAID. He has over 25 years of experience in the scientific and technical peer review of basic through applied research grant applications and contract proposals in HIV/AIDS, other Infectious Diseases, and Immunology at the NIAID, NIH. He is familiar with NIH policies and procedures for developing and evaluating grant applications and contract proposals from US and non-US investigators. In addition to his peer reviewed scientific papers, Dr. Jackson authored peer-reviewed several book chapters on developing a competitive research career, identifying research funding opportunities, and submitting successful grant applications. He has provided NIH grantsmanship training to researchers worldwide, including an extended period in 2009 when he served as a US Embassy Science Fellow in Croatia. Dr. Jackson's training is in Infectious Diseases. His PhD is from Rice University, and his Postdoctoral Fellowships were at the University of Massachusetts and the Walter Reed Army Institute of Research (WRAIR). After serving as a Research Microbiologist at the WRAIR, he joined the American Institute of Biological Sciences and helped

manage the peer review of USAID supported Malaria Vaccine Research Program grant applications. His NIAID, NIH career began in 1990.

Shaun Kennedy

Dr. Kennedy created and leads the Food System Institute, LLC, and is an Associate Professor in the Department of Veterinary Population Medicine at the University of Minnesota. Previously, he created and directed the National Center for Food Protection and Defense (NCFPD), a Department of Homeland Security Center of Excellence, and the Associate Director for the Center for Animal Health and Food Safety. Shaun's research focuses on food system bio-security, food safety and food defense and he has authored leading articles and book chapters on both. Professor Kennedy is the current chair of the International Association for Food Protection Food Defense professional development group, serves on the US Pharmacopeia Intentional Adulterants Expert Panel and is a scientific advisor to food firms, national laboratories and regulatory authorities. Shaun provided the inaugural lecture in the FDA's Chief Scientist Lecture series and received the FDA Commissioner's Special Citation for advancing food defense.

Srinand Sreevatsan

Dr. Sreevatsan is a Professor of Infectious Disease and Director of the Veterinary Medicine Graduate Program at the University of Minnesota. The Sreevatsan laboratory focuses on microbe-host interactions with specific emphasis on the evolution of the pathogen and its adaptation to hosts. Dr. Sreevatsan is currently investigating the molecular diversity in mycobacteria, microbial population structure and functioning in pathogen induced environments, influenza virus ecology and evolution, and developing novel ligands and approaches toward new diagnostics and therapeutic modalities for infectious diseases. He received the MVSc degree from the University of Agricultural Sciences, Bangalore, India, and the PhD and MPH degrees from the University of Minnesota.

Amy McMillen

Amy McMillen is Partnerships and Outreach Coordinator for the Food and Agriculture Organization (FAO) of the United Nations' Liaison Office for North America. Ms. McMillen develops multi-stakeholder partnerships for global food and nutrition security with a current emphasis on One Health and Global Health Security. Previous to this role, Ms. McMillen designed and launched collaborative advocacy campaigns and food security initiatives including the World Food Day Network and public awareness campaign for North America; a global school gardening and internet connectivity project, The Growing Connection; and Groundwork, a week-long fundraising concert series in Seattle, WA featuring major recording artists.

Ajay Markanday

Ajay Markanday is Director of the Food and Agriculture Organization (FAO) of the United Nations' Liaison Office for North America. Trained in agricultural economics, he has over 33 years of agricultural development experience in Asia, the Pacific and Africa with a variety of international development organizations and research institutions. He joined FAO as an economist in the Economics and Trade Division and was later transferred to the Investment Centre Division as Senior Economist. He served as the FAO Representative in Cambodia, where the Prime Minister and Royal Government of Cambodia honored him in recognition for services to the country by FAO, a first for the UN. He has served as Senior Advisor to the FAO Deputy Director-General Knowledge, as Chief of the Donor Liaison and Resource Mobilization Service, and as FAO Representative to the World Bank in Washington DC.

2016 International Conference on One Medicine One Science
Poster Abstracts

Air Quality, Environmental Exposures, and Health - 1

The Web of Causation: A Conceptual Model Assess Environmental Exposures During Foodborne Outbreak Disease Investigations

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The production and distribution of safe food needed to support the health of human civilization represent both a major accomplishment and constant challenge for modern societies. To help address this challenge, the USA enacted the Food Safety Modernization Act to maintain supplies of safe food products and improve health by reducing outbreaks of foodborne illness. While the development of food safety standards domestically and internationally at both pre- and post-harvest steps is anticipated to help reduce such outbreaks, the existence of multiple complex issues surrounding food production and distribution make future occurrences of such outbreaks unavoidable. Along with the need for creating and adopting food safety standards by public policy, so too exists the need for comprehensive standard approaches to discover root causes of health outcomes such as foodborne illness when outbreaks occur. Such approaches must consider the complex relationships that exist among environmental hazards that lead to contamination at all points along the food supply continuum. To address the need for a One Medicine/One Health approach to investigating the complex interactions among pathogens, sources and routes of contamination, farming practices, and the environment, a 'Web of Causation' was created. This conceptual model illustrates the multitude of complex pathways that lead not only to vulnerabilities in production of safe food, but also to an organized approach by which sources for environmental exposures can be identified and health outcomes such as outbreaks of foodborne illness can be prevented.

Air Quality, Environmental Exposures, and Health - 2

Relations between Chemical Exposure in the Home and Young Children's Adjustment

Gustavo Carlo, Alexandra N. Davis, Zehra Gulseven, Luis Diego Conejo-Bolanos, Francisco Palermo, Jane McElroy, Chung-Ho Lin, and Susan C. Nagel, *University of Missouri, Columbia, MO*

Children living in poverty are at-risk for deleterious outcomes resulting from environmental toxicants exposure (need cite). Children can be exposed to toxic substances from cosmetics and cleaning agents; home products, such as paints; pesticides, such as lawn sprays and insect repellant, and gas emissions from home appliances (Faustman et al., 2000). Because children may be unknowingly exposed to harmful substances via products that parents may perceive as safe and routine, it is important to examine how exposure may be linked to children's cognitive and mental health. We examined home toxicant exposure to preschooler's internalizing problems and self-regulation. Data collection is ongoing but participants include 40 parents of their children (*M* age = 49.3 months) enrolled in Head Start centers in Kansas City. Parents completed measures of their use of personal products (e.g., perfumes, lotions; alpha = .64), home products (paints, varnishes; alpha = .64), pesticides (alpha = .40), and gas emissions in the home (alpha = .64). Additionally, parents reported on children's internalizing symptoms (anxiety/depressive, alpha = .82) and effortful control (self-regulation, Eisenberg et al., 2011; alpha = .72). Preliminary correlation analyses demonstrated a significant negative link between personal care products and effortful control; positive links between both personal care and home products and internalizing problems. Pesticide use was negatively associated with internalizing problems (see Table 1). Multiple regression analyses controlling for possible confounds (e.g., quality of parent-child relationships) will be conducted once data collection is completed. Discussion will focus on toxicant exposure and young children's adjustment.

Air Quality, Environmental Exposures, and Health - 3

Associations between Home Toxicant Exposure and Preschooler's Aggressive and Prosocial Behaviors

Alexandra N. Davis, Gustavo Carlo, Zehra Gulseven, Luis Diego Conejo-Bolanos, Francisco Palermo, Jane McElroy, Chung-Ho Lin, and Susan C. Nagel

University of Missouri, Columbia, MO

Young children living in low-SES environments may be particularly prone to the detrimental effects of environmental toxicants (Bouchard et al., 2011). Chemicals from products routinely used in and around the home can contribute to children's health and social functioning (Faustman et al., 2000). Despite the extant research on toxicant exposure and children's social functioning, much of the existing focuses on negative outcomes (such as aggression) but not on prosocial outcomes. Prosocial behaviors are defined as actions that benefit others and have been linked to health and wellbeing (Carlo, 2014). We examine the relations between home chemical exposure and aggressive and prosocial behaviors in young children from low-SES environments. Data collection is ongoing but participants include 40 parents of their children (*M* age = 49.3 months) enrolled in Head Start centers in Kansas City. Parents completed measures of their use of personal products (e.g., perfumes, lotions; alpha = .64), home products (paints, varnishes; alpha = .64), pesticides (alpha = .40), and gas emissions in the home (alpha = .64). Parents reported on children's physical aggression (alpha = .84) and prosocial behaviors (alpha = .88). Preliminary correlation analyses demonstrated a significant negative link between personal care products and prosocial behaviors and a negative link between home products and aggressive behaviors (see Table 1). Once data collection is completed, multiple regression analyses will be conducted to control for confounds (e.g., quality of parent-child relationship). Discussion will focus on the association of home toxicant exposures to young children's social behavioral functioning.

Table 1. Correlations and descriptive information for product use, prosocial behaviors, and aggressive behaviors.

	1	2	3	4	5	6
1. Pesticides						
2. Personal Care Products	-.03					
3. Home Products	-.34	.47				
4. Gas Emissions	-.27	.14	.41			
5. Prosocial Behaviors	.25	-.23	-.18	.03		
6. Aggressive Behaviors	.01	-.06	-.41	-.35	-.18	
Mean/SD	.39/.27	.14/.23	.61/.24	.59/.31	2.32/.41	1.20/.22

Air Quality, Environmental Exposures, and Health - 4

Environmental Persistence of Porcine Epidemic Diarrhea Virus (PEDV), Porcine Delta Corona Virus (PDCoV), and Transmissible Gastroenteritis (TGEV) in Feed Ingredients

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Global commercial animal feed manufacturing is the largest component of producing safe and abundant animal derived food products. Minimizing the risk of contaminants in animal feed is essential for supporting animal and human health. Animal feed is often manufactured in centralized mills for distribution to livestock farms, which may result in contaminated feed ingredients being fed to large numbers of animals. Understanding the mechanism for disease transmission from feed ingredients can help to better manage this risk. This study was designed to characterize the inactivation of three swine coronaviruses in several feed ingredients. Five gram samples of spray dried porcine plasma, meat meal, meat and bone meal, blood meal, corn, soybean meal, or dried distillers grains with solubles were weighed into vials, spiked with 1mL of PEDV, PDCoV, or TGEV, and then stored at room temperature for up to 56 days. At various time intervals, virus was eluted in a buffer solution, centrifuged, and supernatants were used to determine virus concentrations. Virus inactivation kinetics was characterized by the Weibull model, which produced a delta value indicating the amount of time necessary to reduce virus concentration by 1 log. In general, the greatest delta value was observed in soybean meal (PEDV: 7.49±4.62 days, PDCoV: 42.04±14.00 days, TGEV: 41.94±19.81 days) and corn (PEDV: 7.49±4.62 days, PDCoV: 25.60±1.37 days, TGEV: 11.78±16.77 days). Virus survival was generally lower in blood meal (PEDV: 2.84±0.73 days, PDCoV: 1.23±1.31 days, TGEV: 2.15±0.96 days). These results indicate that virus survival may be higher in plant based feed ingredients.

Air Quality, Environmental Exposures, and Health - 5

Characterization and Modulation of Flavor in Extruded Corn Puffs

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The development of flavor in extruded goods has been widely studied. However limited information is currently available regarding the difference in aroma generation or different bitter drivers between whole grain and refined flour. This work focuses on elucidating the key aroma and bitter differences between refined and whole grain corn flour through the utilization of GC-O guided and sensory driven bitter analysis. Initial analysis has shown that there are host of compounds that are responsible for the aroma differences between whole grain and refined grain extruded corn puffs. The different compounds include compounds from a host of reaction pathways including the maillard reaction and lipid oxidation. In addition to the aroma differences identified bitter compounds; cheanorpine and coumaryl-sperimidine have been identified as primary bitter drivers in extruded corn puffs. The final steps of the project aim to determine how the bitter compounds might be degraded using natural chemistry of the corn flour during simulated processing. Aroma will also be monitored to gain insight in to how simulated processing methods might impact the aroma.

Air Quality, Environmental Exposures, and Health - 6

Nanoselenium Sponge Technology for Mercury Removal from Water

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Mercury contamination of water is a global problem that causes a major threat to aquatic life but also to human health by entering the food chain. As much as 10 % of newborn in northern Minnesota have high blood level of mercury due to fish consumption by pregnant women. According to Environmental Protection Agency (EPA), the maximum acceptable levels of mercury in drinking water and fish are 2 µg/L and 1ppm respectively. EPA reports also showed that different types of seafood contain levels of mercury usually higher than or near to the maximum acceptable range. Numerous methods have been employed to remove mercury from water. These include, the use of chemicals to precipitate mercury, activated carbon, bioremediation using bacteria and thiol-based molecules. Despite these efforts, current technologies are still costly when used at a large scale, mercury capture is usually reversible, and there is still no available technology to remove accumulated mercury from large water bodies such as lakes. Using nanotechnology, we have developed a cost-effective nanoselenium sponge technology capable of removing > 99.95 % of mercury from water within a few minutes (US Patent Pending # 62/240,764 [Oct. 10th, 2015]). Unlike commercially available sorbents, the nanoselenium sponge permanently captures mercury to form non-toxic products, thus providing a more sustainable solution. In addition, the sponge exhibits strong antimicrobial properties, which prevents biofouling. Ongoing work is focused on improving the efficiency along with the environmental friendly disposal.

Air Quality, Environmental Exposures, and Health - 7

UltraSensitive Method of Detection for Mercury (II) Ions

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Mercury is widely recognized as a major environmental pollutant, with broad impacts concerning environmental and human toxicity. Owing to these toxic physiological effects of mercury on human health, efforts are being made to detect mercury in environmental systems. The maximum limit set by the US Environmental Protection Agency (EPA) for Hg^{+2} in drinking water is 2 ppb (7.3 Pico molar, pM). In the study, hydroquinone mediated mercury-gold nanoparticles (Hg^{0}-Au) amalgamation is used for the detection of Hg^{+2} ions. Hydroquinone in presence of Hg^{+2} ions gets oxidized to benzoquinone and forms Hg^{0}-Au amalgamation. The benzoquinone and Hg^{0}-Au resulted in a colored product which was analyzed spectrophotometrically. The method gave detection of limit 0.1 ppb (0.36 pM). Thus the study provided a simple, easy and inexpensive method of detection for Hg^{+2} with ultra-low sensitivity.

Air Quality, Environmental Exposures, and Health - 8

Preliminary investigation into the presence of contaminants of emerging concern in aquatic subsistence species in northeastern Minnesota

Tiffany M. Wolf[1], Seth Moore[2], Mark Ferrey[3], Mark Jankowski[4], Nicholas Phelps[1], Matteo Convertino[1], Jamie Middleton[5], Aimee Hunt[1], Dominic Travis[1]

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Tribal communities rely heavily on fish and other species in the Lake Superior watershed for subsistence; however, concerns for the impact of endocrine-active or toxic chemicals in the environment on the health of fish populations and humans that consume them raises questions about the safety and security of subsistence food. To address these concerns, the University of Minnesota is collaborating with the Grand Portage Band of Chippewa and other agencies to assess concentrations of chemicals of emerging concern (CECs), such as pharmaceuticals, current-use pesticides, and organic wastewater contaminants, in the Lake Superior watershed. A recent pilot study was carried out to screen for over 100 CECs in water and fish tissue from four distinct locations on the Grand Portage Indian Reservation. These efforts resulted in the detection of five compounds in water (androstenedione, androsterone, cotinine, hydrocodone, and metformin), seven compounds in fish tissue (betamethasone, venlafaxine, triclosan, clotrimazole, hydrocortisone, iopamidol, and triclocarbon), and DEET in both water and fish tissues. Although the effects of such CECs on animal and human health are generally unknown, these results provide the basis for future studies to explore the impacts of CECs on the safety and security of important subsistence species. This project supports the UMN Grand Challenge for food and water security and the 2015 Lake Superior Lakewide Action and Management Plan in the identification of emerging chemicals of concern.

Animal Health and Disease - 9

Attitudes of pharmacy and nutrition students towards team-based care after first exposure to interprofessional education in Qatar

Al Abdi, Tamara, et al.

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Little is known regarding attitudes of healthcare professional students towards team-based care in the Middle East. As modernization of health systems is rapidly occurring across the Gulf Cooperation Council countries, it is important for students to engage in interprofessional education (IPE) activities. The objective of this study was to assess pre-clinical student's attitudes towards interprofessional healthcare teams after completion of their first IPE activity. A previously validated questionnaire was distributed to 25 pharmacy and 17 nutrition students at Qatar University after participation in an IPE event. Questions related to quality of team based care and physician centricity. Results showed high agreement regarding high quality care provided by teams yet students were unsure of the value of team-based care when considering required time for implementation. Results provide baseline data for future studies to assess student attitudes throughout the professional programs and give valuable insight for future IPE program design in the Middle East.

