Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

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Contents

International Symposium on

Sustainable Animal Production and Health

more information on page 3

To Our Readers

Dear colleagues,

The focus of the Animal Production and Health Subprogramme activities is on enhancing food security by supporting sustainable livestock production systems in developing countries. This is to be achieved by strategic and applied research, technology transfer and capacity building. The three principal components of the subprogramme are animal nutrition, animal reproduction, breeding and genetics and animal health. Animal production and health problems are identified and solutions developed through the use of strategically applied isotopic, nuclear, nuclear-based and nuclear-derived tools, in conjunction with conventional technologies to:

- characterize and optimally utilize the nutritional value of locally available feed and feed resources to enhance energy conversion, whilst protecting the environment and minimizing greenhouse gas emissions;
- enhance animal reproduction and breeding through the introduction of artificial insemination, embryo transfer and productive breed selection, and the characterization of livestock genetic make-up to drive the integration of locally adapted animal breeds with trait selected exotic breeds to satisfy the increasing demand for more and better-quality animals and animal products;
- assess and reduce the risk of transboundary animal and zoonotic diseases to livestock and livestock owners through the implementation of early and rapid diagnosis and control technologies and their use in national and international control and eradication programmes.

The above activities are complemented by tools developed for computerized data management in disease diagnosis and animal production; use of geographic information systems in management of farm resources and diseases; and distance learning through information communication technologies in the related areas. The FAO/IAEA Veterinary Diagnostic Laboratory (VETLAB) Network is instrumental for the development, validation and dissemination of technologies, know-how and expertise worldwide. Please note the 'Sustainable Animal Production and Health' symposium that will take place from 22 to 26 June 2020 at the IAEA's Headquarters in Vienna, Austria.

Finally, I wish you and your families all the best in 2020.

Gerrit Viljoen
Head, Animal Production and Health Section

APH team at the APH Laboratory in Seibersdorf, Austria

International Symposium on Sustainable Animal Production and Health: Current Status and Way Forward 22 to 26 June 2020

Background

Systems of livestock production in developing countries are becoming progressively more intensified as producers and traders respond to increasing demands from consumers in urbanized societies for milk, meat, other livestock products and animals. This includes the challenges of increasing productivity without degrading feed and genetic resources, and of ensuring that diseases of a transboundary or zoonotic nature are early recognized and brought under control. Increasing demand can only be met through the selection of animals that produce more meat and milk and show disease resistance and heat tolerance; the optimal utilization of local resources that simultaneously protects animal biodiversity and the environment; and the protection of animals and their caretakers from diseases.

It is necessary to assess and manage the risks and the opportunities arising from intensification and to control emerging and re-emerging animal and zoonotic diseases to minimize adverse effects on farmers' livelihoods. In turn, this requires developing capacities to adapt and foster the application of the appropriate production and protection enhancing technologies, as well as sound and mutually supportive policies.

The symposium will draw on lessons learned and current best practices to provide a roadmap for the sustainable improvement of animal production whilst protecting the environment. The focus of the symposium will be on the contributions and impact of nuclear technologies and applications.

Objectives

The objectives of the symposium are to provide information and share knowledge on modern and novel technologies in animal production and health, and their application to support sustainable livestock production systems; identify capacity and research needs and address gaps and new opportunities for the effective transfer of nuclear and nuclear derived/related technologies; and build capacities for ameliorating or solving factors that are limiting livestock productivity and causing animal diseases.

Submission of Synopses

Each synopsis should have from one to maximum three printed A4 pages, in single space, including tables, figures and references. More than one synopsis per participant is allowed. All communications and papers must be sent in English.

The synopses must be prepared in MS Word or similar software and submitted through a competent national authority with Forms A and B.

Opportunities for exhibitors

Approximately 400 participants from FAO and IAEA Member States and invited organizations are expected to attend the symposium.

Exhibitors wishing to take advantage of this opportunity are encouraged to make a voluntary contribution in support of the symposium. The contribution will be used for the costs directly related to the organization of the symposium and to financially support scientists from developing countries.

Each exhibitor will have, free of charge, an exhibition space of 6m2 (3x2m) including one table (80x160cm) and 2 chairs. Alternatively, professional booths with walls can be rented from an outside company.

Please contact the event organizer for further details:

APHSymposium2020@iaea.org

Deadlines

31 January 2020: Submission of synopses (including Forms A and B*)

31 January 2020: Submission of grant application (Forms A and C*)

31 March 2020: Notification of acceptance of synopses

No deadline: Registration only (no paper submission, no grant request, Form A*)

* Through a competent national authority

More information: www.iaea.org/events/aphs2020

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

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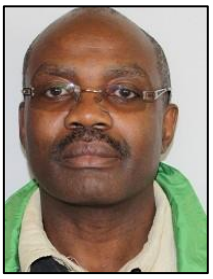
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Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

VETLAB Network Bulletin

01/2020

VETLAB is an initiative of the Joint FAO/IAEA Division

In this issue:

To the readers

2019 has been very challenging for the VETLAB Network. Several partners faced the emergence and spread in their countries of infectious diseases such as African Swine Fever, Foot-and-Mouth, Avian and Equine Influenza, Lumpy Skin Disease and Peste des Petits Ruminants.

