Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

http://www-naweb.iaea.org/nafa/index.html
http://www.fao.org/ag/portal/index_en.html

ISSN 1011-2529

No. 68, July 2018

Contents

To Our Readers	1	Past Events	10	Research Activities at the Animal Production and Health Laboratory	21
Staff	4	Stories	15	Technical Cooperation Projects	26
VETLAB Network Bulletin	6	Coordinated Research Projects	18	Publications	31
Forthcoming Events	8				

To Our Readers

Indigenous cattle well adapted to the harsh environment in Mauritania

Dear colleagues,

Our Animal Production and Health Section's newsletter and our website are our main mechanisms for communication and contacting scientists, policy makers and all persons interested in technical support for improving animal productivity. The Animal Production and Health (APH) Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture contributes to the enhancement of global food security through the implementation of sustainable animal production systems using nuclear and nuclear-related/derived techniques, used independently or in combination with standard or advanced biomolecular techniques. We assist Member States to improve productivity of all livestock through integrated programmes that address the efficient use of locally available feed resources for feeding the animals in a sustainable manner whilst protecting the environment; the implementation of reproductive-assisted programmes, including the selection of superior animals

for improved reproductive and productive efficiency (i.e. more and of better quality milk and meat); and the development and adaptation of early and rapid diagnostic tools for the prevention, diagnoses, characterization and control of transboundary animal and zoonotic diseases and those with biothreat potential.

Selected sheep flock in Costa Rica performs well on pastures

The application of isotopic and nuclear derived techniques for the optimization of locally available feed resources to increase animal production while reducing impact on the environment together with adequate management practices and efficient reproductive and breeding programmes is our aim towards sustainable animal nutrition. In particular, support is given to strengthen animal nutrition laboratories for quality feed analysis and feed formulations and estimating intake and diet selection and feeding strategies to improve productive performance of ruminants, increase farmers' income and reduce gas emissions. More recently, stable carbon isotope composition (δ13C) of n-alkanes in conjunction with near-infrared reflectance spectroscopy (NIRS) and conventional wet chemistry analysis is being utilized.

In animal reproduction and breeding we focus on the development and strengthening of artificial insemination programmes supported by nuclear and nuclear-derived techniques and assisted reproductive technologies for enhancing reproductive performance of cattle, buffalo and small ruminants, and therefore increasing herd level productivity and farmers income. Support is given to develop and strengthen semen laboratories, farm data recording, selection of elite males based on animal performance and genetic data, and the delivering of artificial insemination services using both chilled and frozen semen as well as frozen embryos. The use of radioimmunoassay (RIA) and ELISA techniques for monitoring reproductive performances and for early pregnancy and non-pregnancy detection are still the most utilized technologies. Among the latter, RIA and ELISA for determination of Pregnancy Associated Glycoproteins (PAG) concentrations in blood and in milk on days 35–42 after service; changes in micro-RNA in the bloodstream and milk to identify pregnancy in cattle as early as 18 days after service; and the presence of RNAs and conceptus-derived proteins in blood are some of the ongoing topics of applied research.

The application of nuclear, nuclear-derived and molecular techniques for genetic characterization of indigenous and/or locally adapted animal species, populations and breeds, and for the identification of genetic markers related to productive (i.e. milk, meat, wool and fibre) traits and those related to resistance to diseases, especially to gastrointestinal parasitism in ruminants aiming for inclusion in genetic selection programmes is a priority in the APH programme. Institutional capacity is being built in more than 25 Member States, where genetic data and baseline records on phenotypes and pedigree are becoming available, for making better breeding decisions by breeders. In addition, the Animal Production and Health Laboratory (APHL) in Seibersdorf developed genomic radiation hybrid panels (RH) for goat and camel, which allows us to look more closely at phenotypic expression of the genes.

A major part of the APH programmatic activities is in the control and prevention of major emerging transboundary animal and zoonotic diseases in developing countries through improved diagnosis and surveillance using immunological, molecular and isotopic methods. Main diseases of interest include the highly pathogenic avian influenza (HPAI), foot-and-mouth disease (FMD), peste des petits ruminants (PPR), Rift Valley fever, brucellosis, contagious bovine pleuropneumonia (CBPP), Middle East respiratory syndrome (MERS), Newcastle disease, classical/African swine fever (CSF/ASF), lumpy skin disease (LSD) and trypanosomosis, as well as gastro-intestinal parasites (i.e. *Haemonchus* and *Fasciola* spp.). It is important that the development, adaptation and validation of early and rapid diagnostic methods can be implemented in national and decentralized laboratories, and even at field level, for prompt diagnoses and immediate action. This also includes capacity building for ISO accreditation of national disease diagnostic laboratories to build self-confidence on sample analysis and reporting. Efforts are placed on multi-pathogen detection systems for cost-effective syndromic surveillance and rapid differential diagnosis.

Good fertility is important for livestock farming

The strengthening and expansion of the Veterinary Diagnostic Laboratory Network (VETLAB Network) to support exchange coordination and harmonization of early diagnosis and early response to animal disease outbreaks has led to the improvement of animal and public health in Member States in general. The iVETNet information platform currently in development will be used to facilitate data collection, storage and sharing of information. The VETLAB Network also includes the provision of a sequencing service to VETLAB partner laboratories to improve pathogen characterization and disease diagnostics and the sharing of developed and harmonized standard operating procedures (SOPs), protocols, guidelines and standards to Member States' laboratories.

Special mention is needed on the development and validation of stable isotope technologies for the tracing of bird migrations to support the prevention and control of avian influenza; the development and validation of irradiated vaccine methodologies with longer immunity without risk of spreading disease, especially for the prevention and control of parasitic infections in livestock; and the support to the Global Strategy for the Control and Eradication of PPR of FAO and the World Organisation for Animal Health (OIE).

In addition to our programme of work, I would like to welcome Mr Mario Barbato, Ms Elena Lucia Sassu and Ms Jessica Fan. Mr Barbato will support the team in setting up a pipeline for bioinformatics analysis of genomic data and enhance APHL's capacity to meet Member States' demands on genetic evaluation of livestock. Ms Sassu will contribute to APHL's activities on irradiated vaccines by assisting in the development of immunological assays for *in vitro* evaluation of cell mediated immune response in swine to virus infections and vaccination. Ms Fan will work on the development of the iVetNet information platform. We hope that they will have a pleasant and productive time with the Section. Sadly, we also say goodbye to Ms Vandana Manomohan who completed a four-month internship on animal genetics and returned to India to continue her Master programme.

Gerrit Viljoen
Head, Animal Production and Health Section

Staff

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture

Name	Title	Email	Extension	Location
Qu LIANG	Director, NAFA	Q.Liang@iaea.org	21610	Vienna

Animal Production and Health Section

Name	Title	Email	Extension	Location
Gerrit J. VILJOEN	Section Head	G.J.Viljoen@iaea.org	26053	Vienna
Ivancho NALETOSKI	Veterinarian, Serologist	I.Naletoski@iaea.org	26054	Vienna
Mohammed SHAMSUDDIN	Veterinarian, Livestock Reproductionist/Breeder	M.Shamsuddin@iaea.org	21619	Vienna
Hermann UNGER	Veterinarian, Virologist	H.Unger@iaea.org	21644	Vienna
Mario GARCIA PODESTA	Veterinarian, Theriogenologist	M.Garcia-Podesta@iaea.org	26048	Vienna
Roswitha REITER	Programme Assistant	R.Reiter@iaea.org	26052	Vienna
Fabia BAPTISTA	Team Assistant	F.Baptista@iaea.org	26051	Vienna
Giovanni CATTOLI	Laboratory Head	G.Cattoli@iaea.org	28355	Seibersdorf
Charles E. LAMIEN	Biochemist	C.Lamien@iaea.org	28314	Seibersdorf
Kathiravan PERIASAMY	Livestock Geneticist Breeder	K.Periasamy@iaea.org	28358	Seibersdorf
Viskam WIJEWARDANA	Immunologist	V.Wijewardana@iaea.org	28380	Seibersdorf
Richard KANGETHE	Molecular Parasitologist	R.T.Kangethe@iaea.org	28385	Seibersdorf
Rudolf PICHLER	Livestock Geneticist	Rudolf.Pichler@iaea.org	28378	Seibersdorf
Bharani SETTYPALLI	Molecular Biologist	T.B.K.Settypalli@iaea.org	28252	Seibersdorf
Francisco BERGUIDO	Immunologist	F.Berguido@iaea.org	28356	Seibersdorf
William DUNDON	Molecular Microbiologist	W.Dundon@iaea.org	28379	Seibersdorf
Tesfaye CHIBSSA	Veterinarian, Biotechnologist	T.R.Chibssa@iaea.org	28314	Seibersdorf
Francis CHUMA	Biotechnologist	F.Chuma@iaea.org	28356	Seibersdorf
Joanna MLETZKO	Team Assistant	J.Mletzko@iaea.org	28362	Seibersdorf
Elena SASSU	Veterinarian, Microbiologist	E.L.Sassu@iaea.org		Seibersdorf
Mario BARBATO	Biotechnologist, Bioinformatician	M.Barbato@iaea.org		Seibersdorf
Jessica FAN	Intern	J.Fan@iaea.org		Vienna/Seib

Animal Production and Health Section
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture
Head Office: Vienna International Centre, P.O. Box 100, A-1400 Vienna, Austria
Telephone: (+43 1) 2600+Extension; Fax (+43 1) 26007

The Animal Production and Health Laboratory, in Seibersdorf, is an OIE Collaborating Centre for ELISA and molecular technologies in animal disease diagnosis

Animal Production and Health Section


G. VILJOEN


I. NALETOSKI


M. SHAMSUDDIN


H. UNGER


M. GARCIA


R. REITER


F. BAPTISTA


J. FAN


G. CATTOLI


C. LAMIEN


K. PERIASAMY


V. WIJEWARDANA


R. PICHLER


B. SETTYPALLI


R. KANGETHE


W. DUNDON


F. BERGUIDO


T. CHIBSSA


J. MLETZKO

Joint FAO/IAEA Programme
Nuclear techniques in Food and Agriculture

VETLAB Network Bulletin

01/2018

VETLAB is an initiative of the Joint FAO/IAEA Division

In this issue:

VETLAB Highlights

VETLAB Capacity Building Initiatives

- Fellowship training in Seibersdorf
- Training in VETLAB countries: Regional training course in Ghana on avian influenza and Newcastle disease

VETLAB Networking Activities

- Missions to Bangladesh and Zambia
- Interlaboratory test for the diagnosis of PPR and for multiplex detection
- 3rd VETLAB Coordination Meeting

Forthcoming Events

- Training courses on TADs diagnoses, sequencing and bioinformatics

To the readers

In April 2018, the Animal Production and Health Section hosted in Vienna the first meeting of the PPR Global Research and Expertise Network (PPR-GREN), a forum for scientific and technical consultations to foster a science-based and innovative debate on Peste des petits ruminants (PPR). This meeting brought together representatives from FAO and OIE PPR Reference Laboratories, experts, national veterinary laboratories and research institutes in developing countries, wildlife conservation and civil society organizations, vaccine manufacturers, regional economic communities, AU-PANVAC, Joint FAO/IAEA Division, FAO and OIE. Some VETLAB partners also attended the meeting and actively participated in the discussions. This meeting highlighted the research and diagnostic needs and challenges for the control and eradication of PPR as well as the strategic importance of networking activities at global level. From the outputs of the meeting it appears clear that the potential of the VETLAB Network and the added value it can bring to the PPR-Global Eradication Program (PPE-GEP) in terms of improving rapid and accurate diagnosis, validation and harmonization of laboratory assays, external quality assurance, capacity building and sharing of information. Indeed, PPR control and global eradication represents a big challenge but also a unique opportunity to value the expertise and skills available within the VETLAB. We all need to continue working together and ensure the VETLAB network is ready and prepared to successfully face this global challenge.

VETLAB Highlights

Mycoplasma mycoides subsp. mycoides (Mmm) strains with allelic profile A11 identified for the first time in Senegal

A recent survey by Laboratoire National de l'Elevage et de Recherches Vétérinaires (LNRV) in 50 communes showed a wide distribution of contagious bovine pleuropneumonia (CBPP) (70% and 12.2% prevalence at the communal and individual level respectively). The Multilocus Sequence Analysis (MLSA) of 13 Mmm strains, isolated following the reintroduction of CBPP between 2012 and 2016, showed that all belong to the allelic A11 profile, which is new in Senegal.

First report of H9N2 avian influenza in Senegal

The first H9N2 avian influenza (AI) case was diagnosed in poultry in April 2017 by the LNRV on diagnostic samples submitted for initial suspicion of Newcastle disease. This report, together with outbreak reports from Ghana and Burkina Faso, confirms the emergence and rapid spread of this virus in West Africa. Senegal has resumed AI virus active and passive surveillance after a 5 years break. Due to the serious economic impact, its control requires strong cooperation between countries.