Animal Health and Disease - 10

Epidemiological Tools for Real-Time Management of Swine Disease Risk

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The Swine Health Monitoring Project (SHMP) is a national initiative to monitor and control swine pathogens in sow herds across the United States. As of March 2016, approximately 40% of the U.S. sow population was enrolled in the SHMP, representing 26 production systems. The objective of this study was to develop analytical methods for near real-time prediction of porcine reproductive and respiratory syndrome (PRRS) risk using SHMP data. Region-specific sow herd density maps and cumulative incidence risk maps were constructed (timeframe: July 2015 - February 2016). A total of six regions were defined, representing the southeastern US, Pennsylvania, the Oklahoma panhandle, southern Minnesota/Northern Iowa, southern Iowa/Illinois, and South Dakota/Nebraska. Swine farm density and risk maps were created using Gaussian kernel smoothing implemented in the package 'spatstat' in R v. 3.2.3. Within each region, PRRS cumulative incidence risk ranged from approximately 3 to 23%, with the highest incidence recorded in the Oklahoma panhandle, southern Minnesota/Northern Iowa, and southern Iowa/Illinois regions. Risk maps showed that the areas where cumulative incidence was the highest did not necessarily correspond to areas with the highest swine density. Future work in this project includes incorporation of additional epidemiological factors to inform predictions, such as movement and environmental data, to develop a platform for real-time risk management for PRRS and other diseases. This work will ultimately help to prevent and control PRRS spread in the United States.

Animal Health and Disease - 11

Evaluation of a Brucellosis Vacciantion Campaign and Management Practices in Two Districts of Buenos Aires, Argentina

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In Argentina, bovine brucellosis is endemic. Vaccination of heifers with strain S19 is mandatory. SENASA entrusts the vaccination campaign execution to Local Sanitary Entities (LSEs).
Purpose: to evaluate brucellosis management practices concerning and the vaccination campaign and vaccine coverage in two districts. Questionnaires were performed to 113 farmers, 11 veterinarians, 13 vaccinators and 2 people of the LSEs. To check the vaccine coverage, serum of 20 heifers vaccinated 30-50 days earlier from 21 of the 113 farms were randomly taken. The BPA verified the vaccine exposure. Farms with at least 19 BPA + heifers were considered "corrected vaccinated". Results: a) Farmers: 65% tried to diagnose reproductive disorders (Neospora caninum, the most common cause). Dairy farmers diagnosed more than beef ones. 42% purchased cattle, only 38% did so from free certified farms and 27% tested the purchased animals, although all veterinarians suggested it. In beef, more "unacceptable" answers were found. b) Vaccinators: 77% calibrated the syringe, 40% homogenized the vaccine and 75% injected it again if it dropped. c) Vaccine coverage: 83% of heifers was BPA+, significantly lower than the expected coverage of 100%. At all farms at least one heifer was BPA+, but only 52% can be considered "corrected vaccinated". Although well advised by veterinarians, farmers should improve some management practices. The vaccination campaign is globally well implemented but some aspects should be improved. The low coverage is not due to the quality of the vaccine but more related to the lack of goof vaccination practices.

Animal Health and Disease - 12

Cell Culture Adaptation of Parvoviral Starins Obtained From Cats

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Canine parvovirus (CPV) is the most important and significant disease causing contagiousvira enteritis in pups and adult dogs charaterized by acute haemorrhagic enteritis, myocarditis and leucopenia. The feline parvovirus (FPV) is the ancestor for the current CPV strains. The FPV infects cats, minks and raccoons, which is characterized by leucopenia,enteritis additionally CNS symptoms like seizures. Since the cats can be infected with both FPV and CPV variants the cats can act as a source for emergence of new mutants. And also the CPV variants from the cats are highly prone to mutations, suggesting that still the virus evolves. So the study was taken up to study about the rate of amino acid substitution by subjecting the virus under pressure by adapting in heterologous cell line. Two isolates obtained from cats CPV-2a and FPV were characterized by full length sequencing of the VP2 gene were selected. Each strain was passaged in both homologous (CRFK cell line-Feline origin) and heterologous (A-72 cell line-Canine origin). Each virus was passaged in both the cell line for fifteen times. At the end of the fiteen passage the virus was full length sequenced. The full length sequence of VP2 gene of the field and the passaged viruses was analyzed for amino acid substitution. The study reveals that the CPV variant isolated from the cat showed several numbers of amino acid substitution when passaged in heterologous cell line (A-72 canine origin) suggesting that the virus from cats were still evolving and act as a source of emergence of viral mutants.

Animal Health and Disease - 13

Comparison between Real-Time Rt-Pcr and Virus Isolation for Testing Early Protection of O1 Manisa Vaccinated Cattle against Heterologous Challenge

Paula Bonastre[1], Jacquelyn Horsington[2], Andrea Pedemonte[1], Eduardo Maradei[1], Ricardo D' Aloia[1], Ana Nicola[3], Claudia Perez Beascoechea[1], Sabrina Galdo Novo[1], Enrique Lago[1], Daniela Pereyra[1], Angeles Ponde[1], Mercedes Maradei[1], Valeria Gonzalez Thomas[1], Pilar Muntadas[1], Graciela Cadenazi[1], Gabriela Madonni[1], And Wilna Vosloo[2]

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Foot-and-mouth disease (FMD) is a contagious viral disease and endemic in many parts of the world that demand a highly potent vaccine for emergency in the vaccine bank of the different region of the world. Therefore in the frame of a collaborative project between SENASA -National Service for Agrifood Health and Quality, Argentina and CSIRO-Australian Animal Health Laboratory (AAHL), Australia. We analyze the protection at 4 and 7 days post vaccination with a high potency (>6pd50) O1 Manisa double oil emulsion vaccine when challenged with O/Southkorea/2010, comparing Real-Time RT-PCR and Virus Isolation. The comparison between Real-Time RT-PCR and virus isolation for testing early protection of O1 Manisa vaccinated cattle against heterologous challenge was also used as tool to analyze if vaccination prevent the carrier state in infected cattle or not.

Animal Health and Disease - 14

Transmission of Foot and Mouth Disease Virus in Vaccinated Cattle

Sergio Duffy

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Objective: to evaluate the effect of vaccination on transmission of foot-and-mouth disease (FMD). Non vaccinated calves without antibodies (Ab) against FMD were randomly assigned to the groups, A: Non vaccinated and challenged (n=10); B: vaccinated day(-7) and challenged (n=10); C: vaccinated day(-14) and challenged (n=10) and D: vaccinated day(-14) and not challenged (n=5). On day(0), five animals from the groups A, B and C were housed in separate rooms and inoculated via intranasal (10.000DI;virus A2001). After 24 hours, they were released again in contact with the other five of their group for 29 days. Commercial oil vaccine (A_{2001};A_{24};O_1Campos;C_3Indaial) was used. An animal was considered infected if there was either (CS) clinical signs or lesions compatible with FMD, viral isolation, detection of viral genome (RT-PCR) or Ab against non-structural proteins. Transmission was estimated using the R reproductive rate. Results: Group A, all cattle became infected, presenting CS and lesions. Groups B and C, animals intranasal challenged became infected but had not CS or lesions. In contrast, none of the calves challenged by contact became infected. Group D, the animals remained negative. In Group A, R=0 (CL95%: 0.67-∞), (P=0.08). For groups B and C, R =0 (CL95%: 0-2.18), (P=0.13). The estimates for groups B and C, R were significantly lower than for the group A (P=0.013). Conclusion: Under these conditions, vaccination conferred complete clinical protection and significantly reduced the transmission of the A2001 virus in cattle from 7 days post-vaccination on. FMD vaccination may help to improve food security and poverty alleviation.

Animal Health and Disease - 15

Investigation of the Role of the Aryl Hydrocarbon Receptor and Endocrine Disrupting Chemicals in Equine Metabolic Syndrome

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Equine metabolic syndrome (EMS) is a clustering of abnormalities including insulin dysregulation, dyslipdemia and adiposity analogous to human metabolic syndrome (MetS). Our lab demonstrated EMS phenotypic variability is explained by individual (51-77%) and environmental (23-49%) factors. Despite up to 49% of variability being related to environment; only 4-18% is explained by diet, exercise and season, suggesting that other environmental factors play a role. Recently, associations between Endocrine Disrupting Chemicals (EDCs) and MetS have been identified. Preliminary data demonstrated that horses housed <30 miles of EDC disposal sites had higher post sugar challenge insulin concentrations (OST-insulin) (p=0.00005), suggesting EDC exposure may be an EMS risk factor. A genome-wide association and sequence analysis identified four synonymous and three non-synonymous single nucleotide polymorphisms (SNPs) within the transactivation domain (TAD) of the aryl hydrocarbon receptor *(AHR)*, which is responsible for downstream metabolic effects of EDCs. The objective of this study was to determine if plasma EDC concentration and variants within the *AHR* are associated with metabolic measures of EMS. Plasma EDC concentrations were measured using the CALUX-DR bioassay in 158 Morgans and 137 Welsh Ponies from 32 farms. Mean EDC concentration was 0.23 TEQ/ml. Plasma toxin concentration was not associated with EMS measures except plasma triglyceride concentrations (p=0.040). A single SNP was associated with fasting insulin concentrations (p=0.008). A second SNP was associated with OST-insulin (p=0.0002), OST-glucose (p=0.0003). A SNP haplotype spanning the TAD was associated with plasma leptin concentrations (p=0.041). The results suggest that *AHR* variants and EDCs may play roles in EMS.

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Pcv2 Neutralizing Antibody Levels in Colostrum from Farms With High or Low Levels of Viremia

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Porcine circovirus type 2 (PCV2) is the causative agent of porcine circovirus-associated disease (PCVAD). Vaccination against PCV2 at or around weaning effectively controls disease in finishers. Nearly all pigs in the US are vaccinated and develop PCV2-specific antibodies, but virus is not eliminated. Neutralizing antibody titers may be a more effective indicator of controlled infection than PCV2-specific antibody. Four sow herds were evaluated on vertical transmission of PCV2, sow PCV2 ELISA and colostrum PCV2 NA to gain information on antibody control of infection. Significant differences in PCV2 PCR were observed between Farms A&B and Farms C&D. No significant differences were observed analyzing antibodies from sows using a PCV2 ELISA. A broad range of 50% neutralizing antibody titers, from 1:159 to $1:1x10^6$ was observed and a significant difference in average neutralizing antibody titers was shown between Farms A&B and Farms C&D. Sow ELISA results do not indicate differences in sow herd stability. However, in this study, NA titers differed significantly between stable (A&B) and unstable farms (C&D); higher NA titers observed in farms with no to low virus levels compared to farms with high levels of vertical transmission. This suggests that sows on farms with higher vertical transmission may develop less protective NA and may be more susceptible to disease due to amounts of replicating virus present. Likely, protective colostrum antibodies need to be produced and passed to piglets in order to protect against disease.

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Potential Distribution of the Viral Hemorrhagic Septicemia Virus (Vhsv) in the Great Lakes Region

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Viral Hemorrhagic Septicemia virus (VHSV) genotype IVb is responsible for large fish mortality in the Great Lakes of North America. Anticipating the areas of potential VHSV occurrence is key to designing epidemiological surveillance and disease prevention strategies to mitigate the impacts of VHSV in the Great Lakes basin. We explored the environmental features that could shape the spatial distribution of VHSV, based on remote sensing and climate data via ecological niche modeling. Environmental variables included temperature measured during the day and night, precipitation, vegetation, bathymetry, solar radiation, and topographic wetness. VHSV occurrences were obtained from available reports of virus confirmation in laboratory facilities. We fit a Maxent model using VHSV-IVb reports and environmental variables under different parameterizations to identify the best model to generate continuous and binary maps of potential VHSV occurrence based on environmental suitability. VHSV reports were generated from passive and active surveillance, thus, occurrences were abundant in shorelines. We, however, were able to capture the environmental signature of VHSV based on the environmental variables employed in our model, allowing us to identify patterns of VHSV occurrence. Our findings suggest that VHSV is not at an ecological equilibrium and more areas could be affected, including areas not in close geographic proximity to past VHSV reports.

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Tuberculosis in Calves Associated with Colostrum Management

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Bovine tuberculosis (BT) is an infectious disease caused by *Mycobacterium bovis* (*M. bovis*). Information about risk associated with the pooling of colostrum is scarce in dairy herds of Argentina. The aim of this study was to evaluate the risk of BT in calves that were fed with pool of colostrum (PC). A longitudinal study was conducted in endemic BT dairy herd. PC comprised colostrum collected by farm personnel within 12 h post-calving from cows or heifers and frozen at -20 ° C. All animals received colostrum during the first 12 h of life and then they were fed with milk replaced. The exposed group (*n* = 354) received PC with teat-bottle (between 2 and 4 liters). The unexposed group (*n* = 154) received fresh colostrum from the dam. All calves were subjected to the tuberculin skin test (≈ 10 week-old). The relative risk (RR) and population attributable proportion was calculated. The incidence of BT in calves exposed was 19.3% and in unexposed calves was 9.8%. Calves receiving PC had almost doubled risk of BT (RR = 1.9; 95% CI = 1.1 - 3.3; p = 0.0087). Population attributable proportion indicates that 40% of the total incidence of BT in calves would be reduced by avoiding the PC. We conclude that exposure to PC is a potent risk factor associated with BT in calves. The implementation of technologies such as pasteurization of colostrum would be an important factor to consider in order to advance in the control and eradication of BT in dairy herds.

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Tuberculosis in Calves and Cats in a Dairy Herd

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Bovine tuberculosis (BT) is an infectious disease endemic in Argentina, caused by *Mycobacterium bovis* (*M. bovis*). Domestic cats (*Felis silvestris catus*) are also susceptible to infection by *M. bovis*. However, there is little local information about BT in cats of rural areas. The aim of this study was to confirm the *M. bovis* infection in calf and cats that cohabiting in an endemic BT dairy herd. Calves prevalence was 22% (12/55). One calf positive to tuberculin skin test were necropsy at 90 days-old. A colony of cats, consisting of 30 individuals, cohabiting in the area of artificial rearing of calves. Eight cats was necropsy. Samples for bacteriology and histopathology were collected in the calf and cats. Spoligotyping technique was used for identify *M. bovis* and spoligotypes. The calf showed typical lesions of BT in thorax (lung, lymph node mediastinal and tracheobronchial). Histopathology detected granulomatous foci coinciding with macroscopic lesions sites. Two cats showed typical lesions of BT in lung and in one of them, the histopathology showed granulomatous foci and acid-fast bacilli. *M. bovis* was detected in lesions of the cats and two calf, with the same spoligotypes in both species. In dairy herds endemic for BT, cats that cohabiting with calves may be infected by *M. bovis*. A unique spoligotypes of *M. bovis* can affect calves and cats. These findings alert about the role of cats in the epidemiology of BT in dairy herds, and their potential zoonotic risk.

Animal Health and Disease - 20

Characteristics, Evolution, and Development of Livestock Traceability System in Uruguay

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A traceability system is critical to animal health and food-safety control and surveillance programs. Uruguay has a strong livestock-based economy, and animal traceability systems aimed to it development and enrichment. Currently, Uruguay has a complete cattle individual traceability system that allows to identify the origin of individual meat-cuts. The goal of this work is to describe the evolution and characteristics of the Uruguayan traceability system since started. Since 1912, the government authorities required farm-level registration, and identification of livestock with iron brand and ear notches. Whit the beginning of foot-and-mouth (FMD) control program, in the sixties, the understanding of the importance of traceability for disease control was critical. Therefore, in 1974, the national agency to control livestock population and identification (DICOSE) was created to register and recorded all livestock stakeholders (farmers, brokers, auction markets, slaughterhouses, etc.), including farm demography, and movements. DICOSE database was initially in paper-forms and later with an electronic system. After the latest FMD outbreak in 2001, the government authorities implemented jointly to group traceability, an individual system for cattle. In 2004, a pilot project was placed, and two-years later became compulsory to identify all cattle with electronic ear-tags. Since 2011, complete Uruguayan cattle population has an individual identification, and requires an electronic authorization to move cattle. At the level of slaughterhouses, animal identification is maintained until the individual beef-cut, giving the possibility to link them with the origin farm. Nowadays, the traceability system in Uruguay is essential to implement animal health programs in the country.