In many instances, the preparedness demonstrated by partner laboratories and the network have successfully contributed to contain and control the diseases and facilitated the exchange of information and data. It indicated that the efforts taken by the network so far have been effective and we are on the right track, however we need to keep ourselves updated and prepared, make efforts to identify the gaps and seek further improvements.

During the past year, several events were organized by the network and the major activities of the past semester are briefly highlighted in this issue. More and exciting activities and events are waiting for us in 2020. Among those, the International Symposium on Sustainable Animal Production and Health will take place in Vienna on 22-26 June 2020.

At this event, you can share information and knowledge on modern and novel technologies in animal production and health and their applications to support sustainable livestock production systems. The symposium also aims to identify capacity and research needs, address gaps and identify new opportunities to improve or solve issues that are currently limiting livestock productivity. Please book the date and visit the webpage for more information (https://www.iaea.org/events/aphs2020). We look forward to your participation!

VETLAB Highlights

Foot-and-mouth disease (FMD) serotype O East Africa-3 in Morocco

At the beginning of 2019, FMD outbreaks occurred in Morocco. Serotype O East Africa-3- has been identified as the causative agent. The preliminary results were obtained by the Regional Laboratory for Analysis and Research of Casablanca (LRARC). The sequencing service organized by the VETLAB project enabled the laboratory to confirm the virus typing rapidly and accurately. Samples were submitted to the OIE Reference Laboratory for FMD (ANSES, Maisons Alfort, France) and results were confirmed.

Continuous support provided by the VETLAB network in Eastern Asia to combat the ASF epidemic

ASF emerged in China in August 2018; since then more than 100 million pigs have died or were culled to limit the spread of the infection. The economic impact on the pork industry worldwide and small-scale farmers is huge. The VETLAB Network continues its support to partners in the affected countries and assists at risk countries to strengthen preparedness by transferring protocols and reagents and by organizing training courses to make laboratory staff familiar with the disease and related diagnostic techniques.

VETLAB Network supports equine influenza surveillance in the aftermath of the severe epidemic in West and Central Africa

Severe respiratory disease and mortality have been reported this year in donkeys and horses in West and Central Africa. In some countries, cases were associated with equine influenza (EI) virus infection. The VETLAB network, in collaboration with the OIE Reference Laboratory for EI in Ireland has equipped selected laboratories (Morocco, Nigeria and Senegal) with reagents and reference material to conduct EI serological surveillance and post-vaccination monitoring.

ISO 17025 Accreditation of IRVT laboratories in Tunisia

As part of its efforts to strengthen the quality of the services, two laboratories of the Institut de Recherche Vétérinaire of Tunisia (IRVT) have received the ISO17025 accreditation certificate from TUNAC, the accreditation body in Tunisia: the laboratories are the Food Microbiology laboratory (LAD) in Tunis and the Biotoxins Laboratory of the Center for Veterinary Research (CVR) in Sfax.

01/2020

VETLAB Network Bulletin

VETLAB Capacity Building Initiatives

Training course on the Organization of Interlaboratory Comparisons of Diagnostic Tests for Transboundary Animal and Zoonotic Diseases

The training, supported by the Enhancing Research for Africa Network (ERFAN) and the VETLAB Network, will be organized at the Botswana National Veterinary Laboratory, Gaborone, from 20 to 24 April 2020. It is open to scientists from selected laboratories supported by the two networks

Training in Seibersdorf

Two VETLAB training courses will be organized in relation to the FAO/IAEA International Symposium. A prerequisite for application for these courses is an accepted abstract for the symposium.

- VETLAB Training Course for Veterinary Diagnostic Laboratory Network Partners on Transboundary Animal Diseases: Early Diagnosis and Pathogen Characterization. IAEA Seibersdorf Laboratories, Austria, from 15 to 26 June 2020.
- VETLAB Training Course for Veterinary Diagnostic Laboratory Network Partners on Sequencing and Bioinformatics. IAEA Seibersdorf Laboratories, Austria, from 22 June to 3 July 2020.

VETLAB Networking Activities

Support missions

Three VETLAB laboratories (in Indonesia, Lesotho, Vietnam) were visited by APHL staff during the last semester 2019. The visits aimed to promote and strengthen the VETLAB activities and network among the different laboratories as well as transferring novel protocols and technologies.