Fowlpox in Africa – a molecular epidemiology study in Mozambique

Fowlpox (FP) is a viral disease of poultry caused by avipox viruses. Little is known about the epidemiology of the virus in Africa. A recent study (https://doi.org/10.1007/s00705-018-3864-0) conducted by the Central Veterinary Laboratory in collaboration with the Mondlane University in Maputo revealed the circulation of three genetic clades of avipox viruses in poultry in Mozambique.

Field validation of multiplex qPCR on swine disease detection in Cameroon

The application of the multiplex qPCR assay for simultaneous detection of red pig diseases pathogens (African swine fever [ASF] virus, Salmonella sp, Erysipelas sp, and classical swine fever virus) developed by the Seibersdorf Laboratory is making the difference in the confirmatory disease diagnosis. In Cameroon, this assay has confirmed many cases of co-infections. As the Laboratoire National Vétérinaire (LANAVET) reported, a retrospective survey conducted on samples collected in 2007-2012 revealed that Salmonellas or/and Erysipelas and not ASF were the pathogens detected in about 60% of pigs stamped out because of clinically-based ASF suspicion.

01/2018

VETLAB Network Bulletin

VETLAB Capacity Building Initiatives

Training in Seibersdorf

One fellow from the National Animal Disease Diagnostic and Epidemiology Centre, Uganda was trained for two and a half months on the most updated techniques for the rapid detection of transboundary animal diseases.

Two visitors from Lesotho and Mozambique were hosted to discuss advanced diagnostic applications for animal and zoonotic disease detection.

Training in VETLAB Countries

In the framework of the AFRA project RAF 5068, 20 participants from 11 countries (Burundi, Ethiopia, Ghana, Lesotho, Libya, Malawi, Mauritania, Sierra Leone, Sudan, Tanzania and Zimbabwe) attended a training course organized in the Accra Veterinary Laboratory (AVL), Ghana, from the 9 to 20 April 2018. The training consisted of theoretical and practical sessions on nuclear-derived and molecular based techniques, ELISA and virus isolation in embryonated chicken eggs. The Newcastle disease NDI-2 vaccine production was also a subject of the training course.

VETLAB Networking Activities

Interlaboratory test for the diagnosis of PPR

The Animal Production and Health Section is organizing the yearly PPR proficiency test focusing on serology and PCR-based detection methods. Invitation will be sent to laboratories by summer 2018. The panel is expected to be shipped to participating laboratories by October 2018.

Interlaboratory testing of a multiplex detection of PPRV, Capripoxvirus, Pasteurella and Mccp Asia

The Animal Production and Health Section will also organise an interlaboratory testing of the multiplex assay for small ruminants' respiratory diseases (PPR, Capripox, Pasteurellosis and CCPP). It is anticipated that the panels and reagents will be sent together with the PPR proficient testing panel.

Support missions

Nine VETLAB partner laboratories (Bangladesh, Botswana, Cameroon, Congo, Mongolia, Senegal, Tanzania, Thailand and Zambia) were visited by APH staff in 2018. The local laboratory staff received training on real time PCR diagnostics, quality assurance, sequencing and bioinformatics. In some cases, on multiplex detection for the differential diagnosis of respiratory diseases of small ruminants, haemorrhagic diseases of swine and pox like disease of ruminants.

The VETLAB Network Laboratories: Central Veterinary Research Institute - Zambia

The Central Veterinary Research Institute (CVRI) is the research and diagnostic unit in the Department of Veterinary Services of the Ministry of Fisheries and Livestock.

The lab provide quality animal disease diagnostic services, surveillance for animal diseases, conduct animal health research and production of animal vaccines.

In the past 3 years has been working on putting the quality management system in place. Essential equipment was procured enhancing the laboratory capacity in the diagnosis of important livestock diseases.

The lab got accredited by the Southern African Community Accreditation Service (SADCAS) in August 2017 for the first time ever. Four test methods were accredited (detection of heavy metals in bovine serum; determination of CBPP by complement fixation and competitive ELISA and FMD using ELISA).

CVRI aims in the next 3 years to: 1) increase the accredited test from 4 to 20; 2) establish and strengthen the food safety laboratory; 3) strengthen research in animal health; 4) continue to participate to inter-laboratory comparison schemes; 5) support staff to participate in trainings on advanced laboratory techniques.

Forthcoming events

Training course on transboundary animal diseases diagnosis: sequencing and bioinformatics analysis of animal pathogen genomes

To strengthenAfrican and Asian Member States' capacity in genomic sequence data analysis for the diagnosis and identification of pathogens causing zoonotic and transboundary animal diseases. The course will be held from 10 to 21 September 2018 at Seibersdorf Laboratories, Austria.

Group training course on animal and zoonotic diseases for Asian fellows

A group training course to improve the skills and the technical competence of laboratory staff on early detection and differentiation of animal and zoonotic diseases will be organized in Seibersdorf, Austria from 8 October to 2 November 2018. Eight fellows from Cambodia, Lao PDR, Myanmar and Viet Nam will attend the course supported by the IAEA Technical Cooperation Department.

Advanced Training of trainers on Transboundary Animal Diseases Diagnoses and molecular epidemiology

The purpose of the training is to provide in-depth training to selected staff from the Veterinary Diagnostic Laboratory Network (VETLAB Network) partner laboratories that are serving or will serve as trainers for other VETLAB Network member countries. The course will be held from 5 to 16 November 2018 at Seibersdorf Laboratories, Austria.

Coordination Meeting with Directors of Veterinary Laboratories in Africa and Asia

Directors of laboratories supported by the African Renaissance and International Cooperation Fund and the IAEA's Peaceful Uses Initiative will participate in the coordination meeting to discuss work done and detail a work plan, including steps for technical improvement. The meeting will take place at the Vienna International Centre, Austria from 6 to 10 August 2018.

Impressum VetLab Network Bulletin No. 05 • Edited and designed by the Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture • International Atomic Energy Agency • Vienna International Centre, PO Box 100, 1400 Vienna, Austria • Printed by the IAEA in Austria, Mai 2015

Forthcoming Events

Consultancy Meeting on Implementation of the Quality Assurance and Quality Control Standards in Counterpart Laboratories

Ivancho Naletoski

The meeting will take place on 6 and 7 August 2018 in Vienna, Austria.

The purpose of the event is to advise on quality assurance and quality control (QA/QC) during production and testing of secondary reference standards. Five experts from reference laboratories will join the directors of the VETLAB Network laboratories and the Chief Scientific Investigators of the coordinated research project D32032 to discuss the development of a procedure for universal coding of standard reference materials to be used in Member States laboratories and how to enable record keeping and authorized sharing QA/QC results of individual laboratories.

Third Research Coordination Meeting on Early Detection of Transboundary Animal Diseases to Facilitate Prevention and Control through a Veterinary Diagnostic Laboratory Network (D32032)

Ivancho Naletoski

The research coordination meeting (RCM) will take place from 6 to 10 August 2018 in Vienna, Austria.

The aim of the meeting is to review the activities and achievements in the production of secondary standard reference materials for priority diseases of the project; to update on the use of multiple pathogen detection platforms for syndromic diseases; to share the experiences in the use of the sequencing services of APH; and to share the experiences with the testing of the iVetNet information platform, aimed to support Member States laboratories in the development and the maintenance of the ISO 17025 standard.

The RCM will be held together with the meeting of the directors of the VETLAB Network laboratories and a consultancy meeting with experts of the reference laboratories which deliver most of the validated SOPs for animal and zoonotic diseases.

Coordination Meeting with Directors of Veterinary Laboratories in Africa and Asia that Are Supported by the African Renaissance Fund and the Peaceful Uses Initiative

Charles Lamien and Giovanni Cattoli

The coordination meeting will take place from 6 to 10 August 2018 in Vienna, Austria.

This will be the third joint technical meeting of the VETLAB network with directors of veterinary laboratories in Africa and Asia that are supported by the African Renaissance Fund and the Peaceful Uses Initiative to strengthen animal disease diagnostic capacities.

The purpose of this meeting is to review the achievements for 2017–2018 and formulate new work plans for the participants' respective laboratories for 2018–2019. In addition, this meeting will be a forum for participants to share experience and knowledge, and to identify activities of common interest for enhancing capacity of veterinary laboratories in Africa and Asia.

As usual, the meeting will be held in parallel with the third RCM of the VETLAB CRP D32032 to allow interaction between the laboratory directors and the CRP experts and their critical assessment of the CRP progress.

First Research Coordination Meeting on the Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of the Highly Pathogenic Avian Influenza Phase II (D32034)

Ivancho Naletoski

The coordination meeting will take place from 27 to 31 August 2018 in Novosibirsk, Russian Federation.

Phase one of the coordinated research project D32034 on 'Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of the Highly Pathogenic Avian Influenza' was aimed to prove the principle for the use of stable isotopes in feather samples, as indicators of the origin of the wild migratory waterfowl, as well as to check the possibility (feasibility) of integration of these techniques in the disease monitoring programmes aimed at investigations of the long-range transmission of diseases (primarily avian influenza).

The second phase of the project will target only 'pathogen carrier' birds (those who carry and can potentially transmit avian influenza) and investigate their origin.

The participants will review and discuss the procedures for sampling, sample packing and sample shipment and will have the chance to practice collection of laryngeal and cloacal swabs from wild migratory waterfowl.

Training Course on Transboundary Animal Diseases Diagnosis: Sequencing and Bioinformatics Analysis of Animal Pathogen Genomes

Charles Lamien and Giovanni Cattoli

The training course will be held from 10 to 21 September 2018 at the Seibersdorf Laboratories, in Seibersdorf, Austria.

DNA sequencing is increasingly being used to improve disease diagnosis by providing a means for the accurate identification and characterization of pathogens. With the growing number of sequencing providers and the drastic drop in the cost of the sequencing, this technology is becoming more accessible to Member States laboratories with limited resources. In addition, to promote the use of gene based identification and tracking of animal pathogens, the Joint FAO/IAEA Division is facilitating the access to sequencing services by veterinary laboratories in several countries around the world. Therefore, the objective of this training is to strengthen African and Asian Member States' capacity in genomic sequence data analysis for the diagnosis and identification of pathogens causing zoonotic and transboundary animal diseases. This will enable national and regional agencies to provide quick and appropriate responses for the control of disease outbreaks.

The course is open to veterinary diagnostic laboratory scientists of the VETLAB Network supported by the IAEA Peaceful Uses Initiative (PUI) and African Renaissance Fund (ARF) projects.

Regional Training Course on Genetics of Parasite Resistance in Sheep and Goats: Application of Genomics and DNA Marker Information to Improve Small Ruminant Breeding (RLS5071)

Kathiravan Periasamy and Mohammed Shamsuddin

The regional training course will take place from 24 September to 5 October 2018 in Seibersdorf, Austria.

The purpose of the course is to improve the skills on DNA marker based genotyping and molecular genetic characterization of local sheep and goat for parasite resistance and to enhance the skills for applying phenotypic, genomic and DNA information to improve sheep and goat breeding for enhanced host resistance against parasites. The course is open to participants from the Latin American and the Caribbean countries participating in the IAEA TC project RLA5071 with experience in animal breeding and genetics of small ruminants, extension services to farmers, field data recording and data analysis.

Interlaboratory Trial for Peste des Petits Ruminants (PPR) 2018

Giovanni Catolli

This year, as in previous years, APHL (Animal Production Health Laboratory) will organize an interlaboratory trial (ILT) for peste des petits ruminants (PPR) diagnosis consisting of 20 gamma-irradiated vials in total; 10 for nucleic acid and 10 for antibody detection using well-established serological and molecular techniques. The ILT is an exercise to evaluate in a qualitative manner the ability of the participating laboratories to detect the presence of antibodies against, or genome from, peste des petits ruminants virus (PPRV).

APHL encourages all members of its laboratory network to participate in the ILT as this is a useful exercise to determine the ability of a laboratory to diagnose PPRV (VETLAB CRP D32032/ARF/ PUI).

The ILT panels are expected to be delivered to participating laboratories by October 2018.

Advanced Training on Transboundary Animal Diseases Diagnoses and Molecular Epidemiology

Charles Lamien and Giovanni Cattoli

The training course will be held from 5 to 16 November 2018 at the Seibersdorf Laboratories, in Seibersdorf, Austria.

Capacity building and technology transfer are key components of the mandate of the Joint FAO/IAEA Division. The purpose of the training is to provide in-depth training to selected staff from the Veterinary Diagnostic Laboratory Network (VETLAB Network) partner laboratories that are serving or will serve as trainers for other VETLAB Network member countries. This will promote the use of regional experts to facilitate transfer of technologies as well as strengthening the sharing of expertise among VETLAB partners.

