Diagnostics in the Veterinary Field:

The Role in Health Surveillance and Disease Identification

May 15-17, 2019

Wiesbaden, Germany

Organized by IABS

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About the Conference

Diagnostics are an essential tool to ensure the health of domestic and wild animals for both endemic and emerging diseases.

They allow animal health professionals to understand and manage the general health status of domestic animals. They are also important tools to support public health initiatives in the case of zoonotic disease control.

The meeting will provide an overview of existing systems and approaches / strategies for the use of diagnostics and to discuss the currently available diagnostics.

The advantages / benefits and disadvantages / gaps of the current methods and methodologies will be identified and discussed.
Proposals on how to increase the quality, efficacy, and utility of the existing strategies and methods and those under development will be made.

Scientific & Organizing Committees

SCIENTIFIC COMMITTEE

Dr. Sandra Blome, Friedrich Löffler Institut
Dr. Attila Farsang, CEVA
Dr. Cyril Gay, USDA
Dr. Richard Hill, IABS
Dr. Carmen Jungbäck, IABS, Chair
Mr. Vaughn Kubiak, Zoetis
Dr. Serge Leterme, IDEXX
Dr. David Mackay, EMA
Dr. Paul Midtlyng, University of Oslo
Dr. Egbert Mundt, Boehringer-Ingelheim
Prof. Dr. Amir Noormohammadi, University of Melbourne
Dr. Sjaak de Wit, Deventer

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Scientific Program

Day 1 Wednesday, May 15, 2019

Speaker Abstracts begin on Page 9

13:00 **Registration**

14:00 Opening

14:10 Introductory remarks: Expectations of all stakeholders (authorities, farmers, veterinarians etc) on Diagnostics and their use in outbreak investigations of Transboundary Animal Diseases
Prof. Dr. Hans-Joachim Bätza, Federal Ministry of Food & Agriculture, Germany

Session 1 - Diagnostics: Current and new methods

Chairpersons: **Dr. Paul Midtlyng,** Norwegian University of Life Science
Mr. Vaughn Kubiak, Zoetis Belgium SA, Belgium

14:40 Classical serological test in the modern age: Are we moving in the right direction?
Dr. Gleeson Murphy, National Veterinary Services Laboratories, U.S.A.

15:00 Multiparameter-testing for pathogens and antibodies in a Point of Care approach
Dr. Heinz Schoeder, Boehringer Ingelheim VRC GmbH & Co KG, Germany

15:20 Carry your lab in-your-pocket – qPCR results whenever needed
Dr. Carsten Schroeder, Indical Bioscience, Germany

15:40 Coffee break

16:10 Biotechnology-based diagnosis of infectious diseases in veterinary medicine
Dr. Fredric Granberg, Swedish University of Agricultural Sciences, Sweden

16:30 Rapid genome sequencing of animal pathogens from clinical or environmental samples
Dr. Marc Marenda, Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Australia

16:50 Long Read DNA sequencing technology for diagnostic of poultry pathogens
Dr. Claudio Afonso, National Poultry Research Center, Southeast Poultry Research Laboratory, U.S.A.

17:10 A bead-based multiplex immunoassay for simultaneous measurement of antibody responses to multiple antigens; an example from Atlantic salmon
Dr. Hege Lund, Norwegian University of Life Sciences (NMBU), Faculty of Veterinary Medicine, Norway

17:30 Modern antimicrobial sensitivity testing: current state of affairs and future development
Dr. Alex van Belkum, bioMerieux, France

17:50 Discussion

Scientific Program

Day 2 Thursday, May 16, 2019

Session 2- Diagnostics in epidemiological in clinical surveillance: practical applications

Chairpersons: **Dr. Sandra Blome,** Friedrich Loeffler Institut
Dr. Serge Leterme, IDEXX
Prof. Dr. Amir H. Noormohammadi, University of Melbourne

09:00 Diagnostic strategies for endemic diseases: surveillance and control
Dr. Margaret Good, previously Veterinary Head of the Ruminant Animal Identification and Traceability, Disease Eradication, Division, of the Irish Department of Agriculture, Food and the Marine, Ireland

09:20 Survival of viral pathogens in animal feed ingredients under transboundary shipping models
Dr. Scott Dee, Pipestone Veterinary Services, U.S.A.

09:40 A novel modified-indirect ELISA based on spherical body protein 4 for detecting antibody during acute and long-term infections with diverse Babesia bovis strains
Dr. Carlos Suarez, Animal Disease Research Unit, Agricultural Research Service, USDA, U.S.A.

10:00 Surveillance of TSE in Italy: a success story
Dr. Elena Maria Bozzetta, Istituto zooprofilattico sperimentale del piemonte liguria e Valle d'Aosta, Italy

10:20 Genome sequencing and evolutionary analyses of Newcastle disease viruses from formalin fixed paraffin-embedded chicken tissues collected during disease outbreaks
Dr. James B. Stanton, Department of Pathology, University of Georgia, U.S.A.

10:40 Serology vs. real-time quantitative PCR (qPCR) screening for viral infections; experiences from the control of salmon pancreas disease in Ireland and Norway
Dr. Marian McLoughlin, Fish Vet Group, United Kingdom

11:00 Coffee break

11:30 Point-of-care rapid diagnostic tests and their clinical use: diagnosis and prevention of calves diarrhea
Dr. Estelle Hess, Bio-X Diagnostics, Belgium

11:50 Emerging diseases: Lumpy Skin Disease: history, lessons and perspectives on diagnostics and control
Dr. David Wallace, Onderstepoort Veterinary Institute, Agricultural Research Council, South Africa

12:10 Emerging diseases: African Swine Fever
Dr. Carmina Gallardo, Centro de investigación en sanidad animal (CISA-INIA), Spain

12:30 Lunch

Scientific Program

14:00 ICT (Information and Communication Technology) and Big Data applied to veterinary diagnostics: the today various approaches of the subject
Dr. Belen Barreiro, Ingenasa, Spain

14:20 DIVA in DNA: Pseudorabies and IBR
Dr. Patricia König, Friedrich Loeffler Institut, Germany

14:40 DIVA in RNA: Avian influenza, strategies in control, surveillance and eradication – problems with DIVA
Prof. Timm Harder, Friedrich Loeffler Institut, Germany

15:00 Advances in diagnostic and control strategies for Rift Valley Fever
Dr. William Wilson, Arthropod-Borne Animal Diseases Research Unit, Agricultural Research Service, USDA, U.S.A.

15:20 Discussion

15:50 Coffee

Session 3- Acceptance of data, qualification tools for laboratories and methods

Chairpersons: **Dr. Suelee Robbe-Austerman,** National Veterinary Services Laboratory, Animal and Plant Inspection Service, USDA., U.S.A.
Dr. Heinz Schoeder; Boehringer-Ingelheim
Mr. Vaughn Kubiak; Zoetis

16:20 Role of OIE and FAO networks to maintain laboratory quality assurance systems for transboundary livestock diseases
Dr. Donald King, The Pirbright Institute, United Kingdom

16:40 Network: AAVLD the role of veterinary diagnostics in health surveillance and disease, including new technologies, standardization and quality assurance
Dr. Keith Bailey, American Association of Veterinary Laboratory Diagnosticians (AAVLD), U.S.A.

17:00 OMCL: quality assurance of labs and methods - the need for physical standards to assure the quality and comparability of diagnostic testing
Dr. Neil Almond, National Institute for Biological Standards and Control (NIBSC), United Kingdom

17:20 General guidance for test kits intended for diagnosis of animal diseases
Dr. Larry Ludemann, USDA, Center for Veterinary Biologics, U.S.A.

17:40 Licensing EU
Dr. Sandra Blome, Friedrich Loeffler Institut, Germany

Scientific Program

Day 3 Friday, May 17, 2019

08:30 Technical and regulatory challenges of developing veterinary diagnostic tests
Dr. Serge Leterme, IDEXX, U.S.A

08:50 Experience from a manufacturer: Qualification / validation of methods challenges of developing quality control tests
Marianna Ivok, CEVA, Hungary

09:10 Experience from inter-laboratory proficiency tests among European national reference laboratories for detection of viral infections in fish
Dr. Niels Jorgen Olesen, Technical University of Denmark, National Institute of Aquatic Resources, Denmark

09:30 OIE Procedure for Registration of Diagnostic Kits
Mária Szab, World Organization for Animal Health (OIE), France

09:50 Discussion

10:20 Coffee break

Session 4- Summary of the sessions, discussion, conclusions and recommendations

Chairpersons: **Dr. Attila Farsang, CEVA,** Hungary
Dr. Richard Hill, IABS-North America (IABS-NA)

10:50 Summary of the sessions and the discussions

11:30 Conclusions and recommendations

12:00 Plenary /Panel discussion

12:30 Closing remarks

Farewell lunch

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Upcoming IABS Conferences and Workshops

2019-2020

>> **Towards rabies elimination in Asia-Pacific: from theory to practice**
September 25-26, 2019 – Bangkok, Thailand

>> **Quality of challenge agent**
October 22, 2019 – Paul-Ehrlich Institute, Langen, Germany

>> **2nd Next Generation Sequencing for adventitious virus detection in biologics**
November 13-14, 2019 – Ghent University, Het Pand, Belgium

>> **Non-Animal testing of vaccines – A global congress**
December 3-4, 2019 – Bangkok, Thailand

>> **3rd Human Challenge Trials**
February 6-7, 2020 – Oxford, United Kingdom

>> **IABS 65th Anniversary: A global health conference**
February 26-28, 2020 – Lyon, France

>> **5th Cell & Gene Therapy**
Q1 – Tokyo, Japan

>> **Maintaining the quality of vaccines through the use of references standards**
Q2 2020, Canada

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Speaker Abstracts

Claudio **Afonso, Ph.D**
US National Poultry Research Center

Neil **Almond, Ph.D**
National Institute for Biological Standards and Control (NIBSC)

Keith **Bailey, DVM, Ph.D**
American Association of Veterinary Laboratory Diagnosticians (AAVLD) / Oklahoma Animal Disease Diagnostic Laboratory (OADDL)

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Ingenasa

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Friedrich Löffler Institut

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Istituto Zooprofilattico Sperimentale Del Piemonte Liguria E Valle d'Aosta

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GD Animal Health

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Pipestone Veterinary Services

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Centro de investigación en sanidad animal

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Swedish University of Agricultural Sciences

Timm **Harder, Ph.D.**
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Carlos **Suarez, Ph.D.**
Animal Disease Research Unit, Agricultural Research Service, USDA

Alex **Van Belkum, Ph.D.**
bioMerieux

David **Wallace, Ph.D.**
ARC-Onderstepoort Veterinary Research institute

William **Wilson, Ph.D.**
U.S. Department of Agriculture

Speaker Abstracts

Claudio Afonso, Ph.D.

Long Read DNA sequencing technology for diagnostic of poultry pathogens

Afonso, C.L.
Exotic and Emerging Avian Viral Diseases Research Unit, Southeast Poultry Research Laboratory, US National Poultry Research Center, ARS, USDA, 934 College Station Road, Athens, GA 30605, USA

BACKGROUND— Avian Influenza, Newcastle disease, and ILTV are among the most serious avian respiratory diseases of poultry. These diseases, caused by small RNA or DNA viruses and are often associated with human infective bacterial pathogens . Rapid diagnostic tests based on real time PCR have limitations, as they are agent specific, fail to detect mutants or specific strains, and do not provide specific genetic or epidemiological information.

MATERIALS & METHODS— The long read sequencing technology provided by MinION Oxford Nanopore was used to characterize large amplicons from clinical samples or from purified DNA from viruses or bacterial genomes in order to characterize avian infectious agents. Custom bioinformatics workflows were designed for rapid automated sequence analysis using publicly-available tools

RESULTS— Deep sequencing of large amplicons from randomly amplified nucleic acids, or from DNA provided 1) confirmation of PCR results, 2) genetic characterization, 3) identification of lineages of virus and bacteria and 4) detection of mixed infections. A MinION device allowed detection of mixed infections including co-infections with different strains of Newcastle disease virus, or different avian Influenza virus as well as characterization of different ILTV strains. This technology also allowed rapid, multiplexed, whole genome and plasmid sequencing of key foodborne pathogens. Long-read sequencing allowed simultaneous sequencing the entire chromosome and plasmid of Salmonella enterica subsp. enterica serovar Bareilly and Escherichia coli O157:H7. In sequencing runs as short as four hours, using MinION data alone, we obtained full-length genomes with an average identity of 99.87% for Salmonella Bareilly and 99.89% for E. coli in comparison to the respective MiSeq references. These assemblies provided readily available information on serotype, virulence factors, antimicrobial resistance genes, and rapid epidemiological inference and outbreak tracing.

CONCLUSIONS— Although established short-read, NGS technologies are known to provide highly accurate data, Nanopore sequencing provides additional advantages as very low capital investment and footprint, and shorter (10 hours library preparation and sequencing) turnaround time compared to other NGS technologies.

Speaker Abstracts

Neil Almond, Ph.D.