5th Coordination Meeting with Directors of Veterinary Laboratories of Africa and Asia

The coordination meeting will take place from 22 to 26 June 2019 in Vienna, Austria. The purpose of this meeting will be to review the achievements of the last year and formulate new work plans for the participants' respective laboratories. The meeting is organized in parallel with the FAO/IAEA International Symposium on Sustainable Animal Production and Health.

Highest number of laboratories participating in the 2019 interlaboratory trial for PPR

The VETLAB Network has organized the yearly interlaboratory comparison exercise to assess countries' diagnostic capacity for the accurate detection of PPR. In 2019, the participation was the highest ever recorded in VETLAB, with 35 laboratories conducting the exercise and submitting results, demonstrating the high interest and priority for this disease and the need of partners for interlaboratory trials.

The VETLAB Network Laboratories:

IThe ONSSA laboratories network, Morocco

The National Office of Food Safety (ONSSA) is a department under the supervision of the Ministry of Agriculture and Maritime Fisheries which exercises, on behalf of the State, the missions and powers relating to the protection of consumer health and the preservation of animal and plant health. In order to fulfil its mandate, ONSSA has a network of eight laboratories across the country.

The areas of competence of the ONSSA laboratories are animal health (Immuno-serology, Bacteriology, Parasitology, Molecular biology), food hygiene (Microbiology, Chemistry-Bromatology-Toxicology), phytopathology and quality control of seeds and plants, control of veterinary drugs and search for residues, analyses of livestock disinfectants and antibiotic resistance.

Since 2012, ONSSA has been undertaking a proactive approach to implement a quality system in the laboratories with the ultimate objective of their accreditation according to the requirements of ISO / IEC 17025. At present, seven laboratories have obtained the accreditation (two have been relocated and re-accreditation is planned).

Headquarters of the Office National de Sécurité Sanitaire des Produits Alimentaires in Morocco

Analysis of bacteriological plates in the microbiology laboratory (ONSSA, Morocco)

A laboratory network management strategy has been established for the period 2020-2024, including three key issues: a) improving laboratory management processes and systems; b) improving the analytical capacities; 3) exploitation of analytical data for the improvement of food safety. To strengthen the lab capacities in case of crisis events, two advanced analytical expertise units, one in chemistry (in Meknes) and another in molecular biology (in Casablanca), will be developed and strengthened soon.

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Forthcoming Events

Training Course on the Organization of Interlaboratory Comparisons of Diagnostic Tests for Transboundary Animal and Zoonotic Diseases

Charles Lamien and Giovanni Cattoli

The purpose of this training is to support veterinary laboratories in organizing and conducting interlaboratory comparisons to ensure the quality of test results and to sustain their quality systems and accreditation processes.

The Botswana National Veterinary Laboratory, Gaborone, Botswana, will host the training from 20 to 24 April 2020. The training is a joint activity of the Enhancing Research for Africa Network (ERFAN) and the Veterinary Diagnostic Laboratory (VETLAB) Network, coordinated by the Joint FAO/IAEA Division. It is open to scientists from selected laboratories supported by the two networks.

Technical Meeting on the Use of Laboratory Techniques to Support the Peste des Petits Ruminants Global Eradication Programme

Charles Lamien and Giovanni Cattoli

The main objective of this meeting is to identify and select laboratory tests that will contribute to the implementation of the Peste des Petits Ruminants (PPR) Global Eradication Programme. The meeting will also enable partners of the Veterinary Diagnostic Laboratory (VETLAB) Network to discuss PPR diagnostic gaps and collaborative research opportunities.

The meeting will be held at the IAEA Headquarters in Vienna, Austria, from 4 to 15 May 2020.

Training Course for Veterinary Diagnostic Laboratory Network Partners on Transboundary Animal Diseases: Early Diagnosis and Pathogen Characterization

Charles Lamien

The objective of this training is to strengthen the capacity of the Veterinary Diagnostic Laboratory (VETLAB) Network partner laboratories in selecting and applying suitable algorithms and nuclear-derived/molecular assays for the detection of major pathogens causing transboundary and zoonotic diseases. It will take place at the IAEA Laboratories, Seibersdorf, Austria, from 15 to 26 June 2020.

During the first week, the participants will receive practical training and lectures on the principle and applications of molecular assays for the detection of major transboundary diseases. During the second week, the participants will take part in the FAO/IAEA International Symposium on Sustainable Animal Production and Health. A prerequisite for application is an accepted abstract for the symposium.