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Cytopathological and Cytokine Expression Studies Associated with Mycobacterial Infections in Bovine Lymphadenopathies

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The present study included 32 cases of bovine lymphadenopathies. Out of these, on necropsy one case of tuberculosis and two cases of Johne's disease were diagnosed. In tuberculosis cases, cytology revealed numerous acid fast bacilli in bronchial and mediastinal lymph nodes and lungs. Histopathological examination showed multifocal caseocalcifying granulomas in lymph nodes, lung, spleen and liver. *Mycobacterium bovis* was confirmed by using *M. bovis*, CFP-10 and ESAT-6 antibodies by immunohistochemistry. Using INS1/INS2 and JB21/JB22 primers PCR showed amplication of mycobacterium in lymph nodes and lungs and TB was further confirmed by TaqMan Real-Time PCR. Phylogenetic analysis revealed 100% homology with Human TB isolates. Cytokine expression studies showed significant increase in INF-γ. Johne's disease was also confirmed by immunohistochemistry. Conventional PCR also showed amplication of *Mycobacterium avium paratuberculosis* (MAP) in intestine and mesenteric lymph nodes. MAP was further confirmed by using TaqMan Real-Time PCR. Phylogenetic analysis of our isolate revealed 97% homology with JD isolates of Mathura, India. Cytokine expression studies showed upregulation of Th1 and Th2 immune response. The study concluded that immunohistochemistry, molecular techniques, gene sequencing and cytokine expression studies were important in diagnosis of mycobacterial infection associated with bovine lymphadenopathies.

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Johne's Disease Distribution in Minnesota Dairy Cattle

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Mycobacterium avium subsp. *paratuberculosis*, the bacterium responsible for Johne's disease (JD), causes a chronic debilitating enteritis in cattle, resulting in far-reaching economic losses. Approximately 60% of the dairy herds in the Midwestern U.S. has JD, with an estimated cost of infection of 200-250 USD per infected cow. Minnesota is 6th in milk cow numbers in the U.S. and thus JD has a major impact on its dairy industry. Control of JD in the U.S. is not legislated, and therefore limited epidemiological information is available. Here, we used data collected in 2015 from a voluntary JD-testing (milk ELISA) program, in herds enrolled in the Minnesota Dairy Herd Improvement Association (MNDHIA) to i) evaluate the usefulness of this dataset to determine the JD status at herd and county levels; and ii) characterize disease distribution in the state. Values at the herd level were adjusted to account for the uncertainties associated with limited sampling in the herd and limited test accuracy. Up to 607 herds were tested at least once for JD during the study period (approximately, 37% and 13% of all MNDHIA and Minnesota dairy herds, respectively), with >50% of them having at least one positive test. Spatial distribution of tested herds demonstrated a good coverage in areas with high density of dairy farms, though confidence in test results was heterogeneously distributed. This information will help to define regionally distributed risk factors, inform the dairy industry regarding the potential risk based management and contribute to mitigate the impact of JD in Minnesota.

Animal Health and Disease - 23

A Case Control Study to Reveal Risk Factors Associated with Highly Pathogenic Avian Influenza Outbreaks in Korea 2014-2015

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From January 2014 to June 2015, Highly Pathogenic Avian Influenza (HPAI) H5N8 outbreaks was occurred on poultry farms in Korea. To evaluate risk factors for infection with HPAI in poultry farms, we conducted a retrospective matched case-control study. Thirteen farms were selected as case group from poultry farm where HPAI H5N8 had been confirmed with a positive real time PCR test from infected poultry samples within January-July 2014. Forty farms were designated as control group matched on farm location and species. Veterinarians interviewed the farmers regarding the environmental characteristics, possibility of contacts with wild animals, and their knowledge of HPAI and biosecurity. Univariable logistic regression was used to assess possible risk factors related with HPAI infection of farms. Four variables were identified as risk factors for the HPAI infection on the poultry farms by Univariable logistic regression: "no handwashing of farm workers" (OR= 4.18; 95% CI: 1.09-16.04, P-value=0.037) "no professional advisor for biosecurity" (OR= 5.97; 95% CI: 1.09-32.59, P-value=0.039), "no net fence around farm area" (OR= 4.80; 95% CI: 1.16-19.81, P-value=0.039) and "no shoe disinfectant mat on farm entrance" (OR=27.13; 95% CI: 9.52-405.62, P-value<0.001). We believe that strict biosecurity on farm is critical to prevent HPAI infections in Korea. These data may give insight into the epidemiology of HPAI risk factors.

Animal Health and Disease - 24

The Impact of Farm Structure and Biosecurity on Foot-And-Mouth Disease in Swine

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Foot and mouth disease (FMD) is a highly contagious viral pathogen capable of causing outbreaks with severe animal welfare and economic consequences. In this study, a stochastic transmission model was formulated and parameterize to describe intra-herd transmission of FMD virus, and to assess the impact of farm structure and biosecurity on disease dynamics. We considered direct and indirect transmission on a farrow to finish, farrow to wean, wean to finish, and finishing operations. Results were compared to those obtained in a model simulation that assumes random mixing of animals, to assess the impact that farm structure may have on the likelihood of FMD spread within a farm. Key model parameters including latent period, subclinical period, incubation period and β were estimated from published data and expert opinion. The results of this study will be used to guide biosecurity practices and to inform between-herd FMD models. Ultimately, results will help to inform decisions intended to improve preparedness for hypothetical FMD epidemics in the U.S.

Water at the Interface of Health, Economics and Environment - 25

After the Flood: Water Quality and Health Considerations of Post-Flood Conditions in Kasese, Uganda

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The declining access to clean drinking water has become a global concern in the face of an ever-expanding human population, increasing agricultural activities, and the major fluctuations that climate change has on the hydrological cycle. Sub-Saharan African countries, like Uganda, are particularly vulnerable to the transmission of water-borne diseases due to limited water, sanitation and public health infrastructure. Heavy rains occurring in Kasese district, Uganda in May 2013, resulted in the overflow of the Nyamwamba, Mobuku and other rivers in the region leading to the death of 8 individuals and the displacement of thousands. After the floodwaters receded, a public health team comprised of public health residents, veterinarians and microbiologists was sent to Kasese district to conduct post-flood water quality sampling of natural waterways and wells. In addition to water quality indicators such as pH, conductivity, dissolved oxygen, turbidity, and redox, sites were also tested for E. coli, Salmonella and Vibrio cholerae and heavy metals. Seventy percent of the sites sampled tested positive for E. Coli. In contrast, only 3% of the sites tested positive for Salmonella and none tested positive for Vibrio choleara. Lead, copper, cobalt, zinc and nickel were also identified in samples throughout the study. The locations of positive samples were used to characterize the vulnerability of the infrastructure to future flood events. The results of this study will be useful in infrastructure development and planning.

Animal Health and Disease - 26

Detection of Novel Pathogens in Baitfish

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The baitfish industry is a multi-million dollar business in Minnesota and moves hundreds of millions of fish from one location to another each year with very little oversight. This risk of inadvertent disease transfer is a serious concern for managers. To establish baselines, thirty golden shiners (*Notemigonus crysoleucas*) were collected with a dipnet from 56 baitshops in Minnesota from May – October 2014 (n=25) and December 2014 – February 2015 (n=31). All collected fish were delivered live same-day to the University of Minnesota Veterinary Diagnostic Laboratory. Upon arrival, fish were euthanized with an overdose of MS-222 and necropsy performed. The entire viscera of 30 fish were pooled in groups of five, resulting in six pooled samples per location. Diagnostic assays were performed to characterize parasites, bacteria, and viruses. A variety of parasites were identified, including *Ovipleistophora ovariae*, not previously known to be in Minnesota. More than 62 bacteria species were identified, some of significant concern. Cell culture did not yield many positive results, however molecular assays for specific viruses and next generation sequencing (non-specific virus identification) resulted in the identification of seven viruses. Most of the viruses have never been described/reported and are the focus of ongoing research efforts to better understand the disease causing potential and management recommendations.

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Molecular Detection of Pathogens Associated with Honey Bee Colony Collapse in Minnesota

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Honey bees (*Apis mellifera*) are critical pollinators of important agricultural crops. Thus, they are very important in U.S. agriculture producing roughly a quarter of the food consumed by Americans with a value of over $17 billion per year. In recent years, high honey bee mortality has been reported from all over the world, which has raised the concern of beekeepers, growers, scientists, and government officials. The disease hit 42.1% of managed honeybee colonies from April 2014 through April 2015 in the USA. To determine the cause of such a high mortality in Minnesota honey bees, we collected samples from different counties in Minnesota from colonies which had high bee mortality. A total of 22 samples collected in spring and winter of 2014-2015 were tested. Swab samples were subjected to bacterial culture. Nucleic acids were extracted from 10% clear supernatants of homogenized bee samples for molecular detection of viruses (RNA and DNA viruses) and parasites. Black Queen Cell Virus (16/22, 72.7%) and Sacbrood Virus (16/22, 72.7%) were the most common RNA viruses detected. In addition, Deformed Wing Virus, Israeli Acute Paralysis Virus, Lake Sinai virus, Aphid Lethal Paralysis Virus, Chronic Bee Paralysis Virus and Tobacco Ringspot Virus were also found. *Nosema ceranae*, a microsporidian parasite, was also detected in combination with different viruses. This study showed a high prevalence of various pathogens in Minnesota honey bees. This information should help in the design of various preventive and control measures.

Animal Health and Disease - 28

Exploring the Health Benefits and Economic Opportunities of the Bioactive Compounds Isolated from Eastern Redcedar in Missouri

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Emergence of bacterial pathogens that are multiply antibiotic resistant is a growing public health problem worldwide. These microbes limit treatment options in both human and veterinary medicine, increase morbidity and mortality, and escalate patient hospitalization times and costs. In order to overcome this problem, new chemotherapeutic approaches are needed. Our lab recently had isolated an antimicrobial diterpenoid from Eastern Redcedar (ER, *Juniperus virginiana*) named A. Our studies showed that it exhibits strong antimicrobial activity against many Gram positive bacteria pathogens, including methicillin resistant Staphylococcus aureus or MRSA. To further investigate the actual mode of action of diterpenoid, two diterpenoid resistant S. aureus strains were created by ethyl methane sulfonate mutagenesis followed by diterpenoid A selection. A bioinformatics analysis on genomic sequences of the mutant strains and the parent strain was performed using BWA alignment and SAMtools following by snpEff to determine the SNPs candidate for diterpenoid A-resistance. In addition, a cost-effective and environmentally friendly bioprocessing procedure was developed to extract the bioactive compounds. The immediate and potential commercial applications were also identified. The findings of this project not only contribute to identifying a unique antimicrobial mode of actions, but also have potential to create a new industry for state of Missouri, where ERs are abundant.

Animal Health and Disease - 29

The Results of a Preliminary Investigation on Small Ruminant Brucellosis and Tuberculosis and Caprine Arthritis-Encephalitis in El Salvador

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This paper reports a first-time study performed in El Salvador on the presence or absence of antibodies to three important animal diseases in small ruminants. The work was conducted in the west and central departments of the country, selecting 42 and 43 cantons with an existing sheep and goat population, respectively. Serum samples were collected from 396 sheep and 335 goats and tested for seropositivity to *Brucella (B.)* spp. The specimens from goats were also tested for antibodies to caprine arthritis-encephalitis (CAE) virus. Four (1%) sheep and none of the goats were seropositive by Rose Bengal test. All animals were negative by indirect ELISA (iELISA) for *B. abortus*. All animals were negative by iELISA for CAE. 383 sheep and 330 goats underwent the single intradermal cervical tuberculin (SICT) test for tuberculosis. 70 (18%) sheep and 43 (13%) goats reacted to the SICT test. Those reactors were subjected to the single intradermal comparative cervical tuberculin (SICCT) test and one (0.3%) goat was deemed to be a positive reactor. No mycobacteria were diagnosed in concluding analyses and further studies are considered necessary to determine the prevalence of the investigated diseases. Additionally it is recommended that small ruminants should be included in the national eradication program on bovine brucellosis and tuberculosis to prevent potential reservoirs.

Animal Health and Disease - 30

Exosomes Can Transfer Viral Components between Cells

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Exosomes have recently emerged as a novel mechanism involved in the pathogenesis of diseases. These membrane-bound nanovesicles (30-100 nm) are released from various cell types and can be taken up by other cells thus mediating intercellular communication. Exosomes can contain a wide variety of materials (miRNA, mRNA, proteins) specific to the cells from which they were released. Theiler's murine encephalomyelitis virus (TMEV) is a picornavirus that has a single positive strand RNA genome. TMEV infection of susceptible mice leads to the persistent infection of microglia in the central nervous system (CNS). The persistent infection contributes to the development of a chronic progressive demyelinating disease associated with an inflammatory immune response in CNS, similar to multiple sclerosis in humans. Microglia are resident macrophage type cells of the CNS. TMEV infection of microglia activates an innate immune response with expression of type I interferons (IFNa and IFNb). Recently, we have determined that TMEV- infected microglia secrete exosomes. Our current study shows that exosomes secreted from TMEV-infected microglia contain viral RNA and proteins that could be transferred to bystander uninfected CNS cells, microglia, astrocytes, and neurons. The viral RNA from the exosomes was replicated in the recipient cells. Furthermore, the viral RNA from the exosomes activated an innate immune response by the bystander cells leading to expression of IFNa and IFNb. These results show a mechanism in which exosomes can transfer viral components to uninfected cells leading to transfer of viral RNA and activation of the innate immune response.

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Migratory Hmultidrug Resistant Extended-Spectrum β-lactamases Producing *Klebsiella pneumoniae* in Pakistan with Potential Transboundary Spread

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Objectives: We focused on the occurrence and molecular characterization of extended-spectrum β-lactamases (ESBL) producing *Klebsiella pneumoniae (K. pneumoniae),* with focus on CTX-M type, from wild migratory avian hosts across wetland habitats in Pakistan.
Methods: A total of 150 migratory birds faecal swabs from four wetland habitats in Pakistan were screened for ESBL producing *K. pneumoniae*, carbapenem resistance, ESBL encoding genes, CTX-M genotype, and genetic diversity. **Results:** A total of 13 (8.6%) ESBL producing *K. pneumoniae* were recovered. Molecular detection of ESBL genes showed 9 harboured $bla_{\text{CTX-M}}$ gene and 7 contained bla_{TEM}. Co-existence of the $bla_{\text{CTX-M}}$ and bla_{TEM} was detected in 3 isolates. None of the isolates was positive for bla_{SHV}, bla_{OXA}, bla_{CMY} genes. Of the 9 $bla_{\text{CTX-M}}$ positive isolates, 88.8%) belonged to CTX-M-1 group and 1 (11.2%) CTX-M-9. DNA sequencing confirmed $bla_{\text{CTX-M-15}}$ as the single dominant ESBL genotype. None of the isolates showed positive carbapenemase phenotype or genotype i.e bla_{KPC}, $bla_{\text{NDM-1}}$, $bla_{\text{OXA-48}}$ and bla_{VIM}. In total 9 (69.2%) isolates were multidrug resistant. BOX PCR fingerprints revealed 4 major clones; of which clone A was the most widespread. **Conclusions**: This study is the first to report the wildlife contamination of ESBL producing *K. pneumoniae* in Pakistan. Dissemination of clinical relevant $bla_{\text{CTX-M-15}}$ genotype in wild migratory birds is worrisome indicating the extent of environmental contamination of antimicrobial resistance with potential zoonotic risks.

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Improving the Detection of H9N2 Viruses by use of DNA Aptamers

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Highly pathogenic avian influenza (HPAI) poses an enormous threat to both animal and human health and safety. As highlighted by the rapid spread of HPAI in the Midwest during 2014-2015, effective therapeutics and highly sensitive diagnostic tools are necessary to prevent this disease from causing huge economic losses. Current diagnostic methods are culture-based, relying on enrichment and antibodies for detection of virus. These methods are time consuming and often unreliable, making these approaches less than ideal for outbreak investigations and disease monitoring. To overcome these limitations, we are designing DNA aptamers as highly sensitive diagnostic tools. DNA aptamers are small, single stranded DNA oligonucleotides that can bind with high affinity to antigens and are exceedingly more stable under field conditions than antibodies. In our lab, we identified five potential DNA aptamers against the hemagglutinin (HA) surface protein of an H9N2 influenza strain using systematic evolution of ligands by exponential enrichment (SELEX). These five aptamers were further characterized for binding affinity (K_d) and specificity using a dot blot technique. The ability of these aptamers to bind live virus and prevent viral entry into target cells will be assessed using a hemagglutination inhibition assay with H9N2 virus and Turkey red blood cells. If the selected aptamers are able to bind H9N2 virus with high affinity and block entry into host cells, we hypothesize that these aptamers could be used for rapid detection of and potential antiviral therapy against H9N2 viruses.