This training will cover practical aspects of diseases diagnosis, molecular epidemiology, diagnostic laboratory set-up as well as research methodology including scientific writing, presentations and communication.

The course is open to scientists/veterinary laboratories from African and Asian countries, members of the VETLAB network and supported by the IAEA Peaceful Uses Initiative (PUI) and African Renaissance Fund (ARF) projects. A good knowledge and record in molecular diagnostic and epidemiology and previous experience in training technicians and scientists is required.

Second Research Coordination Meeting on Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits (D31028)

Mohammed Shamsuddin and Mario Garcia Podesta

The second RCM will take place from 10 to 14 December 2018 in Vienna, Austria.

The purpose of the meeting is to review the achievements that have been made so far in accordance with the updated workplan agreed in the first RCM, identify and address lessons learnt and to finalize the workplan for future activities.

The RCM will focus on discussion and agreement on the details of harmonized work plans and protocols of work for the second half of the CRP.

Past Events

Regional Training Course on Assisted Reproductive Techniques to Enhance Small Ruminant Productivity (RLA5071)

Mario Garcia and Mohammed Shamsuddin

The training course was held from 11 to 15 December 2017 at the Estación Experimental Agropecuaria of the Instituto Nacional de Tecnología Agropecuaria (INTA) in Balcarce, Argentina.

The course director was Dr Fernando Hozbor, Chief of the Biotechnology of Reproduction Section, INTA-Balcarce.

The objectives of the course were to increase the skills for the conduction of routine artificial insemination (AI) services involving ram selection and management, semen collection, evaluation and preservation, oestrus synchronization and insemination, both transvaginal and laparoscopic, and pregnancy diagnosis; and to enhance the skills of technicians to technically assist farmers reproduction in sheep and goat farms. Nine participants from nine Latin American countries plus six local participants attended the course. Lectures, demonstrations and practical work on the laboratory and in the breeding facility, were conducted by INTA staff and the IAEA expert Dr Jorge Gil from Uruguay.

Three half-days were devoted to artificial insemination using the intracervical and the laparoscopic techniques. The laparoscopic technique was explained and demonstrated using a large screen attached to the endoscope. Then, course participants did 4 to 10 inseminations each. Emphasis was given on the application of tranquilizers prior to the restrain of the animal in the AI cradle, on the correct use of trocars and endoscopes, on how to manipulate the uterus and close-by organs (intestines, rumen, bladder and ovaries), and on the suitable location for puncturing the uterine horn and depositing the semen. For intracervical insemination, ewes were restrained in a chute where participants practiced the use of the vaginoscope and the AI gun. In addition, practical work was done on ultrasonography to visualize the reproductive organs of both females and males.

Participants of the training course in Argentina

National Training for Professionals and Technicians for Improving Skills to Effective Use of Artificial Insemination Services Coupled with Hormone Assay to Benefit Cattle Farmers (URT5031)

Mohammed Shamsuddin

The training course took place from 11 to 15 December 2017 at the Vector and Vector Borne Diseases Research Institute (VVBDI), Tanga, United Republic of Tanzania.

The course director was Mr Imna Malele, from VVBDI. The IAEA appointed expert lecturer was Mr Victor Tsuma, from the University of Nairobi, Kenya.

The objective of the course was to conduct a refresher training to improve skills and update knowledge of artificial insemination (AI) technicians and veterinarians working with cattle; to improve participant's proficiency in the use of hormone assays as a tool to monitor AI service outcome and to ensure the quality of AI services.

Fifteen participants from a range of institutes viz. VVBDI, three district councils, the city council, livestock training institutes in Tanga, Unguja and Pemba and the National Artificial Insemination Centre in Arusha, attended the training.

Participants of the training course in Tanzania

Lectures, demonstrations and practical exercises were carried out at the VVBDI facilities. The cows for the practical training were provided from the VVBDI farm in Pangani.

After the expert's presentations, the participants practiced gynecological evaluation of a cow for soundness and readiness for insemination, semen thawing, preparation of AI gun and doing AI in the cow. Cows' excised genital tracts were used to train the participants followed by practices in animals. Additionally, the field operation of an AI programme was presented.

The bovine female reproductive physiology was explained, the importance and methods of oestrus detection were discussed and different options for manipulating oestrus cycles were presented to the participants.

Techniques of AI and pathological factors influencing the success of AI, the ideal timing of insemination and methods of pregnancy diagnosis on field as well as the procedure of progesterone radioimmunoassay and its practical application in AI and animal reproduction were discussed.

Training Course on Advanced Geo-Visualization Techniques to Follow on the Events in Animal Health and the whole Agriculture

Project Officer: Ivancho Naletoski

Remote sensing through the available satellite imaginary can generate important information on the variables influencing agricultural and animal production. Most important among them are the precise locations of the event (latitude, longitude and altitude), temperature and humidity of both, the air and the land, wind speed and directions, water surfaces (ground water levels, precipitations, tidal changes, storm waters and snow coverage), as well as land cover and the vegetation indexes.

An important advantage of the remote sensing data and image repositories is the availability of series of snapshots taken during each of the satellite circles along their orbits, and their integration in the geo-visualization platforms used to follow up on the events in agriculture or animal production (for example, what were the suitable climatic conditions for increased abundance of an insect vector, around the area where vector borne disease outbreaks were reported). Therefore, the technology offers unlimited possibilities, not only for analysis of the events on the ground, but also for developing probability models and predicting events in the future.

In order to start integration of these technologies into the Joint FAO/IAEA Programme, APH organized a three-day training for the project/technical officers of the Joint FAO/IAEA Division, at the IAEA Headquarters in Vienna, from 12 to 14 December 2017.

The course was attended by five FAO/IAEA staff members and the lecturers were scientists from the Remote Sensing Group of the Department of Geodesy and Geoinformation at the Technical University in Vienna, Austria.

Analyzing land cover using remote sensing satellite imaginary

National Training on Improving Proficiency of Semen Laboratory and Technicians Skills in Doing Artificial Insemination in Cattle (BKF5021)

Mohammed Shamsuddin and Kathiravan Periasamy

The training course took place from 12 to 16 February 2018 at Centre de Multiplication des Animaux Performants (CMAP) in Loumbila, Ouagadougou, Burkina Faso.

The Institut National d'études et de Recherches Agricoles (INERA), Ministry of Animal and Fisheries Resources organized the training with Mr Amadou Traoré as the Course Director. The International Atomic Energy Agency appointed Mr Naceur Ben Mekki, from Tunisia, as an expert lecturer.

The objective of the course was to conduct a refresher training to improve skills of artificial insemination (AI) technicians working with cattle. Eleven participants, all CMAP staff, attended the training. The training included lectures, demonstrations and practical exercises, which took place in the laboratory, the bull breeding facilities and cowshed of CMAP.

Participants prepared to practice AI in cattle

The participants learned how to prepare a bull for semen collection and practiced semen collection from bulls. They practiced semen evaluation and processing steps at the laboratory, which involved the assessment of sperm motility, estimation of sperm concentration, semen dilution and freezing. The staff learned the operation and management of laboratory equipment and activities. They also practiced semen thawing, preparation of AI gun and doing AI in the cow.

Additionally, the lecturer presented and explained the procedures for bull selection and management with emphasis on bull welfare and personal safety in the premises and potential risk and precautionary measures.

Further, explanations and updates were given on protocols and standards to follow, especially in recording and management of documents and data and preparation of reports. Factors influencing the success of AI, the ideal timing of insemination and methods of evaluation of various stages of laboratory works and pregnancy diagnosis on field were also discussed.

National Training for Improving Technicians Skills to Improve Artificial Insemination Services Quality in Madagascar (MAG5024)

Mohammed Shamsuddin

The training course took place from 18 to 25 March 2018 at the Département de recherches Zootechniques, Vétérinaires et Piscicoles (DRZVP), FOFIFA, Antananarivo, Madagascar.

The objective of the course was to conduct a refresher training to improve skills and update knowledge of artificial insemination (AI) technicians working with cattle. Sixteen participants from FOFIFA and the Department of Livestock Services attended the training. Lectures, demonstrations and practical exercises were carried out in the DRZVP facilities with required number of cows made available for the training.

After the expert's presentations, the participants practiced gynecological evaluation of a cow for soundness and readiness for insemination, semen thawing, preparation of AI gun and doing AI in the cow. Cows' excised genital tracts were used to train the participants followed by practices in animals. Additionally, the expert lecturer presented and explained to participants on the field operation of an AI programme. The bovine female reproductive physiology was explained, the importance and methods of oestrus detection were discussed and different options for manipulating oestrus cycles were presented to the participants. Zootechnical and pathological factors influencing the success of AI, the ideal timing of insemination and methods of pregnancy diagnosis in the field were also discussed.

Participants prepared for field training

Second Regional Coordination Meeting on Decreasing the Parasite Infestation Rate of Sheep (RLA5071)

Mohammed Shamsuddin

The meeting took place from 12 to 16 March 2018 at the National University of Costa Rica (UNA), Heredia, Costa Rica.

The objectives of the meeting were to review the work plan and record the results achieved; identify challenges to address for smooth implementation of the project; discuss and revise the work plan for 2018–2019; discuss and agree with training and further capacity building; and identify future R&D and capacity building support needed.

Participants of the second coordination meeting in Costa Rica

The counterparts presented their reports, which were followed by discussions to improve understanding of diverse production systems and production goals of small ruminants in participating ARCAL countries. Challenges faced by the counterparts were presented, discussed and regional knowledge was shared to address the challenges. The 2018–2019 work plans were discussed and updated.

All counterparts made progress in implementing the country project work plans that were agreed in the first coordination meeting in March 2016. Altogether, phenotypes and performance data were recorded from 6232 sheep and 170 goats and 3545 samples were collected for DNA analysis.

Through four regional training courses, 91 professionals were trained on conducting field survey and collection of phenotypes, genetic evaluation, selection and breeding of sheep and goats, assisted reproductive techniques and health management of sheep and goats with emphasis on parasites control. Besides, 300 farmers and 168 professionals were trained by project counterpart teams. Protocols, guidelines and manuals developed through the expert meetings were crucial for the smooth implementation of the project.

Meeting of the PPR Global Research and Expertise Network (PPR-GREN)

Gerrit Viljoen

Since its initial identification in Côte d'Ivoire in 1942, Peste des petis ruminants (PPR) has spread at an alarming rate with now more than 70 countries throughout Africa, Asia, Europe and Middle East being infected. Consequently, today, over 80% of the world's sheep and goat populations are at risk. The PPR Global Control and Eradication Strategy (GCES) was endorsed in April 2015 with the vision of a PPR-free world by 2030. Furthermore, the membership of the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE), through governing body resolutions of both organizations confirmed their commitment to this initiative. To further advance towards the eradication of PPR, in March 2016, FAO and OIE established the Joint PPR Secretariat to support countries and drive the PPR eradication effort. An initial PPR Global Eradication Programme (PPR GEP) 2017—2021 was developed and launched by FAO and OIE in October 2016.

The PPR GCES considered the establishment of a PPR Global Research and Expertise Network (PPR GREN) to build strong partnerships between researchers and technical bodies, regional organizations and well-recognized experts and development partners. It will also play an important advocacy role with policy-makers at national, regional and international levels.

Participants representing 22 Member States in the PPR-GREN meeting

The inaugural meeting of the PPR-GREN took place at the IAEA Headquarters, in Vienna, Austria, from 17 to 19 April 2018.

The meeting was opened by Ms Meera Venkatesh, acting Deputy Director General for Nuclear Sciences and Applications of IAEA, Mr Matthew Stone, Deputy Director General of OIE, and Mr Berhe Tekola, Director of Animal Production and Health Division of FAO.

Sixty representatives from FAO, and OIE PPR reference laboratories, research institutes, national veterinary

research institutes in developing countries, wildlife conservation and civil society organizations, vaccine manufacturers, regional economic communities, PPR experts, AU-PANVAC (African Union Panafrican Veterinary Vaccine Centre), Joint FAO/IAEA Division, FAO and OIE attended the meeting.

Mr Adama Diallo (CIRAD) was elected as Chair of the PPR GREN, together with Ms Amanda Fine (Wildlife Conservation Society - WCS), Jeremy Salt (Global Alliance for Livestock Veterinary Medicines - GALVmed), Mr Hamid R. Varshovi (Razi Institute) and Ms Barbara Wieland (International Livestock Research Institute - ILRI) as members. The PPR GREN terms of reference were adopted and four thematic areas were considered: PPR epidemiology including socio-economic factors and the livestock-wildlife interface; PPR laboratory diagnostic tools; PPR vaccine production, quality and delivery; and outreach, advocacy and communication to facilitate awareness raising, resource mobilization, and both local and national participation in the PPR GEP.