Training Course for Veterinary Diagnostic Laboratory Network Partners on Sequencing and Bioinformatics

Charles Lamien and Giovanni Cattoli

The purpose of the training is to strengthen the capacity of the Veterinary Diagnostic Laboratory (VETLAB) Network partner laboratories in using conventional and new sequencing technologies and the relevant bioinformatic tools for the accurate identification of pathogens causing transboundary animal and zoonotic diseases. The training will take place at the IAEA Laboratories, Seibersdorf, Austria, from 22 June to 3 July 2020.

During the first week, the participants will take part in the FAO/IAEA International Symposium on Sustainable Animal Production and Health. During the second week, the participants will receive practical training in phylogenetic analysis and bioinformatics. A prerequisite for application is an accepted abstract for the symposium.

Coordination Meeting of the Veterinary Diagnostic Laboratory Network with Directors of African and Asian Veterinary Laboratories

Charles Lamien and Giovanni Cattoli

The purpose of the meeting is to update partners on the activities of the Veterinary Diagnostic Laboratory (VETLAB) Network and to discuss the main challenges and gaps in implementing animal and zoonotic diseases diagnosis. The meeting will be held in Seibersdorf, Austria, from 22 to 26 June 2020.

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

The is meeting will be held in parallel with the fifth research coordination meeting of the VETLAB coordinated research project (CRP) D32032 to allow interactions between the laboratory directors and the CRP experts and their critical assessment of the CRP progress. In addition, the participants will attend all presentations relevant to disease diagnosis and epidemiology during the FAO/IAEA International Symposium on Sustainable Animal Production and Health.

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

Ivancho Naletoski

The meeting, whose purpose is to review the serological and molecular standards produced for the priority diseases covered by the project, and, if necessary, to adjust the project work plan, will take place the IAEA Headquarters in Vienna, Austria, from 22 to 26 June 2020.

Participants will discuss the methodologies for verification of the produced quality control standards and the dissemination of the use of the multi-pathogen detection platforms, iVetNet support in sharing validated standard operational procedures and the sequencing service of APH among partner laboratories in the subprogramme.

A presentation with the project summary will be prepared for the International Symposium on Sustainable Animal Production and Health, to present the project achievements and future plans to the wider veterinary audience.

Second 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 meeting, whose purpose is to review the samples collected for analyzing avian influenza and other diseases transmitted by migratory birds, as well as the feather samples collected for determining birds' origin, will take place at the IAEA Headquarters in Vienna, Austria, from 22 to 26 June 2020.

Project partners will discuss the current achievements, as well as the future workplans. A presentation with the project summary will be prepared for the International Symposium on Sustainable Animal Production and Health, to demonstrate the participants the use of stable isotopes in tracing bird migrations and identifying pathways of long-range disease transmission through migratory birds.

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

Victor Tsuma and Mario Garcia

The meeting, whose purpose is to present the final research reports of individual and technical contract holders, to identify the most relevant achievements of the coordinated research project (CRP) and to discuss possible topics and opportunities for research that could be supported by a new CRP, will take place at the IAEA Headquarters in Vienna, Austria, from 22 to 26 June 2020.

First Research Coordination Meeting on Novel Animal Vaccine Formulations Enhancing Mucosal Immunity (D32035)

Hermann Unger and Viskam Wijewardana

This is a new coordinated research project (CRP) under the umbrella of improvement of diagnostic and vaccine tools for emerging and re-emerging animal health threats.

The aim of this CRP is to gather vaccine manufacturing institutions to work on novel mucosal formulations of vaccines which must be cost effective and can be produced with good thermostability. The applying institutions must have experience in vaccine formulation and have an experimental animal facility to prove the efficacy of the experimental vaccine. The target species are ruminants, pigs and poultry.

The meeting, whose purpose is to discuss and design workplans of individual institutions participating in the coordinated research project, will take place at the IAEA's Headquarters in Vienna, Austria, from 22 to 26 June 2020.

Read more about the scope of this CRP on page 32 of this edition.

Past Events

National Training Course on Strategies for Data Collection and Animal Sampling Related to Genetic Characterization of Livestock Breeds (PAP5003)

Kathiravan Periasamy

The domestic animal genetic resource (AnGR) represents a unique source to respond to the present and future needs of livestock production. The international community agreed to adopt Global, Regional and National Action Plans on AnGR to document, characterize and improve locally available livestock to foster food security. As part of Papua New Guinea's National Action Plan on Animal Genetic Resources and the IAEA technical cooperation project (PAP5003) "Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding – PHASE-II", a national training course was organized from 24 to 28 June 2019 at the Papua New Guinea University of Natural Resources and Environment (PNGUNRE), Kokopo, Papua New Guinea.