OMCL: quality assurance of labs and methods - The Need for Physical Standards to Assure the Quality and Comparability of Diagnostic Testing

Rob Anderson, Sarah Kempster, Clare Morris and Neil Almond
Division of Infectious Disease Diagnostics, NIBSC, POTTERS BAR, EN6 3QG, United Kingdom

BACKGROUND— Biological Medicines require special considerations to ensure that clinical products are safe effective. Within Europe special attention is focused on prophylactic vaccines and blood products, derived from donated human plasma. The Official Control Authority Batch Release (OCABR) network exists within the General European OMCL Network. One component of OCABR testing is to undertake independent evaluation of these plasma pools applying pharmacopoeial molecular and serological tests for evidence of blood borne virus contamination.

CHALLENGE— OCABR tests for detection of blood borne viruses must meet or exceed the specifications described in the European Pharmacopoeia (EP). Molecular tests continue to improve rapidly so that "State of the Art" that exceed EP limits, sometimes by >10 fold. For serological assays, commercial development of better assays works at the cusp of assay sensitivity and specificity. Nevertheless, testing plasma pools frequently require commercial tests to be used outside of designated purpose. Differential results may ensue between laboratories applying the "same" test.

APPROACH— A robust framework of assurance is required applying a multi-faceted approach to ensure not only the selection of the most appropriate testing platform, but ongoing evaluation of assay performance. External physical standards are essential for making intra- and inter-lab comparisons. Nevertheless, the testing algorithm may also be crucial. Examples will be presented and discussed.

CONCLUSIONS— Robust molecular and serological detection of infectious disease requires more than the "best" assay. Validated assays of defined analytical sensitivity should be embedded within a testing framework that assures results of the highest quality.

Speaker Abstracts

Elena Maria Bozzetta, Ph.D.

SURVEILLANCE OF TSEs IN ITALY: A STORY SUCCESS

BACKGROUND—Transmissible spongiform encephalopathies (TSEs) are fatal neurodegenerative infectious diseases of man and animals: Bovine spongiform encephalopathy (BSE) and Scrapie in sheep and goats are the most known TSEs. BSE was responsible for a huge epidemics starting from the mid eighties, spreading from UK to all Europe. While BSE causes vCJD in humans, Scrapie has never been convincingly associated with any form of human TSE, whenever endemic in Europe for more than 200 years. Nevertheless, the fact that sheep may have been exposed to BSE prions poses a risk to humans. Due to public health implications, the European Regulation (EC) 999/2001 provided a harmonized legislation intended to prevent, control and eradicate these diseases.

METHODS— Atypical types of both BSE and Scrapie, different from the classical forms in clinical presentation, molecular characteristics and distribution of PrPSc, have been detected since 1998. TSEs are characterized by the concentration of an anomalous isoform (PrPres) of the natural prion protein (PrPc) in the central nervous system (CNS). PrPres differs from PrPc in its high insolubility and partial protease resistance: these characteristics are exploited by the majority of the methods currently used for BSE diagnosis. To date the diagnosis is based only on post-mortem tests.

APPROACH BEING TAKEN— The trend of BSE and Scrapie and thus the effectivness of the enforcement of the control measures in place are monitored through an EU surveillance program. The Italian Ministry of Health appointed the net of State Veterinary Istituti Zooprofilattici Sperimentali as official laboratories for TSEs screening through rapid tests, coordinated by the NRL for Animal Encephalopathies (CEA), that carries out confirmatory tests. This approach allows to rely on laboratories operating in the frame of ISO17025 and applying harmonized Standard Operating Procedures. Furthermore a unique highly performing rapid test for BSE and Scrapie is in use.

CONCLUSIONS— The surveillance program through rapid testing in place allowed the detection of the first case of BSE in Italy as well as in most EU countries and ensures the monitoring of Scrapie trend; considering the easing of measures related to the disappearence of BSE, it is of outmost importance as an early warning tool in the case of the eventual re-emergence of the disease.

Speaker Abstracts

Sjatt de Wit, DVM, Ph.D.

ISO 17043 for organisers of proficiency testing schemes: Experiences with ring tests/collaborative studies

GD Animal Health, Deventer, the Netherlands

BACKGROUND— The NEN-EN-ISO/IEC 17025:2018 requires laboratories to participate in proficiency testing schemes for their accredited tests. The International Standard NEN-EN-ISO/IEC 17043:2010 specifies general requirements for the competence of providers of proficiency testing schemes and for the development and operation of proficiency testing schemes. These requirements are intended to be general for all types of proficiency testing schemes, and they can be used as a basis for specific technical requirements for particular fields of application. Providers of PTS that meet the requirements of ISO / IEC 17043 are considered competent by NEN-EN-ISO/IEC 17025:2018.

CHALLENGE— NEN-EN-ISO/IEC 17025:2018 describes amongst many other aspects of organising a PTS the kind of statistical analyses that are allowed on the different kind of results: quantitative, semi-quantitative (ordinal) and qualitative. For many circumstances, the required statistical analyses including outlier analyses is clear. This includes testing for homogeneity and stability of the samples that are send to the participants. A challenge is the statistical analyses of ELISA's that produce an antibody titre based on the intensity of the reaction and a mathematical formula. Antibody titres in general are not truely quantitative tests (number of antibodies) as are the result of the amount of antibodies (different kinds), affinity and avidity. How to determine the assigned value of a serum?

PROPOSED APPROACH— Including the source of a serum (e.g. derived from animal X that was infected or vaccinated with strain Z at Y days before sampling) helps to determine the expected qualitative result of a serum. The true value or assigned value can hardly be determined by a single (reference) laboratory. Using the results of all participants can be helpful to determine the assigned value.

CONCLUSIONS— Providers of PTS that meet the many requirements of ISO / IEC 17043 are considered competent by NEN-EN-ISO/IEC 17025:2018. Being competent is a challenge, together we know more.

Speaker Abstracts

Scott Dee, DVM, Ph.D.

Survival of viral pathogens in animal feed ingredients under transboundary shipping models.

Dee SA, Bauermann FV, Niederwerder MC, Singrey A, Clement T, de Lima M, et al

PLoS ONE 13(3): e0194509. https://doi.org/10.1371/journal.pone.0194509

BACKGROUND— The goal of this study was to evaluate survival of important viral pathogens of livestock in animal feed ingredients imported daily into the United States under simulated transboundary conditions.

METHODS— Eleven viruses were selected based on global significance and impact to the livestock industry, including Foot and Mouth Disease Virus (FMDV), Classical Swine Fever Virus (CSFV), African Swine Fever Virus (ASFV), Influenza A Virus of Swine (IAV-S), Pseudorabies virus (PRV), Nipah Virus (NiV), Porcine Reproductive and Respiratory Syndrome Virus (PRRSV), Swine Vesicular Disease Virus (SVDV), Vesicular Stomatitis Virus (VSV), Porcine Circovirus Type 2 (PCV2) and Vesicular Exanthema of Swine Virus (VESV). Surrogate viruses with similar genetic and physical properties were used for 6 viruses. Surrogates belonged to the same virus families as target pathogens, and included Senecavirus A (SVA) for FMDV, Bovine Viral Diarrhea Virus (BVDV) for CSFV, Bovine Herpesvirus Type 1 (BHV-1) for PRV, Canine Distemper Virus (CDV) for NiV, Porcine Sapelovirus (PSV) for SVDV and Feline Calicivirus (FCV) for VESV. For the remaining target viruses, actual pathogens were used. Virus survival was evaluated using Trans-Pacific or Trans-Atlantic transboundary models involving representative feed ingredients, transport times and environmental conditions, with samples tested by PCR, VI and/or swine bioassay.

RESULTS— SVA (representing FMDV), FCV (representing VESV), BHV-1 (representing PRV), PRRSV, PSV (representing SVDV), ASFV and PCV2 maintained infectivity during transport, while BVDV (representing CSFV), VSV, CDV (representing NiV) and IAV-S did not. Notably, more viruses survived in conventional soybean meal, lysine hydrochloride, choline chloride, vitamin D and pork sausage casings.

CONCLUSIONS— These results support published data on transboundary risk of PEDV in feed, demonstrate survival of certain viruses in specific feed ingredients ([a]high-risk combinations) under conditions simulating transport between continents and provide further evidence that contaminated feed ingredients may represent a risk for transport of pathogens at domestic and global levels.

Speaker Abstracts

Carmina Gallardo, Ph.D.

Emerging diseases: African Swine Fever

Nieto R., Soler A, Fernandez-Pinero J., Arias M., and Gallardo C.

European Union Reference Laboratory for African Swine Fever (EURL), Centro de Investigación en Sanidad Animal, INIA-CISA, Valdeolmos 28130, Madrid, Spain.

INTRODUCTION— African swine fever (ASF) is a serious viral hemorrhagic disease affecting domestic pigs and wild boar. In 2007 ASFV arrived at Georgia and in 2014 the infection reached the European Union (EU). The huge capacity of transboundary and transcontinental spread of ASFV was exemplified by the jump to China in August 2018, to Belgium in September 2018 and, recently to Mongolia in January 2019, several hundreds of kilometers away from previously known infected regions. This represents a new change in the epidemiological situation of ASF worldwide, suggesting that the disease may have reached global proportions.

CHALLENGES— Since there is no vaccine available, prevention, control, and eradication of ASF is based on the implementation of appropriated surveillance and strict sanitary measures. Success of surveillance activities is dependent on the availability of the most appropriated diagnostic tests. Although a number of good validated ASF diagnostic techniques are available, the interpretation of the ASF diagnostic results is complex and not always easy. The reasons lies in the complexity of the epidemiology with different scenarios, as well as the characteristics of the viruses circulating giving rise to a wide range of clinical forms of ASF.

RELEVANT GUIDANCE AND PROPOSED APPROACH— This review provides a guidance for an appropriated interpretation of the ASF diagnostic results linked to the different clinical presentations ranged from per-acute to chronic disease, including apparently asymptomatic courses. Fixed criteria's have been established to determine the timing of the ASF clinical infection based on laboratory diagnostic results by the analysis of more than 3,000 field and experimental samples obtained from animals infected with genotype II ASFV.

CONCLUSIONS— The use of the most appropriated diagnostic tools combining both ASF virus and antibody detection improve the efficacy of disease-control measures, regardless of the nature of the circulating ASFV strains.

Speaker Abstracts

Margaret Good, Ph.D.

Diagnostic strategies for endemic diseases: surveillance and control.

When considering diagnostic surveillance and testing regimes for endemic disease a policy/decision maker will need to determine a few fundamentals – why test? What is the goal? Any regulatory requirements or issues? What budget?

Then, they seek the 'ideal test' i.e. a test that recognises every true infected case, never misdiagnoses a healthy individual and functions perfectly in any and all situations – is inexpensive and easy to perform on an easily obtained 'sample'. Alas such tests do not exist for (m) any diseases thus surveillance and testing regimes must be designed using less-than-perfect tests.

So how does one choose and use a less-than-perfect test?

One needs to be mindful that the available/published sensitivity, specificity, positive and negative predictive value estimates can be dependent upon the animal and the disease characteristics within the population studied; then cautious in extrapolating these estimates to different populations of animals.

One must consider how the estimates were made, what was the sample size and if estimates are relative to the culture of post-mortem or other biological or environmental samples, will they be imperfect and variable and by how much depending on the techniques used and the range of materials examined.

Will the test perform equally well in all situations, laboratories etc.

What QA procedures underpin the test in the manufacturing plant and what are necessary when performing the test - what lab oversight, proficiency/ring trials, independent checks are routine or will be required.

Having chosen the test – what strategies can be applied to ensure it fulfils the desired purpose?

Speaker Abstracts

Fredrik Granberg, Ph.D.

Biotechnology-based diagnosis of infectious diseases in veterinary medicine

Fredrik Granberg*[1, 3], Maja Malmberg[1, 3], Mikael Leijon[2, 3], Mikael Berg[1], & Sándor Belák[1, 3]

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[2] Department of Virology, Immunobiology and Parasitology (VIP), National Veterinary Institute (SVA)

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INTRODUCTION— Our globalized world is currently facing many different challenges; one of which is the spread of infectious diseases that emerge or re-emerge at the interfaces between animals, humans and their ecosystems. Several factors have been suggested to contribute to disease emergence by altering the distribution of both vectors and pathogens, including climate change, urbanization, and global trade and transportation. In addition, larger and larger animal populations are kept together in animal husbandry and breeding units, supporting the rapid spread of infectious agents.

CHALLENGES— Considering the global situation, there is significant risk that imported livestock and/or arthropod carriers, as well as infected travelers are bringing unwanted new pathogens. Diagnostics are crucial in mitigating the effect of disease outbreaks. However, although a broad arsenal of diagnostic methods is at our disposal, the majority of the conventional diagnostic tests is highly specific or is targeted entirely towards a limited group of infectious agents. This specificity complicates or even hinders the detection of new or unexpected pathogens. There is also few systems that allow the integration of sample preparation and enrichment steps with detection.