Animal Production and Health (APH) at the Long Night of Research

Giovanni Cattoli

On 13 April 2018, the Long Night of Research took place at the IAEA Headquarters, in Vienna, Austria. The event was held in the large rotunda of the building and attracted about 1600 visitors, which confirms the great interest of people in nuclear research and application. The Animal Production and Health (APH) booth was equipped with instruments and tools used to handle genetic material and dangerous pathogens safely.

Visitors had access to microscopes showing and counting living cells, and could experience the challenges and test their ability to manipulate laboratory pipettes and other small equipment under biosafety conditions.

Animated infographics and material to explain the application of irradiation to develop novel vaccines and the use of stable isotopes in tracing animal movements were also presented and available for the visitors. The use of radioisotopes in developing accurate testing for hormones and other analytes useful in animal reproduction was also explained.

The APH staff demonstrated tools used in farms and research centres to identify and record the performances of livestock. Above all, the APH booth attracted the curiosity of children and students, very excited to test themselves operating with laboratory gloves, pipettes and safety hoods and fascinated by the peaceful nuclear applications in agricultural and livestock science as well as by the modern technologies such as the miniaturized DNA genetic sequencer machine.

Part of the APH team ready to receive the public during the Long Night of Research

Meeting on the Developing Strategies to Enhance Capacities in Europe for the Detection and Differentiation of Vectors and Vector Borne Diseases (RER5023)

Ivancho Naletoski

In the beginning of 2018, APH has started with the implementation of a new Technical Cooperation Project entitled RER5023 'Enhancing National Capabilities for Early and Rapid Detection of Priority Vector Borne Diseases of Animals (Including Zoonoses) by Means of Molecular Diagnostic Tools'.

In order to develop strategies for enhancing capacities to detect and differentiate vector borne diseases and to identify host vector carriers, as well as to fine tune the project work plan, IAEA organized the coordination meeting aimed on the use of techniques for early and rapid detection of both, animal and zoonotic vector borne diseases.

Participants of the RER5023 project at the meeting in Tbilis

The meeting was held from 16 to 20 April 2018 in Tbilisi, Georgia. Representatives from twenty-one Member States (Albania, Azerbaijan, Bosnia and Herzegovina, Bulgaria,

Croatia, Cyprus, Georgia, Greece, Hungary, Kyrgyzstan, Latvia, Lithuania, Montenegro, Republic of Moldova, Portugal, Romania, Serbia, Slovakia, Slovenia, Tajikistan, Turkey), working in the field of veterinary diagnostics, attended the meeting, organized collaboratively between IAEA, FAO and Georgia's National Food Agency of the Ministry of Environment Protection and Agriculture.

National Training Course on Bull Semen Collection and Preservation in Togo (TOG5001)

Mohammed Shamsuddin

The training course took place from 14 to 18 May 2018 at the Togolese Institute of Agronomic Research in Avétonou, Agou, Togo. The course was organized by the Ecole Supérieure d'Agronomie, Université de Lomé with Dr Abalo Kulo as the Course Coordinator.

Participants of the training course in Togo

The objective of the course was to introduce the participants to the bull semen processing technology and thereby assisted the start of a bovine semen collection and preservation laboratory. Specific focus was on assisting with the installation of the equipment in a semen laboratory, training of lab personnel on the operation of the equipment, semen collection from bull, evaluation and preservation, preparation of protocols and guidelines for the operation of the semen lab and the management and welfare of bulls.

Nineteen participants, from several Togolese institutes attended the training. Theoretical lectures, demonstrations and practical exercises were carried out in the laboratory and in the bull breeding facilities in Avétonou.

The exercises also included the operation and calibration of laboratory equipment and routine laboratory handling procedures for the semen collection, evaluation, dilution, preservation, cooling, freezing and storage. Additionally, the conditions necessary for an AI project to function properly, its premises and facilities as well as bulls' selection process were discussed.

Other topics reviewed were the importance of precision, adoption of standard operating procedures, safety measures in the laboratory, at the bull breeding facilities and in the collection area, especially when handling liquid nitrogen, keeping proper records and routine management of laboratory equipment besides methods of control, monitoring and evaluation of activities in a bovine semen conditioning laboratory.

Stories

Exploring Nuclear Technologies to Foster Agriculture Sustainability in the Eastern Caribbean

A delegation from the International Atomic Energy Agency (IAEA), in response to a request from the OECS Commission to support the sustainable development of livestock and plant production systems utilizing nuclear energy, mounted a fact-finding mission to the OECS as a precursor to the development of a technical cooperation package to the region during the period 23-27 April 2018.

The OECS Commission solicited the assistance of IAEA and FAO in seven (7) strategic areas:

Capacity building to veterinary diagnostic and plant health laboratories; improved animal and plant nutrition; improved animal reproduction strategies; improved plant breeding techniques; improved plant pest risk analysis and surveillance; improved epidemiological surveillance of animal diseases; and improved methods and techniques of technology transfer.

Accreditation recognizes competence of Zambian veterinary laboratory for diagnosing and reporting animal and zoonotic diseases

In Zambia, livestock provides subsistence income to more than 80% of the country's smallholder farmers and contributes more than 40% to the agricultural share of GDP. In November 2017, when Zambia's Central Veterinary

Research Institute (CVRI) received word that it had achieved ISO 17025 accreditation, the news was well received by the veterinary authority, the farmers and the business community in the country – they all had waited a long time for a competent laboratory to certify that their animals and animal products are free from diseases of trade concerns. The accreditation also took CVRI to a higher level in its support of livestock disease monitoring and surveillance programmes. This was largely a result of efforts made by the Government of Zambia, working with the IAEA in partnership with FAO, especially the Joint FAO/IAEA Division and its VETLAB network, to modernize its equipment and increase staff capacity to diagnose animal diseases quickly and accurately. This is particularly important in countries such as Zambia, where rapid diagnosis enables containment of deadly disease outbreaks which, if allowed to spread, will have a damaging impact on the livestock industry, public health (in case of zoonotic diseases), community livelihoods and trade.

Source: IN ACTION. Nuclear applications in agriculture. On-the-ground success. Part IV

Argentine Farmer Folklore of Parasite Resistant Sheep Now Backed by Science

At one point, farmers' belief that some of their sheep were naturally resistant to gastrointestinal parasites was put under the heading of "farmer folklore". However, as parasites began to develop resistance to drugs used to kill them, and the world's farmers dealt with losses due to parasites estimated in billions of dollars, researchers began seeking scientific evidence that would form a basis of breeding for natural resistance. As it turned out, farmers were right. Not only are some sheep naturally resistant to parasites, there are relatively easy ways to tell which ones are, such as checking the conjunctiva colour in their eyes, but also more advanced scientific ways, which identify the genetic markers of resistance. In Argentina, where mutton and wool are enormous contributors to the agriculture sector, the Joint FAO/IAEA Division works with the National Institute for Agricultural Technology (INTA), which maintains a large flock of sheep to record results of breeding. Incorporating data on natural resistance into breeding programmes has meant millions of dollars in extra income for Argentina's sheep farmers.

Source: IN ACTION. Nuclear applications in agriculture. On-the-ground success. Part IV

Artificial Insemination of Cattle Supports Boost in Milk and Meat Production in Bangladesh

Modern animal breeding technologies, a network of artificial insemination services, a flourishing feed industry and functional delivery of veterinary services have had an extremely positive impact on milk and meat production in Bangladesh, especially for its crossbred cattle. In the past decade, the country has seen a 4-fold increase in milk production and 7-fold increase in meat production. The Bangladesh Agricultural University (BAU) in Mymensingh and the Bangladesh Department of Livestock Services (DLS) played important roles in this development, with technical support offered by the Joint FAO/IAEA Division. The work with BAU focused on increasing the success rates of artificial insemination, working through a farmers' organization with 800 members. But the project's goal of improving both the genetics and conception rates of the cows was so well received that it spread across the country. Nearly 6 million cows were artificially inseminated in the country during 2017 alone.

Source: IN ACTION. Nuclear applications in agriculture. On-the-ground success. Part IV

Fast Response to HPAI Outbreak Avoids Economic Losses in Democratic Republic of the Congo

At the end of May 2017, the Democratic Republic of the Congo (DRC) was faced with what appeared to be its first-ever outbreak of highly pathogenic avian influenza (HPAI). Rapid confirmation was critical. Animal and public health officials needed to know if it really was the avian influenza virus, and, if so, which strain of the virus was present. The Central Veterinary Laboratory (CVL) in Kinshasa, the capital city, was prepared with sampling and testing protocols to deal with the emergency. The Joint FAO/IAEA Division had previously provided CVL with diagnostic equipment and training for staff both in the laboratory and in the field. Thus, when samples from the outbreak area were brought for analysis, the lab was prepared, and it quickly determined that, yes, it was avian flu. Although it would take more time to find out exactly what strain was present, the veterinary service activated a precautionary response programme. While previous outbreaks in Africa had meant the loss of millions of birds, the fast reaction in Congo meant the outbreak was contained with minimal poultry losses and no human casualties.

Source: IN ACTION. Nuclear applications in agriculture. On-the-ground success. Part IV

IAEA Director General Visits Botswana: Highlights Support for Technical Assistance Using Nuclear Technology

January 2018. The IAEA Director General, Mr Yukiya Amano, visited Gaborone, Botswana, to discuss with senior authorities the role of nuclear science and technology on ensuring safe food for consumers and exports to third countries. As part of the visit, Mr Amano met senior scientists at the National Veterinary Laboratory in Sebele and saw first-hand the various IAEA-supported nuclear-derived diagnostic techniques that help ensure milk, dairy and meat products are fit for human consumption.

https://www.iaea.org/newscenter/news/iaea-director-general-visits-botswana-highlights-support-for-technical-assistance-using-nuclear-technology

Mongolia Enhances Control of Cross-Border Animal Diseases through Innovative Approaches

March 2018. The livestock sector in Mongolia is the main pillar of the rural economy, contributing to 16% of the national GDP and providing livelihoods for 30% of its population. However, over the decades, the livestock industry has been confronted by occasional flare-ups of transboundary animal diseases (TADs). Animal diseases like foot-and-mouth disease (FMD), peste des petits ruminants (PPR), and brucellosis, are transmitted to livestock through direct contact, air, foodstuffs, and contaminated objects. The link between these diseases and infected meat and animal products cause many countries to impose trade restrictions on Mongolia to minimize the risk of disease importation. The support of the FAO/IAEA Joint Division has enabled Mongolia to strengthen capacities in controlling animal diseases, especially TADs, by boosting research on safe nuclear and nuclear-derived techniques for diagnosis for quicker detection of the disease, training personnel on these techniques, and providing equipment and expert services.

http://www.fao.org/in-action/kore/good-practices/good-practices-details/en/c/1105279/

These stories as well as other articles are also available under 'Highlights' on our Homepage
http://www-naweb.iaea.org/nafa/aph/index.html

Coordinated Research Projects

Project Number	Ongoing CRPs	Project Officers
D31028	Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits	M. Shamsuddin, M. Garcia Podesta
D31029	Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pasture Using Compound Specific Stable Isotopes	M. Shamsuddin M. Garcia Podesta
D32031	Early and Rapid Diagnosis and Control of Transboundary Animal Diseases (TADs) - Phase II: African Swine Fever	H. Unger G. J. Viljoen
D32032	Early Detection of Transboundary Animal Diseases (TADs) to Facilitate Prevention and Control through a Veterinary Diagnostic Laboratory Network (VETLAB Network)	I. Naletoski C. E. Lamien
D32033	Irradiation of Transboundary Animal Disease (TAD) Pathogens as Vaccines and Immune Inducers	H. Unger G. J. Viljoen
D32034	Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of the Highly Pathogenic Avian Influenza - Phase II	I. Naletoski G. J. Viljoen

Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits (D31028)

Mohammed Shamsuddin and Mario Garcia Podesta

The CRP aims at enabling Member States in the application of genetic evaluation and selection involving genomic tools in artificial insemination (AI) programmes for rapid but sustainable improvement of livestock productivity. Ten research contracts (RC), two technical contracts (TC) and three research agreements (RA) have already been awarded.

Two major lines of research work are planned, one for those who target crossbreeding and the other for those who keep purebred taurine populations. The crossbreeding group aims at admixture analysis to assess the distribution of genetic groups of crossbreds, evaluate their performance and identify suitable genotypes for the prevailing production systems. The group with purebred taurine populations works to estimate PTAs (predicted transmitting ability) of sires under local conditions, which will be correlated with genomic PTAs of sires at their origin. Two technical contracts were awarded, one on whole genome sequencing of the radiation hybrid clones of camel cells with that of hamster and the other on the use of isotope labelled amino acids for the detection of proteins synthesizes and released into maternal blood by embryos (day 16 pregnancy) as a marker for early pregnancy diagnosis tests. The second RCM will be held in December 2018 aiming at a midterm evaluation of the CRP and finalizing work plans for the rest of the CRP period.

Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pasture Using Compound Specific Stable Isotopes (D31029)

Mohammed Shamsuddin and Mario Garcia Podesta

The CRP aims at developing a practical method to predict pasture intake of ruminants grazing heterogeneous pastures and rangeland using stable isotopes to provide tools for better grassland management that enhance animal productivity and reduces impact on environment due to overgrazing, and to allow the design of effective feed supplementation strategies at farm level to optimize animal production. Eight research contracts (RC), two technical contracts (TC) and two research agreements (RA) constitute the CRP team.

The first research coordination meeting (RCM) held in January 2017 discussed and finalised the work plan and detailed research protocol.

During the first phase of the CRP, a minimum of eight mature cattle/yaks will be penned and fed with a known set of five pasture/browse fresh grasses. Half of the animals will

receive 10% extra of maintenance levels and the other half will be fed *ad libitum*. During the enclosure, feed composition and feed intake will be recorded, n-alkane will be orally administered, and feeds and faecal samples will be collected. This procedure will be conducted in two major seasons within 18 months. Of the two technical contracts (TCs), one assists with the analysis of n-alkane and stable carbon-13 isotope and the other with NIRS analysis of forages, diets and faeces. Results from the two TCs will be used in computing formulas for the estimation of dry matter and diet composition of ruminants grazing on heterogeneous pasture or ranch land. RC and TC holders will report progress done based on these work plans in the 2nd RCM by the first quarter of 2019. Based on the results obtained, additional research activities will be developed.

Early and Rapid Diagnosis and Control of Transboundary Animal Diseases (TADs) - Phase II: African Swine Fever (D32031)

Herman Unger and Gerrit Viljoen

This CRP started in 2014 and focuses on evaluating technologies which could help to control ASF worldwide.

African swine fever is a contagious viral disease of pigs transmitted by ticks or through contact. In domesticated pigs, it leads to acute disease with high mortality and survivors are chronically infected serving as the reservoir for further transmission. Wild boars are the natural reservoir in Africa. Endemic in wide parts of sub-Saharan Africa it has spread in the last 10 years to the Northern Caucasus and keeps expanding primarily to the West and North. The disease creates severe economic hardship for pig farmers and due to the lack of a vaccine, culling and quarantine measures are the only tools available to control the disease. As pig production is in many cases a small-scale business, farmers often lack the means and education on how to fend off disease. Even with the availability of diagnostic tools, some issues regarding ASF epidemiology or virology are not understood.

Under the CRP, a validation trial for the serological diagnostic ASF tests (ELISA based) has been completed and the contract holders will now begin testing molecular diagnostic tools to define the fitness for purpose for each available test. In parallel, samples from infected pigs, wild or domestic, will be collected for virus isolation. These isolates should be further characterized by sequencing to gain a better understanding of the genetic diversity on a spatial scale. This knowledge together with information regarding the pathology of each strain should allow some insight into the underlying pathogenic mechanisms and might help identify epitopes of interest for a candidate vaccine.

Finally, control measures will be initiated to see how efficient they are in the context of small scale commercial production.

The final research coordination meeting took place from 11 to 14 June at the Friedrich Loeffler Institute in Greifswald, Germany.

Early Detection of Transboundary Animal Diseases (TADs) to Facilitate Prevention and Control Through a Veterinary Diagnostic Laboratory Network (VETLAB Network) (D32032)

Ivancho Naletoski and Charles Lamien

The Veterinary Laboratory Network (VETLAB Network) currently integrates 44 African and 19 Asian Member States which are dedicated to the sharing of knowledge and experience and to supporting each other during the implementation of international standards, routine diagnostic procedures, diagnostic approaches for specific disease outbreaks, thus facilitating emergency preparedness and response to animal health emergencies. The concept of networking proved very successful during the rinderpest eradication campaign. Nowadays, this concept has resulted in great successes in some of the Member States where diagnostic laboratories have received the ISO 17025 accreditation. Additionally, several other laboratories in this network are in advanced phases of implementation of the ISO 17025 standard and expect accreditation soon.

The VETLAB Network aims to establish a unique regional and interregional communication and activity structure which enables the sustainable functioning and upgrading of the member laboratories under internationally recognized principles.

A critical step for harmonization of diagnostic techniques is the establishment of primary and/or secondary standards (as appropriate) which can be used as references during the calibration and maintenance of the diagnostic tests. The present CRP will target the establishment of such standards for use in serological and molecular diagnostic techniques and produce the following outputs:

i) A set of internationally acceptable standards for the serological diagnostic techniques for priority diseases among the partners of the VETLAB Network;

ii) A set of internationally acceptable standards for the molecular diagnostic techniques for priority diseases among the partners of the VETLAB Network;

iii) Procedures for simultaneous detection of multiple pathogens (multi-pathogen detection panels);

iv) Procedure for easy access, free-of-charge genetic sequencing services for pathogens of the priority diseases among the partners of the VETLAB Network;

v) Establish an information platform for integrated information collection, geo-visualization, analysis and decision making.

The project team is comprised of eight research partners (Argentina, Cameroon, Croatia, Ethiopia, Ivory Coast, The FYR of Macedonia, Morocco and Sudan), two technical partners (France and United Kingdom) and three agreement holders (two from France and one from Australia).

The third research coordination meeting will take place from 6 to 10 August 2018 in Vienna, Austria.

Irradiation of Transboundary Animal Disease (TAD) Pathogens as Vaccines and Immune Inducers (D32033)

Hermann Unger and Gerrit Viljoen

A recent CRP on the 'Evaluation of irradiation for vaccine production' clearly showed, that protection delivered through irradiated pathogen preparations is possible. Specifically, good results obtained with irradiated intestinal and haemo-parasites allow us to speculate that one can really induce protection against these parasites. This would be a big relief for farmers as the use of anti-parasitic drugs is expensive, reduces innate immunity and can lead to resistant strains. As man and animals are both affected by many parasites, this research addresses human health as well.

A recent consultancy meeting on immunology agreed that vaccines against parasites will be a breakthrough in livestock production as many of these parasites, in addition to the symptoms and performance reduction they cause, can have immune compromising effect which can lead to other infectious diseases. So far, the irradiation of Theileria, Haemonchus and Fasciola has been addressed successfully and will now be followed up in this new CRP. For Haemonchus contortus the expansion of production of the stage III larvae was addressed and larger volumes achieved. These irradiated larvae given orally lead to a substantia protection, which soon will be elevated with a new irradiation technology in a large farm trail. Other newer approaches address Mannheimia, influenza and Salmonella gallinarum.

The next coordination meeting is foreseen for 2019 in Vienna, Austria.

Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of The Highly Pathogenic Avian Influenza - Phase II (D32034)

Ivancho Naletoski and Gerrit Viljoen

The objective of this CRP is to evaluate the origin of wild birds that carry avian influenza (AI) and other potentially dangerous pathogens at their stopover places and match the obtained results with the knowledge obtained through conventional migration monitoring approaches. Stable isotopes (SI) are promising huge potential when the origin (migration) of individual wild birds is required, because the probability of capturing labelled bird with specific characteristics (disease carrier) using conventional methods is negligible. Knowledge and experience obtained through the previous project (D32030) will be of great value for the success of this project.

The use of SI in migration studies of wild animals, including wild birds, primarily in environmental protection studies and conservation activities etc. has attracted the attention of the scientific community; however, this can be used in epidemiological studies which target long-range transmissions of animal pathogens.

The development and maintenance of the IAEA global network of isotopes in precipitation (GNIP) became a significant facilitator of these studies, as it offered geo-spatial reference values for correlation of the SI ratios in the animal tissues (especially metabolically inert tissues like beaks, claws and feathers) and the isotope ratios in the environment (especially open waters).

During the first phase of the IAEA CRP D32030 (Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of the Highly Pathogenic Avian Influenza), several important fragments in the linking of SI ratios of feather samples (bird migrations) with the epidemiology of AI were established, including:

i) Development of a database of most common wild bird carriers of AI, including their migration patterns obtained from conventional studies (ringing, radio- and GPS locators). This database is to be used as reference information for the SI studies;

ii) Development of protocols for sampling, transport and testing of samples obtained from wild migratory birds;

iii) Evaluation of "PrimeStore" as a solution to inactivate pathogen infectivity by simultaneous preservation of the viral RNA. The component was important to facilitate international transport and decrease the price of international shipment of samples;

iv) Adaptation of validated standard operating procedures (SOPs) for detection of the AI virus and the Newcastle disease virus (NDV) in wild birds;

v) Development of a validated SOP for DNA barcoding of feather samples, used for determination of the species from feathers (or parts of feathers) collected from the environment. The SOP can be also used for phylogeny of genotypes within a single species;

vi) Development of an algorithm for SI assignment of birds based on the feather and environmental SI ratios;

vii) Development of geo-visualization indicating the probability of origin of the birds, calibrated using established algorithms for SI assignment of birds.

Achievements of the CRP D32030 have shown not only that the isotope assignment works, but have delivered a full package of techniques that will compact and supplement (SI component) the official wild bird monitoring programmes of Member States.

In the current project, the partners will focus on two critical issues: to detect birds that carry avian influenza viruses and eventually other dangerous pathogens and to evaluate the stable isotope ratios in feathers of these birds (only the pathogen carriers) to understand their origins and migration pathways.

The first research coordination meeting will take place from 27 to 31 August 2018 in Novosibirsk, Russia.

Submission of Proposals

Research contract proposal forms can be obtained from the IAEA, the National Atomic Energy Commissions, UNDP offices or by contacting the Project Officer. The form can also be downloaded from the URL:

http://cra.iaea.org/cra/index.html

Research Activities of the Animal Production and Health Laboratory

Animal Genetics

Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits (CRP D31028)

Radiation hybrid (RH) mapping for dromedary camel

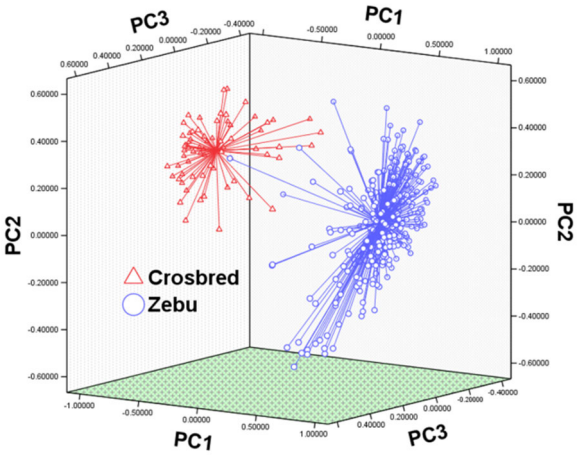
The programme on development of genomic resources for camelids is aimed to support FAO/IAEA Member States' efforts in developing genomic tools for selection and breeding of camel for increased productivity. In 2017, the Animal Production and Health Laboratory (APHL) completed the construction of two panels of camel radiation hybrids for producing chromosome level reference genome maps. During 2018, APHL continued the characterization of camel radiation hybrid panel to develop the first-generation radiation hybrid map. 5000RAD panel was typed for 96 custom designed DNA markers using integrated fluidic circuits based real time polymerase chain reaction (PCR) methodology. Additionally, the same panel was typed for 40 more DNA markers using conventional PCR based methods. Typing of additional markers is currently under progress and the RH genotype data will be utilized to order and assemble the genomic scaffolds to camel chromosome 16.

Development of genetic tools for marker assisted dairy cattle improvement

Dairy production in tropics is characterized by low input system based on crop residues, agroindustrial by-products, community grazing, etc., and productivity per cow (milk yield/day/cow) is relatively low. The reliable and sustainable supply of improved animal genetics is one of the major obstacles for increased productivity. Developing countries in South Asia and sub-Saharan Africa with small holder production systems lack organized breeding structure for dairy cattle (except for few institutional capacities). Genetic improvement of dairy cattle has been attempted mostly through crossbreeding (by artificial insemination (AI) using semen from intensely selected temperate breeds like Holstein-Friesian, etc.) rather than selection of superior indigenous animals. However, crossbreeding programmes were constrained by several factors resulting in lack of stabilization of crossbreds with desired genetic makeup.

This led to varying levels of genetic admixture in crossbred animals with problems of adaptability, reproduction, etc. Survival and performance of crossbreds under field conditions did not improve the expected level due to various factors related to genotype x environment interaction. The fundamental limitation is the absence of infrastructural facilities for pedigree and performance recording and lack of efficient genetic evaluation programmes to meet out the demands for genetically superior breeding bulls. Further, the genetic composition of crossbreds available with the farmers is not known and the performance of the crossbred cattle is not optimized for the existing production environment.