Training participants with the expert at Papua New Guinea University of Natural Resources and Environment, Kokopo, Papua New Guinea

Nineteen participants from Papua New Guinea attended the course. Dr. Ranjit Singh Kataria, from the National Bureau of Animal Genetic Resources, India, served as a key resource person for the training course. The course included lectures and practical hands-on training on strategies for phenotypic and genetic characterization of livestock, phenotype and biometry data collection on indigenous livestock breeds, genetic characterization of local livestock using nuclear-related molecular technologies, and animal sampling, extraction of DNA and sample quality control for molecular characterization of livestock breeds. The training is expected to help improve the national capacity on survey and characterization of indigenous livestock breeds in Papua New Guinea.

Regional Training Course on Genetics of Parasite Resistance in Sheep and Goats: Bioinformatics analysis of genomic data to assess population structure, genotype-phenotype association and genomic prediction (RLA5071)

Kathiravan Periasamy and Mario Garcia

Gastro-intestinal (GI) parasitic infection is a major constraint for sheep rearing in Latin America. The training course was targeted to support ongoing national efforts in the Latin American region to apply genetic and genomic technologies for breeding and improvement of sheep with enhanced host resistance against gastrointestinal parasites. The training course was held from 1 to 12 July 2019 at the Animal Production and Health Laboratory, Seibersdorf (APHL), Austria.

Nineteen participants from 10 countries (Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru and Uruguay) were provided with hands-on practical training on bioinformatics analysis of large sets of genomic data to assess population structure and genetic admixture, analysis and interpretation of genomic data for association with phenotypes related to parasite resistance, establishing gene bank of performance recorded animals, and application of genomics for breeding local sheep and goat with enhanced host resistance against parasites.

The objectives of the training course were successfully achieved and each of the participants was provided with a package of different software tools for analysis of genome-wide data in livestock. It is expected that the training will help the national breeding programs in Latin American countries towards controlling the gastrointestinal parasites in sheep.

Participants at IAEA Animal Production and Health Laboratory, Seibersdorf, Austria

Regional Training Course on Collection, Sorting, Storage and Identification of the Most Important Vectors for Vector Borne Diseases (RER5023)

Ivancho Naletoski

A regional training course on collection, sorting, storage and identification of the most important vectors for vector borne diseases was held in Ankara, Turkey, from 1 to 12 July 2019. Thirty-three participants from Albania, Armenia, Azerbaijan, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Georgia, Greece, Hungary, Kyrgyzstan, Latvia, Lithuania, Montenegro, North Macedonia, Poland, Portugal, Moldova, Romania, Russian Federation, Serbia, Slovakia and Uzbekistan were attending the course, as well as 13 local participants from different veterinary institutions in Turkey.

The course was comprised of practical exercises on vector capture and storage in the field (mosquitoes, culicoides, sand flies and ticks), and practical classes on vector identification in the host laboratory.

During the course, the standard operating procedures adapted under the RER5023 project were use and four teaching video materials were recorded in order to produce open access movies for the counterparts of the APH sub-programme.

Participants exercising collection of ticks (tick-dragging) in the field during the training course under the RER5023 project

National Training Course on Cattle Artificial Insemination in Zimbabwe (ZIM5024)

Victor Tsuma

The national training course was held in Bulawayo, Zimbabwe from 22 July to 2 August 2019 and was attended by 34 participants consisting of veterinarians, para-veterinarians, livestock field officers and veterinary students from the University of Zimbabwe. Dr. Paul Egesa, from the Kenya Animal Genetic Resource Centre (KAGRC), Nairobi, Kenya, was the expert trainer, providing guidance, material and skills to all trainees.

During the 10-day training course, lectures, practices, demonstrations and hands-on artificial insemination practice in cattle were conducted. The course content included overview of the bovine anatomy and reproductive physiology as it relates to artificial insemination (AI), manipulation of the oestrous cycle to optimize breeding, semen collection, processing and preservation, AI as a breeding tool; AI equipment, semen and liquid nitrogen handling; bovine AI step-by-step, Standard operating procedures for successful AI practice, and trouble-shooting causes of AI failure.

Dr. Egesa (in the centre in the foreground) conducting a hands-on training on cattle artificial insemination

National Training Course on Feed Analysis and Ration Formulation for Improved Dairy Cattle Productivity in Kenya (KEN5038)

Victor Tsuma

A 5-day national training course on dairy cattle feed analysis and ration formulation was held from 5 to 9 August 2019 at the Kenya Agricultural and Livestock Research Organization (KALRO), Beef Research Institute, Nakuru, Kenya. Twenty-nine participants attended the course.

Lectures, practices and demonstrations were used to strengthen the skills of the participants on livestock feed analysis (nutritive and anti-nutritive components), feed additives, livestock feed formulation and, feed preservation including hay and silage making. Feeding of different classes of livestock was also covered, in addition to on-farm exercises on sample collection for feed analysis, demonstration of best forage harvesting stages for feeding and/or preservation and discussion on storage of forages and concentrates.