APPROACH BEING TAKEN— The continuous efforts to develop new and improved biotechnology-based tools have resulted in molecular diagnostic assays that, with the exception of culture-based assays, may supersede all other direct detection methods. The most widely applied are the assays based on polymerase chain reaction (PCR) and nucleic acid hybridization. The relatively recent introduction of more powerful sequencing technologies, i.e. next-generation sequencing (NGS), and concurrent advances in sequence data analysis, have greatly improved pathogen identification and characterization. It is now possible to obtain comprehensive and detailed genomic information that allows simultaneous detection of most, if not all, infectious agents within a sample. However, even though NGS-based approaches now have bridged the gap between research and diagnostics, there are still some challenges to overcome. Most importantly, there is still an ongoing discussion concerning analytical and clinical validation, as well as compliance with current accreditation standards.

CONCLUSIONS— When considering the development of new technologies, a trend can be observed towards more robust and affordable automatic systems that also integrate sample preparation steps for rapid and highly sensitive multiplex detection. It is also desirable that the systems allow detection of an easily enlarged panel of pathogens. NGS-based assays can be develop both for (i) rapid screening of single samples for selected pathogens, and (ii) broad-range pathogen detection and characterization, including previously unknown, in multiple samples.

Speaker Abstracts

Timm Harder, Ph.D.

DIVA in RNA: Avian Influenza, Strategies in control, surveillance and eradication – Problems with DIVA

Friedrich-Loeffler-Institute, Isle of Riems, Germany

INTRODUCTION— The concept of distinguishing infected from vaccinated animals (DIVA) was created as a tool to improve vaccination-based control of animal diseases. A key issue of this strategy is the detection of an immune reaction in vaccinees to markers added to the vaccine antigen (positive marker) or lack thereof in case an authentic antigen has been removed from the vaccine composition (negative marker). Thus, the immune reaction of vaccinees becomes distinguishable from that of animals infected by wild-type virus.

CHALLENGES— Population heterogeneity in terms of induction of an immune reaction to vaccine antigens challenges the concept of positive markers. Relying on negative markers calls for marker-specific assays with excellent performance characteristics with respect to sensitivity and specificity. Molecular detection and characterization by PCR of genomic fragments of the pathogen has been suggested as an alternative to serologic differentiation.

PROPOSED SOLUTIONS— The use of positive markers in avian influenza virus (AIV) vaccines had not been advocated for in the past. True negative markers only became available with the production of recombinant inactivated AIV vaccines which focus on a single viral protein such as the hemagglutinin (HA). Absence of another highly immunogenic viral protein, the nucleocapid protein (NP), from such vaccines complemented the serologic DIVA concept. In modified live influenza vaccines deletions of a non-structural protein (NS-1) has been exploited both for attenuation and as a negative marker. Yet, clear-cut serological differentiation of vaccinees from virus-infected individuals proved to be a challenge.

CONCLUSIONS— The widespread use of real-time RT-PCR for detection of AIV opens more possibilities to put the concept of "genetic DIVA" into practice. In light of an increasing incidence in poultry populations of endemic infections of highly pathogenic AIV (some of which bear substantial zoonotic potential), convincing vaccination and complementing DIVA concepts remain a pivotal pillar in disease control strategies.

Speaker Abstracts

Estelle Hess, Ph.D.

Point-of-care Rapid Diagnostic Tests and their clinical use: Diagnosis and Prevention of calves diarrhea.

BACKGROUND— Half of the deaths among unweaned calves are attributed to diarrhea, which can be caused by several enteric bacteria, viruses and protozoa. The absence of pathognomonic signs hampers the clinical diagnosis of this syndrome and has required a laboratory method. At Bio-X Diagnostics, we have developed an easy-to-use and accurate point-of-care test (POCT) to allow veterinarians to rapidly diagnose the etiology of diarrhea and treat the calves accordingly. For the prevention of the disease, we offer another POCT to identify herds with a failure in passive transfer of immunity. Hence bovine placenta does not allow the passive transfer of maternal antibodies to the fetus. For a calf to be protected against diarrhea, it is crucial that it receives a high-quality colostrum in sufficient quantity in its first hours of life.

MATERIALS AND METHODS— Both POCTs devices were developed to be easy to use in the field, according to the specific requirement of each test. Diagnostic POCT were validated using ELISA (n=101 at least) and preventive POCT using ELISA (n= 677) and radial immunodiffusion (RID, n= 76).

RESULTS— A test device intended for the detection of up to 5 pathogens simultaneously was validated using ELISA as references. Good and excellent kappa concordance values were found for each of the pathogens: 0.84, 0.76, 0.85, 0.88 and 0.72 for rotavirus, coronavirus, Escherichia coli F5, Cryptosporidium parvum and Clostridium perfringens respectively. Similarly, a device was developed to detect passive transfer of immunity in calves, by quantifying IgG in calf blood. It was validated using ELISA (r2=0.77) and RID assay (r2=76). This POCT technology allows an easy storage and export of data.

CONCLUSIONS— Two easy-to-use and accurate POCTs are available and can be performed by veterinarians in the field. While the diagnostic POCT helps identify the causative pathogen(s) of diarrhea and choose an appropriate treatment, both diagnostic and preventive methods are designed to monitor and improve the herd health management, thereby reducing the risk of animal loss and associated economic loss.

Speaker Abstracts

Marianna Ivók, MSc

Experience from a manufacturer 2: Qualification / validation of methods challenges of developing quality control tests

M. Ivók, Z. Pénzes
Ceva-Phylaxia, Budapest, Hungary

BACKGROUND— As to the validation of a bioassay is rather uniform, and well regulated by VICH, EDQM, OIE, the presentation would like to highlight the special view of a vaccine manufacturer via some examples. The subject of the presentation is ELISA tests used for quality control.

APPROACH—The main steps and key milestones of assay development at Ceva Phylaxia is discussed to have a suitable in-process control or potency test (i.) selection of target epitope; ii.) correlation with target analyte concentration; iii.) effect of matrix; iv.) in-vitro potency; v.) recovery from vaccine; vi.) correlation with efficacy).

RESULTS— As to virus detection huge number of samples (> 5000) are used to determine the appropriate positivity cut-off: symptomes should be compared to the ELISA +/- evaluation and PCR.

A significant change in potency tests is to use in vitro methodology instead of in vivo anywhere it is possible due to 3R requirement. In case of an inactivated NDV vaccine the data collection for two years is still ongoing for registration variation. In this way we can replace an in vivo method, which used hundreds of chicken for the release of this vaccine, which is a huge achievement of Ceva. The performance and reproducibility of the test is superior and production is proved to be very consistent.

Finally the presentation highlights the importance of assay robustness tests during validations.

CONCLUSIONS— Development of in vitro methods for quality control, which are in concordance to manufacturer's requirements and needs, can replace in vivo methods according to our present achievements, and it is our goal to increase the proportion of in vitro methods within the potency test in line of 3R requirements.

Speaker Abstracts

Donald King, Ph.D.

ROLE OF OIE AND FAO NETWORKS TO MAINTAIN LABORATORY QUALITY ASSURANCE SYSTEMS FOR TRANSBOUNDARY LIVESTOCK DISEASES

Donald P. King, Ginette Wilsden, and Anna B. Ludi

OIE/FAO Reference Laboratory for Foot-and-Mouth Disease, The Pirbright Institute, United Kingdom on behalf of the OIE/FAO FMD Laboratory Network.

INTRODUCTION— Foot-and-mouth disease (FMD) is a viral disease that infects cloven hoofed animals including cattle, sheep, goats and pigs. The causative virus (FMD virus [FMDV]) is highly contagious and has the capacity for rapid spread among susceptible livestock. The disease is present in many countries in sub-Saharan Africa and Asia, and can be transmitted across long distances via transboundary routes. Diagnostic laboratories play a key role to detect and monitor the spread of FMD; however, performance of individual tests is continuously challenged by the high inherent variability of FMDV within each of the seven viral serotypes. Since 1977, the FMD Reference Laboratory at Pirbright has organised proficiency testing (PT) schemes to help demonstrate test equivalence between different FMD reference laboratories, and highlight issues relating to local test performance that require improvement.

CHALLENGES— The most recently completed PT exercise (Phase 30) was reported in 2018 included results for 71 participating laboratories. Panel of samples provided to these laboratories comprised sera from infected and vaccination animals and representative FMDV specimens. Since 2005, these PT exercise have included samples suitable for testing by RT-PCR which is now adopted by many laboratories as a front-line diagnostic test. These samples closely match the most important contemporary epidemiological risks (such as emerging FMD virus lineages in Asia and North Africa), and are validated to ensure their suitability for diagnostic tests with widely different sensitivity and specificity. International shipping of PT panels continues to be expensive and logistically challenging (especially where panels contain “live” FMDV), while the use of inactivated samples can pose difficulties when using these materials in down-stream assays (such as genome sequencing).

CONCLUSIONS— These PT exercises contribute to the establishment of quality assurance standards (such as ISO/IEC 17025) adopted by FMD Reference Laboratories. In the future, it can be anticipated these QA activities will be further complemented by the availability of a wider range of reference standard materials for different tests from partners within the OIE/FAO Network.

Speaker Abstracts

Patricia König, Ph.D.

DIVA in DNA: Pseudorabies and IBR

Friedrich-Loeffler-Institut

INTRODUCTION— Endemic viral diseases are of global significance and impact to the livestock industry. Control and eradication is especially in high-prevalence regions based on repression of the circulating virus by intensive vaccination. Pseudorabies virus (PRV) and Bovine herpesvirus type-1 (BoHV-1) are typical herpesviruses which establish latency in the neuronal tissues of the infected animals. These animals harbor the virus lifelong and may reactivate virus replication under stress with abundant shedding of infectivity. Therefore, field virus-infected animals have to be identified and preferably removed from the livestock population. Immunization with glycoprotein E (gE)-deleted DIVA vaccines enables the subsequent selection of marker-negative animals. In 1980, the national directive on the prevention of Pseudorabies virus, which declared the disease as notifiable, was issued. A mandatory nationwide control program has been initiated in 1989 and the disease was eradicated in domestic pigs by 2000.

By applying an obligatory disease control program for 20 years, Germany has also successfully eradicated Bovine herpesvirus type 1 following the idea of DIVA vaccination in cattle. In 2017, the whole country was recognized as officially free from infectious bovine rhinotracheitis (IBR).

CHALLENGES— Efficient disease control requires a complex interplay of efficient diagnostics, consistent selection of infected animals, stringent vaccination schedules, professional farm management, and effective hygiene- and quarantine measures.

Since the start of the BoHV-1-control program, several millions of BoHV-1 antibody assays are conducted yearly in Germany. Monitoring and status control are maintained in at least yearly sampling intervals. In the year 2017, more than 2.8 million individual blood- or milk samples from about 65,000 holdings and approximately 250,500 bulk milk samples from 51.000 holdings were serologically tested.

DIVA tests have to be extremely sensitive and must detect infected individuals, which may allow field virus replication only at very low levels. On the other hand, especially in increasingly free populations, the tests have to be robust and highly specific. Furthermore, the DIVA principle itself has intrinsic factors like a reduced sensitivity or the lack of confirmatory test systems which can influence DIVA-based eradication programs.

CONCLUSIONS— The use of DIVA vaccines in combination with the accompanying marker diagnostic test systems has proven to be a very successful tool in controlling and eradicating both PRV and BoHV-1, two economically important diseases in livestock in Germany. This was even possible in regions with a high prevalence of infected animals. Certain limitations of the diagnostic marker tests are apparent - therefore approaches like enhanced testing frequency or control of the epidemiological plausibility of the results by the veterinary authorities are crucial for the effectiveness of the DIVA strategies.

Speaker Abstracts

Serge Leterme, Ph.D.

Technical and Regulatory Challenges of Developing Veterinary Diagnostic Tests

Leterme S., Schelp C.

IDEXX

INTRODUCTION— Veterinary diagnostic tests are common tools used in all veterinary clinics or laboratories. They are the requisite step prior to establishing the correct diagnosis and subsequent treatment to an animal. More generally, they allow the measure of the health or physiological status of an animal, herd or livestock in its respective environment. The quality of the results is guaranteed through an extensive verification and validation of fit for purpose of a diagnostic test. However, the development of such tests is punctuated of technical challenges inherent to the targeted parameter, disease and technology in use as well as of regulatory and compliance challenges.

CHALLENGES— Technical challenges originate from multiple sources. Some analytes are obviously more difficult to measure than other by their nature or lack of data. Different disease status in different geographies make it difficult to have one product fitting all regions and needs. Sourcing of well characterized samples, multiple matrix (blood, milk, feces, oral fluids, organs, etc..) from well characterized animals, sometimes for multiple species or breeds is another hurdle to overcome. Increasing demand for DIVA tests implies partnerships with vaccine developers. Request for more information or lower cost is driving the development of complex multiplex platforms. In addition, there is a tendency to pool samples and to reduce confirmatory testing in cost sensitive production animal industries which is increasing performance requirements. Regulatory and compliance challenges make a second layer of complexity, impacting diagnostic assays for livestock more than for pets. Regulatory challenges are becoming an important part of the development because of multiple national agencies, contradictory requirements, no mutual recognition, multiple reference sample panels and regulatory requirements which might be derived from regulation of pharmaceutical products.

CONCLUSIONS— All manufacturers having a certified quality management system are facing the same complexity in serving the market with new products. Although veterinary diagnostic tests are frequently decried as common simple products, they are the result of years of investment in research, development and extensive validation.