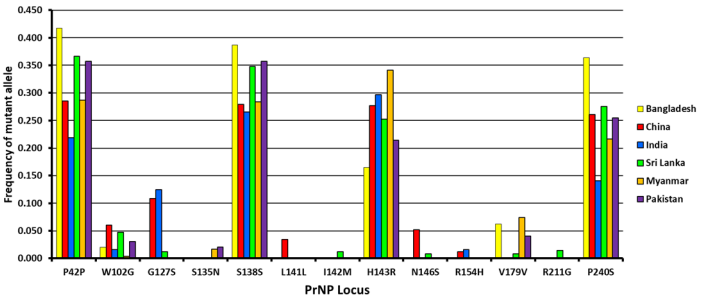
Advanced nuclear and genomic technologies permit the characterization of the dairy cattle genome with markers at a decreasing cost. Low cost genomic tools are now available and can be adapted for use in developing countries to implement genetic improvement programmes. For example, application of nuclear and DNA marker tools can help in estimating levels of genetic admixture in crossbred animals, verify purity of purebred animals and match data with appropriate genetics to select superior stocks for breeding. Under the coordinated research project (CRP) D31028, APHL initiated a research programme on development of low density marker panel for estimation of genetic admixture in crossbreds with the objective of assessing the distribution and performance of different crossbred genotypes under field conditions; identifying optimal genotype for a given production environment; and breeding crossbred cows with bulls of appropriate genotype and stabilize exotic inheritance. In 2018, about 290 zebu cattle from South Asia and 70 crossbred cattle were assessed using classical short tandem repeat markers to identify purebred zebu cattle. Those animals with >99% purity will be selected for genome-wide typing of single nucleotide polymorphic markers to establish baseline genetic differentiation of Asian Zebu and European taurine cattle. Genotyping of purebred taurine and additional zebu cattle breeds are currently under progress.



Baseline genetic differentiation of zebu and crossbred cattle based on multi locus short tandem repeat genotype data

Screening indigenous Asian goat breeds for genetic resistance and susceptibility to transmissible spongiform encephalopathy

Scrapie is a well-known disease of goats worldwide. Prion protein gene (PRNP) polymorphisms have been shown to strongly modulate the resistance/susceptibility to the disease. APHL collaborated with Friedrich-Loeffler-Institut, Institute of Novel and Emerging Infectious Diseases, in Germany, to screen indigenous Asian goat breeds for PRNP gene variations. More than 1000 goats belonging to 16 breeds/populations located in six Asian countries (India, Bangladesh, Sri Lanka, Myanmar, China and Pakistan) were investigated. A total of 13 polymorphisms were detected within PRNP, of which nine are associated with an amino acid exchange, while four were silent mutations. Among these, 11 have been reported earlier while variations at S135N and L141L are novel and reported for the first time. The widely reported Q222K and R211Q alleles that are strongly associated with disease resistance were not observed in any of the Asian goat breeds studied. However, N146S allele reported to confer Scrapie resistance through the productive lifetime of goats was found in relatively higher frequency among Chinese crossbred (8.3%) and Yichang White (5.8%) goats. Similarly, G127S allele was at least three times more prevalent in certain Chinese and Indian goat populations as compared to European goats. R154H allele was either less frequent or completely absent among goats in different countries indicating the potentially low risk of Asian goats to atypical scrapie. Haplotype reconstruction revealed a total of 14 unique PRNP haplotypes with the observed number ranging from 5 (Myanmar and Pakistan) to 10 (Sri Lanka) across goats from different countries. Three major central PRNP haplotypes were observed among Asian goats as compared to two such haplotypes found in North American and European goats. Prevalence of the third major central haplotype originating from H143R dimorphism was distinctly high among Asian goats. Haplotype based tests for selective neutrality using Tajima's D, Fu and Li's D and Li's D statistic did not reveal any significant deviation in any of the Asian goat breeds investigated. Further studies addressing the disease association of PRNP polymorphisms in Asian goats are required to establish a possible explanation for the low prevalence/reporting of Scrapie cases in the region.



Frequency distribution of 13 polymorphic (synonymous and non-synonymous) loci within PRNP gene in indigenous Asian goats

Implementing Global Plan of Action for Animal Genetic Resources (AnGR)

Genetic characterization of indigenous guinea fowl populations in Burkina Faso (BKF5017)

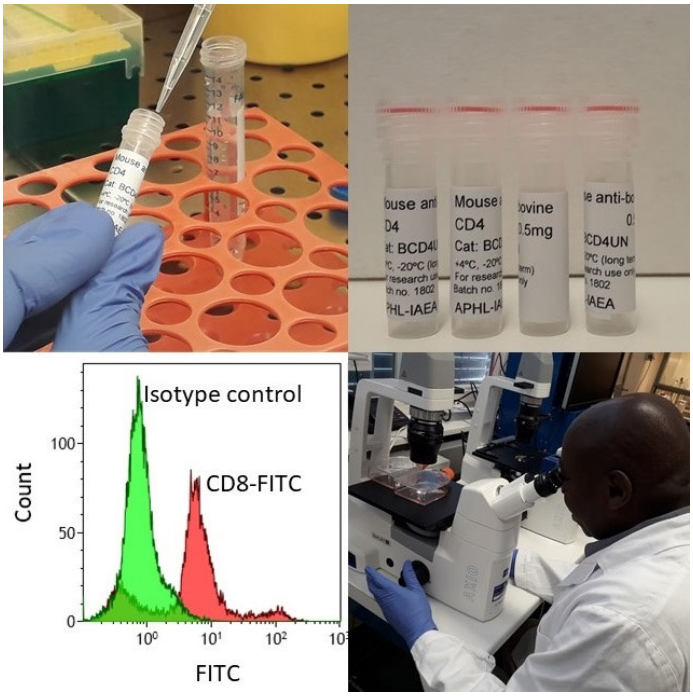
In continuation of Joint FAO/IAEA efforts towards implementing the Global Plan of Action for Animal Genetic Resources (AnGR), APHL supported genetic characterization of native cattle populations in Bulgaria. Three cattle breeds (Bulgarian brown cattle, Rhodope Shorthorn cattle and Bulgarian Rhodope cattle) were evaluated using nuclear and extra nuclear DNA markers. A total of 80 samples from three breeds were subjected to sequencing of mitochondrial DNA control region and multi locus genotyping of short tandem repeat markers. The results of molecular characterization will help to establish genetic admixture levels, population structure and demographic dynamics of Bulgarian cattle. The genetic biodiversity information will be utilized in formulating effective strategies for the conservation and genetic improvement programs of Bulgarian native cattle.

Animal Health

Monoclonal Antibodies Against Bovine Immune Markers to Characterize Vaccine Induced Immunity

Vaccines play a significant role in the prevention and control of diseases. In the livestock industry, many diseases continue to burden farmers due to the unavailability of effective vaccines or suboptimal efficacy in already licensed vaccines. Hence, measuring immunity induced by vaccines plays a key role in developing novel vaccines as well as in the quality control of existing vaccines. Monoclonal antibodies raised against immune markers are used to define cell-mediated immunity which is an essential branch in immunity that provides protection against future infections. The cost of these monoclonal antibodies is high, thus preventing access by vaccine R&D institutes in developing countries. In addition to cost, a higher quality of these antibodies is required for better research.

Recently, a large number of hybridoma cell lines that produces monoclonal antibodies against bovine immune markers were transferred to APHL from the International Livestock Research Institute. Using this resource, APHL is characterizing, purifying and producing monoclonal antibodies to assist Member States in R&D of livestock vaccines. Already, antibodies are available for identifying immune cell subsets and activation markers. Antibodies against bovine CD4, CD8, CD25, CD80, CD86, MHC class II, Gamma-delta cells and IgG are among the list of antibodies that are already available for distribution. Most of these antibodies are available in unconjugated forms and custom conjugation could be done upon request. Standard operating protocols are also available to use these antibodies in flow cytometry. In addition, these antibodies could also be used in other applications such as immunohistochemistry and ELISA. Currently, the APHL-produced antibodies are freely available for the VETLAB network partners and any APHL associated CRP partners. Those who are interested in receiving these antibodies should contact APHL.



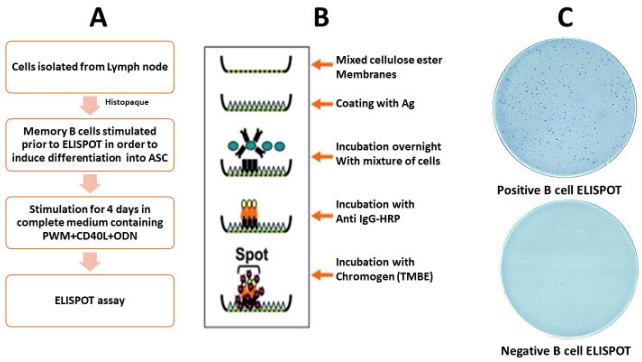
Production and quality control of monoclonal antibodies against bovine immune markers

Development of a New B-cell ELISPOT Assay that Can Be Used to Characterize Vaccine Induced Immunity

Antibody response is a key determinant of vaccine induced immunity. However, a measurable antibody response can take two weeks or more after vaccination. In some cases, it might not be easy to measure the antibody response without challenging the vaccinated animals. B-cell ELISPOT provides a platform where antibody responses could be induced *in-vitro* from memory B cells that are generated following vaccination. APHL has undertaken experiments to develop a B-cell ELISPOT assay that can be used to monitor antibodies produced by B cells during immunization studies. In order to test the viability of this assay, APHL in collaboration with the Austrian Agency for Health and Food Safety (AGES) used this technique in accessing the development of an irradiated PRRS vaccine. Irradiated PRRSV was used as the vaccine candidate and was injected in pigs by the intra-muscular route. Two vaccine doses were given at two-week intervals and three weeks following the last vaccination, animals were sacrificed and immune responses were measured.

In order to complement T cell data that was measured, B cells were also induced to produce a humoral response.

Lymph nodes obtained from the sacrificed animals at the end of the experiment were re-stimulated with the inactivated virus in the presence of a stimulation cocktail containing Pokeweed mitogen (PWM), CD40-ligand (CD40L) and CpG containing phosphorothioated oligodeoxynucleotide (ODN). As shown in the image below, panel A for a period of four days before incubation on the ELISPOT plate. The ELISPOT plates were then processed as shown in panel B before using an ELISPOT plate reader to interpret the results as shown in panel C. This technique will be used to access B cell response in future animal experiments that will help evaluate the performance of experimental irradiated vaccines.



Schematic diagram of ELISPOT assay protocol

Molecular Epidemiology of African Swine Fever in Africa

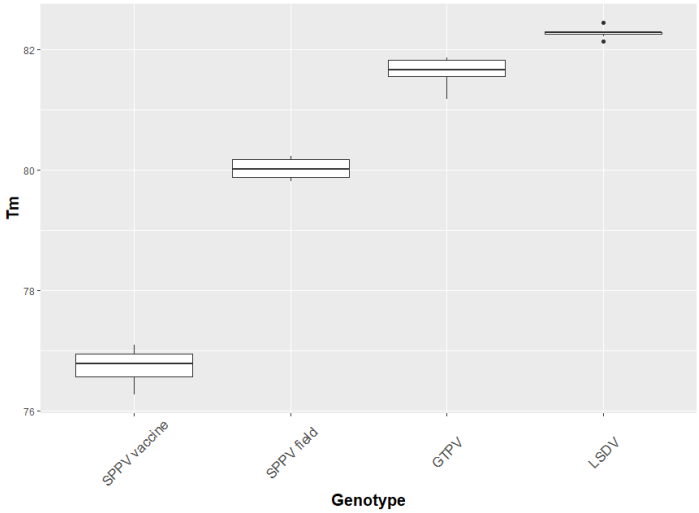
Since 2012, APHL is supporting the efforts of several African Member States to tackle African swine fever (ASF) by reinforcing the local laboratory capacities to detect and perform in-depth analysis of the ASF virus. From 2017, APHL has worked with VETLAB partners in Burkina Faso, Cameroon, Mozambique and Tanzania to further characterize their local ASFV isolates collected during 2016 and 2017 outbreaks.

The results showed that only ASFV isolates of genotype I were involved in outbreaks in Cameroon and Burkina Faso in 2016 and 2017. In Mozambique, only genotype II was found in samples collected during ASF outbreaks in the same period. In contrast, we have identified two different genotypes (genotype II and IX) from the samples collected between 2016 and 2017 in Tanzania. Interestingly, we have found that only genotype II isolates were associated with high mortality, while genotype IX was associated with low morbidity and mortality. This shows that at least two genotypes of ASFV are circulating in Tanzania. It also highlights the risk of underestimating the presence of genotype IX in the country due to low morbidity and mortality, thus a continuous monitoring of outbreaks and characterization of local isolates remain priorities.