The course was conducted by Prof. Jamel Rekhis, an expert from the Central Livestock Feed Analysis Laboratory, Soukra Ariana, Tunisia.

Dairy cattle ration formulation for improved productivity

Second Research Coordination Meeting on Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pastures Using Compound Specific Stable Isotopes

Mario Garcia

The meeting took place at the Centro de Energia Nuclear na Agricultura (CENA), part of the University of Sao Paulo (USP) in Piracicaba, Brazil from 12 to 16 August 2019. Six of eight research contract holders, two agreement holders and two technical contract holders attended the meeting.

Research contract holders presented progress on individual work plans based on technical specifications agreed during the first research coordination meeting. The results of sample analysis conducted at James Hutton Institute (UK) on the stable carbon isotope composition (d13C) of n-alkanes and the NIRS analysis done at the Walloon Agricultural Research Centre – WARC (Belgium) were presented and discussed. Dry matter intake observed in the field showed good similarities in most of the participating countries. Correlation and other statistical data need to be analyzed after all samples are analyzed. Pooled NIRS data from all analyzed trials showed an R correlation of 54%, which is still low for good global prediction.

A large field experiment was designed for the second phase of the project. A paddock containing pasture species representative of the region with enough biomass to allow pasture selection and expected milk yield will be selected in each country. Six cows or steers (similar breed or cross) or yaks will be used. N-alkane bungs will be dosed to the animals for 12 days, and faecal and plant samples collected at various intervals according to the designed protocol. All samples will be dried and split into three subsamples: 1) for n-alkane analysis and C13, 2) for NIRS analysis + wet chemistry (to be analyzed in the laboratories of the technical contract holders), and 3) for local wet chemistry and NIRS.

Participants of the meeting at CENA in Piracicaba, Brazil

National Training Course on Automated Sequencing and Genotyping for Animal Genetic Characterization (BKF5021)

Kathiravan Periasamy

Advanced molecular and genomic technologies play an important role in characterizing and improving locally available livestock and poultry for increased productivity. As part of Burkina Faso's National Action Plan on animal genetic resources and the IAEA technical cooperation project (BKF5021) "Improving Local Poultry Production Through Incorporation of Nutraceuticals in Feeds and Genetic Characterization", a National Training Course was organized from 19 to 30 August 2019 at Institut de l'Environnement et Recherches Agricoles (INERA-CREAF de Kamboinsé,), Ouagadougou, Burkina Faso.

Participants at Animal Genetics Unit, INERA-CREAF, Ouagaodougou, Burkina Faso

Fifteen participants from four countries (Burkina Faso, Niger, Senegal and Zimbabwe) attended the course. The participants were provided hands-on practical training on extraction and quantification of DNA from livestock, sample quality control, polymerase chain reaction of short tandem repeat and mitochondrial DNA markers, sequencing and genotyping techniques for animal genetic resource characterization, workflow of capillary electrophoresis based Sanger sequencing methodology, fragment length analysis and automated multiplex genotyping of microsatellite markers and good laboratory practice standards for a molecular genetic laboratory.

The objectives of the training course were achieved successfully, and the participants were provided with a manual of laboratory protocols for genotyping and DNA sequencing. The training is expected to improve the capacity in developing baseline genetic information and molecular characterization of local livestock biodiversity in the West African region.

Coordination Meeting with Directors of Veterinary Laboratories in Africa and Asia Supported by the African Renaissance Fund and the Peaceful Uses Initiative to Strengthen Animal Disease Diagnostic Capacities

Charles Lamien and Giovanni Cattoli

The meeting was held at IAEA Headquarters in Vienna, Austria from 19 to 23 August 2019.

Twenty-six directors of the Veterinary Diagnostic Laboratory (VETLAB) Network partner laboratories from Bangladesh, Botswana, Benin, Cameroon, Chad, Ethiopia, Indonesia, Jordan, Kenya, Lao, Malaysia, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Niger, Senegal, Thailand (2), Tanzania, Tunisia, Viet Nam, Uganda, and Zambia took part in the meeting.

Representatives of the FAO Animal Health Service, the Enhancing Research for Africa Network project (Italy), the OIE/FAO/EU reference laboratory for avian influenza and Newcastle disease, and the FAO Reference Centre for Rabies (Italy), were also present. The partners from Burkina Faso, Côte d'Ivoire, the Democratic Republic of the Congo, Ghana, Mali, and Zimbabwe could not attend the meeting.