Speaker Abstracts

Larry Ludemann, DVM

USDA Center for Veterinary Biologics

General Guidance for Test Kits Intended for Diagnosis of Animal Diseases

INTRODUCTION— All veterinary diagnostic test kits for infectious animal diseases sold in the U.S. are required to have a USDA license or permit. This talk will present the licensing requirements needed to distribute test kits within the U.S.

CHALLENGES— Some of the challenges kit manufacturers have is determining the true status of the diagnostic samples used to estimate their kit sensitivity and specificity.

REVELANT GUIDANCE— Guidelines will be presented to assist manufacturers in estimating the sensitivity and specificity to develop a consistently manufactured kit. In addition, information regarding all required documentation for licensing test kits will be presented.

CONCLUSIONS— Diagnostic test kits should, with reasonable certainty, yield the results intended when used according to label (insert) instructions. The licensing process provides controlled production of the kit components to minimize variations within and between batches.

Speaker Abstracts

Hege Lund, DVM, Ph.D.

A bead-based multiplex immunoassay for simultaneous measurement of antibody responses to multiple antigens; an example from Atlantic salmon

Hege Lund, Paul J. Midtlyng
Faculty of Veterinary Medicine, Norwegian University of Life Sciences (NMBU)

BACKGROUND— Vaccination is a key element in the success of Norwegian Atlantic salmon (Salmo salar) aquaculture. The objective of the current study was to develop a novel bead-based multiplex immunoassay for the simultaneous detection of antibodies directed towards individual antigen components of multivalent Atlantic salmon vaccines.

MATERIALS AND METHODS— Purified native protein or whole cell sonicate of two bacterial vaccine components, Aeromonas (A.) salmonicida subsp. salmonicida and Moritella (M.) viscosa, was covalently coupled onto different magnetic bead sets. The bead sets were used in a multiplex immunoassay to analyze seroconversion of Atlantic salmon parr, immunized with commercially available or experimental multivalent oil emulsion vaccines.

RESULTS— The results showed an increased level of antibodies measured as increased mean fluorescent intensity (MFI) against the bacterial vaccine antigens during the immunization period. The overall dynamic range varied depending on the capture antigen. In fish immunized with reduced antigen content, the antibody response showed a significant dose-dependent reduction from the baseline (100 %) antigen formulation at 500 degree-days after vaccination.

CONCLUSIONS— Our results confirm the assays wide dynamic range and versatility, and suggest that this technology can become a valuable tool for studies of antibody-responses to multivalent vaccines in Atlantic salmon. In particular, multiplex assays may lay the foundation for development of antibody-based tests that can facilitate the replacement or reduction of number of fish used in potency testing of multivalent vaccines.

Speaker Abstracts

Marc Marenda, DVM, Ph.D.

Rapid genome sequencing of animal pathogens from clinical or environmental samples.

Marc Marenda, Rys Bushell, Kinza Asif, Kanishka Kamathewatta, Anne Watt, Ling Zhu, Amir Norrmohammadi and Glenn Browning.
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BACKGROUND— The Oxford Nanopore Technologies (ONT) MinION is a portable DNA sequencing device that can rapidly produce large amounts of long DNA reads. This is a potential diagnostic tool for veterinary clinical microbiology laboratories. We have applied this technology 1/ to detect antimicrobial resistance genes (ARGs) in environmental samples; 2/ to ascertain the taxonomic position of unknown organisms isolated from infected animal; 3/ to finish de novo assemblies of bacterial genomes with repeated sequences; 4/ to sequence large viral genomes directly from animal tissue samples.

METHODS— DNA was purified from bacterial cultures or infected bird livers. Sequencing libraries were made with conventional laboratory equipment and ONT native ligation kits with or without barcoding, typically taking 2-3 hours of preparation time. Datasets were processed on a standard laptop computer running Linux OS and public domain programs. Sequencing runs are conducted over 16-20 hours or less. After basecaling, ARGs were detected within minutes and bacterial genomes were fully assembled and analyzed within 24-48 hours.

RESULTS— Reservoirs of environmental ARGs associated to pathogens or mobile genetic elements were identified in the Veterinary Hospital waste collection points, prompting targeted intervention measures to improve biosecurity practices. A novel species of Pasteurellaceae associated with severe respiratory infections of pigs and several Mycoplasma strains have been characterized. A protocol for extracting sequencing-grade viral particles directly from bird livers is currently under optimisation.

CONCLUSIONS— Nanopore sequencing can complement conventional microbiology very effectively. Although this technology is still error-prone, in many cases the data is of sufficient quality to assist clinical microbiologists in their tasks, significantly expanding the molecular toolkit of modern veterinary diagnostic laboratories.

Speaker Abstracts

Marian F McLoughlin, Ph.D.

Serology vs. real-time quantitative PCR (qPCR)screening for viral infections; experiences from the control of salmon pancreas disease in Ireland and Norway.

Marian F McLoughlin[1], Paul J Midtlyng[2], Aoife F H Westgard[3], David G Graham[4], Paul Savage[5].

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BACKGROUND— Pancreas disease is an economically important disease of the European farmed salmon industry affecting all production areas including Norway, Scotland and Ireland. It is caused by an aquatic alphavirus, salmon pancreas disease virus, (SPDV), also known as Salmonid alphavirus (SAV). In European rainbow trout farming, a strain of the same alphavirus is known to cause so-called Sleeping Disease.

ISSUES— Pancreas disease is confirmed in Atlantic salmon by a combination of histopathology, PCR and serology. Currently all salmon sea sites in Norway (> 600) must be sampled monthly for evidence of PD infection using qPCR, where amplification will indicate infection irrespective of clinical signs, and ct values will indicate viral load in individual fish. Norwegian regulations require heart samples from 20 fish to be submitted each month, creating cumulative cost of 20-30000 Euro per production cycle per farming site.

APPROACH BEING TAKEN— PD serology testing requires a small non-lethal serum sample, it can detect both viraemia and seroconversion and is a very suitable inexpensive test for PD surveillance at a population level. In addition biochemical markers such as creatine kinase (CK) can be simultaneously checked as a prognostic/recovery indicator.

PROPOSED APPROACH— Experience from PD monitoring in Ireland and Scotland has shown that more useful information about the infection prevalence and progress in a fish population can be gleaned from targeted blood sampling. This paper will present comparative qPCR and serological results from Norway and Ireland and discuss the advantages and disadvantages of either approach for PD surveillance in endemic vs. in disease-free zones.

SSS— This paper wishes to promote best practice for PD disease surveillance programmes worldwide.

Speaker Abstracts

Gleeson Murphy, DVM, Ph.D.

Classical serological tests in the modern age: are we moving in the right direction?

INTRODUCTION— The extant validated diagnostic platforms for diseases that were eradicated from areas in the early to mid 20th Century, such as complement fixation and intradermal skin tests, are less palatable in the 21st Century because of intolerance toward (presumably) false positive results; and there is an ever-increasing demand for more advanced molecular detection platforms, such as nucleic acid- or protein-based characterizations. The OIE Terrestrial Manual provides specific guidance for diagnostic methods that can be used by countries for animal import and export purposes in the international trade setting or for internal disease control programs; and these guidelines are designed to provide disease-free countries with a high level of confidence in maintaining their statuses.

CHALLENGES— As animals move from one disease-free area to another, any positive result is met with skepticism; but because of the incredibly low prevalence of the diseases among these areas, interest and funding for the advancement of diagnostic methods for these diseases is difficult to muster. And, for myriad reasons, such as increasing animal welfare concerns, minimal research and development investment in the face of sporadic yet immediate demands for robust diagnostics, chronic or cryptic infections, and natural wildlife movements, enormous challenges remain to fully and independently maintain national-level disease control programs.

PROPOSED APPROACH— With the OIE as the most centralized guiding body for diagnostics, it may be prudent to systematically re-organize the designated international experts for the more challenging diseases to determine if pooling resources or efforts could facilitate the advancement of additional or more reliable diagnostics. In many cases, the limiting factor is the availability of well-defined natural or experimental control samples for these diseases; so leveraging the OIE-based networks or other international consortia could provide access to areas where the diseases are prevalent and/or where an active outbreak is occurring.

CONCLUSIONS— Robust modern laboratory technology is ripe for the opportunity to explore advanced diagnostic platforms for controllable yet pernicious animal diseases, particularly the neglected bacterial and parasitic pathogens affecting international livestock trade.

Speaker Abstracts

Niels Jørgen Olesen, DVM, Ph.D.

Experience from inter-laboratory proficiency tests among European national reference laboratories for detection of viral infections in fish

Niels Jørgen Olesen, Teena Klinge, Niccolò Vendramin
Technical University of Denmark, National Institute of Aquatic Resources, Denmark

BACKGROUND— With the aim of harmonizing and assuring the quality of the diagnostic methods used by National Reference Laboratories in Europe for surveillance and detection of listed fish diseases, annual inter-laboratory proficiency tests have been conducted by the EU-RL for Fish Diseases since 1995. The tests are accredited according to the quality assurance standard DS/EN ISO/IEC 17043 and include both qualitative and quantitative assessments of the ability of the participants to detect and identify more than 10 different fish pathogenic viruses.

METHODS— Each annual proficiency test (PT) is divided in two: One for viruses replicating in cell cultures and one for viruses primarily detected by bio molecular methods. All viruses included in a PT are propagated, mixed with equal amount of lactalbumine, lyophilized and sealed under vacuum in glass ampoules. Homogeneity, purity, stability and reduction in viral titres following the lyophilisation process are assessed before shipment. The tests are shipped by courier to approx. 40 laboratories worldwide including all EU Member States- as participation is mandatory for these laboratories. An 8-week deadline for submission of results is given and in a detailed and comprehensive report all laboratories are scored according to their performance. Underperforming laboratories are contacted for assessing the reason and for possible re-testing.

RESULTS— Lyophilization cause significant reduction in viral titres but once sealed no reduction is observed after long time storage under various temperatures. Shipment of live notifiable pathogens ww is challenging. Participants are performing increasingly well over the years- and their score in relation to pathogen identification is in general high. However cell line susceptibility varies a lot between laboratories and within cell line. The same applies for Ct values and sequences among laboratories using similar procedures.

CONCLUSIONS— The PTs are the backbone in accreditation and QA of notifiable fish diseases WW and are essential for safe international trade. Significant increases in performance both for pathogen identification and characterization was been observed.

Speaker Abstracts

Heinz Schoeder, Ph.D.

Multiparameter testing for pathogens and antibodies in a Point of Care approach

For diagnostic purpose, testing of a several parameter becomes more and more regular to identify and confirm certain diseases. Instead of performing several assays, a multiparameter setup can generate several results in one shot, running out of the unique sample material.

Testing several parameter out of one sample material requires on one hand a synchronization in the assay setup and on the other hand, the circumstance that the targets of interest are present in the sample material to a comparable level to obtain reliably results. Interdependencies between the combined assays need to be considered and corrections might be necessary to correct for individual influence of one assay to the other (-s). Setup of such multiparameter assays is even more complex, when the assays are run in a Point of Care (PoC) approach, where environmental conditions and the hygienic situation is not as defined as in a laboratory surrounding.

The PoC approach requires a high level of easiness of use, as complex or complicated handlings around the application of the assay is not reasonable in non-laboratory environment. For that reason, all complex handling steps need automation and capsulation to guarantee a high-level performance of the assay.

A microfluidic cartridge was designed to run PCR and immunological assays at a high level of automation. A dedicated portable analyser is used as driving and result reading device. It drives and controls the flow of the reagents, the temperature of the reagents and performs the measurement of the targets of interest. The targets of interest are measured electro-chemically with a fully digitized, semiconductor-based chip. The results are displayed on a mobile device and additional transferred to a cloud based data portal for further evaluation.

PoC diagnostic needs a certain level of automation and simplification, which depends on the expectations on the performance of the assays used. The short path of the sample from the animal into the PoD device allows a better controlled quality of the sample, which can increase the quality of the final results.

Speaker Abstracts

Carsten Schroeder, DVM

Carry your lab in-your-pocket – qPCR results whenever needed

Carsten Schroeder, Christine Gaunitz, Katja Schramedei, Daland C. Herrmann, Oliver Sasse, Leslie Moussi, Claudia Engemann, Fredrik Ullman
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INTRODUCTION— Point-of-care (POC) PCR diagnostics has arrived in veterinary medicine. To meet the rising demand for rapid, reliable molecular diagnostic tools for use away from centralized laboratories in veterinary clinics and even on farms, INDICAL introduces a novel POC PCR platform that transforms your smartphone into a portable lab for the real-time PCR diagnosis of animal diseases. At the heart of it is a handy, ultra-portable qPCR thermocycler no bigger than a box of tissues. This portable thermocycler enables multiplex real-time detection of up to 27 targets from a single sample or 9 samples to be tested for up to 3 targets each.

It also comes with shelf-stable PCR reagents, meaning no cold chain is required. The qPCR test results are analysed and displayed in real time on your smartphone using intuitive software.

In this study, we compared INDICAL's new POC qPCR platform to commonly used real-time thermocyclers to see whether it was just as good or even better at detecting infectious animal pathogens.