Animal Health and Disease - 33

Risk Mapping of Japanese Encephalitis (JE) using Swine Movement Network Analysis and Environmental Factors Including Land Use Patterns in Nepal

S Nepal

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Japanese Encephalitis (JE), a mosquito-borne viral zoonosis, cycles between birds, pigs and people and can cause irreversible neurological damage in humans. High mortality and disability rate in infected individuals due to JE has posed a serious threat particularly to children in Nepal. In Nepal, JE has been recorded since 1978 A.D., but limited studies have been done for predicting the risk of its spread and outbreaks based on the putative risk factors including swine movement and environmental factors. Also, information on network of pig movement from JE endemic to JE free areas in Nepal and the biosecurity status of pig farming have not been adequately assessed for spread of JE and other infectious diseases here. In this study we have collected information on biosecurity status of pig farms and pig movement networks. Risk mapping of JE will be done using this information of pig movement network analysis from JE endemic to free areas. Retrospective data on environmental factors including land usage pattern will also be evaluated for the same cause. The holding and network level parameters of pig movement generated will be used for simulation modelling of JE virus infection. Furthermore, the risk maps representing the hot spots for human JE cases will be generated using historical data of JE cases in humans. The result from the study will be further used to assess the cost effectiveness of different control options for JE in Nepal and will be employed for designing the appropriate control policy for JE in Nepal.

Animal Health and Disease - 34

Improved Serodiagnosis of Porcine and Caprine Brucellosis, Using a Glyco-Engineered Antigen

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Brucellosis is a highly contagious zoonosis and still a major public health problem in endemic areas of the world. There are different serological diagnostic test with different performance and ability to differentiate negative and infected animals. We evaluated the use of antigen previously characterized and validated for diagnosis in humans (infected with *B. abortus*, *B. melitensis* and *B. suis*) and cattle, for improved serodiagnosis of porcine and caprine brucellosis. An indirect immunoassay based on the detection of anti *O*-polysaccharide IgG antibodies was developed coupling OAg-AcrA to ELISA plates (Glyco-iELISA), wich comprises the O-polysaccharide of the LPS of *Yersinia enterocolitica* O:9 (identical to *B. abortus* O-polysaccharide) covalently linked to the carrier protein AcrA, derived from *Campylobacter jejuni*. This antigen can be produced in uniform batches without the risk of exposure and culture *Brucella* spp. To validate the assays, more than 560 porcine and 440 caprine serum samples obtained from uninfected and infected (with *B. suis* biovar 1 and 2 and *B. melitensis* biovar 1) animals were analyzed and, a receiver-operating characteristic (ROC) analysis was performed. Based on this analysis, the area under the ROC curve for the test was 0.9999 (95% CI, 0.9997–1.000) and the optimum cutoff value was 0.56 for swine samples and, was 0.9977 (95% CI, 0.9952-1.000) and the cut off value 0.24 for caprine. The results indicate that glyco-iElisa can clearly discriminate individual positive animals from negative, resulting in a diagnostic test sensitivity of 100% for swine and goats and specificity of 99.7% and 97.03% respectively.

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Synergistic Effect of Antibiotics and Some Chemical Agents on Biofilms of *Staphylococcus aureus* and *Pseudomonas aeruginosa* Isolated from Bovine Mastitis

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In the present work 18 isolates of *Staphylococcus aureus* and seven isolates of *Pseudomonas aeruginosa* recovered from various clinical cases of bovine mastitis were studied for their biofilm producing ability and genes responsible for its formation. These isolates were also investigated for their minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), minimum biofilm inhibitory concentration (MBIC) and minimum biofilm eradication concentration (MBEC) with Gentamicin, Ampicillin and Polymixin-B alone and in combination with 2-acetyl salicylic acid (SA). The phenotypic characterization of biofilm producing strains of *S. aureus* by Microtitre plate assay and slime production assay on Congo red agar (CRA) revealed that all the isolates had the capability to produce biofilms. For *P. aeruginosa* its pellicle forming capabilities were also studied. All the *P. aeruginosa* isolates were biofilm producers. PCR amplification of genes responsible for biofilm production revealed that icaA gene was present in 61.11% and icaD was present in all the isolates of *S. aureus*. All the isolates of *P. aeruginosa*, were positive for algD. MIC values correlated well with the ABST and SA had a significant effect in combination with antibiotics in lowering the doses required to either inhibit or kill the organisms both in planktonic form and in biofilms. The efficacy of SA in combination was more effective against the *S. aureus* biofilms as compared to that with *P. aeruginosa* biofilms. But, out of the three combinations studied, the combination of SA with gentamicin proved to be better as compared to other two combinations.

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Epidemiological Investigation of Bovine Tuberculosis Outbreaks in Uruguay (2011-2013)

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Bovine tuberculosis (BTB) is a chronic disease of cattle caused by infection with the *Mycobacterium bovis*. BTB prevalence in Uruguay has been traditionally low (<11 outbreaks-year) as a consequence of a national control program. However, between 2011 and 2013 annual incidence increased up to 15, 26 and 16 infected herds each year, raising concerns from livestock stakeholders and the government. The goal of this study was to assess the spatial dynamics of BTB in Uruguay from 2011-2013, and the association between BTB and potential demographic and movement risk factors at the herd level using data provided by the Uruguayan Ministry of Livestock, Agriculture, and Fisheries. Clustering of incident outbreaks was assessed using the Cuzick-Edwards' test and the Bernoulli model of the spatial scan statistic, and a conditional multivariate logistic regression model was used to assess risk factors associated with BTB in a subset of dairy Uruguayan farms. Significant (P=0.05) global clustering was detected in 2012, while high-risk local clusters were detected in southwestern (2011, 2012, 2013), northwestern (2012), and southeastern (2012) Uruguay. Increased risk of BTB in different regions of Uruguay suggests a potential role of animal movements in disease dissemination. Larger herds, higher number of animals purchased, and steers entering the farm were associated with increased odds of breaking with BTB. These results will contribute to enhance the effectiveness of BTB control programs in Uruguay.

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Establishment and Characterization of a Porcine Lymphoma Cell Line

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The lack of well characterized, established domestic porcine cell lines hinders advancement of porcine cellular immunology understanding in disease resistance and anti-viral immunity. Numerous cases of multicentric lymphoma were diagnosed in pigs at the time of slaughter. Affected organs were harvested and submitted for single cell isolation and analysis. Culture of disaggregated single cell suspensions in RPMI 1640 with weekly passage resulted in clusters of dividing cells in about 2% of attempted isolations. In one pig, cells grew in approximately 50% of wells. Cell lines were established by limiting dilution repeated 3 times from splenic and subiliac lymph node lymphomas. Initial flow cytometry analysis showed a population of CD3+, CD79a+, CD21+, CD4-, and CD8- cells which have grown and been maintained in culture for more than 7 months and more than 10 subcultures. To further characterize the nature of this paradoxical homogenous population of CD3+ and CD79a+ cells, transcriptome analysis was carried out and identified lymphoma cells which displayed a B cell phenotype with no CD3 gene expression. Ingenuity pathway analysis is ongoing. This new porcine lymphoma cell line will be a valuable resource for more in-depth cellular investigations into the porcine immune system, as well as providing a potential tool for the growth of lymphotropic viruses of pigs and humans.

Animal Health and Disease - 38

Stray Dog Attack on a Horse and Negative Pressure Wound Therapy

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Free roaming stray dogs can cause numerous common problems around the world. These dogs are independent of human control and live apart from people. These dogs occasionally might be aggressive and may bite walkers or other animals. In this case a16 year old female pony badly attacked and bitten while it was in its pasture by a group of stray dogs in the Central Anatolian province of Ankara. The horse was immediately brought to the clinics of Faculty of veterinary Medicine, Ankara University with external bleeding due to dog bites. The bite wounds were excessive and deeply penetrated the gluteal and perianal area in both hind limbs. A part of the tail was ruptured and some of it was lost. Following a conventional wound management technique; negative-pressure wound therapy (NPWT) was used. It is a vacuum dressing to promote healing in wounds and has extensively been used in human patients and recently in veterinary practice. NPWT dressing was placed on the wound and the vacuum was set at -125mm Hg for 24 hours to drain the wound cavity. Granulation of tissue began to form 3 to 4 days after the beginning of treatment and NPWT was concluded in a month without further drainage or dressing requirements. In conclusion stray dogs and abandoning of a dog by an owner is a great concern to many people in Turkey and this problem should be addressed. However NPWT is a useful form of wound therapy particularly, with excessive tissue loss in horses.

Animal Health and Disease - 39

The Role of Fur in Iron Regulation during *Mycobacterium Avium* Subsp. *Paratuberculosis* Infection – Johne's Disease

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Johne's disease (JD), or paratuberculosis, is a chronic enteric infection in ruminants by intracellular pathogen *Mycobacterium avium* subsp. *paratuberculosis* (*MAP*). To control JD, we must better understand the metabolic and virulence determinants of *MAP*. A fastidious bacterium, *MAP* requires siderophore supplementation for optimal growth *in vitro*. Our group identified an *in vivo* upregulated ferric uptake regulator (Fur)-like element on the *MAP*-specific phage-like region as a likely candidate (MAP3773c), and we sought to define if MAP3773c is involved in iron homeostasis. *In silico* analysis identified 23 pathways directly regulated by MAP3773c, including those critical for metabolism and virulence. Furthermore, multiple sequence alignments of well-studied Fur proteins (*E.coli* and *S. typhimurium*) and MAP3773c showed 41% overall amino acid similarity with a nearly identical "Fur box" binding site. Based on sequence similarity and conserved "Fur" domains, we conclude MAP3773c acts as a ferric uptake regulator (Fur-like protein). A transposon mutant of the gene (3776c) upstream of MAP3773c in *MAP* K-10 demonstrated concomitant knockdown of Fur transcription. We characterized the MAP3773c knockdown phenotype and a MAP3773c complementation strain was shown to restore Fur function. Cell invasion studies using a bovine mammary epithelial cell line (MAC-T) provided invasion efficiency and survival data for each *MAP* strain (Wild-type, mutant and complement). Data showed a positive correlation between intact Fur (wild-type and complement) and cell invasion. Cloning and expression of MAP3773c was generated for protein-DNA studies through EMSA and ChIP-seq assays. These results support Fur playing a role the virulence of MAP

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Potency of Cpg Odn as Molecular Adjuvant in Stimulating Immune Response Against Recombinant Virus Like Particle (Vlp) of Foot and Mouth Disease Virus Serotype 'O'

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Immuno stimulating molecules like CpG Oligodeoxynucleotides (CpG ODN) are being used in improving the potency and efficacy of vaccine. CpG ODNs boost the immune response elicited by vaccines by improving protein immunogenicity, inducing both humoral and cellular responses and increase magnitude of vaccine induced responses. In this study, CpG were tested in virus like particle (VLP) of foot and mouth disease (FMD) vaccine formulations obtained from baculovirus expression with mutated 3C in tandem with O-P1-2A in guinea pigs. The animals were bled on 0,14,28,44 and 56 days post vaccination and systemic immune response was analyzed for IgG, IgG1, IgG2, serum neutralization test and lymphocyte proliferation assay. The protection level achieved upon foot pad challenge with 1000 GPID50 virulent type 'O' FMDV for

VLP+CPG was comparable with the conventional group suggesting the induction of protective cell mediated than wholly antibody mediated. This could be used for improving the potency and efficacy of VLP vaccines in control of FMD in endemic counties as well as in FMD free countries in the event of disease outbreak.

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Airborne Transport of Infectious H5n2 Highly Pathogenic Avian Influenza Virus during the 2015 Spring Outbreaks in the Midwestern U.S.

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Since first detected in December 2014, the cases of H5N2 highly pathogenic avian influenza (HPAI) virus resulted in the most severe foreign animal disease outbreak in United States causing devastating losses to the poultry industry. Due to the rapid spread of cases, we investigated the plausibility of airborne transmission of the virus in farms acutely infected during the spring of 2015 in the U.S. Midwest area. Air samples were collected inside and outside of infected turkey and layer facilities at distances up to 1000 m. Samples were tested to assess HPAI concentration (RNA copies/m^3 of air), virus viability and virus distribution by particle size. HPAI RNA was detected inside and up to 1000 m from infected facilities. HPAI was isolated from air samples collected inside, immediately outside and up to 70 m from infected facilities, and in airborne particles larger than 2.1 µm. Direct exposure of surfaces to exhausted aerosols proved to be a significant source of environmental contamination. These findings demonstrate HPAI aerosolization from infected flocks, and that both the transport of infectious airborne particles and the deposition of particles on surfaces around infected premises, represent a potential risk for the spread of HPAI.

Animal Health and Disease - 42

Big Data in Animal Disease Surveillance and Control

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The goal of the STEMMA program is to develop and implement near-real time systems for the prevention and mitigation of animal diseases. Researchers in our program work to achieve this goal through a combination of research to generate new to theoretical and applied knowledge, outreach to transfer such knowledge to decision-makers working in the public and private spheres, and education. Specifically, we leverage data that is already routinely collected by industry and other key stakeholders involved in One Medicine to understand and predict spatiotemporal drivers of infectious diseases in animals. Here, we highlight several examples of our work as it relates to the prevention of infectious diseases in animals, including research, IT development, and outreach to industry partners.

Big Data - 43

A Novel Approach for Anayzing Networks as Potential Pathways for Disease Transmission

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Networks are frequently utilized to incorporate heterogeneity in who-contacts-whom in mathematical models of pathogen spread and are increasingly used to quantify large-scale connectivity patterns of populations at regional and national scales. However, we currently lack tools to evaluate whether potential pathways of transmission are adequately represented by an observed contact network. Here, we describe a novel permutation-based approach, the network *k*-test, to determine if the pattern of cases within the observed contact network are likely to have resulted from transmission processes in the network, indicating that the network represents potential transmission pathways between nodes. We compare the power of this approach to other commonly used analytical methods using simulated data of pathogen spread. We test the robustness of this technique across common sampling constraints, including undetected cases, unobserved individuals, and missing interaction data. We also demonstrate the application of this technique in two case studies of livestock and wildlife networks. We show that the power of the *k*-test to correctly identify the epidemiologic relevance of contact networks is substantially greater than other methods, even when 50% of contact or case data are missing. We further demonstrate that the impact of missing data on network analysis depends on the structure of the network and the type of missing data.

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Whole Transcriptome Analysis of Young and Aged Host Porcine Alveolar Macrophages (Pams) Infected by PRRSV

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Different outcomes occur when pigs are infected with Porcine reproductive and respiratory syndrome virus (PRRSV); adult pigs often show a non-significant to mild syndrome while young pigs (including neonates, sucking and nursery pigs) suffer much more serious respiratory disease, secondary infections, and significantly higher morbidity and mortality. Porcine alveolar macrophages (PAMs), an early and key target of PRRSV intrusion, are likely to contribute to this age-dependent infection outcome. *In vitro* experiments have shown that PRRSV grows better in PAMs from young pigs. Previous research demonstrated no differences in PAM expression of CD163 and CD169, surface proteins that are implicated in PRRSV cell entry between different aged pigs. Therefore, this age-dependent resistance ability towards PRRSV infection could be an intrinsic characteristic of PAMs. The general presence of cellular restriction factors that suppress replication and growth of various viruses led us to propose the age-dependent expression of anti-viral restriction factors. Therefore, we hypothesize that age-dependent presence of intrinsic cellular factors mediating restriction or permissiveness that are responsible for this resistance difference against PRRSV infection. We have examined PAMs from young and adult pigs for susceptibility to PRRSV infection *in vitro*, and RNA-seq on high-throughput sequencing has been done for the whole transcriptome analysis in order to identify differences in age-dependent restriction factors that are expressed constitutively or are induced following viral infection. This project is expected to provide novel insights towards determining molecular mechanisms of PRRSV resistance.