Differentiation of Sheep Poxvirus Vaccines from Field Isolates and Other Capripoxvirus Species

The genus capripoxvirus (CaPV) within the family poxviridae comprises three closely related viruses, sheep pox virus (SPPV), goat pox virus (GTPV) and lumpy skin disease virus (LSDV). Capripox diseases: sheep pox (SPP), goat pox (GTP) in sheep and goats and lumpy skin disease (LSD) in cattle are controlled mainly by using a live attenuated vaccine. Although the appearance of disease in previously vaccinated cattle herds is well documented, the problem in small ruminants is neglected. APHL has been working to develop tools to investigate SPP in previously vaccinated sheep and goat herds. We recently reported on the development of a new diagnostic tool for differentiation of SPPV field isolates from attenuated vaccine strains using gel-based PCR alone or in combination with sequencing (Chibssa et al. Virology Journal (2018) 15:59 https://doi.org/10.1186/s12985-018-0969-8).

This work was further extended to develop a high-resolution melt analysis (HRM) based method to differentiate SPPV vaccines from SPPV field isolates and further enable the genotyping of capripoxviruses isolates into SPPV, GTPV and LSDV. Using the HRM-based method to evaluate 61 capripoxviruses form various genotypes and geographical origins, we identified 4 SPPV vaccines, 14 SPPV field isolates, 11 GTPVs and 32 LSDVs. Both gel-based and HRM-based methods were sensitive and specific and in agreement with the sequencing data. These methods are suited for routine use during outbreak investigations in both capripoxvirus enzootic and disease-free countries.



Boxplots showing good separation between the melting temperatures (Tm) of SPPV vaccine, SPPV field isolates, GTPV and LSDV. The Tm ranged as follows: SPPV vaccines (76.7325±0.35), SPPV field isolates (80.02±0.16), GTPV (81.66±0.21); LSDV (82.29±0.01)

Molecular Epidemiology of Lumpy Skin Disease in Eastern Africa

Lumpy skin disease (LSD) is an important transboundary disease of cattle. Initially confined to the African continent, LSD has spread from 2010 to the Middle East, where it became endemic and emerged in Europe in 2015. APHL supports Member States in the control of LSD by developing diagnostic tools (serological and molecular), molecular epidemiology tools and supporting vaccine research for this disease.

The characterization of LSD isolates can assist in tracing the movement of the virus and understanding its evolution, thus enabling the implementation of more efficient control measures. APHL has worked with MS partners in Ethiopia, Sudan and Kenya to characterized LSD virus (LSDV) isolates from outbreaks that occurred between 2011 and 2015 in these three countries and compared them to LSDV samples collected earlier in the same region and elsewhere.

The analysis of the GPCR and the RPO30 genes showed that these LSDV genes are well conserved. However, an isolate from Kenya displayed in very distinct features on the GPCR gene, presenting a 12-nucleotide insertion, similar to the LSDV vaccine strain like KS1 and Neethling.

A closer look at all the publicly available GPCR sequences of field isolates showed that the isolate B338/2011 from Kenya is different from all recent field isolates of LSDVs. Similar profiles were found only in two historical isolates: the LSDV RSA/54-Haden isolate in South Africa in 1954 and the isolate LSDV NI-2490-Neethling-2490 isolated from cattle in Kenya in 1958. Such isolates may be difficult to differentiate from the most commonly used vaccine strains (KS1 and Neethling) using PCR and real time PCR methods. However, a detailed analysis of the GPCR, the RPO30 and the EEV glycoprotein gene sequences, revealed some clear and distinct features compared to the KS1 and Neethling vaccine strain.

This demonstrates the need for continuous monitoring of the genetics of LSDV isolates to better fit diagnostic tools and support control strategies. Further work is being undertaken to sequence the full genome and to determine if this isolate could have resulted from a recombination event.

Fellows, interns and consultants

Ms Vandana Choondal Kalarikkal Manomohan from the Tamil Nadu Veterinary and Animal Sciences University, Chennai, India, was trained on 'DNA marker based molecular characterization of South Indian zebu cattle' for three months (1 December 2017 to 23 March 2018) under the CRP D31028.

Mr Tsvetoslav Koynarski from the Department of Animal Genetics, Trakia University, Stara Zagora, Bulgaria, was trained on 'Genetic evaluation of Bulgarian native cattle using DNA markers' at APHL for two months (2 May 2018 to 30 June 2018) under a TC fellowship (FS-RER0044-1705802).

Mr Sam Richard Rekuma Erechu from the National Animal Disease Diagnostics and Epidemiology Centre (NADDEC), Uganda, was trained on the use molecular tools for the diagnosis of transboundary animal diseases for two and a half months (from 15 January 2018 to 30 March 2018) (UGA17005).

Ms Lineo Regina Bohloa Niyonzima from the Department of Livestock Services, Ministry of Agriculture and Food Security, Lesotho paid a scientific visit to APHL to discuss laboratory management and be updated on the diagnosis of transboundary animal diseases by PCR, ELISA and other nuclear derived techniques from 15 January 2018 to 14 January 2018 (LES17006).

Mr Carlos João Quembo from the Agricultural Research Institute of Mozambique visited APHL from 05 February 2018 to 09 February 2018 to be updated on the application of molecular tools for the diagnosis of transboundary animal diseases (MOZ5008).

Ms Elena Lucia Sassu is a veterinarian specialized in immunology and infectious diseases of swine and was awarded her PhD in immunology in 2017. Under the direct supervision of Mr Viskam Wijewardana, during her internship period she will contribute to develop in-vitro assays to measure innate and adaptive responses to swine vaccine candidates.

Technical Cooperation Projects

Country TC Project	Description	Technical Officer(s)
Angola ANG5013	Applying Nuclear and Molecular Techniques for Diagnosis and Control of Transboundary Animal Diseases	G. Viljoen I. Naletoski
Burundi BDI5002	Improving Animal Production Through Enhanced Application of Nuclear and Related Techniques	H. Unger
Benin BEN5010	Using Nuclear Techniques for Better Utilization of Local Feed Resources and Improved Reproduction Practices to Enhance Productivity and Conserve Nature	M. Shamsuddin
Bangladesh BGD5030	Building Capacity to Improve Dairy Cows Using Molecular and Nuclear Techniques	M. Shamsuddin G. Viljoen
Burkina Faso BKF5017	Using Modern Animal Breeding Methods, Nuclear and Genomic Tools to Improve Dairy Production in Smallholder Production Systems	K. Periasamy M. Shamsuddin
Burkina Faso BKF5021	Improving Local Poultry Production Through Incorporation of Nutraceuticals in Feeds and Genetic Characterization	M. Shamsuddin
Botswana BOT5015	Establishing District Laboratories that use Nuclear and Molecular Techniques for Early and Rapid Diagnosis of Endemic and Transboundary Animal Diseases	G. Viljoen C. Lamien
Botswana BOT5016	Developing the Application of Immunological and Molecular nuclear and Nuclear Derived Early and Rapid Diagnosis and Control of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Belize BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	G. Viljoen
Belize BZE5009	Establishing Early and Rapid Diagnoses and Control of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Central African R CAF5009	Controlling Contagious Bovine Pleuropneumonia and Peste des Petit Ruminants	H. Unger
Central African R CAF5010	Building National Capacities for the Diagnosis and Control of Animal Diseases and for Increasing Animal Production	H. Unger
Chad CHD5005	Studying the Causes of Pulmonary Diseases in Small Ruminants	H. Unger C. Lamien
Cameroon CMR5019	Using Nuclear Techniques to Improve Milk Production	M. Garcia Podesta M. Shamsuddin H. Unger K. Periasamy

Country TC Project	Description	Technical Officer(s)
Cameroon CMR5022	Controlling Transboundary Animal diseases with Special Emphasis on Peste des Petits Ruminants	H. Unger
El Salvador ELS5012	Optimizing Livestock Production Systems through Cultivation and Efficient Use of Local Feed Resources, Monitoring of Performance and Reduction of Environmental Pollution through Solid Waste and Biogas Utilization	M. Shamsuddin I. Naletoski
Eritrea ERI5010	Increasing Small Scale Dairy Production Through Improved Feeding, Cattle Management and Higher Conception Rates, Thereby Improving Rural Livelihood and Contributing to Food Security	M. Shamsuddin
Ethiopia ETH5020	Enhancing the Livelihood of Rural Communities through Addressing Major Zoonotic and Economically Important Small Ruminant Diseases	H. Unger C. Lamien
Indonesia INS5042	Improving Cattle Productivity Through Improved Feeding and Enhanced Reproduction	M. Shamsuddin
INT5155	Sharing Knowledge on the Sterile Insect and Related Techniques for the Integrated Area-Wide Management of Insect Pests and Human Disease Vectors	I. Naletoski
Côte d'Ivoire IVC5038	Studying Small Ruminant Respiratory Diseases	H. Unger G. Viljoen
Cambodia KAM5003	Supporting Sustainable Livestock Production	M. Shamsuddin M. Garcia
Kenya KEN5038	Using Nuclear Techniques to Evaluate and Improve the Impact of Mutated Forages on the Performance of Smallholder Dairy Cows	M. Shamsuddin
Lao P.D.R. LAO5003	Using Nuclear and Molecular Techniques for Early and Rapid Diagnosis and Control of Transboundary Animal Diseases in Livestock	G. Viljoen
Lao P.D.R. LAO5004	Enhancing National Capability for Crop Production and Controlling Trans-Boundary Animal Diseases	G. Viljoen
Lesotho LES5006	Enhancing Animal Production and the Health of Sheep and Goats in Lesotho	G. Viljoen
Lesotho LES5007	Enhancing Livestock Production and Health	G. Viljoen
Madagascar MAG5024	Applying Nuclear and DNA-Based Techniques to Improve Productivity of Local Livestock germplasm through an efficient artificial insemination programme.	M. Shamsuddin K. Periasamy
Mauritius MAR5025	Improving the Productivity of Dairy Cattle through On-Farm Application of Achieved Research Information on Feeding Practices	M. Shamsuddin
Mauritania MAU5004	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases	H. Unger M. Shamsuddin

Country TC Project	Description	Technical Officer(s)
Mauritania MAU5007	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases - Phase II	M. Shamsuddin
Mali MLI5026	Improving the Diagnosis of Livestock Diseases	I. Naletoski C. Lamien
Mali MLI5027	Using Nuclear and Molecular Techniques for Early and Rapid Diagnosis, Epidemiological Surveillance and Control of Transboundary Animal Diseases	I. Naletoski C. Lamien
Mali MLI5029	Upgrading Capacities to Differentiate Priority Animal and Zoonotic Diseases Using Nuclear Related Molecular Techniques	I. Naletoski
Malawi MLW5002	Strengthening Capacity for the Diagnosis, Prevention and Control of Animal Diseases of Public Health Importance	H. Unger
Montenegro MNE5003	Improving Diagnosis of Animal Diseases and Food Pathogens	I. Naletoski
Mongolia MON5022	Implementing Early Diagnosis and Rapid Control of Transboundary Animal Diseases, Including Foot-and-Mouth disease (FMD) and Peste des Petits Ruminants (PPR)	H. Unger G. Viljoen
Mongolia MON5023	Enhancing Livestock Production Through the Improved Diagnosis and Prevention of Transboundary Animal Diseases	H. Unger G. Viljoen
Morocco MOR5037	Enhancing Control of Chemical Food and Feed Contaminants, Animal Disease Diagnosis and Trade in Fresh Fruits	I. Naletoski
Mozambique MOZ5007	Enhancing Mutation Breeding of Sorghum and Pearl Millet to Develop High Yield, Disease Resistance and Drought Tolerance	G.Viljoen
Mozambique MOZ5008	Strengthening National Capacity for the Application of Nuclear and Related Techniques to Improve Animal Health and Production	G.Viljoen
Myanmar MYA5024	Supporting the National Foot-and-Mouth Disease Control Programme	G. Viljoen
Myanmar MYA5026	Improving the Livelihoods of Smallholder Livestock Farmers by Developing Animal Feeding Strategies for Enhanced Food Security	M. Shamsuddin
Nepal NEP5004	Improving Animal Productivity and Control of Transboundary Animal Diseases using Nuclear and Molecular Techniques: Phase II	I. Naletoski
Nepal NEP5005	Strengthening Capacity in Veterinary Diagnosis	I. Naletoski
Nigeria NIR5040	Controlling Parasitic and Transboundary Animal Diseases to Improve Animal Productivity in Smallholder Farms Using Nuclear and Molecular Techniques	I. Naletoski,