METHODS— For this study, RNA and DNA samples from different viral pathogens such as African Swine Fever Virus (ASFV) and Influenza A Virus were tested. The purified nucleic acids were then analysed using INDICAL's certified virotype ASFV PCR Kit and the virotype Influenza A RT-PCR Kit on the portable qPCR thermocycler versus the standard protocol developed for central labs and tested on two widely used standard thermocyclers (BioRad CFX96 and Agilent Mx3005P). Furthermore, new lyophilized PCR reagents especially developed for POC diagnostics were tested and first results compared to the performance of the certified lab assays on the different thermocyclers.

RESULTS— Testing ASFV-positive DNA in real time qPCR showed better Ct value results on INDICAL's portable qPCR thermocycler than on the BioRad CFX96.

Influenza A virus-positive RNA was detected with better Ct values on the new portable qPCR thermocycler compared to the Agilent Mx3005P.

For Influenza A virus-positive samples tested with lyophilized RNA reagents, the Ct values were slightly higher than the results obtained with the virotype Influenza A Kit.

In most cases, combining the lyophilized DNA reagents with a modified primer/probe mix for the virotype ASFV PCR Kit produced comparable results for ASFV-positive samples on both the standard lab and on INDICAL's POC PCR platform.

CONCLUSIONS AND OUTLOOK—INDICAL's new qPCR platform for POC applications with its ultra-portable qPCR thermocycler and hand-held smartphone-based analysis achieved comparable or even better results when compared to the standard molecular lab equipment also used here.

INDICAL's portable qPCR thermocycler can also be combined with a novel portable extraction solution using small cartridges to extract nucleic acids from a variety of different sample types without any lab equipment. This ultra-fast POC extraction is currently in validation and also being tested with INDICAL's magnetic bead-based sample preparation kits on the IndiMag 48 instrument.

INDICAL's novel solution for veterinary POC diagnostics also includes the possibility of implementing new PCR assays using lyophilized reagents without the need for a cold chain.

Speaker Abstracts

James B Stanton, DVM, Ph.D.

Genome sequencing and evolutionary analyses of Newcastle disease viruses from formalin fixed paraffin-embedded chicken tissues collected during disease outbreaks

Salman Latif Butt[1,2], Ying He[1,3], Jian Zhang[1], Kiril M Dimitrov[2], Tonya L. Taylor[2], Iryna V. Goraichuk[2], Poonam Sharma[2], Patti J Miller[2], Marcos Isidoro Ayza[4], Hon S Ip[5], Heather Fenton[6], Rebecca Poulson[6], Abdul Wajid[7,8], Shafqat Fatima Rehmani[8], Tasra Bibi[8], Asma Basharat[8], Corrie C Brown[1], Claudio L Afonso[2] and *James B Stanton[1]

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BACKGROUND— Highly virulent Newcastle disease viruses (NDV), including their genetic variants (e.g., pigeon paramyxoviruses) cause Newcastle disease (ND), which is a threat to poultry production worldwide. Next-generation sequencing (NGS) has emerged as a research tool for thorough genetic characterization of infectious organisms; however, the utility of using formalin-fixed paraffin-embedded (FFPE) tissues, which are a staple of routine pathology and archival material, has not been fully investigated. In this study, the molecular characterization of near complete NDV genome sequences obtained from FFPE tissues is presented.

METHODS— Tissue samples from commercial Pakistani chickens (n=33) and from wild birds (collared doves and rock pigeons) from the USA (n=45) were used for total RNA extraction employing the RNeasy FFPE Kit. DNA libraries were prepared using the KAPA Stranded RNA-Seq kit and sequenced on an Illumina MiSeq platform. Data analyses were performed on a customized workflow using de novo assembly within the Galaxy platform.

RESULTS— In Pakistani chickens, NDV sub-genotype VIIi was detected in 10/11 birds with eight nearly complete (>95% coverage) and two partial genomes. Phylogeny of the NDV concatenated complete genome coding sequences demonstrated two distinct lineages of sub-genotype VIIi co-circulating in Pakistani poultry. In U.S. pigeons, 23 of 29 IHC-positive FFPE pigeon samples were NDV positive by NGS. Sub-genotype VIa and a novel sub-genotype (VIn) of NDV were identified in these 10 pigeon mortality events in the U.S.

CONCLUSIONS— This work demonstrates the use of FFPE samples for detection and **ge**nome sequencing of APMV-1 in chickens and wild birds. The complete coding sequences isolated from these samples allowed for fine resolution of NDV lineages for monitoring of this continually evolving virus in production and wildlife species.

Speaker Abstracts

Carlos Suarez, Ph.D.

A novel modified-indirect ELISA based on spherical body protein 4 for detecting antibody during acute and long-term infections with diverse Babesia bovis strains

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BACKGROUND— Cattle persistently infected with Babesia bovis are reservoirs for intra- and inter-herd transmission. Developing a reliable, high-throughput assay that detects antibody during all stages of the infection could be pivotal for establishing better control protocols.

METHODS— A modified indirect enzyme-linked immunosorbent assay (MI-ELISA) was developed using the spherical body protein-4 (SBP4) of B. bovis to detect antibody against diverse strains through all infection stages in cattle. This SBP4 MI-ELISA was evaluated for sensitivity and specificity against field sera from regions with endemic and non-endemic B. bovis. Sera were also evaluated from cattle infected experimentally with various doses and strains during acute and persistent infection with parasitemia defined by nested PCR.

RESULTS— The format variables for SBP4 MI-ELISA were optimized and the cutoff for positive and negative interpretation was determined based on receiver operating characteristic curve analysis using B. bovis positive and negative sera tested in the reference immunofluorescence assay (IFA). The diagnostic specificity of the SBP4 MI-ELISA using IFA-negative sera collected from Texas was 100%, significantly higher than the cELISA (90.4%) based on an epitope in the rhoptry-associated protein-1 (RAP-1 cELISA). The diagnostic sensitivity of the SBP4 MI-ELISA was 98.7% using the IFA-positive sera collected from several areas of Mexico, in contrast to that of the RAP-1 cELISA at 60% using these same sera. In cattle infected with low and high doses of three B. bovis strains, the SBP4 MI-ELISA remained antibody positive for 11 months or more after initial detection at 10 to 13 days post-inoculation. However, the RAP-1 cELISA did not reliably detect antibody after eight months post-inoculation despite the fact that parasitemia was occasionally detectable by PCR and initial antibody detection by RAP-1 cELISA in low-dose infected animals was delayed approximately nine and a half days compared to the SBP4 MI-ELISA.

CONCLUSIONS— The novel SBP4 MI-ELISA has higher diagnostic sensitivity and specificity than current serological methods, and ideal to use in countries that have B. bovis-endemic herds. This assay may be pivotal in preventing the spread of this disease to non-endemic herds.

Speaker Abstracts

Alex van Belkum, Ph.D.

MODERN ANTIMICROBIAL SUSCEPTIBILITY TESTING: CURRENT STATE OF AFFAIRS AND FUTURE DEVELOPMENT

bioMerieux, Data Analytics Department, La Balme Les Grottes, France.

INTRODUCTION— Antimicrobial susceptibility testing (AST) is a microbiological procedure that distinguishes between living, growth-arrested and dead bacteria. Main target for AST is to demonstrate the (lack of) efficaciousness of antimicrobial agents and the importance of AST is increasing in the current era of globally rising antimicrobial resistance (AMR). In essence, any new method that distinguishes successfully between living, arrested and dead cells can be used for the development of innovative AST systems.

ISSUES— Most of the current methods use culture-based viabilit

y testing or DNA testing for genes encoding resistance factors. However, culture is (very) slow and DNA testing does not cover all the clinically relevant combinations for all microbial pathogens and all antibiotics. Ideal high-throughput routine methods that are also cheap do not exist and the need for speed is an unmet one. AST requires significant and continuous innovation and better tests are urgently needed.

PROPOSED APPROACH AND SOLUTIONS— Besides the existing AST formats there are dozens of new technologies that claim to facilitate the detection of AMR. These range from purely physical (spectrometry-, spectroscopy-, nuclear magnetic resonance-, weight- and fluorescence-based methods and more), chemical, enzymatic and "omics"-based technologies. What these new formats all have in common is that their usefulness has solely been demonstrated in the confines of the research lab. It is urgent that clinical validation of the new technologies is taken up by clinical researchers and companies experienced in test development.

CONCLUSIONS— Currently, existing AST methods are well appreciated and their results are key deliverables in any clinical microbiology laboratories. Innovative tools are ready to be evaluated in high-throughput clinical settings and some of these new technologies are at the brink of clinical breakthrough. However, given the continuous rise in AMR, development of AST tests should be prioritized and accelerated. I will present developmental pipelines for new AST systems and discuss the value of the various innovative technologies proposed.

Speaker Abstracts

David Wallace, Ph.D.

EMERGING DISEASES - LUMPY SKIN DISEASE: HISTORY, LESSONS AND PERSPECTIVES ON DIAGNOSTICS AND CONTROL.

WALLACE, D.B., MATHER, A.S., KARA, P.D. & LUBISI, A.
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A new disease was reported in cattle in Northern Rhodesia (Zambia) in 1929. At first the infectious nature of the disease was not known, but once it started spreading rapidly, reaching South Africa in 1944, von Backstrom (1945) concluded it was infectious. Despite quarantine measures it affected almost the entire South Africa within a short period. It moved northwards, being described in Kenya in the late 1950's and is now endemic in most of Africa. The disease is a growing international problem and has spread into Europe from the Middle East. Although primarily a disease of cattle, there is evidence that the causative agent, lumpy skin disease virus (LSDV), is able to infect water buffalo and wildlife species, such as antelope.

LSD is a listed disease by the OIE and is notifiable in South Africa. Effective vaccines are available, but outbreaks occur almost every summer season due to a number of factors, including movement of animals from high-risk to low-risk areas and lapse in vaccination. The disease is economically important.

Diagnostic tests for LSD have come a long way over the years – from virus isolation and virus neutralisation testing to real-time PCR and recombinant antigen ELISAs.

Speaker Abstracts

William C. Wilson, Ph.D.

Advances in Diagnostic and Control Strategies for Rift Valley Fever

William C. Wilson[1], Barbara S. Drolet[1], Bonto Faburay[3], A. Sally Davis[3], Jessie D. Trujillo[2,3], Izabela K. Ragan[2,3], Raymond R. Rowland3, D. Scott McVey[1], and Juergen A. Richt[2,3]

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BACKGROUND— Rift Valley fever (RVF) virus (RVFV) is a USDA/CDC Select Agent, Category A, zoonotic pathogen that poses a threat to U.S. animal and public health. The National Veterinary Stockpile (NVS) Steering Committee's priorities listed RVFV as the third most important biological threat and RVF is the number one arthropod-borne animal disease threat to U.S. livestock. A research gap analysis in 2006 and performed again in 2013 identified the need for research to advance diagnostics and vaccine control measures for RVF. Although attenuated vaccines were the furthest along in development in 2006, the only one licensed for use in Africa was known to be teratogenic in livestock. To address these gaps, we developed diagnostics and a vaccine strategy that included the ability to differentiate infected from vaccinated animals (DIVA).

METHODS— Advances in diagnostic technologies include a multi-genome segment real-time RT-PCR that was translated into a point of need diagnostic test for pathogen detection and lateral flow test, ELISA, and fluorescence microsphere immunoassay for multiplex detection of antibodies to specific viral proteins. Many advances have been made in the last decade still, only one additional attenuated vaccine is licensed for use in Africa while another has conditional licensure for emergency use in the US. Newer attenuated vaccine strategies, developed by others, based on gene deletions in one or both nonstructural proteins (NSs, NSm) are promising; however, they have not been demonstrated to be DIVA compatible. We have developed a recombinant glycoprotein-based vaccine that has proven efficacious in prevention of RVFV infection following virulent challenge in target livestock species. This subunit vaccine has been developed in parallel with aforementioned companion DIVA diagnostic assays.

CONCLUSIONS— Advances have been made in the development of diagnostic and vaccine measures for RVF. Translation of these technologies will aid in pathogen control and surveillance for they allow for a DIVA control strategy, currently not available.

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US National Poultry Research Center

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American Association of Veterinary Laboratory Diagnosticians (AAVLD) / Oklahoma Animal Disease Diagnostic Laboratory (OADDL)

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U.S. Department of Agriculture

Biosketch

Claudio L Afonso, Ph.D.

Newcastle Disease Lead Scientist

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Dr. Afonso is the Lead Scientist for Newcastle Disease at the Southeast Poultry Research Laboratory of the USDA in Athens Georgia. He obtained his Ph.D. in Genetics, Cellular and Molecular biology from the University of Nebraska, and after a post-doc training at Yale University he was involved in multiple studies on functional viral genomics. While working at the Plum Island Animal Disease Laboratory of the USDA, he performed the first complete genomic sequencing and analysis of key poxviral pathogens such as Canary pox, Fowl pox, Lumpi Skin Disease Virus, Sheep pox, Goat pox, Horse pox, Camel pox, Crocodile pox, and Swine pox, among others. He was also involved in sequencing and analyzing large herpesviruses genomes such as Marek Disease Virus and Herpesvirus of Turkey. More recently he has been involved in conducting evolutionary and epidemiological studies on Newcastle disease virus while developing new diagnostic tools for this disease. Other relevant experience includes development and evaluation of experimental recombinant vaccines against Newcastle disease and the analysis of NDV pathogenesis. With over 100 articles published in peer reviewed journals, some of his achievements include the characterization of the large genomic diversity of Newcastle disease viruses, a proposal for a unified nomenclature for Newcastle disease, and studies on the role of vaccination on Newcastle disease outcomes. Dr. Afonso has mentored numerous graduate students and post-docs, and been part of numerous review panels. His research has been supported by extramural grants from the Gates Foundation, the Department of State, AFRI and DTRA among others.