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A Transfer Entropy Model for the Inference of Influenza Information Networks

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Variations in seasonal influenza epidemic initiation, timing, and magnitude yield highly variable illness data that can help researchers to understand the spatial spread of influenza. Historically, these data have been examined for characterizing local contagious diffusion. Long-distance connections of cases – for instance in the form of autocorrelation – have not been fully explored using these data. For the United States, predictable spatial patterns will contribute to more accurate predictive models for ascertaining when influenza infection will occur and to understand long distance connections. This has huge public health implications as well as theoretical and technological relevance. In order to evaluate the interdependence of cases we propose the use of a transfer entropy model (TE) that measures the amount of information transfer from one variable to the other; yet, in this context the number of cases ''transferred'' from one region to another. Data are taken from the US Center for Disease Control and Prevention (CDC) that provides influenza information from 1997 to 2014 at the scale of Department of Health and Human Services (HHS) regions via the FluView online data portal. TE is a non-parametric and non-linear model that offers an alternative measure of effective connectivity based on information theory, more powerful than Granger causality or assumption-based dynamic causal models. More precisely, TE is quantifying causal networks between time series where node/variable distance, node connectivity, and link weights are related to variable undirected statistical closeness, dependence, and directional entropy reduction. Furthermore, transfer entropy is an asymmetric measure that conveys directional information. Considering TE on CDC data it results that Northeast and Northwest US are the most influential nodes in the network. Conversely, Midwest and Southwest regions are strongly affected

by other regions. There are long-distance connections between Northeast and Midwest, and between Mid-Atlantic and Southwest regions. These connections are also verified by the Spearman correlation coefficient between influenza season onset timing and distance. Some pairs regions that are very far from each other (~1500-3000km) still show significant correlation with each other (r=0.45-0.65) that emphasizes the importance to assess effective connections rather than geographical connections. In a simple beta regression model, long-distance connections show statistical significance ($p<0.05$). The results allow us to conclude that long-distance effects are relevant in the dispersion of influenza cases and to infer locally generated cases. Thus, future development of influenza predictive tools should take both local generation/diffusion and long-distance dispersal into consideration. The TE model can be useful in analyzing any other complex disease where interactions among sub-systems/regions are expected to be non-linear and where minimal a priori knowledge is available. Yet, TE can be used successfully as a reverse engineering metric to infer causal networks from population patterns. In this way, the inferred information networks can inform about the relative importance of transmission networks.

Animal Health and Disease - 46

An Information Theoretical Global Epidemic Prediction Model

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Dengue fever is a multi-serotype mosquito-borne disease that is steadily increasing in incidence worldwide and sharing animal vectors with other rapidly spreading viruses like Zika virs. Strong ties between environmental factors – temperature and humidity, predominantly – and vector dynamics have been consistently reported. However, also in relation to the uncertainty in the life cycle of the primary vector, translating the environment-vector dependencies into predictive models is challenging because of the wide range of time lags in these dependencies. The better understanding of the epidemiology of Dengue and the improvement of predictive models has huge public health implications; yet, computational models are improved for this purpose.

In an Epidemic Prediction Initiative context, a new computational method is proposed as a new approach for constructing Stochastic Generalized Linear Models (SGLM) with multiple diversely lagged input factors based on the aim to improve prediction accuracy. The two sites considered as case study are San Juan, Puerto Rico and Iquitos, Peru. The sites were chosen specifically for their ecosystem diversity that is potentially linked to a different Dengue dynamics. Public health data were provided by the United States Center for Disease Control and Prevention, and environmental data are from the National Oceanic and Atmospheric Administration. The proposed computational method uses mutual information (MI) to evaluate the dependencies between predictive and outcome variables at different time lags. The window with the highest MI in the time series of each predictive variable is selected as the input of a negative binomial SGLM that predicts the weekly incidence of DF. Predictions were generated every four weeks. More precisely, total cases, outbreak timing and magnitude are the variables used to design the most accurate predictive model. The mean absolute error and a logarithmic scoring rule were used as accuracy tests. Global Sensitivity and Uncertainty Analysis (GSUA) is applied to attribute the variability of the output to each predictive factor and their interactions. The selected models are tested on four years of data that were excluded from the model calibration phase.

Environmental factors that have shown the highest mutual information are temperature and humidity for San Juan and the Normalized Difference Vegetation Index (NDVI) for Iquitos. These results reflect the micro/meso ecosystem dependence on Dengue fever incidence. For instance, temperature and humidity are more important in urban settings like in San Juan; NDVI is more important in rural settings like in

Iquitos, Peru. For both study sites, annual and inter-annual trends and autoregressive components are the most influential independent variables. This epidemiological information has higher lag for San Juan than Iquitos considering the quicker response of the latter to ecohydrological fluctuations. Independently of the geographical area, in endemic periods most of independent variables present the same importance in terms of prediction accuracy, while during epidemic peaks one variables dominates over all others. Overall, for both sites the proposed model performs significantly better than a baseline model built as a seasonal autoregressive integrated moving average (SARIMA).

The accuracy in predictions shown by the proposed SGLM is significantly improved by applying mutual information as a metric to design the predictive model. MI allows one to construct a varied lag factor model that can both investigate the universal epidemiology of a disease and make useful and site-dependent fine-resolution predictions. Yet, the mutual information based SGLM is proposed as a powerful. Epidemic prediction model not just for Dengue fever but also for any other environmental dependent infectious diseases.

Balancing Personalized Medicine and Public Health in a Changing Environment - 47

Sero-Epidemiology and Molecular Characterization of Hepatitis E Virus Infection in Swine and Human Risk Population in Punjab, India

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Hepatitis E Virus (HEV) has 2 discrete epidemiological patterns: (1) water borne epidemics in developing countries, caused by HEV genotype 1 and (2) sporadic zoonotic outbreaks in developed countries caused by genotype 4. The present study was designed to investigate seroprevalence, molecular detection and characterization of HEV by using nested RT-PCR in swine and human occupational risk population in Punjab, North India. The occupational risk group was comprised of swine farmers (organized - formulated feed feeders and unorganized - swill feeders), abattoir workers, sewage workers and veterinary students. During the study period, around 300 swine blood and fecal samples and 360 human blood and fecal samples were collected from occupational risk and healthy control low risk population. The overall seroprevalence of swine HEV was 65.00% with significantly higher seropositivity in growing pigs (2-8 months of age) and swill fed pigs. The prevalence of HEV in swine fecal samples by nRT-PCR was detected as 8.75%. In human risk population, significantly higher (60.48%) anti-HEV IgG sero-positivity was observed as compared to control population (10.71%). Human HEV by nRT-PCR was detected as 1.11% in the occupational risk population. In conclusion, strong evidence of association was observed between human anti- HEV IgG seropositivity and certain occupational risk groups ($p < 0.0001$), indicating that HEV infection is an important occupational hazard in unorganized swine farmers, slaughter house workers and sewage workers. Molecular characterization revealed the circulation of G IV and G I genotypes among swine and human population, respectively in Punjab, India.

Balancing Personalized Medicine and Public Health in a Changing Environment - 48

Crimean Congo Hemorrhagic Fever (Cchf) in Turkey

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First case of CCHF in Turkey was seen in Tokat, a province of the northeast region in 2002. Then cases increased through Kelkit Valley in the Black Sea region in Turkey. There are twenty CCHF endemic provinces defined as incidence of CCHF is higher than the mean incidence of Turkey.
National CCHF Advisory Board established in 2003 and develops annual strategies for CCHF control program in Turkey. Those strategies include increasing awareness of the public on personal preventive/protective measures and increasing knowledge of health staff, surveillance of tick migration, monitoring and treatment of patients, strengthening laboratory infrastructure, and health facilities. Public training activities are held by medical staff not limited to the endemic areas as well as across the country. Guidance of 'The approach to a patient with tick bite' and 'CCHF case Management' were prepared and distributed by Ministry of Health to all health facilities. Prepared documentations were consisting of printed materials, documentary and short animation videos with subtitles as well the availability of these materials uploaded online. Moreover, specific referral centers and PCR laboratories were designated for critically ill patients with possible CCHF. The Ministry of Food, Agriculture and Livestock is responsible for control of tick on livestock not limited to endemic area of CCHF but also across the country. For this purpose, Flumethrin is being used for 2.000.000 animals per year. In summary, Turkey as a country gained very significant experience with the CCHF control program, which needs multidisciplinary approach and collaboration to be effectively carried out. During the CCHF control program, Turkey improved the quality of health services and activities. Most important outcome during this program is that we realized to have people more alert on main message of prevention needs different materials.

Balancing Personalized Medicine and Public Health in a Changing Environment - 49

Gastro-Intestinal Parasites in Mountain Gorillas (*Gorilla Beringei Beringei*) of Rwanda Volcanoes National Park: Impact on Public Health

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The study was carried out in the Volcanoes National Park of Rwanda, which is home to mountain gorillas, between March and June 2015. The study aimed at assessing the prevalence of the GIT parasites affecting the gorillas and identifying those of which that can be of public health importance. Twenty four faecal samples were randomly collected from two gorilla families at different intervals. The faecal samples were examined for parasites using flotation and sedimentation methods. Of the twenty four fecal samples examined, the study revealed 5 nematodes, 1 cestode and 4 protozoa. The nematodes eggs found include Trichostrongyle-type (11/24), *Strongylus spp* (6/24), *Ascaris spp* (3/24), *Hyostrongylus* (2/24) and *Probstmayria spp*. (1/24). The cestode parasite recovered is *Anoplocephala gorillae* (5/24). The protozoa include *Iodamoeba buetschlii* cysts and trophozoites (7/24), *Entamoeba coli* cysts and trophozoites (4/24), *Entamoeba histolytica* trophozoite (3/24) and *Giardia* sp. cyst (1/24). There was no significant difference in the prevalence between the two families. Some of the parasites could not be identified. *E. hystolytica* and *Giardia* are of zoonotic nature and could therefore be shared with humans. Most of the nematode types found are also found in humans, it is possible that these parasites were from daily human-gorilla interactions by zoonotic, reservoir or paratenic ways. However, there is a need to make the systematic coproculture to definitely identify some parasites and determine the transmission mode in order to confirm whether or not these are multi-host pathogens that can be shared.

Balancing Personalized Medicine and Public Health in a Changing Environment - 50

Anti-Toxoplasma Antibodies Prevalence and Associated Risk Factors Among HIV Patients Attending Treatment and Counseling Package at Agaro Town Health Center in Southwestern Ethiopia

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Objectives: Toxoplasmosis is a major public health concern mainly among immunocompromised individuals and the objective of this study was to assess the seroprevalence and associated risk factors of toxoplasmosis among HIV patients in Agaro Town Health Center of Jimma zone. **Methods**: It was a cross sectional study based in public health center and convenient sampling was used to collect blood samples from 135 patients attending anti-retroviral therapy from February to March 2015. Serum samples were tested for anti-*T.gondii* antibody by using latex agglutination test. Structured questionnaire was used to collect data on socio-demographic and risk factors associated with toxoplasmosis. **Results**: Overall seroprevalence of toxoplasmosis was 80.7% (109/135, CI:74.04 - 87.36). In multivariate analysis significant association was observed between anti *T.gondii* seropositivity and raw meat consumption (OR: 3.514, CI: 1.167 -10.581, P=0.025), knowledge about toxoplasmosis (OR : 5.225, CI: 1.382, P=0.015) and sex (OR: 4.023, CI; 1.382-19.762, P=0.015). **Conclusion:** Immunocompromised patients showed high rate of seropostivity and thus, it is highly advisable to introduce routine anti-*T. gondii* antibodies serological screening test prior to ART commencement.

Balancing Personalized Medicine and Public Health in a Changing Environment - 51

One Health Approaches in the Antibiotics Resistance of *Escherichia Coli* Isolates from Cattle, Pig and Chicken in Korea

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Antimicrobial drugs have contributed to the overcoming of illness and death caused by bacterial infections in animals and humans. However the excessive use of antimicrobials resulted in emergence and spread of antimicrobial resistant bacteria. Especially *Escherichia coli* have been considered as the significant reservoir of antimicrobial resistance transferring resistance determinants in one health aspect. In this study, we investigated the prevalence of antimicrobial resistant *E. coli* isolated from food producing animals and the transferability of their resistance determinants. Total 586 *E. coli* isolates collected from cattle, pig and chicken were tested for antimicrobial susceptibility. Of the bacterium, MIC value of ampicillin and tetracycline resistant isolates were determined using cephalosporin and tetracycline. The presence and transferability of antimicrobial resistance determinants were determined by PCR and conjugation assay, respectively. The PCR-based plasmid replicon typing was also conducted. All isolates showed resistance to one or more antimicrobials, with half isolates exhibiting multidrug resistance. Ampicillin-resistant isolates harbored TEM-1 gene and transferred that mostly by IncFIB. The tetracycline resistance gene, *tet*(A) and *tet*(B), were frequently detected in tetracycline-resistant isolates. MIC test revealed that isolates carrying *tet*(B) had higher MIC than isolates carrying *tet*(A). Conjugation assays showed that isolates could transfer a tetracycline resistance gene via the IncFIB. Conclusively, the high prevalence of ampicillin and tetracycline-resistant *E. coli* from food-producing animals is due to the transferability of resistance genes between *E. coli* populations which have survived selective pressure caused by the use of antimicrobial agents. This study suggests that *E. coli* with transferable antimicrobial resistant gene(s) should be considered as an important reservoir in one health aspect.

Big Data - 52

One Medicine in Action: Use of Data Gathered from the Raptor Center for Syndromic Surveillance of Zoonotic Diseases

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Many wildlife species are reservoirs of important emerging zoonotic pathogens (EZP). For timely detection and prevention of the spread of these agents, there is a continual call from human and animal health organizations to enhance wildlife disease surveillance. Wildlife rehabilitation centers across the United States routinely gather health-related data from diverse wildlife species. Their potential to signal the occurrence of EZP and improve the efficiency of traditional surveillance remains largely unexplored. We assessed the utility of such data from raptors admitted to The Raptor Center (TRC) between 1990 and 2014 for syndromic surveillance, using West Nile Virus (WNV) as a proof of concept. As raptor species are susceptible to WNV, we hypothesized that monitoring the frequency of raptors admitted to TRC with specific syndromes could indicate WNV circulation in this region. Using grouped time-series structures and classical time-series models, we studied the variability of raptor admissions according to the avian group, species and clinical signs grouped by body systems. We uncovered underlying frequencies and trends for the main groups and identified syndromes that increased in periods with high incidence of WNV. Despite the lack of specificity, the influence of other non-controlled factors and the difficulty in retracing data, monitoring data from wildlife rehabilitation centers may help to target populations at high-risk and disease trends. Digital medical records with standardized data sets and terminology would help advance syndromic surveillance in wildlife. Ultimately, this information could contribute to the early detection of zoonotic diseases and help prevent the spread into human populations.

Big Data - 53

Spatio-Temporal Trends of Q Fever Cases in Minnesota (1997-2014)

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Q fever, caused by *Coxiella burnetii*, is a widely distributed yet neglected zoonotic disease for which domestic ruminants are considered the main reservoir. Although present in most of the world, and leading to 1-6 cases every year in Minnesota, there are still many gaps on our knowledge of its epidemiology and the main causes leading to infection. Here we show how Q fever surveillance data used in combination with information routinely collected by different agencies (animal and human population counts) can be used to characterize patterns of occurrence of cases and detect variables potentially associated with increased incidence. Thirty-eight Q fever cases were reported between 1997 and 2014 in Minnesota, with annual case counts ranging between 1-3 and 1-6 prior and after 2006, respectively. Cluster analysis revealed the presence of areas in the south of the state at significantly higher risk of Q fever for certain time periods throughout the study period. These results were in agreement with the standardized incidence ratios, which suggested an increased risk in counties in the south. Poisson spatial Bayesian regression models suggested that inclusion of information on presence of small ruminants at the county level helped to explain the expected number of cases, thus pointing at a possible association with the outcome. This example demonstrates how already available information can be combined with health data to characterize disease occurrence.

Comparative Medicine – 54

Ctl-Based Vaccine-Induced Protection with Induction of High Follicular to Extra-Follicular Ratios of Virus-Specific Cd8 T Cells

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There is an urgent need to develop an effective HIV vaccine. We previously showed that during chronic HIV-1 and SIV infections, HIV and SIV replication is concentrated within B cell follicles, whereas HIV and SIV-specific CTL are largely excluded from these sites suggesting that the inability of HIV and SIV-specific CTL to fully suppress virus replication may be due to their deficiency in B-cell follicles. We hypothesize that a successful HIV vaccine will either prevent the seeding of B cell follicles or induce high levels of virus-specific CTL in B cell follicles. Here we investigated whether protection associated with three CTL inducing SIV vaccines was associated with levels of SIV-specific CTL in follicular (F) and extrafollicular (EF) compartments in lymph nodes of vaccinated animals after challenge with pathogenic SIV relative to a cohort of non-vaccinated chronically infected animals using *in situ* tetramer staining with MHC tetramers combined with immunohistochemistry. We found lower levels of tetramer^{+} cells in F compared to EF areas of unvaccinated animals ($P<0.0001$), but not in vaccinated animals ($P=0.41$). Although, similar levels of tetramer+ cells were detected in F areas between vaccinated and unvaccinated animals ($P=0.9$), the vaccinated animals had significantly higher F: EF ratios of tetramer+ cells ($P=0.04$). Also, there was a significant inverse correlation between F: EF ratio of tetramer+ cells and plasma VL in vaccinated ($P=0.016$) but not in unvaccinated animals ($P=0.85$). These results support developing CTL-based HIV vaccines that augment relative levels of virus-specific CTL within B-cell follicles.