Country TC Project	Description	Technical Officer(s)
Pakistan PAK5050	Developing a Facility for the Diagnosis of Transboundary Animal Diseases and Vaccine Production	H. Unger, V. Wijewardana
Palestine PAL5007	Upgrading Animal Feeding Laboratory in Terms of Human Capacity Building and Infrastructure	I. Naletoski, M. Shamsuddin
Papua New Guinea PAP5002	Genetically Characterizing and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding	K. Periasamy, M. Shamsuddin
Papua New Guinea PAP5003	Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding - PHASE-II	M. Shamsuddin
Peru PER5032	Conducting Genetic Characterization of Alpacas for Resistance to Diseases	K. Periasamy, M. Shamsuddin
Congo, Rep. PRC5001	Monitoring Livestock Diseases and Certifying Animal Health	H. Unger
RAF0042	Promoting the Sustainability and Networking of National Nuclear Institutions for Development	I. Naletoski
RAF0051	Supporting Specific Needs in the African Region Due to Emergencies	H. Unger G. Viljoen
RAF5068	Improving Livestock Productivity through Strengthened Transboundary Animal Disease Control using Nuclear Technologies to Promote Food Security (AFRA)	H. Unger C. Lamien
RAF5073	Strengthening Africa's Regional Capacity for Diagnosis of Emerging or Re-emerging Zoonotic Diseases, including Ebola Virus Disease (EVD), and Establishing Early Warning Systems.	H. Unger I. Naletoski
RAS5078	Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	G. Viljoen
RER5023	Enhancing National Capabilities for Early and Rapid Detection of Priority Vector Borne Diseases of Animals (Including Zoonoses) by Means of Molecular Diagnostic Tools	I. Naletoski
RER9137	Enhancing National Capabilities for Response to Nuclear and Radiological Emergencies	I. Naletoski
RLA5071	Decreasing the Parasite Infestation Rate of Sheep (ARCAL CXLIV)	M. Shamsuddin
Senegal SEN5036	Controlling *Mycoplasma mycoides* Infection — Contagious Bovine Pleuropneumonia (CBPP) and Contagious Caprine Pleuropneumonia (CCPP)	H. Unger
Seychelles SEY5008	Building Capacity for Diagnosis of Animal Diseases using Nuclear and related Techniques (Phase I)	H. Unger G. Viljoen
Sierra Leone SIL5018	Strengthening Artificial Insemination and Disease Diagnosis Services Coupled with Improved Feeding to Enhance the Productivity of Cattle	H. Unger M. Shamsuddin

Country TC Project	Description	Technical Officer(s)
Sierra Leone SIL5019	Strengthening Capacities for the Diagnosis and Control of Zoonoses to Improve Public Health Services and Livestock Production	H. Unger
Sri Lanka SRL5045	Establishing a National Centre for Nuclear Agriculture	H. Unger C. Lamien
Sri Lanka SRL5046	Improving Livelihoods Through Dairy Cattle Production: Women Farmers' Empowerment	M. Shamsuddin M. Garcia Podesta
Sudan SUD5036	Improving Livestock Production for Enhanced Food Security through Genetic Improvement of Indigenous Animal Breeds Using Artificial Insemination, Improved Nutrition and Adequate Animal Disease Control Measures	I. Naletoski M. Garcia Podesta
Syrian Arab Republic SYR5025	Enhancing the Nutritive and Reproductive Characteristics of Small Ruminants by Means of Nuclear and other Related Techniques Using Locally Available Unconventional Feed Resources	M. Shamsuddin
Togo TOG5001	Improving and Promoting Bovine Milk Production through Artificial Insemination	M. Shamsuddin
Tunisia TUN5028	Supporting Watering Strategies to Help Livestock Raised in Semiarid and Arid Regions Coping with Climate Change	M. Garcia Podesta I. Naletoski
Uganda UGA5035	Improving Food Safety through Surveillance of Fish Diseases	H. Unger C. Lamien
Uganda UGA5038	Supporting National Animal Production and Productivity through the Establishment of Regional Animal Health Centres and Improving Disease Control at the National Animal Disease Diagnostics and Epidemiology Centre	H. Unger
U.R. of Tanzania URT5031	Improving Indigenous Cattle Breeds through Enhanced Artificial Insemination Service Delivery in Coastal Areas	M. Shamsuddin
Vietnam VIE5019	Applying Nuclear Related Techniques for Transboundary Animal Diseases (TADs) Diagnosis	G. Viljoen V. Wijewardana
Yemen YEM5012	Improving Diagnostic and Analytical Capabilities of the Central Veterinary Laboratory Including Residue Testing of Animal Products	H. Unger
Yemen YEM5014	Improving Management of Small Ruminants	H. Unger
D.R. Congo ZAI5023	Upgrading Laboratory Services for Capacity Building in Fish and Aquaculture Diseases as a Contribution to Sustainable Poverty Alleviation and Sanitary Security of Food	H. Unger
D.R. Congo ZAI5024	Upgrading Vaccine Production to Protect Livestock from Transboundary Animal Disease	H. Unger V. Wijewardana
D.R. Congo ZAI5027	Developing Early and Rapid Diagnosis and Control of Transboundary and Zoonotic Diseases	H. Unger

Country TC Project	Description	Technical Officer(s)
Zimbabwe ZIM5022	Establishing Molecular Epidemiology Methods, Tissue Culture and Production of Biological Reagents for the Surveillance of Livestock Diseases	I. Naletoski V. Wijewardana
Zimbabwe ZIM5024	Establishing an Artificial Insemination Center to Enhance the Rebuilding of the National Herd	M. Shamsuddin

Publications

Publications in Scientific Journals

Gelaye E, Mach L, Kolodziejek J, Grabherr R, Loitsch A, Achenbach J, Nowotny N, **Diallo A**, **Lamien C.** 2017. A novel HRM assay for the simultaneous detection and differentiation of eight poxviruses of medical and veterinary importance. Scientific Reports 7:42892. doi: 10.1038/srep42892

Luka P, Mwiine F, Yakubu B, Erume J, Pérez-Sánchez R, **Unger H**, Shamaki D. 2017. African swine fever virus transmission cycle in Nigeria: assessment of domestic pig-soft tick contact through detection of antibodies against *Ornithodoros moubata* salivary antigen TSGP1. Veterinary Sciences: Research and Reviews 3(1): 6-12. doi: 10.17582/journal. vsrr/2017.3.1.6.12

Mulumba-Mfumu L, Achenbach J, Mauldin M, Dixon L, Tshilenge C, Thiry E, Moreno N, Blanco E, Saegerman C, **Lamien C**, Diallo A. 2017. Genetic assessment of African swine fever isolates involved in outbreaks in the Democratic Republic of Congo between 2005 and 2012 reveals co-circulation of p72 genotypes I, IX and XIV, including 19 variants. Viruses 9. 31. doi:10.3390

Ashraf W, **Unger H**, Haris S, Mobeen A, Farooq M, Asif M, Mahmood Khan Q. 2017. Genetic detection of peste des petits ruminants virus under field conditions: a step forward towards disease eradication. BMC Veterinary Research 13:34. doi: 10.1186/s12917-016-0940-0

Grema M, Traoré A, Issa M, Hamani M, Abdou M, Soudré A, Sanou M, **Pichler R**, Tamboura H, Alhassane Y, **Periasamy K**. 2017. Hhort tandem repeat (STR) based genetic diversity and relationship of indigenous Niger cattle. Arch Anim Breeding. doi: 10.5194/aab–3–1–2017

Parvez Kabir M, Rashedul Islam M, Al Maruf A, **Shamsuddin M**, Yeasmin Bari F, Nasrin Sultana Juyena, Saidur Rahman M. 2017. Optimization of estrus synchronization protocol for target breeding to decrease voluntary waiting period in lactating cows. Reprod Dev Biol 41(2): 25-31. doi: 10.12749/RDB. 2017.41.2.25

Kangethe R, **Pichler R**, Chuma F, **Cattoli G**, **Wijewardana V**. 2018. Bovine monocyte derived dendritic cell based assay for measuring vaccine immunogenicity in vitro. Veterinary Immunology and Immunopathology. doi: 10. 1016/ j. vetimm. 2018.01.009

Perelman P, **Pichler R**, Gaggl A, Larkin DM, Raudsepp T, Alshanbari F, Holl HM, Brooks SA, Burger PA, **Periasamy K**. 2018. Construction of two whole genome radiation hybrid panels for dromedary (*Camelus dromedarius*): 5000RAD and 15000RAD. Scientific Reports 8: 1982. doi: 10.1038/s41598-018-20223-5

Mapaco LP, Lacerda Z, Monjane IVA, Sussuro A, **Viljoen GJ**, **Cattoli G**, **Dundon WG**, Achá SJ. 2018. Molecular characterization of avipoxviruses circulating in Mozambique, 2016-2018. Archives of Virology. doi: 10.1007/s00705-018-3864-0

Salehi B, Motamedi-Sedeh F, Madadgar O, Khalili I, Ghalyan Chi Langroudi A, **Unger H, Wijewardana V**. 2018. Analysis of antigen conservation and inactivation of gamma-irradiated avian influenza virus subtype H9N2. doi: 10.1556/030.65.2018.025

Molini U, Aikukutu G, Khaiseb S, **Cattoli G, Dundon WG**. J Wildl Dis. 2018. Phylogenetic analysis of pigeon paramyxoviruses type-1 identified in mourning collared doves (Streptopelia decipiens) in Namibia, Africa. doi:10.7589/2017-10-246. [Epub ahead of print]

Dundon WG, Adombi CM, Kanu S, Loitsch A, **Cattoli G**, Diallo A. 2018. Complete genome sequence of a lineage II peste des petits ruminants virus from Sierra Leone. doi: 10.1128/genomeA. 01417-17

Chibssa TR, Grabherr R, Loitsch A, **Settypalli TBK**, Tuppurainen E, Nwankpa N, Tounkara K, Madani H, Omani A, Diop M, **Cattoli G**, Diallo A, **Lamien CE**. 2018. A gel-based PCR method to differentiate sheeppox virus field isolates from vaccine strains. Virology Journal 15:59. doi: 10.1186/s12985-018-0969-8

Chaudhry M, Rashid HB, Angot A, Thrusfield M, Bronsvoort BMD, Capua I, **Cattoli G**, Welburn SC, Eisler MC. 2018. Risk factors for avian influenza H9 infection of chickens in live bird retail stalls of Lahore district, Pakistan 2009-2010. doi: 10.1038/s41598-018-23895-1

Molini U, Aikukutu G, Khaiseb S, Haindongo N, Lilungwe A, **Cattoli G**, **Dundon W**, **Lamien C**. 2018. Molecular characterization of lumpy skin disease virus in Namibia, 2017. Archives of Virology. Doi: 10.1007/s00705-018-3891-x

Publications in Books

Babiuk S, Diallo A, **Lamien C**, Kitching, RP. 2018. Sheeppox and goatpox. In: JAW Coetzer, GR Thomson, NJ Maclachlan, M-L Penrith and A Michel (Eds), Infectious Diseases of Livestock. Anipedia, www.anipedia.org

VETLAB Network

The Veterinary Diagnostic Laboratory Network (VETLAB Network), coordinated by the Animal Production and Health Section (APH) and supported through IAEA and FAO programmatic activities as well as by South Africa through the African Renaissance Fund (ARF) and USA and Japan Peaceful Uses Initiative (PUI), consists of national veterinary diagnostic laboratories located in 44 African and 19 Asia and Pacific Member States.

In the first semester of 2018, the VETLAB network continued to help Member States to improve their national laboratory capacities to early detect and control transboundary animal and zoonotic diseases threatening livestock and public health through the provision of equipment, reagents and standard operating procedures.

In terms of capacity building and technology transfer, a staff member from the national veterinary laboratory in Ethiopia (NAHDIC – a VETLAB partner) is implementing a scientific program on animal Pox virus infections at the APHL in Seibersdorf and BOKU University in Vienna supported by VETLAB network funding. In addition, VETLAB support was provided to the partner laboratory in Ghana organizing a training course on avian influenza and Newcastle disease. In the last semester of 2018 APH will organize two VETLAB training courses (see section on Forthcoming events). Also, the Annual VETLAB Laboratory Directors Meeting will be held next August in Vienna, Austria. APH is issuing on a regular basis the VETLAB Network Bulletin in the hope of providing a forum for participating laboratories and other stakeholders to communicate and exchange knowledge/information, to showcase achievements and to share expertise within the VETLAB Network. The latest issue of the VETLAB Network bulletin can be found on pages 6 and 7 of this newsletter.

-

Impressum

Animal Production and Health Newsletter No. 68

The APH Newsletter is prepared twice per year by the Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture & Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, July 2018

18-03201