Biosketch

Neil Almond, Ph.D.

Head of Infectious Disease Diagnostics

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Neil gained his Ph.D by studying Humoral Responses to Parasitic Nematodes at the National Institute for Medical Research at Mill Hill, London. After post-doctoral research positions at New York University Medical Center and ICRF in London, Neil joined NIBSC in 1988. His scientific interests have focused on the development and application of model systems to establish the scientific basis of vaccine protection, leading groups in the Divisions of Retrovirology and Virology. He is head of the Division of Infectious Disease Diagnostics, which was established at NIBSC in December 2018. The work of this Division includes performing independent testing of plasma pools for evidence of contamination with blood borne viruses as part of the EU OCABR network. In addition the Division prepares physical standards and reference materials (including International Standards and external quality controls) that are needed to assure the quality and comparability of clinical diagnostic assays for infectious agents. In response to the emergence of Ebola and Zika, the Division is preparing serological reference materials that support vaccine development for a number of emerging diseases. Neil is an author or co-author on over 100 publications.

Biosketch

Keith Bailey , DVM, Ph.D.

President of the American Association of Veterinary Laboratory Diagnosticians (AAVLD)

Director of the Oklahoma Animal Disease Diagnostic Laboratory (OADDL)

Organization: the Oklahoma State University
Stillwater, Oklahoma
U.S.A.

Keith L. Bailey DVM, PhD currently serves as President of the American Association of Veterinary Laboratory Diagnosticians (AAVLD) and Director of the Oklahoma Animal Disease Diagnostic Laboratory (OADDL) on the Oklahoma State University campus in Stillwater, OK. He is a member of AAVLD's Accreditation Committee and Pathology Committee. Dr. Bailey also serves on the Coordinating Council for the United States Department of Agriculture (USDA) National Animal Health Laboratory Network (NAHLN).

Dr. Bailey earned DVM and PhD degrees from the University of Missouri-Columbia and is board certified by the American College of Veterinary Pathologists. He has worked at three university-based veterinary diagnostic laboratories, a state veterinary diagnostic laboratory, and two major biopharmaceutical companies in the U.S.

In addition to his administrative roles, Dr. Bailey is actively involved in veterinary diagnostics as well as the instruction and training of anatomic pathology residents, graduate students and veterinary students. He also provides pathology suppo rt on several veterinary and human health research projects each year.

Biosketch

Sandra Blome, DVM

Head of the German National Reference Laboratory for ASF and CSF

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Sandra BLOME studied veterinary medicine at the University of Leipzig, Germany, and has a doctorate degree in veterinary medicine. Since 2008 she is senior scientist at the Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health (FLI), Germany, and responsible for the national reference laboratories for classical and African swine fever. Sandra Blome has long-term experience in working with transboundary viruses under high containment conditions up to BSL 3+ including animal experiments. She is deputy head of the Institute of Diagnostic Virology since 2015. Her research focuses on studies on pathogenesis of viral infectious diseases with particular emphasis on virus-host interaction and diagnostics/ vaccine development.

Education, training

2016 Habilitation in veterinary virology and venia legendi at the FU Berlin, DE
2011 Board certified expert in Veterinary Virology
2006 Doctoral degree (Dr. vet. med.), University of Veterinary Medicine Hannover, DE
2002-2004 Junior Researcher at the EU Reference Laboratory (EURL) for classical swine fever, University of Veterinary Medicine Hannover, DE
1996-2002 Study of Veterinary medicine, University of Leipzig, DE

Position, experience, employment

Since 2016 Lecturer (Privatdozent) at the Freie Universität Berlin, DE
Since 2015 Deputy head of the Institute of Diagnostic Virology
Since 2008 Senior Scientist, National Reference Laboratory for classical and African swine fever, Friedrich-Loeffler-Institut, Greifswald-Insel Riems, DE
2004-2008 Senior Scientist, Head of the virus laboratory at the EURL for classical swine fever, Hannover, DE

Biosketch

Elena Maria Bozzetta, Ph.D.

Head of Department of Histopathology and Rapid tests

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Responsible for management and coordination of TSE active surveillance of the institute as National Reference Center for TSE. Coordinates TSE active surveillance carried out by rapid test national laboratories. Represents the National Reference Center in national and international meetings on TSE surveillance and diagnostics. Trainer in courses applied to TSE, BSE. Wide experience in rapid tests, and histological and immunohistochemical diagnostics applied to animal pathologies and food security
Her field of research has widened to the set up and validation of screening methods applied to residues in food (SRM, contaminants) with particular reference to high quality products and baby food products, in collaboration with national SME.
From 2009 she is in charge of the coordination of the Histological National Control plan for growth promoters. Responsible for standardization and validation of the histopathological test to identify microscopic changes induced by illicit hormonal treatments. Wide experience in rapid tests standardization and evaluation (ELISA, immunocromatography, WB) and histological and immunohistochemical diagnostic techniques applied to animal diseases and food safety. In the last field she is the scientific coordinator of national researches based on experimental studies for evaluation of lesions related to growth promoter molecules and for the development of innovative techniques (nanotechnologies, proteomics) for the diagnosis of illegal treatments.

Biosketch

J.J. (Sjaak) de Wit, DVM, Ph.D.

Senior researcher

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Sjaak is a diplomat of the European College of Poultry Veterinary Science and works as poultry specialist and senior scientist at GD Animal Health, Deventer, the Netherlands. Most of his applied research is in several poultry viruses. Another part of the work is international consultancy and the responsibility for the technical aspects and quality system of the poultry serology at GD. He is involved in organizing proficiency tests for 20 years and has been quality manager for 17043 for 8 years.

Biosketch

Scott Dee , DVM MS Ph.D. Dipl;ACVM

Director of Research

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Scott Dee earned his DVM, MS and PhD from the University of Minnesota. He is a board certified veterinary microbiologist and a past President of the AASV. After working in swine practice for 12 years, Scott was a Professor at the University of Minnesota College of Veterinary Medicine where he focused his research on the transmission and biosecurity of PRRSV for a 12-year period. This effort culminated in the development and validation of a nationally-applied air filtration system for reducing the introduction of airborne diseases to swine facilities. In 2011, Scott joined Pipestone Veterinary Services in Pipestone, MN where he currently serves as Director of Pipestone Applied Research (PAR), a business unit which conducts collaborative research efforts with production companies across North America comprising approximately 1.5 million sows. Scott has been awarded > 9.5M in research funds, has published 148 papers in peer reviewed journals (including the initial publication providing proof of concept of PEDV transmission in feed) and is currently studying the transboundary risk of pathogen spread through feed ingredients with emphasis on ASFV. He has received the AASV Practitioner of the Year award, the Leman Science in Practice award and the AASV Howard Dunne Memorial award. Scott and his wife Lisa have 2 children (Nicholas and Ellen) and live in Alexandria, MN along with their Scottish terrier, Abigail.

Biosketch

Attila Farsang, Ph.D.

Biological Project Manager

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Dr. Attila Farsang graduated from Eötvös Lorand University, Budapest with a degree in molecular biology. In 1998 he started his carreer at the competent authority, Institute for Veterinary Medicinal Products, Budapest, Hungary. His duty was to develop and apply molecular methods in quality control of veterinary vaccines wirth special regard to strain identification and investigation of vaccine-related adverse effects, and to offer support to assessors in the veterinary vaccine market authorisation procedure.

He was the Hungarian representative at Immunological Working Party between 2011-2016. He joined to Ceva-Phylaxia as biological project manager in 2017. Now his responsibility is to manage viral and bacteriological new developments of the company.

At IABS he is member of the Veterinary Biologicals Committee. He was the member of scientific and organising committe for IABS conference on «Emerging Diseases in Animals: Strategies in Surveillance, Control and Eradication » held in Budapest in 2016.

Biosketch

Carmina Gallardo, Ph.D.

Research Coordinator of the European Union Reference Laboratory ASF

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Dr. Carmina Gallardo, born in Toledo, Spain, obtained the PhD degree on Molecular Biology in 2003 in the Science Faculty (UAM, Madrid, Spain) with the Thesis titled "Development of new serological and molecular diagnosis methods of African swine fever" developed at the Animal Health Research Center (CISA), belonging to the National Institute of Agricultural and Food Research and Technology (INIA), in Madrid, Spain. Since 2003 up to 2009 she was working at the International Research Livestock Institute (ILRI) in Nairobi (Kenya) in collaboration with INIA-CISA, on the epidemiology of ASF in East Africa. Since 2009 she has been the Laboratory Coordinator at INIA-CISA of the European Union reference laboratory (EURL) for ASF and for the FAO reference centre since 2011.

Her main expertise is in R&D on ASF, mainly related to the development of new diagnostic tools, molecular epidemiology and/or control strategies, including vaccine development. Throughout her career, Dr. Gallardo has been concerned in over twenty national and EC-funded R&D projects and agreements for scientific and technical cooperation with national and international institutions and companies. As a result of these collaborations, has produced more than 180 scientific and technical publications and 168 presentations at international congresses, conferences and meetings. In addition she has participated in over forty international courses on ASF, organised in Europe, Africa, Asia and Central and South America, often as coordinator. Since 2014 has participated as ASF diagnostic expert in the Community Emergency Veterinary Teams (CVET) organized by the EU as a response to the ASF outbreaks.

Biosketch

Margaret Good MVB, Ph.D., MRCVS

Private Consultant

Organization: Irish Department of Agriculture, Food and the Marine.
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Having risen through the regional organization of the Irish Department of Agriculture I joined HQ and became head of Animal Health and Welfare Division with specific responsibility for Animal Remedies, including participation in drafting Animal Remedies Control and Prohibition Directives at EU level, Animal Breeding, Animal Welfare including Animal Welfare Conventions in Strasbourg, Disease monitoring systems, and provision of general disease advice, including TSEs, in cattle, sheep goats, and pigs e.g. I designed the Aujeszky's disease eradication programme that was later successfully implemented.

For seventeen years to December 2016, I was Senior Veterinary Manager for Ruminant Animal Identification/Traceability systems and Health matters, notably Paratuberculosis and BVD, and also the Veterinary Programme manager for the bovine TB Eradication, Brucellosis and bovine Leucosis surveillance programmes.

I completed my PhD at the Faculty of Veterinary Medicine Utrecht with a Thesis entitled 'The Tuberculin Test and its role in the Strategic Management and Eradication of Tuberculosis in Cattle'. I was a member of EU Cost Groups 811 and 833 on Warble fly, Manage and Myiasis; the EU Bovine Tuberculosis sub-group of the Task Force; the Badger Vaccines Project Board at DEFRA (UK). For 3 years to June 2018, I was a member of EFSA's Animal Health and Welfare Panel.

Presently on the Johnes Disease Technical working group of Animal Health Ireland and a member of the International Colloquium on Paratuberculosis and the M. bovis Conference organisation committees – both Conferences due to be held in Ireland 2020.

I have authored/co-authored 100 peer reviewed publications.

Biosketch

Fredrik Granberg, Ph.D.

Associate professor

Dept. of Biomedical Science and Veterinary Public Health

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Dr. Fredrik Granberg has more than 17 years' experience in infectious diseases and is the Research Coordinator for the Section of Virology at the Swedish University of Agricultural Sciences. The Section constitutes, together with the Swedish National Veterinary Institute, the World Organisation for Animal Health (Office International des Epizooties; OIE) Collaborating Centre for Biotechnology-based Diagnosis of Infectious Diseases in Veterinary Medicine. He has participated in several larger research projects, most recently Epi-SEQ (for improved epidemiology of epizootic diseases using next-generation sequencing technology) and Formas-biobridges (for improved diagnosis and control of major infectious diseases in domestic and wild birds). He is also currently a member of the OIE ad hoc group on "High-throughput sequencing, bioinformatics and computational genomics". His research mainly focuses on two areas: (i) the understanding of host-microbe relationships, and (ii) the detection of infectious agents (including new variants and previously unknown) using novel and emerging technologies. These areas have both conceptual and methodological similarities and the long-term goal is to better understand why certain microorganisms are pathogenic while other, genetically similar, variants are harmless. This can be broken down into several more specific research questions. For example, how does pathogenicity arise and how are host-range and vector-transmission regulated on a genetic and molecular level? A related question is how microorganism adapt and gain new abilities, such as different types of resistances, upon changing conditions. Another challenge is to understand the individual contribution of specific microorganisms in complex and multifactorial disease scenarios (i.e. diseases caused by combinations of contributing factors).