Comparative Medicine - 55

β-Adrenergic Signaling Modulates Metabolic Programs in Hemangiosarcomas and Angiosarcomas

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Tumor cells often hijack metabolic pathways to gain a survival advantage. Recent studies suggest canine hemangiosarcomas and human angiosarcomas signal through β-adrenergic receptors (β-ARs) to acquire a metabolically plastic phenotype, which may promote tumorigenesis. Inhibition of these pathways by β-AR antagonists likely reprograms cellular metabolism, reducing cell viability. Specifically, β-AR antagonists may modify fatty acid oxidation (FAO) and fatty acid transport by reducing the expression of mitochondrial uncoupling protein 1 (UCP-1). β-AR expression by hemangiosarcoma and angiosarcoma cell lines was assessed by immunoblotting, and the effects of β-AR specific antagonism on cell viability were ascertained. Changes in UCP-1 expression after treatment with the β-AR antagonist propranolol were assessed, and the changes correlated to alterations in mitochondrial uncoupling with TMRE assay. Our results show that β-ARs are expressed in hemangiosarcoma and angiosarcoma cell lines and beta blockade decreases tumor cell viability. Inhibition of β−AR signaling also reduces UCP-1 expression in a concentration dependent manner, partially restoring mitochondrial coupling. Furthermore, beta blockade reduces the expression of transcription factors involved in fatty acid transport. Our data suggest that β-AR signaling regulates several lipid metabolic pathways in hemangiosarcomas and angiosarcomas, and inhibition may result in an Achilles heel for tumor cells. Future studies will establish the receptor(s) needed for metabolic plasticity, and identify key metabolic pathways regulated by β-ARs necessary for progression.

Comparative Medicine - 56

Biochemical Constituents and Steroid Hormones Concentration in Different Stage Follicular Fluid in Malabari Goat

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The oocyte quality is mainly focussed on the various physiological constituents in follicular fluid (FF). These constituents appear to be a key nutrients controlling ovarian activity in animals.Therefore, a study was conducted in cross-bred (CB) Malabari breed of Southern India to study the changes in biochemical constituents of follicular fluid during different stages of follicle development. For this purpose, 120 ovaries were collected from adult CB Malabari goats immediately after slaughter from a local slaughter house. After classifying the follicles based on size i.e. small (1-3 mm) and large (>3 mm), the fluid was aspirated and centrifuged. The supernatant fluid was separated and stored at -4^{0}C for further analysis. The follicular fluid was analyzed to estimate the concentration of various biochemical constituents including total protein, albumin, globulin, glucose, triglycerides, cholesterol and high density lipoprotein (HDL) and steroid hormones (estrogen and progesterone) using commercial kits. The results showed that the concentrations of glucose was significantly higher ($p<0.05$) in small follicles. However, the level of HDL was significantly higher ($p<0.05$) in large follicles. Also, the level of oestrogen was significantly higher ($p<0.05$) in large follicles. However, follicular fluid protein, albumin, globulin, triglycerides, cholesterol and progesterone did not differ between the small and large follicle. The results of the present study suggest that the biochemical constituents in the antral follicular fluid vary with the follicular size in Malabari goat. These data can contribute to understand the FF metabolite concentrations which could be helpful for *in vitro* culture of follicles and oocytes in goats.

Comparative Medicine - 57

Microglial Immune Response to Low Concentrations of Silver Nanoparticles: A Novel in Vitro Model of Brain Health

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The brain is the central regulator for integration and control of response to environmental cues. Worldwide increases in the use and production of nanoparticles have raised concerns regarding the potential neurological impact and downstream effects on brain health. Recent studies show that nanoparticle (NP) components of air pollution from combustion engine exhaust can directly and adversely affect brain health, such as neuroinflammation. Metal NPs contained within the particulate matter of engine exhaust can trigger neuroinflammation, a deleterious immune response in brain tissue. Epidemiological data and animal studies suggest that air pollution affects brain regions controlling central energy balance may contribute to the propensity for obesity. To test this association, we developed a novel *in vitro* biological sensor model of low-dose NP exposure using microglia, the resident immune cells of the brain. Here we demonstrate that low concentrations of 20 nanometers (nm) silver-NP (AgNP) promote low-grade microglial activation as measured by increased metabolic activity and pro-inflammatory cytokine release (tumor necrosis factor-α), and upregulated pro-inflammatory gene expression (interleukin-1β and inducible nitric oxide synthase). We also demonstrated increased production of reactive oxygen species and nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) p65 activation in microglia with AgNP stimulation. Finally, we show that microglial secretions following low-dose AgNP significantly reduced cell survival of hypothalamic neurons *in vitro*. To our knowledge, this data shows for the first time the activation of NF-κB in microglia exposed to low dose of AgNP and similar immune response as others have shown for high dose of AgNP.

Ethics and Economics of Individual versus Population Health- 58

Current Practice and Associated Ethical Issues of Radiation Protection among Referring Clinicians Practicing in Bharatpur, Nepal

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A cross-sectional study was carried out during July- August, 2015 among 60 referring clinicians from 3 randomly selected hospitals of Bharatpur sub-metropolitan city, Nepal to assess their current knowledge and practice on radiation protection. The respondents were not the radiation professionals but did refer for the radiation as part of their work. The result of this study showed that the level of knowledge among referring clinicians was only 52.08% while their current practice was 60.55%.The practice was found to better than knowledge which was due to habituation in once acquired practical skills and lack of regular update on knowledge. There was no significant difference ($p > 0.05$) in the level of knowledge of clinicians of the three hospitals. But significant difference ($p < 0.05$) occurred in the practice of clinicians among hospitals because one of the hospitals was a cancer hospital which uses radio diagnostic modalities and radiation therapies regularly in bulk for cancer diagnosis and treatment. The findings showed that 33.3% (n=20) respondents referred cases for radiological investigation just to satisfy patients while 15% (n=9) for ionizing radiation during pregnancy. It seems extremely necessary for clinicians to decide for appropriate radio diagnostic modality based on need rather than patient's desire. Therefore, there is a need of soundness in knowledge in relevant aspects of radio diagnosis and radio safety among the referring clinicians to prevent the patients from unnecessary risks and hazards of radiation and equally the cost of the expensive procedures.

Food Safety and Security - 59

Heavy Metal Levels in the Mediterranean Mussel *Mytilus Galloprovincialis* from the Turkish Black Sea Coast as Biomonitor and Potential Risk of Human Health

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The concentrations of Fe, Zn, Mn, Cu, Pb, Cd and Hg in the soft parts of Mediterranean mussel *Mytilus galloprovincialis* collected from the Turkish Black Sea coast have been measured by ICP/MS (Inductively Coupled Plasma – Mass Spectrometer) for monitoring metal pollution in 2013. Statistically significant differences in the concentrations of all metals investigated were observed among four sampling stations namely Igneada, Sinop, Samsun and Trabzon in order to evaluate health risk for mussel consumers, using mussels as biomonitors. The results were compared with the guidelines set down by the Ministry of Agriculture, Fisheries and Food (MAFF), the Turkish Food Codex and Commission Regulation (EC) for the safe consumption limits of Molluscs and the other studies. The concentrations (µg metal g^{-1} wet wt.) of metals ranged from 16-55 for Fe, 5-46 for Zn, 2,4-5,25 for Mn, <0,5-2,1 for Cu, <0,05-0,45 for Pb, <0,02-0,11 for Cd and <0,05 for Hg. In Sinop, essential element Fe, Zn and Mn are present at the lowest concentrations reaching 55 µg metal g^{-1} wet wt. Sinop is the smallest city and pollutants load more less than other cities. On the basis of metal levels, Samsun shows the higher concentrations of metals with the exception of Mn that is maximum in İğneada. According to permissible limits, results in all studied stations show that there is no health risk for mussel consumers in the coastal areas of the Black Sea.

Food Safety and Security - 60

Single Steps on Selection of Dna-Aptamers for Detection of Norovirus Capsid Protein Vp1

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The epidemic non-bacterial outbreaks of gastroenteritis in humans caused by the noroviruses in the United States alone, are estimated to result in 21 million illnesses each year and contribute to some 70,000 hospitalizations and 800 deaths. Commonly used methods for the norovirus detection, such as RT-qPCR and EIAs, are not selective enough when both fast and accurate detection is required (e.g., *on-line* and *on-site* analysis). This research was aimed to develop short-time and reliable approach for selection of the DNA-sequences capable of the specific and tight binding to the target molecule, norovirus VP1 protein. The appropriate search was carried out by the consequent application of the step gradient salt elution assay, dot blotting and cloning of the selected candidates for their further sequencing. Initially, the immobilized target molecules were incubated with the randomized oligonucleotide library, and eluted with the gradient concentrations of NaCl. The DNA sequences bound to VP1, eluted with the 1.4 M and 1.5 M solutions of NaCl were then amplified and selectivity was demonstrated in a dot blot assay. Sequences eluted from the dot blot membranes were amplified and successfully cloned and sequenced. Selected oligonucleotides will be assessed for avidity and specificity using a novel direct detection system for field applications.

Food Safety and Security - 61

Validation of In-House Developed Test Kit for Detecting Antimicrobial Residues in Meat

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The objective of this study aims to validate test kit for antimicrobial residues in honey that produced by Faculty of Veterinary Medicine, Chiang Mai University (CMU test) using microbial inhibition assay. In order to apply in meat products, Limits of Detection (LOD) of Tetracycline and Penicillin G were determined. The result showed that the LOD of Tetracycline and Penicillin G were 400 and 5 µg/kg respectively. Antimicrobial residues in 150 meat samples sold in fresh markets were detected by using CMU test. The positive result was 6.7 % in 150 meat samples mostly found in chicken. Moreover, we used the result from CMU Test to compare with the result of Premi® Test and CM Test for measure of agreement using Cohen's kappa coefficient. The result from CMU test was not in accordance with the result of Premi® Test however, it was highly accordance with CMU Test. Therefore, CMU Test can be possibly developed as screening test for detect antimicrobial residues in meat products.

Food Safety and Security - 62

Instantaneous Microbial Screening: Detecting Pathogens in Less Than 30 Min

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A rapid and cost-effective microbial detection technology capable of providing reliable results in less than 2 hours is in persistent today in food industry, food safety agencies and diagnostic laboratories. The 2-hour time frame is highly critical as food producers seek to control the quality and safety of their products on-site before shipment. Once the product is released, any undetected contamination or spoilage would lead to significant cost due to recalls, food waste, food poisoning or negative impact on the product perception and consumer trust. Although many commercially available technologies are labeled for "rapid microbial detection", they always require 12-48 hours enrichment before detection. We have developed instantaneous microbial screening assays that is capable of identifying the microbial content of food samples (bacteria, fungi, viruses) in less than 30 min without using antibodies, enzymes or equipment using bionanotechnology. The technology is based on specific microbial coating with gold nanoparticles, named "plasmonic cell nanocoating" (US Patent Pending # 62/287,894 (Jan. 27th, 2016), where gold nanoparticles are used to target specific surface phylogenetic markers at the surface of the microorganisms and induce a visible colorimetric change in the sample solution. The same technology was successfully applied to lateral flow assays using a newly developed hand-held device to separate and concentrate the sample and allow a detection limit lower than 100 cfu/mL (US Patent Pending # 62/287,892 (Jan. 27th, 2016). We hope that this technology will provide an effective tool for rapid decision making to reduce food spoilage and food poisoning.

Role of Science in Formulation of Local and Global Health Policy - 63

Building Antimicrobial Resistance (Amr) Capacity in Cariforum Countries

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Based on a specific need identified by the Region, a project entitled "Antimicrobial Use and Antimicrobial Resistance in Agriculture" was developed in collaboration with the Ohio State University (OSU), College of Veterinary Medicine. Twenty-seven professionals were trained from the fifteen CARIFORUM Countries on Antimicrobial Use and Antimicrobial Resistance (AMR) in Agriculture during June and December, 2015. This training was specially designed and customized for official veterinarians, diagnosticians, epidemiologists and other public health professionals from different countries in the Caribbean.

The main objectives of the program were to provide foundational and applied knowledge on the use of antibiotics and related antimicrobial agents in different animal production systems and to understand the emergence and epidemiology of AMR in agriculture. The impact of AMR on the health of humans, animals and the environment, as well as on international trade and commerce was emphasized. In addition, course participants were trained in the establishment or enhancement of surveillance and monitoring systems for AMR in zoonotic and foodborne pathogens. One outcome of the in-person training was the development of a multi-country pilot project as the first step to contribute in the establishment of a Regional Antimicrobial Resistance Surveillance system for the Caribbean. The overall purpose of these pilots is to establish an AMR baseline, while expanding the laboratory capacity and expertise in the respective countries. The pilot project is expected to start in June, 2016.

Role of Science in Formulation of Local and Global Health Policy - 64

Epidemiology, Impact, Prevention and Control of Nipah Encephalitis in Bangladesh: A Systematic Review of One Health Issue

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Introduction: Nipah virus poses an eminent threat in Bangladesh & the region as it encounters almost yearly outbreak since 2001. The objective of this review is to summarize the epidemiology &control of Nipah encephalitis. **Method:** We searched three different databases- Pubmed, Web of Science & Google Scholar using different appropriate search terms mixing the Boolean operators that yielded 144, 113 &1530 articles respectively. We screened the titles first for relevance & later abstracts. 47 articles met our criteria &were finally reviewed. A literature matrix was formed in Excel for compilation & analysis.
Results: Unlike Malaysian outbreak, person to person transmission occurred in Bangladesh leaving humans most vulnerable. Infections were reported in domesticated pigs, dogs & cats in South Asia. Serological study in Bangladesh showed 6.5%, 4.3% &44.2% seroprevalence in cattle, goat & pig respectively. *Pteropus* bat plays a key role in Nipah transmission. Risk factors include drinking raw date palm sap contaminated with bat urine or faeces, eating half-eaten bat saliva laden fruit & close contact or involvement in burial of cases. It mostly occurred during winter (date palm sap harvesting season). Nipah occurred within the "Nipah belt" & had a high case fatality (> 70%). Avoiding raw date palm sap & drinking sap from trees protected with bamboo skirt remain the principle preventive measures along with strict infection control in hospitals to prevent secondary cases. **Conclusion:** Extensive knowledge of this emerging zoonosis is the key for prevention. Multisectoral intervention through One Health approach can prevent this deadly disease.

Science Informing Public Policy and Economics of Health - 65

Cost of Illness in Diarrheal Diseases among Under Five Children: A Gender Biased Attitude of Parents in Bangladesh

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Background: Diarrhea is a common cause of childhood mortality and morbidity in Bangladesh. The purpose of the study is to identify the gender discrepancy made by the parents for the cost of illness in diarrheal diseases among under five children. **Methods:** The parents or the guardians of 30 male children and 30 female children were interviewed at homes who were treated for diarrhea in a diarrheal treatment center in Dhaka city. The interview was done within 15 days of discharge to avoid the recall bias. The total and average out of pocket payment were calculated. **Result:** Results show that parents spend more for male children during diarrheal disease treatment. The average out of pocket payment for male child was 624.57 Bangladeshi taka (BDT) or 7.97 USD which was 515.87 BDT (6.58 USD) for female child for each episode of diarrheal disease. The average out of pocket payment for under five children was 570.22 BDT (7.27 USD) **Conclusion:** Further study is required to ascertain in detail why parents are spending more for male children during diarrheal disease treatment. The health policy of the country should consider this gender issue regarding the prevention and control measures of any disease of importance. Besides, to reduce the cost of diarrheal disease, different types of vaccine like Rotavirus vaccine, Cholera vaccine would be the suitable options.

Role of Science in Formulation of Local and Global Health Policy - 66

Climate and Health: Observations and Modeling the Impact of Climate Parameters on Seasonal Malaria Outbreaks in Senegal

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An extensive literature survey shown that climate has an important impact on malaria, a vector-borne disease which is a public health problem, particularly in the Sub-Saharan Africa. This study has an important component of simulations of malaria parameters using the Liverpool Malaria Model (LMM). Malaria model outputs are compared with observed malaria cases recorded by the National Malaria Control Program in Senegal. The different reanalysis datasets used to drive the LMM are: 20th century reanalysis, NCEP reanalysis, ERA40, and ERA Interim. The simulated malaria parameters are EIR (Entomological Inoculation Rates), HBR (Human Biting Rate), and Nm (Number of adult mosquitoes). It is found that in Senegal, high malaria transmission season takes place from September to November with a peak in October corresponding to two months after the peak of rainfall in August. Also, the spatial distribution of malaria has been characterized. Observed malaria data and simulated malaria outputs are consistent.