The objectives of the meeting were to update partners on the activities in 2018-2019, update partners on important ongoing initiatives to support disease diagnosis and surveillance by veterinary laboratories in Africa and Asia (FAO, IAEA and reference laboratories), discuss ways to improve laboratory diagnostics for emerging transboundary animal and zoonotic diseases, discuss the work plan for the a new VETLAB project on peste des petits ruminants funded by Peaceful Uses Initiative , discuss the 2019-2020 common and individual country plans, discuss and refine the 2019-2020 work plan for the VETLAB coordinated research project (D32032), and allow experience, knowledge and information exchange among the Asian and African Laboratories.

The participants also discussed laboratory capacity building in Africa and Asia, the outbreaks of equine diseases in West and Central Africa, and the outbreaks of African swine fever in Asian countries.

The meeting participants recommended the Joint FAO/IAEA Division to:

- Continue the building capacity of VETLAB partner laboratories to improve the diagnosis and surveillance of priority and emerging diseases using validated tests that are fit-for-purpose
- Promote the implementation of quality systems through facilitation of proficiency testing, supply of controls and sharing of ISO 17025-compatible standard operating procedures, and additional support, integrated in the iVetnet information platform, including equipment monitoring and maintenance
- Promote gene-based identification of pathogens through facilitating the use of modern techniques such as multiplex assays, sequencing, next-generation sequencing, and the relevant bioinformatics

Meeting participants encouraged VETLAB partners to:

- Use multiplex technology for differential diagnosis
- Use the sequencing service facilitated through the Joint FAO/IAEA Division and make the data publicly available
- Undertake more inter-laboratory collaboration, including research work for assay validation
- Use the VETLAB bulletin as a platform to communicate their activities, achievements, share experience, and promote their activities.

Participants of 4th research coordination meeting of the VETLAB coordinated research project (D32032) with the directors of the Veterinary Diagnostic Laboratory (VETLAB) Network laboratories

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

Ivancho Naletoski

The meeting, whose purpose was to review the achievements and to fine-tune the project, took place at the IAEA Headquarters in Vienna, Austria, from 19 to 23 August 2019.

Eleven project partners from Cameroon, Croatia, Ethiopia, Ivory Coast, North Macedonia, Morocco, Sudan, Argentina, France, United Kingdom and Australia attended.

The priority topic for discussion was the progress of production of the secondary quality control standards for serological and molecular diagnostic techniques for African swine fever, avian influenza, brucellosis, lumpy skin disease / sheep and goat pox, Newcastle disease, peste des petits ruminants and rabies.

The progress of the dissemination of the sequencing service, iVetNet information platform and the adaptation of the validated standard operating procedures was also discussed. Summary of the activities performed under the project was prepared during the meeting and presented to the directors of the Veterinary Diagnostic Laboratory (VETLAB) Network laboratories, held parallel to the research coordination meeting.

National Training Course on Artificial Insemination and Pregnancy Diagnosis in Cattle (PAP5003)

Kathiravan Periasamy

Artificial insemination (AI) using frozen semen technology is an important means of multiplying superior germplasm for sustainable improvement of livestock productivity. Through the national Technical Cooperation project (PAP5003) "Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding – PHASE-II", IAEA provided technical support to the national AI programme in Papua New Guinea. Equipment and materials required for implementing AI in cattle under field conditions were supplied and a national training course was organized from 30 September to 11 October 2019 at the Papua New Guinea University of Natural Resources and Environment (PNGUNRE), Kokopo, Papua New Guinea.

Practice of rectal palpation and artificial insemination in a cow

Forty participants from Papua New Guinea attended the course. Dr. Alexander Ponweera Arachchige Basil Douglas from the University of Peradeniya, Sri Lanka, served as a key resource person for the training course. The course included lectures and practical hands on training on introduction to AI and frozen semen technology in cattle, hormonal manipulation of the oestrous cycle and oestrus synchronization for timed AI in cattle, selection of breeding bulls, collection and preservation of semen, handling liquid nitrogen, thawing semen, loading the AI gun and inseminating live cattle, and pregnancy diagnosis in cattle using rectal palpation. The training is expected to help the participants to improve their skills in performing AI and pregnancy diagnosis in cattle under field conditions.

National Training Course on Local Livestock Feed Analysis and Ration Formulation (TOG5001)

Victor Tsuma

The training workshop was conducted from 7 to 11 October 2019 at the University of Lome, Togo, bringing together 30 participants from different relevant Togolese organizations involved in the animal industry: University of Lome, Office National des Abattoirs et Frigorifique (ONAF) and Togolese Institut Togolais de Recherche Agronomie.

Participants of the training course in Lome, Togo

The course consisted of lectures, practices and demonstrations on nutrition physiology and nutrient requirements for ruminants, local feed resource mapping, identification, analysis and incorporation into feeding rations, standard operating procedures for effective livestock feed analysis and ration formulation, and demonstration of equipment for feed analysis.