Biosketch

Timm Harder, Ph.D.

Senior scientist

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Timm Harder is a veterinary virologist with a broad general interest in animal influenza viruses ranging from diagnostic improvements, molecular epidemiology, and pathogenicity, to applied preventive measures. He seeks to combine in-field and experimental approaches to study the evolution of, and to deduct improved control measures against, animal influenza viruses. He is a nominated expert of the O.I.E. for avian influenza and currently head of the German National Reference Laboratory for Avian Influenza located at the Friedrich-Loeffler-Institut, Isle of Riems. The laboratory is a designated FAO Reference Center for animal influenza.

Biosketch

Estelle Hess, Ph.D.

R&D Manager

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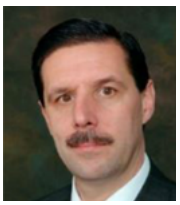
Estelle Hess earned a master's degree in microbiology and a PhD in immunology from the University of Strasbourg, France. Her work helped unravel new mechanisms controlling lymph node expansion, which are crucial during immune responses. Hess pursued her career with a postdoctoral training to study host pathogen interaction of a dog commensal bacterium (Capnocytophaga canimorsus), which can cause severe infection in humans. Her work set the basis for the detection of potentially dangerous strains hosted by dogs.
She joined Bio-X Diagnostics in early 2018 and currently holds the position of R&D Manager. Bio-X Diagnostics is a Belgian manufacturer of innovative and affordable veterinary diagnostic tests to address health and environmental issues, for laboratory, point-of-care and on-farm use. The company's technology is intended for the prevention of diseases and the monitoring of the therapeutic arsenal.
With her strong background in immunology and microbiology, Hess plays a key role in the development of novel ELISA kits and immuno-chromatographic, lateral-flow diagnostic assays.

Biosketch



Richard E. Hill, Jr. DVM, MS, Diplomate ACVPM

Board Member, Communication Committee Chair, Veterinary Biologicals Committee Member, Biologicals Section Editor, President IABS-NA

Organization: International Alliance for Biological Standardization (IABS)

Dr. Richard E. Hill, Jr., (Rick) received a D.V.M. degree from Michigan State University in 1983 and following graduation, worked in private veterinary practice. In 1985, he joined the USDA and worked as a field Veterinary Medical Officer before joining the Biologics Program in 1986. Rick worked as an Inspector, Epidemiologist, and Team Leader, for the Biologics Program where he was involved in regulatory compliance and coordination of the pharmacovigilance program. In 1990, he received an M.S. degree in Veterinary Preventive Medicine at Iowa State University and is a Diplomate in the American College of Veterinary Preventive Medicine. In 1995, Dr. Hill transferred to the position of Quality Assurance Manager, responsible for overseeing the Quality Assurance Program at the National Veterinary Services Laboratories and Center for Veterinary Biologics Laboratory. In November 1998, he rejoined the Center for Veterinary Biologics as Director of Licensing and Policy Development and then served as the Center Director from 2005 through 2013. In 2013, Dr. Hill assumed the position of Executive Director for Veterinary Services, National Import and Export Services until his retirement in 2016 after 30+ years of Federal service. Dr. Hill remains active in veterinary medicine through volunteer positions with the American Veterinary Medical Association and as Exam Committee Chair for the American College of Veterinary Preventive Medicine. Dr. Hill is a long-term member of IABS, Biologicals Section Editor, and served as inaugural member and Chair of the Veterinary Scientific Conference Committee (now the Veterinary Biologicals Committee). He is currently serving on the Board, and is President of the North American Affiliate (IABS-NA).

Biosketch

Anja E. H. Holm, DVM

Consultant, advice and assistance for authorisation of veterinary medicines

Organization: Central VetPharma Consultancy

Central VetPharma Consultancy Aps
2016 - now: Independent consultant in development and authorisation of veterinary medicines, including development plans, study review, EMA oral explanations, referrals, scientific advice, list of questions, PSURs, and courses for the animal health industry.

Panion Animal Health AB
2016 - now: CEO (part time) of Panion Animal Health, Sweden, developing gene therapy and innovative medicines for the veterinary market.

European Medicines Agency
2010 - 2016: Chair of CVMP, Committee for Medicinal Products for Veterinary Use, EMA
2004 - 2010: Member of CVMP for Denmark.
2006 - 2010: Vice-chair of CVMP
2004 - 2016: Member of the Scientific Advice Working Party.
2004 - 2006: Member of Immunologicals Working Party.
1998 - 2003: Member of Pharmacovigilance Working Party.

Danish Medicines Agency
2016 (Feb-July): Head of Unit Clinical Trials, human & vet
2002 - 2010: Senior scientific officer at the Danish Medicines Agency, involved in centralised, MRP and national procedures, clinical trials and pharmacovigilance.
2001 - 2002: Researcher at the Virology Department of the Danish Veterinary Institute, DNA-vaccines.
1998 - 2001: Assessor at the DKMA for safety and efficacy of veterinary medicinal products.

1994 - 1998: **Veterinary practitioner** (small and large animals) in Denmark.
1991 - 1993: Department of **toxicology** at H. Lundbeck A/S in Copenhagen.

Biosketch

Marianna Ivók, Dipl. Ing. MSc

Head of ImmunoMethods Platfrom, Bio R&D

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Fax: +36 1 260 3889
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Marianna Ivók, Dipl. Ing., M.Sc., is the Head of ImmunoMethods Platform at the R&D of the global veterinary health company, Ceva, in Budapest, Hungary. She joined to Ceva in 2010. Her team of 15 people is dedicated to develop, validate and transfer immunoassays and bioassays for new vaccines, to support clinical trials, and to produce immunoreagents including monoclonal antibodies. She has a significant experience in protein chemistry and bio-conjugation techniques.
She is an experienced immunoassay development engineer with established track record in both R&D and manufacturing environment in human and veterinarian in vitro diagnostics. Prior to joining Ceva in 2010, she was responsible as a manager for the development of fully automated magnetic bead-based chemiluminescent immunoassays at the R&D of Beckman Coulter Biomedical Ltd, Ireland (2008-2010). She has spent some 24 years at Institute of Isotopes Co. Ltd, Budapest, working on human in-vitro immunoassay product development projects with feasibility studies, optimization, validation, scaling up, and technology transfer to manufacturing and authorization. She was the leader of OEM manufacturing of 27 research radioimmunoassay kits produced for Amersham Lifescience Inc. and GE Healthcare Inc. for ten years (1995 - 2005). In 2000, she was promoted to deputy director of Immunoassay BusinessLine, producing over 100.000 kits annually.
She was graduated as a bioengineer with a Master of Science degree at the University of Technical Sciences, Budapest, Hungary.

Biosketch

Don King, Ph.D.

Head of the FAO World Reference Laboratory for FMD and OIE expert for foot-and-mouth disease

Organization: FAO / OIE

Dr Don King is Head of the FAO World Reference Laboratory for FMD (WRLFMD) and is an OIE (World Organization for Animal Health) expert for foot-and-mouth disease and swine vesicular disease. He works at The Pirbright Institute in the United Kingdom and leads international reference surveillance activities undertaken by the global OIE/FAO FMD Laboratory Network for FMD (http://www.foot-and-mouth.org/). He has a background in veterinary virology and immunology (previously at University of Leeds, UK, University of California, Davis and APHA, Weybridge, UK), and has research interests in understanding the processes that drive the evolution of positive-stranded viruses such as FMD virus. From a practical perspective, work within his research group develops and applies new technologies for the detection and characterisation of important livestock disease agents. These methods underpin the routine diagnostic work of the Reference Laboratories at The Pirbright Institute and are also used to monitor the global patterns of disease, and to recognise new emerging viral lineages that pose threats to the UK and Europe. Don has recently participated in European collaborative research projects that aim to develop new diagnostic tools, and to use next-generation sequencing approaches for molecular epidemiology.

Biosketch

Patricia König, Ph.D.

Deputy head of the OIE and German National Reference Laboratory for BHV-1

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Patricia König graduated in 1990 in veterinary medicine from the "Freie Universität Berlin". She completed her Ph.D. at the Robert-Koch-Institut in Berlin in 1998 in the field of safety of blood products with studies on inactivation of Duck Hepatitis B virus as a model for Human Hepatits B.
In the same year, she joined the FLI on the island of Riems for different postdoctoral positions with a focus on vaccinology. Generation of modified live vaccines for different enzootic viral diseases e.g. BHV-1 and pestiviruses and evaluation of their protective potencies as well as exploitation of their corresponding DIVA diagnostics made up the main field of work bridging foundational research, diagnostics and applied disease control.
Since 2005, she promoted to senior scientist in the Institute of Diagnostic Virology (IVD) at the FLI. The central assignment of the IVD is the diagnosis of virus diseases of farm animals, which are of importance in veterinary medicine. Special emphasis is laid on notifiable animal diseases. In the course of time, Patricia took over responsibility for the German reference laboratories for equine infectious anemia and arteritis, different ruminant retroviruses and the consultant laboratory for rabbit hemorrhagic disease virus. The scientific focus still lies on the development of vaccines and diagnostics in combination with the official duties of a higher federal authority in terms of providing diagnostic support, generation and distribution of reference material, evaluation and standardization of diagnostic methods (licensing and batch release, proficiency tests). Participation in the research on the epidemiology of endemic animal diseases (molecular epidemiology) and in the prevention of non-endemic infectious diseases complete the field of activity.
She is co-author in more than 25 peer-reviewed publications.

Biosketch

Vaughn Kubiak, M.S.

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Vaughn Kubiak has over 35 years of experience in global animal health, with a primary focus on development, licensure, and maintenance of global veterinary biologicals. He has helped develop conventional and innovative immunological veterinary medicinal products for all major species during his career. Vaughn has worked for a number of global animal health companies, with positions in R&D, QA/QC, regulatory affairs, product management, and commercial organisations. Vaughn has spent the last 17 years with Zoetis Inc., where he has held management positions in US Regulatory Affairs, Biologicals Process Development, and Biological Analytical Development. Since 2009, he has been responsible for the European, Middle East, and African Biological Regulatory Affairs team in Sandwich, England and then Zaventem, Belgium. He holds a Bachelor of Science and a Master of Science in Microbiology from the Ohio State University and Emory University, respectively.

Biosketch

Serge Leterme, Ph.D.

Vice President, LPD Technical Operations

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Serge is Vice President Technical Operations at IDEXX Laboratories with responsibility for Livestock, Poultry and Dairy Research & Development, Product Management, European manufacturing and EMEA/LAO Regulatory Affairs. He has over 25 years of experience in diagnostics in the veterinary field. Prior to IDEXX he joined in 2006, Serge has been working for Merial (FR) and Synbiotics (US), developing portfolios of diagnostic products for pets and production animals. He spent 8 years of his professional career in US and quite some time in the Asia-Pacific area. On March 2018, he was elected chairman of the Diagnostics For Animals (D4A) association. D4A federates the manufacturers of animal health diagnostics tools. Serge earned an engineering degree in Chemistry & Bio Industries, and a Ph.D. in Biochemistry from the faculty of Agronomy at the University of Louvain-La- Neuve, Belgium.

IDEXX Laboratories, Inc. is a member of the S&P 500® Index and is a leader in pet healthcare innovation, serving practicing veterinarians around the world with a broad range of diagnostic and information technology-based products and services. IDEXX products enhance the ability of veterinarians to provide advanced medical care, improve staff efficiency, and build more economically successful practices. IDEXX is also a worldwide leader in providing diagnostic tests and information for livestock and poultry, and testing for the quality and safety of water and milk. Headquartered in Maine, IDEXX employs more than 8,000 people and offers products to customers in over 175 countries.

Biosketch

Larry Ludemann, M.S., D.V.M.

Bacteriology Section Leader

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Larry Ludemann received his DVM from Iowa State University. Prior to joining the Center for Veterinary Biologics (CVB), he was in private practice in Minnesota. He has been with the CVB for over 31 years, starting in the CVB laboratory overseeing serial release testing of vaccines and diagnostic test kits. He became a reviewer in 2001 responsible for evaluating sensitivity and specificity data in support of licensing diagnostic test kits. For the last 5 years, Dr. Ludemann has been a supervisor in CVB overseeing the licensing of bacterial products and diagnostic test kits.

Biosketch

Hege Lund, DVM, Ph.D.

Associate Professor

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Hege Lund is a female Associate Professor at the Department of Food Safety and Infection Biology at the Faculty of Veterinary Medicine in Oslo, Norway. A veterinarian by training, she has conducted research on immune responses in several veterinary species, with a current focus on farmed Atlantic salmon. Dr. Lund's training include a degree in Veterinary Medicine from Szent Istvan University in Budapest, a PhD in immunology within the field of innate immunity, and a Post Doc on immune responses to vaccination and infection in Atlantic salmon. Current research projects include development of tools for the assessment of immune competence of Atlantic salmon smolts and growers, discovery of biomarkers of disease and welfare of farmed fish, and the development of alternative methods for replacement of challenge models in batch potency testing of aquaculture vaccines. Her presentation will focus on the latter subject. Dr. Lund is also involved in the teaching of immunology to veterinary students and veterinary technicians, as well as supervision of PhD students and master students at the Faculty of Veterinary Medicine.