Furthermore, we investigate climate change impacts on malaria for two RCP scenarios (RCP4.5 and RCP8.5) from the baseline period (1971-2000) to the near future (2020s) and in the medium future (2050s) to the long-term (2100s). The Coupled malaria model to GCMs shown malaria increasing from the north to the southern part of Senegal. The epidemic belt is generally pushed too far in the south and very low incidence for the northern part of Senegal is consistently simulated.

These findings taking account climate conditions could be useful for climate services, end-users, researchers and decision makers in malaria prevention in Senegal.

Role of Science in Formulation of Local and Global Health Policy - 67

Improving Consumer Acceptance of Sugar-Free Jam through Flavoromics

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Fruit spreads are a broadly consumed category of foods, with over one billion dollars in annual sales within the United States. However, due to the high sugar content of traditional jams, diabetic consumers and consumers following calorie-restricted diets are unable to consume these products within the constraints of their diets. Although sugar-free and low-sugar spreads offer an alternative to traditional spreads for consumers, current products are plagued by flavor defects not present in traditional spreads. These flavor defects lead to low consumer acceptance of sugar-free spreads, making it more likely that consumers may choose to consume traditional products in spite of dietary restrictions. In order to improve consumer acceptance of sugar-free spreads, a fusion of food sensory science and metabolomics, termed Flavoromics, has been used to understand chemical differences between traditional and sugar-free products which may contribute to these flavor defects. Compounds significantly different between product types can be isolated, recombined with jams, and analyzed using consumer sensory panels to determine if they have a causal relationship with acceptance. Using these techniques, compounds which modulate perceived acidity and contribute to a sense of "full" flavor in fruit jams have been discovered. Further work is ongoing.

Role of Science in Formulation of Local and Global Health Policy - 68

Challenges and Opportunities for the Small-Scale Pork Production in Southeast Asia

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Pork production has been rapidly growing and considered as a major meat consumption in many countries in Southeast Asia. The pork processing requires standardization which is currently in a transition state in some countries. The objective of this study is to identify the challenges and opportunities for small-scale pork processing plants in Thailand, Vietnam and Philippines. Knowledge, attitude and perception were identified among stakeholders. Semi- structure in depth interview, focus group discussion and checklists were applied to the stakeholders based on each context. The results of this study indicated the differences and some similarities of processing lines, stakeholders, challenges and opportunities in each countries. Knowledge and attitude of hygiene operation during the process have been identified as an important factor and mostly influences by the workers. Similar to this, the operating cost and enforcement of regulations are the most challenging factor for development of standardization. The demand and perception of consumers plays an important role, and could be the opportunity for improvement of the pork production chain.

Team Science – 69

Building Capacity on Veterinary Service for Asia through Education, Research and Service

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The Veterinary Public Health Centre for Asia Pacific (VPHCAP) is a knowledge and collaborative regional centre in capacity building for veterinary service particularly in Southeast Asia and South Asia. With 12 years of experiences, the ultimate goal of the center is to provide academic information and technical know-how to support public health veterinarians in the region for safe trading and public health wellbeing. VPHCAP offers the International Master of Veterinary Public Health Program (MVPH) which has been developed to strengthen capacity of veterinary service in the region and to produce graduates from Asia countries to have all-round competency in Veterinary Public Health. MVPH also creates network in region level to control, prevent and resolve diseases caused by epidemic diseases, zoonoses and food hygiene, with an emphasis on quality control and safety of food of animal-origin from farms to consumers including environmental hygiene. The MVPH curriculum encourages the student-centered atmosphere and concentrates on universal knowledge to resolve the problems in their own countries and region. Recently, there are 71 graduates in MVPH alumni network, from 6 batches and from 15 countries in Asia Pacific including Thailand, Vietnam, Nepal, Myanmar, Indonesia, Laos, Sri Lanka, China, Bhutan, Philippines, Cambodia, Pakistan, Malaysia, India, and Bangladesh. The MVPH Alumni Network is created to maintain connections between their intuitions in order to reinforce international academic, research and collaboration for transferring knowledge, experiences, problems and taking appropriate action on food safety and zoonoses in the Asia Pacific region.

Role of Science in Formulation of Local and Global Health Policy - 70

One Health Systems Mapping and Analysis Resource Toolkit: A University-Government Partnership to Inform Policy and Strengthen Cross-Sectoral Coordination for Infectious Disease Threats

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Coordination and collaboration across human, animal, and environmental health sectors are essential to address infectious disease threats like Avian Influenza or Ebola. While progress is being made, many evaluation and assessment efforts focus on individual sectors. Additional tools are needed that strengthen cross-sectoral response systems and policy infrastructure.

The One Health Systems Mapping and Analysis Resource Toolkit (OH-SMART), jointly developed by the University of Minnesota and the U.S. Department of Agriculture, is a step-wise, structured approach by which a network of agencies visualize and review their processes for interdisciplinary coordination of complex issues at the human-animal-environmental interface. OH-SMART has been used in the US to train state and federal agency personnel from over 35 states. Trainees have then gone on to use the tool to improve infectious disease response including developing a plan for outbreaks at petting zoos and strengthening state response for Ebola. The tool has also been used to strengthen cross-sectoral response to zoonotic diseases including leptospirosis, anthrax, rabies and avian influenza in 6 provinces and 2 districts in Indonesia. Most recently, it was used to facilitate an After Action Review of the cross-sectoral Avian Influenza response in Minnesota, where participants identified best practices and prioritized future actions to strengthen the system of prevention, early detection, and rapid cross-sectoral response. Minnesota Agencies are currently using the results to revise State Emergency Response Plans. Future implementation includes expansion of the work to the Lower Mekong region of Southeast Asia as well as further expansion of its use in Indonesia.

Role of Science in Formulation of Local and Global Health Policy – 71

The Dri•Bank® Container: an Effective Room-Temperature Solution

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Laboratory specimen maintenance typically requires processes such as cold-chain storage or chemical preservation, which consequently have significant direct and indirect associated costs. An alternative room-temperature solution not requiring powered equipment, toxic chemicals, or coatings was developed. Several independent organizations have evaluated its effectiveness in preserving key bio-macromolecules such as RNA, subsequently stabilizing them for storage at room temperature for months. Here, we present data on preservation of bio-macromolecules from a variety of specimens at room temperature using the Dri•Bank® container. Evaluators compared preserving, storing, and/or shipping their specimens with the Dri•Bank® container at ambient conditions with traditional practices. Bio-macromolecules included DNA extracted from whole organisms (acheta), RNA aliquots from MCF7 cultured cell extracts, and viral antigens from blood sera (primate and porcine). Specimen samples were preserved with the Dri•Bank®, stored at room temperature from weeks to months, and analyzed at different time points. Analyses were conducted in replicate using established methodologies such as Arrayed Immuno-Multiplexing™, qRT-PCR, ELISA, and electrophoresis. Sample integrity was maintained with no detectable/significant differences from controls. RNA aliquots shipped or stored at ambient conditions as well as viral antigens from blood sera were equivalent to their frozen counterparts. Similar results were observed with DNA extracts; more than 50% of DNA fragment ≥5kb were preserved. We deduce from independent evaluations that the Dri•Bank® container is an effective solution for preserving, storing, and/or shipping a variety of lab specimens at ambient temperature, potentially creating significant cost reductions, and improving workflow efficiency.

Role of Science in Formulation of Local and Global Health Policy – 72

Comparative Genomics of Archived Pyrazinamide Resistant *Mycobacterium Tuberculosis* Complex Isolates From Uganda

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Bovine tuberculosis is a 'neglected zoonosis' yet its contribution to the proportion of *Mycobacterium tuberculosis* complex infections in humans is not fully known. In a developing country like Uganda, *Mycobacterium tuberculosis* Complex (MTC) testing is routinely carried out with the use of glycerol as a carbon source for the organism but this inhibits the growth of *Mycobacterium bovis*, if present in a sample. Samples routinely collected for tuberculosis (TB) testing are usually sputum yet *M. bovis* is generally isolated from extra-pulmonary sites like lymph nodes. We undertook a retrospective study on archived MTC isolates in a large reference laboratory in Uganda to determine the proportion of *M. bovis* isolates. We found 1.5 % of the pyrazinamide resistant samples to be *M. bovis;* this was low but expected since over 80% of the samples were from sputum and were cultured using glycerol as a carbon source. Whole genome sequencing (WGS) and phylogenetic analysis helped us determine the extent of diversity and relatedness of our isolates to other MTCs. We also defined a single nucleotide polymorphisms (SNP) set that can be used to differentiate the MTC group of organisms.

Science Informing Public Policy and Economics of Health - 73

Reproductive Behaviors of Stray Dogs in Flocks and Behavioral Changes Observed after Castration: with Emphasized Public Health

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The study is focused on the possible changes observed in the reproductive behavioral patterns of stray dogs following the castration procedure and to see if this changes effect social behavioral patterns of dogs towards people in intercommunal places adoptively.

Three seperate dog packs in three seperate zones were included in the study. The study consisted a total of 23 dogs of which 12 were female and 11 were male. The sniffing, approching, licking, barking, courting, mounting, biting, aggression, sign marking behaviors of dogs, their interest towards people and other animals are observed for 12 weeks pre-castration and 16 weeks post-castration. The observation reports were evaluated weekly and frequency of specific behaviours were noted.

During the 16 weeks following the castration, a decrease in frequency of sniffing, approaching, licking, barking, courting, leaping and marking behaviors was observed in most of the dogs. Biting and aggressive behavior of dogs did not present significant changes.

However the dogs showed an increased "positive interest" towards environmental factors and people, a decrease was not observed in aggressive behaviour in dogs which were aggressive before castration.

As a result, a decrease in reproductive behaviours and an increase interest towards people and other environmental factors were observed in castrated stray dogs in packs during the 16 weeks following the operation.

Science Informing Public Policy and Economics of Health – 74

Applications of Bayesian Phylodynamic Methods in Disease Pandemics: Evolutionary History of Foot and Mouth Disease Serotype O Vp1 Gene in the Middle East and Northern Africa

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The foot-and-mouth disease virus (FMDV) remains one of the most contagious diseases of domestic livestock worldwide and causes severe economic losses within affected countries. Presently, FMDV maintains an endemic state in the Middle East and Northern Africa (MENA), with frequent outbreaks across the region. In this study, we performed analyses of publicly available sequence data of the FMDV serotype O (FMDV-O) VP1 gene segment using different coalescent phylodynamic models within a Bayesian statistical framework to infer the evolutionary and geographic history of this virus within and among the MENA region from 1969 to 2014. Our results indicate that the FMDV-O experienced a substantially elevated evolutionary rate associated with the introduction of the Pan-Asia strain into the MENA region in 1990. Regional-level analyses indicate that the FMDV-O entered the MENA from Eastern Asia; where this is the most significant geographic route of viral migration into the MENA region. However, country-level analyses indicate that Turkey is the point of entry of the FMDV-O into the MENA; where significant dispersal routes of the virus were inferred between Turkey and three different MENA countries. Finally, our analyses indicate that cattle are the most probable host associated with the transmission and maintenance of the virus in the MENA; while sheep, goats and pigs had insignificant role in between species transmission. We demonstrate the ability of phylodynamic models to inform the molecular surveillance and control of the FMDV-O virus in high-risk regions, and guide preparedness in neighboring FMDV-free countries or regions.

Science Informing Public Policy and Economics of Health – 75

Research Quality Assurance: A Strategy for Improving Research Reproducibility

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Scientific research is the fundamental process used to inform public policy and establish the economics of health. This process is reliable if research data are accurate and reproducible. Quality Assurance is defined as a system for ensuring a desired level of quality in the development, production, or delivery of products and services (Dictonary.com). The products of scientific research are data and inference, and data reproducibility is the critical measure of whether a desired level of quality has been reached. While quality systems are employed to support data quality in many scientific environments, they are rare in basic research settings. This leaves scientists without the training and infrastructure needed to achieve research accountability and facilitate research reproducibility. This gap is especially unfortunate as public skepticism of scientific discovery is increasing in light of demonstrated inability to replicate results, growing numbers of publication retractions, inadequate peer review, and the increasing reports of error and misconduct events. The University of Minnesota College of Veterinary Medicine has initiated pilot programs to integrate recommended 'Good Research Practices, GRP' into collegiate research environments by providing research QA training and support. Examples of GRP include the use of standard operating procedures spanning the breadth of research activities, the management of equipment, reagents, and supplies, good documentation procedures, and the management of research data. In this poster, models for GRP integration at the individual, program and consortium level will be described and freely available training resources will be identified.

Science Informing Public Policy and Economics of Health – 76

Modeling the Transboundary Risk of Feed Ingredients Contaminated with Porcine Epidemic Diarrhea Virus

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This study describes a model developed to evaluate the transboundary risk of PEDV-contaminated swine feed ingredients and the effect of two mitigation strategies during a simulated transport event from China to the US. Ingredients imported to the USA from China, including organic & conventional soybeans and meal, lysine hydrochloride, D-L methionine, tryptophan, Vitamins A, D & E, choline, carriers (rice hulls, corn cobs) and feed grade tetracycline, were inoculated with PEDV. Control ingredients, and treatments (ingredients plus a liquid antimicrobial (SalCURB, Kemin Industries (LA) or a 2% custom medium chain fatty acid blend (MCFA)) were tested. The model ran for 37 days, simulating transport of cargo from Beijing, China to Des Moines, IA, US from December 23, 2012 to January 28, 2013. To mimic conditions on land and sea, historical temperature and percent relative humidity (% RH) data were programmed into an environmental chamber which stored all containers. Across control (non-treated) ingredients, viable PEDV was detected in soybean meal (organic and conventional), Vitamin D, lysine hydrochloride and choline chloride. In contrast, viable PEDV was not detected in any samples treated with LA or MCFA. These results demonstrate the ability of PEDV to survive in a subset of feed ingredients using a model simulating shipment from China to the US. This is proof of concept suggesting that contaminated feed ingredients could serve as transboundary risk factors for PEDV, along with the identification of effective mitigation options.

Science Informing Public Policy and Economics of Health - 77

The Western Food Environment; Why Nutrition Policy Is Not Working

Mallory Franklin, *University of Minnesota, Minneapolis, MN, USA*

Since 1980, the U.S. government has published The Dietary Guidelines for Americans every five years. This set of recommendations is generated by a council of experts and researchers in the field of nutrition. Nutrition advice from these professionals has not change much over the past thirty-five years. Every dietary guideline recommends you eat a large variety of fruits, vegetables, and whole grains and recommends you avoid foods that are high in saturated fat, cholesterol, sodium, and added sugar. With such basic and consistent guidelines, it is still very difficult for Americans to obtain a healthy diet. One aspect of our food environment that does not get much attention is how our society gets information about nutrition. Most of the nutrition information the public is exposed to does not come from dietary guidelines that are carefully based in current nutrition discoveries from experts in the field. Rather, society gets information from media and food industry advertisements that often exploit the findings of a single study for their own benefit. This causes a perception that nutrition is rapidly changing and contradicting itself, leaving the public confused, frustrated, and uncertain about what constitutes a healthy diet. Therefore, our food environment cultivates a sense of mistrust around nutrition, rendering basic dietary guidelines less effective. Nutrition research is being misrepresented for media propaganda and food industry profit that is undermining our nutrition policy efforts to help Americans eat a nutritious diet.

Science Informing Public Policy and Economics of Health - 78

Science Informing Public Policy and Economics of Health in South Asia Using a One Health Framework Focussed on Priority Endemic Zoonotic Diseases

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Zoonotic diseases are a threat to people's livelihoods in the developing world. Improving the capacity of governments to respond to these threats require the combined efforts of experts in animal, human, and wildlife diseases. Massey University is implementing a three-year program in Afghanistan, Bangladesh, Bhutan, and Nepal using a One Health approach for design and economic evaluation of disease control policies for endemic zoonotic diseases. The program combines formal training in epidemiology and economics with practical application of the acquired skills. In each country, six medical doctors and veterinarians from the human, animal, and wildlife health sectors participate full-time in a fellowship that includes Master's level training in One Health epidemiology and biosecurity. Systematic assessments of existing data are completed for four zoonotic diseases in each country, followed by field studies designed to provide missing information about each disease. Novel software that integrates epidemiological and economic analyses allows for structured policy evaluation and identification of appropriate One Health control strategies. The formal training component of the fellowship is 80% complete and field studies are currently underway. This fellowship integrates capacity building and collaboration at both individual and government institution levels. Working across animal, public health, and wildlife sectors, both within and between countries, national policy recommendations for each selected disease based on evidence that is supported by systematic epidemiological and economic analysis of real data from each country will be developed; policy recommendations will be created in consultation with the government institutions responsible for zoonotic disease control in each country.