Biosketch

Marc Marenda, DVM, Ph.D.

Senior Lecturer in Veterinary Microbiology

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Marc Marenda obtained a DVM from the National Veterinary School of Toulouse (France) in 1994. He completed a Ph.D. in Molecular Microbiology at the University Paul Sabatier Toulouse III (France) in 1998.

Marc was appointed Lecturer in Reproduction Pathology at the Veterinary School of Toulouse in 1997. He joined the Faculty of Veterinary Science at the University of Melbourne in 2006 as a Lecturer in Veterinary Microbiology.

He is currently the supervisor of the Clinical Microbiology Diagnostic Laboratory and the Chair of the Infection Control Committee at the Faculty Veterinary Hospital.

His research interests include:

- complete genome sequencing, phylogenomic analyses and molecular epidemiology of bacterial pathogens of animals;
- detection and evolution of antimicrobial resistance;
- metagenomics of animal-associated bacteria in veterinary hospital environments;
- regulation of iron transport in animal pathogens for the development of live attenuated vaccines;
- integrative conjugative elements and their role in the evolution of Mycoplasma sp.

Since 1995 he has co-supervised 13 PhD and 8 Masters Students. He is co-author in 51 peer-reviewed publications.

Biosketch

Marian McLoughlin, MVB Ph.D. Dip. ECAAH, MRCVS. RCVS

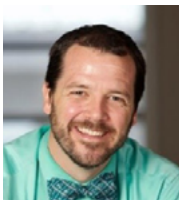
Specialist in Fish Health & Production

Organization: Fish Vet Group

United Kingdom

Dr Marian McLoughlin, has been working in the global salmon farming business for over 30 years and is currently working with Fish Vet Group, UK as a veterinary consultant. She qualified as a veterinarian from University College, Dublin 40 years ago, after 4 years in general farm animal veterinary practice, she joined the pathology department of the Veterinary Research Laboratory at Stormont, Belfast, N. Ireland. In 1990, she set up the Fish Diseases Unit there and her team discovered the first fish alphavirus (Salmon Pancreas Disease Virus/ SAV) in 1993 and showed that it was the cause of the most serious viral disease of European salmon aquaculture at that time, Pancreas Disease (PD). She was awarded her PhD from Queens University, Belfast for her studies of PD and has authored or co-authored over 40 peer reviewed papers on this topic. From 1998 to 2014, she set up her own aquatic veterinary consultancy. She was closely involved in developing a vaccine for PD, which has been widely used to control PD across Ireland, UK and Norway. She developed an experimental model of PD which used histopathological scoring to document the course of PD in vaccinated and unvaccinated fish. This model was used to evaluated vaccine performance, dietary amelioration, serological response, viraemia and clinical pathology markers. She is a strong advocate of proactive non- lethal sampling of fish populations for evidence of infection and disease and continues to work closely with industry providing rapid diagnostic and monitoring services with Fish Vet Group.

Biosketch



Gleeson Murphy, DVM, MPH, MPS, Ph.D. Dip. ACVPM

Director, Diagnostic Bioanalytical & Reagent Laboratory

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Dr. Murphy is currently the director of the Diagnostic Bioanalytical and Reagents Laboratory (DBRL) in the National Veterinary Service Laboratories (NVSL). The DBRL supports national and international livestock disease control programs though official diagnostic testing (serology, entomology/parasitology, and pesticide measurement), laboratory proficiency testing, and diagnostic reagent supplies. Prior to NVSL, Dr. Murphy served on the Zoonoses Team at the Centers for Disease Control and Prevention focused on regulation of animal and animal-product imports concerning public health. Prior to CDC, Dr. Murphy taught veterinary microbiology at the Ross University School of Veterinary Medicine in St. Kitts; and he spent 10 years in the U.S. Army Veterinary Corps with assignments at the U.S. Army Medical Research Institute for Chemical Defense at Aberdeen Proving Ground, Maryland; the U.S. Military Training Mission in Riyadh, Saudi Arabia; and the U.S. Naval Medical Research Unit in Cairo, Egypt.

Biosketch

Amir H. Noormohammadi, DVM, Ph.D.

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Since graduated with a DVM degree from Tehran University in 1990, Amir has been working almost exclusively on avian diseases in various capacities. He completed his PhD study at the University of Melbourne (1997) on molecular pathogenesis of avian mycoplasmosis and since then has led various research projects on molecular diagnosis, epidemiology and control of avian pathogens including Mycoplasma gallisepticum, M. synoviae, Chlamydophila spp, Infectious Laryngotracheitis Virus, Infectious Bronchitis Virus and Fowl Adenoviruses.

Amir has authored more than 100 scientific articles and several book chapters including two chapters in the reference book Diseases of Poultry and two chapters in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.

Amir is a registered veterinarian in Australia, and a member of the Australian & New Zealand College of Veterinary Scientists, and Avian Pathology editorial board. Currently, Amir is a Professor and Heads the Veterinary Anatomic Pathology and Avian Medicine divisions.

Biosketch

Prof. Dr. Niels Jørgen Olesen, DVM, Ph.D.

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Niels Jørgen Olesen, DVM, Ph.D. is Head of Unit for Fish and Shellfish Diseases, Director of the EU Reference Laboratory for Fish and Crustacean Diseases and designated expert of the OIE reference laboratory for VHS. Since 1982 he worked in the field of fish diseases and fish health management and has over the years been deeply involved in advising on European Aquatic Animal Health legislation. Research wise topics include surveillance and control methods, prophylaxis, development of diagnostic methods and emerging diseases in fish and shellfish. The activities comprise studies on host-pathogen interactions, immunological response to infectious diseases, genetic resistance, vaccine development and development of immuno-chemical methods. Epidemiology and risk assessments play an important role in his consultancy for National and International Authorities. Niels J. Olesen is teaching graduate and post graduate students at DTU and at courses given by the EURL for Fish and Crustacean diseases.

Biosketch

Suelee Robbe-Austerman, DVM, Ph.D.

Director of the Diagnostic Bacteriology and Pathology Laboratory (DBPL)

Organization: National Veterinary Services Laboratories (NVSL)
Ames, Iowa
U.S.A.

Suelee is the director of the Diagnostic Bacteriology and Pathology Laboratory (DBPL) at the National Veterinary Services Laboratories (NVSL) in Ames, IA. The DBPL consists of 3 sections with diagnostic responsibilities for brucellosis, salmonellosis, tuberculosis, transmissible spongiform encephalopathies such as scrapie, CWD and BSE as well as the isolation, identification and genotyping of several bacterial pathogens.

Biosketch

Dr. rer. nat. Heinz Schoeder, MBM

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Study of Biology at the University of Regensburg,

- degree: Diplom-Biologe Univ. 1983
- degree: Dr. rer. nat. 1986

Employment accompanying study of marketing at the Free University of Berlin,

- degree: Master of Business Marketing 1998

Sales and Marketing in the area of laboratory instrumentation and antibody based human and veterinary diagnostics (1987 – 1999)
Development of an protein based anti-cancer drug and initiating clinical trials phase I and phase IIa including the production of clinical trial material (2000 – 2004)
Development, sales and marketing of veterinarian diagnostics for the detection of infectious diseases (2005 – 2011, bioScreen)
Development of multiparameter veterinarian diagnostics for the use at the point of care in laboratory quality (2012 – today, Boehringer Ingelheim)

Biosketch

Carsten Schroeder, DVM

Director Global Business Development

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Dr Carsten Schroeder holds a degree in Veterinary Medicine from the Leipzig University, Germany. After three years of research at the German Primate Center in Göttingen, Germany, he moved to the veterinary diagnostics industry focussing on improving the detection of infectious and notifiable diseases in livestock and poultry.

Since 1997, Carsten has successfully held several Sales and Marketing Management positions at IDEXX Laboratories and QIAGEN Animal Health and is now Director of Business Development at INDICAL BIOSCIENCE.

Carsten is a certified specialist in Veterinary Microbiology. From 2015 to 2017, he was listed by the European Commission as an external expert for the assessment of programs for the monitoring, control and eradication of animal diseases and zoonosis.

At INDICAL BIOSCIENCE he is guiding the existing portfolio of diagnostic products for emerging and notifiable diseases (including ASFV, CSFV, Avian Influenza, and BVDV). Carsten is also managing the development and application of new solutions for veterinary diagnostics such as Point-of-Care and DIVA tests.

With over 20 years of experience in veterinary diagnostics, Carsten has become a key person for strategic partnerships with research organisations and companies alike.

Biosketch

James Stanton, D.V.M., Ph.D., Diplomate A.C.V.P.

Associate Professor of Veterinary Pathology

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Dr. James B. Stanton received a D.V.M. degree from the University of Georgia in 2001. In 2008, he received a Ph.D. degree in Veterinary Science from Washington State University, and he is a Diplomate of the American College of Veterinary Pathologists. Dr. Stanton was on faculty in the department of Veterinary Microbiology and Pathology at Washington State University from 2008–2013. In 2014 he joined the faculty in the Department of Pathology at the University of Georgia, where his appointment includes research, diagnostic pathology and resident training. Dr. Stanton's research focuses on using advanced molecular techniques to improve the diagnosis and understanding of veterinary diseases. This includes determining the transcriptomic determinants of prion permissibility and improving detection and characterization of viruses through next-generation and third-generation sequencing. Dr. Stanton is a member of the American College of Veterinary Pathologists and the American Association of Veterinary Laboratory Diagnosticians.

Biosketch

Alex van Belkum, Ph.D.

Research Director

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Professor Alex van Belkum, Ph.D., fellow of the American Academy of Microbiology, born 1959, father of three daughters, grandfather to four, has been primarily involved in research on molecular epidemiology, molecular and culture-based diagnostics and antimicrobial resistance testing in the domain of clinical microbiology. A scientific director of microbiology research at bioMérieux, a diagnostics company based in the South of France, he is also the editor-in-chief of European Journal of Clinical Microbiology and Infectious Diseases, which 2016 impact factor is 2.7. He is the author of more than 540 PubMed-cited papers, with an H index of about 90. He has worked at the Universities of Leiden and Rotterdam, both in The Netherlands, and at the latter institute he is Emeritus Professor in molecular microbiology. He moved to industry 8 years ago where he is a microbiologist in the Data Analytics Department with a prime interest in next generation sequencing and the use of other data-rich technologies in clinical microbiology. He published five books and is one of the editors of "Molecular Microbiology: diagnostic principles and practice" published by ASM Press, American Society of Microbiology, Washington.

Biosketch

David B. Wallace, Ph.D.

Senior Researcher

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Dr Wallace completed his Ph.D. degree in Genetics at the University of Pretoria in 2005, after obtaining various degrees in Microbiology and Biochemistry at the University of Cape Town in South Africa. He joined the Agricultural Research Council-Onderstepoort Veterinary Research (ARC-OVR) institute in 1994 as a Research Fellow.
In 2006 he was promoted to Senior Researcher and in 2010 to Project Manager for the "Viral-vectored Vaccines" unit in the Vaccines and Diagnostics Development programme. He has managed projects involving the use of poxviruses, mainly lumpy skin disease virus, as vectors for recombinant vaccines against livestock diseases of veterinary importance, and projects on new molecular-based diagnostic test development.
He is well published, holding a dual lectureship position at the University of Pretoria's Faculty of Veterinary Science in the Department of Veterinary Tropical Diseases.
He is currently co- and Principle-Investigator on a number of locally and internationally funded research projects, and is an OIE Reference Laboratory expert on lumpy skin disease and recognised as an expert on Rift Valley fever.

Biosketch

William C. Wilson, Ph.D.

Research Microbiologist

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Dr. William Wilson works as Researcher Microbiologist at the USDA, ARS, Arthropod-Borne Animal Diseases Research Unit (ABADRU), Manhattan, KS. Obtained his BSc (honors, 1979) and PhD (1985) in Animal Science at the University of Illinois. He was a Cromwell Postdoctoral Fellow and is a Marty Vanier and Bob Krause Biosecurity Research Institute Fellow. He has served as a scientific consultant to the FAO/IAEA Joint Animal Health Division, Affiliate Faculty at Colorado State University, Texas A&M and Washington State University. Currently serves as Adjunct Professor at Kansas State University. Wilson is working on development of novel detection and pathogen control strategies. Focusing on the molecular biology of Arboviruses that cause important OIE trans-boundary animal diseases (TADs) including bluetongue, Japanese encephalitis, Rift Valley fever and Vesicular Stomatitis viruses. His research has resulted in the ability to monitor viral movement using genetics, the collaborative development of diagnostics and candidate vaccines. Overall goal of his program is to utilize the ABADRU's unique multidisciplinary expertise to fill gaps in knowledge about arboviruses and provide the tools necessary for combating them. Dr. Wilson collaborates with several US national and international partners including the Kansas State University, Canadian Food Inspection Agency, International Livestock Research Institute, Kenya Agricultural Livestock Research Organization, Kenya Department of Veterinary Services, Kenya Wildlife Services, Onderstepoort Veterinary Institute and the University of Pretoria. These scientific activities have generated 10 book chapters and more than 100 peer-review manuscripts.