Science Informing Public Policy and Economics of Health - 79

Assessment of Zoonotic Disease Surveillance Alternatives to Optimize Effectiveness and Cost by Simulating Disease Simultaneously in Wildlife, Livestock, and Humans

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Emergent zoonotic diseases can create social and economic disruptions in affected countries. Timely detection is critical in minimizing these disruptions and objective approaches are needed for predicting the effectiveness of surveillance strategies. A spatially-explicit, spatiotemporal model was developed using Interspread Plus software, to simulate spread of a hypothesized zoonotic disease 'Austeria' amongst feral pigs, domestic pigs, and humans in Australia. Eight surveillance strategies were designed, each focusing on different strata of affected pig or human populations. Variants of each strategy were implemented at high, medium, and low levels of intensity and sensitivity (8*3*3 = 72 sub-strategies). The effectiveness of each sub-strategy was measured by (i) days until outbreak detection, (ii) proportion of outbreaks detected, and (iii) number of farms infected. The most efficient approach (RB2) involved risk-based sampling of commercial pig farms in regions having substantial overlap of commercial and feral pigs and the least efficient approach (FPB) involved collection of blood samples from harvested feral pigs. Strategy RB2 implemented with high intensity and sensitivity detected the outbreak after 108 days, detected 93% of simulated outbreaks, and resulted in 23 farms becoming infected. The FPB strategy implemented with low intensity and sensitivity detected the outbreak after 281 days, detected 3% of outbreaks, and resulted in 2,515 farms becoming infected. Choosing the 'best' combination of surveillance sub-strategies can be economically optimized using additional software (OptiSurv). Simulation of disease spread simultaneously among and between wild and domestic animals, and people was conducted enabling analysis of surveillance strategies involving humans, animals, or both.

Science Informing Public Policy and Economics of Health - 80

What if You Have One Science? Or Even One Policy?

AZIZ ARDA SANCAK, HASAN ALBASAN, EBUBEKİR CEYLAN; *ANKARA UNIVERSITY, ANKARA, TURKEY*

We all agreed on the challenge of extending our productive lives and focused on wellness, mobility, and cognition in maintaining a high quality of life for as long as possible. The One Health concept recognizes that the health of humans is connected to the health of animals and the environment. Likewise, “one health one medicine” shows the world how to work together. This synergism only can be achieved by accelerating science for one health and one medicine. This idea brought about the second idea of “one health one science”. Besides the potential outcomes can only be possible by established regional and global policies, particularly the political and the ethical and social decisions we make, to protect environment, food chain that are global effects to human health. Therefore, at last this idea birthed the idea of “One Policy” (speak one voice which equates to one policy). We all expect when the policies are properly, and especially globally implemented it will help protect and save our lives in the present and the future, consequently “Better policies for better lives”. However there is a close relation between policies and trade. Nevertheless, there are always concerns; who will be making full use of the advantages of global trade? Because trade policies are inherently unequal and developing countries seldom experience rise in wellbeing but increasing unemployment, poverty, and income inequality. In conclusion “Public health, animal health and security sector must speak with one voice on the need to strengthen health systems.” However, climbing the stairs from “one health, one medicine” to “one medicine one science” and eventually “one science, one policy” opens an issue with the argument that we need fundamental change in how we think about the future and how long that future might last ‘this proves to be very, very complex!’

Science Informing Public Policy and Economics of Health - 81

Risks versus Benefits of Controlling Vector-Borne Diseases Using Insecticides: a Case Example in South Africa

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Insecticides are a highly effective method of controlling diseases spread by insect vectors, with benefits including low cost and ease of use. To control malaria, WHO recommends using both insecticide-treated nets (ITN) and indoor residual spraying (IRS). DDT was used extensively in agriculture during the 1940s/1950s before adverse effects in wildlife prompted a ban in many countries. This insecticide is persistent in the environment, bioaccumulates and biomagnifies in the food chain, and health risks are reported in both animals and people. However, due to its efficacy, use of this pesticide for vector control is still permitted by the Stockholm Convention on Persistent Organic Pollutants. Meat samples and eggs were collected from free-ranging chickens in an area of the KwaZulu-Natal Province, South Africa, where DDT is used regularly in an IRS program. Although concentrations of DDT and its metabolites were below published acceptable daily intake levels, calculation of carcinogenic hazard ratios showed a potential increased risk to human health through consumption of these chicken products. Where do we go from here? The first step uses science to assess effectiveness of disease control, but we also need to monitor contaminants in the environment and study at grass roots to understand how these interact with people and animals. Can we store and use chemicals more safely? Can we lower their risk? With that knowledge, we can weigh up risks versus benefits, and make informed decisions about improved, safer control methods for vector-borne diseases such as malaria.

Science Informing Public Policy and Economics of Health - 82

Rural Design as a Link between Science and Society

Dewey Thorbeck, *University of Minnesota, St. Paul, MN, USA*

Gaps in our knowledge about complex biomedical and environmental problems limit our ability to develop durable solutions in the spirit of One Medicine One Health…. Compartmentalized science often misses crucial interactions and science often is not effectively involved into public policy debate…. If science is crucial to create public policies for sustaining human, animal, and environmental health the science needs to be integrated and articulated so that it is impartial, useful and accepted. (iCOMOS 2016) Evidence-based rural design is a problem-solving process that can improve the linkage between science and society. It is a process that recognizes that human and natural systems are inextricably coupled in continuous cycles of mutual influence and response. It is a methodology for holistically crossing borders and connecting issues to nurture new design thinking and collaborative problem solving to create a better and prosperous future for humans, animals, and environments – locally and globally. Rural design can be instrumental in seeking ways that teams of scientists (agricultural, medical, and social) can better bring scientific evidence to a societal problem and in turn raise new issues that science needs to resolve. It is a process to nurture collaboration and cooperation among rural communities to shape the landscape to provide and integrated system of humans, animals, and environments that meets the needs of people in the present without compromising for the future. This poster session will outline the design methodology to illustrate how rural design can better link science with society while integrating human, animal, and environmental wellness.

Science Informing Public Policy and Economics of Health - 83

Medical Waste Pollution from Sinop Sarikum Beach of the Black Sea, Turkey

Ayşah Vişne, Levent Bat, *Sinop University, Sinop, Turkey*

Sarikum Lagoon which is one of the significant wetlands of the Black Sea has been announced as Nature Reserved Area in 1987. Lagoon and its surroundings is a tourism route for local tourists. However, Lagoon beach is exposed to a significant accumulation of solid waste both with sea currents and the influence of the prevailing winds due to its geographical location. This study is a part of the project named «Status of Sinop Sarıkum Lagoon Marine Litter under the Scope of Marine Strategy Framework Directive: A Case Study» and numbered which it is financially supported by TÜBİTAK. In this context encountered medical waste results is shared during the beach litter survey. Sampling stations were selected from 4 sections of the beach's different location for four seasons. Within each sampling area, all debris items were collected, categorized and the possible usage (medical, sanitary, etc.) were recorded. The results indicated that the medical waste proportion to the entire litter item is 2-4% and most of them were composed of syringes and needles, injection containers and serum containers. Also medicine bottles, insulin shots and inhaler drugs were found considerably. In the possible usage category, medical waste were occurred only a small proportion but its possible danger is unignorably. It reduces tourism, recreation and revenue for sea-side cities and causes injuries. Moreover, some medical waste in the sea may be contaminated with pathogens, toxins etc. Moreover they are passed along food chains in the sea and can effect on sea life and human health.

Team Science - 84

Supranational Organizations of Veterinary Education in South America

Daniel Cavestany[1], Catalina Picasso[2], Andrés D. Gil[1]; [1]*Facultad de Veterinaria, Universidad de la Republica*; [2]*University of Minnesota, Saint Paul, Minnesota and Ministry of Livestock Agriculture and Fisheries*, Montevideo, Uruguay

In the last century, the South American (SA) countries created, increased, and consolidated their Veterinary Schools. Transnational veterinary organizations raised in the last 25 years with the aim of enhance, enrich and complement each country research and educational capacities, addressing the region as a whole. Here, we will present current veterinary education organizations existing in the SA region. SAPUVETNET is a Veterinary Public Health Network of universities including fifteen countries aiming to improve veterinary education using updated teaching methods (on-line repository, field practices, integrated learning). Association of Montevideo Group Universities (AUGM), integrates public, autonomous, and self-governing universities of southern SA since 1991. Its committee, with an interdisciplinary approach, addresses animal heath strategic areas for sharing and exchange human and training resources. Since 1992, the Federation of Pan-American Veterinary Schools (FPFECV) is working to promote cooperation developing regional CVs, professional certifications, and school accreditations. Veterinary School Association was created in 1993 by the MERCOSUR countries. Currently, it has members from public and private universities, which discuss veterinary education structure, namely competences, programs' homologation, and international veterinary-accreditation. CEBASEV (Buenos Aires Center for Veterinary Services training and education) is a non-university education center created by Argentinian organizations. It serves as OIE reference center for Official Veterinary Services capacity building in the region, since 2006. In our opinion, there is overlapping of objectives and activities of these organizations, so we need to focus on integrate their efforts, to a more efficient achievement of goals.

Team Science - 85

The Path towards an International One Health Workforce

John Deen, Katey Pelican; *University of Minnesota, St. Paul, MN, USA*

Outbreaks of novel diseases such as Ebola in West Africa can be described in similar manners to an agent host interaction. Though we focus a great deal on the characteristics of the agent in creating such a devastating disease, the focus on the host response has, in some ways, had less publicity. Yet, it is the ability of a country to prevent, detect and respond to emerging infectious diseases that better determines the outcome. It has been difficult for the general public to understand that though an agent such as Ebola can occur in the United States, the likelihood of an outbreak is much lower due to the indigenous capacity of its workforce and support of institutional structures. USAID's One Health Workforce Project focuses on creating adequate one health workforce is to support countries in developing that "immunity" to novel agents. Capacities need to involve and integrate a broad range of competencies that cannot be concentrated in any one profession or governmental agency. Thus the focus of this project is not only on personnel and their skills but their ability to work together as a team.

Team Science - 86

Paradigms and Pitfalls within Team Science: Case Studies on How to Fund and Evaluate Transdisciplinary Action Research

Bruno Sobral, Claire Tucker; *Colorado State University, Ft. Collins, CO, USA*

In its inaugural year, the One Health Institute at Colorado State University provided grant funding to seven projects, with the goal to make innovation in health real and sustainable though the institutionalization of community-engaged transdisciplinary action research. These projects represent interests of all eight colleges at CSU, and teams are required to use systems thinking approaches to promote intersections and interfaces across disciplines. Research teams are formed with individuals from diverse backgrounds, representing CSU faculty, government agencies, non-profits, and community members. Topics range from anti-microbial resistance to food systems to the reintroduction of bison onto the Colorado plains, and funding allotments range from $15,000-$100,000. The One Health Institute is currently conducting an extensive portfolio review to determine how these teams are faring, both within the context of their original grant and beyond, as they seek to secure further funding. This poster will present the seven projects as case-based examples of how team science functions on a day-to-day basis. We will share our metrics for success, and highlight key moments of pivot and problem. The geographic, organizational, and analytic scope of each project will be emphasized, and compared to the initial financial investment. With the data and insight generated from this portfolio review, the One Health Institute will provide invaluable information on best practices within team science, as well as how to set reasonable expectations for "Return on Investment" for transdisciplinary action research.

Water at the Interface of Health, Economics and Environment - 87

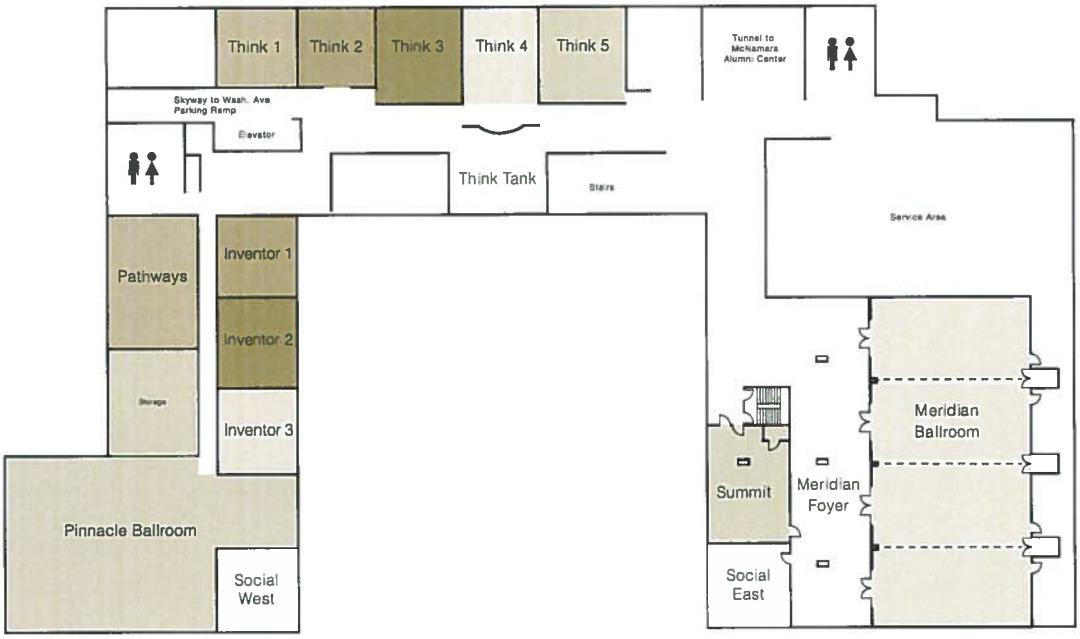
Dual Detection of Nitrate and Mercury in Water using Disposable Electrochemical Nanosensors

Minh-Phuong N. Bui, John Brockgreitens, Snober Ahmed and Abdennour Abbas; *University of Minnesota, St. Paul, MN, USA*

It is extensively recognized that heavy metals are the cause of many disorders in plants, animals, and humans as these metals bio-accumulate in food chains and threaten human and ecological health. Mercury is considered one of the most hazardous heavy metal pollutants because of its toxicity and the mobility of its species throughout different environmental systems. Nitrate contamination also continues to be a problem for the world given the increased use of nitrate fertilizers in agricultural fields. Here, we present a disposable, cost effective electrochemical paper-based nanosensor for the detection of both nitrate and mercury ions in lake water and contaminated agricultural runoff. Disposable carbon paper electrodes were functionalized with selenium nanoparticles (SeNPs) and gold nanoparticles (AuNPs). The AuNPs served as a catalyst for the reduction of nitrate ions using differential pulse voltammetry techniques. The AuNPs also served as nucleation sites for mercury ions. The SeNPs served to reinforce this mercury ion nucleation due to the high binding affinity of selenium to mercury. Differential pulse stripping voltammetry techniques were used to further enhance mercury ion accumulation on the modified electrode. The fabricated electrode was characterized by SEM, EDS and electrochemistry techniques. The obtained results show that the PEG-SH/SeNPs/AuNPs modified carbon paper electrode has a dual functionality in that it can detect both nitrate and mercury ions without any interference with a limit of detection of 8.6 µM and 1.0 ppb, respectively. The modified electrode was used to measure nitrate and mercury in lake water around Minnesota area.

The COMMONS HOTEL

MEZZANINE LEVEL ROOMS



Meeting Room	Sq. Footage	Ceiling Ht.	Theatre	Classroom	Conference	U-Shape	Banquet	Reception
Meridian Ballroom	5,200	15' 0"	600	306	-	-	368	600
Summit	975	9' 11"	70	42	22	27	48	70
Think 1	676	9' 11"	60	39	20	21	40	50
Think 2	546	9' 11"	40	24	20	15	32	40
Think 3	676	9' 11"	60	39	20	21	40	50
Think 4	732	9' 11"	70	45	26	27	48	60
Think 5	676	9' 11"	60	39	20	21	40	50
Pathways	1,000	9' 0"	100	48	36	27	56	70
Inventor 1	625	9' 0"	50	33	20	21	32	45
Inventor 2	625	9' 0"	50	33	20	21	32	45
Inventor 3	625	9' 0"	50	33	20	21	32	45
Pinnacle Ballroom	4,000	9' 0"	320	150	38	45	240	260

Capacities of the rooms may vary depending on function and set-up.

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