The course was conducted by Professor Jamel Rekhis, an expert from the Central Livestock Feed Analysis Laboratory, Soukra Ariana, Tunisia.

Consultancy Meeting on Advances in Nuclear and Genomic Tools to Improve Livestock Productivity – Technology Gaps and New Approaches for Application in Developing Countries

Kathiravan Periasamy

The meeting was held at the IAEA Headquarters in Vienna, Austria, from 14 to 18 October 2019. The meeting was attended by eight expert consultants, nine FAO/IAEA staff/consultants and seven professionals/students/trainees. The participants hailed from 15 Member States.

The objective of the meeting was to review the current status of scientific information related to the use of genomic tools in animal genetics and breeding with a particular focus on developing countries, including smallholder, commercial and community-based breeding programs. The experts discussed the potential of nuclear related genomic technologies in increasing the efficiency, profitability and sustainability of livestock production and breeding programmes. The participants agreed that such new technologies will help livestock systems meet the goals of feeding the increasing global human population, improving the livelihood of smallholder families and reducing environmental impact by increasing production efficiency.

During the meeting, potential challenges were identified in applying genomic technologies to diverse husbandry systems, including smallholder systems. A detailed work plan, including technical procedures for implementation of a potential coordination research project (CRP) was prepared. Important suggestions were made on specific objectives to be set in different dairy animal species including cattle, buffalo and camel. The proposed CRP would help developing countries to implement advanced genomic technologies for improved milk productivity per animal.

The consultants also highlighted the need to build capacity and improve the expertise in bioinformatics analysis of data among scientists especially in developing countries and the growing role of international organizations in accomplishing this task.

Participants at the IAEA Headquarters in Vienna, Austria

Staff Development Course on the Application of Satellite Remote Sensing in Agriculture

Ivancho Naletoski

Under the umbrella of the FAO Staff Development Programme, a training course on the use of satellite remote sensing (SRS) in agriculture was organized from 28 to 31 October 2019 at the IAEA Headquarters in Vienna, Austria.

The course covered different aspects of the use of SRS, such as the monitoring of soil characteristics (soil types, moisture and humidity), calculating vegetation indexes, assessing quality of agriculture production and monitoring weather abnormalities; and incorporating these data in the risk modelling of vector borne diseases.

Discussions on the combined use of SRS and Unmanned Aerial Vehicles (UAVs) in monitoring animal movements and the potential integration (especially the use of multi-spectral cameras) of these technologies in national and regional disease control programmes were held. Thirteen technical officers of the Joint FAO/IAEA Division participated in the course.

The lecturers were experts from the National Aeronautics and Space Administration (NASA) of the USA.

Participants and lecturers at the staff development course on the use of satellite remote sensing in agriculture

National Training Course on Implementation of Bioinformatics Tools and Techniques for Breeding and Management of Argentinian Sheep (RLA5071)

Kathiravan Periasamy

Nuclear-related genomic technologies play an increasingly important role in the selection and breeding of livestock for increased productivity. Genomics also permit a range of applications that include paternity testing, estimation of inbreeding, assessing genetic admixture and identifying genes/variations that control traits related to adaptation (e.g. disease resistance). With increasing availability and access to large sets of genome-wide data on livestock, it is important to build capacities to analyze such datasets for application in practical animal breeding programmes. As part of the regional technical cooperation project RLA5071, "Decreasing the Parasite Infestation Rate of Sheep", a training course was organized from 11 to 15 November 2019 at Institute of Genetics, Centro Investigación en Ciencias Veterinarias y Agronómicas (CICVyA), Instituto Nacional de Tecnología Agropecuaria (INTA), in Buenos Aires, Argentina.

10 participants from Argentina attended the course. Dr. Mario Barbato from Università Cattolica del Sacro Cuore, Italy, served as a key resource person for the training course. The training consisted of specialized lectures and practical trainings on handling and managing large sets of genomic data on livestock – whole genome sequence to genotypes, imputation of genotypes, genome-wide association studies on parasite resistance in sheep, and evaluation of population structure, genetic admixture and selection signatures. The training is expected to help improve the national capacity in bioinformatics analysis of genome-wide data and application of genomic information in national animal breeding programmes in Argentina.

Training participants with the expert at Institute of Genetics, Instituto Nacional de Tecnología Agropecuaria (INTA), Buenos Aires, Argentina

Training Course on the Detection of Multiple Pathogens for the Differential Diagnosis and Syndromic Surveillance of Transboundary Animal Diseases

Charles Lamien and Giovanni Cattoli

This training aimed to strengthen the capacity of the Veterinary Diagnostic Laboratory (VETLAB) Network partner laboratories for the diagnosis and surveillance of African swine fever (ASF), peste des petits ruminants (PPR), and capripox (sheep pox, goat pox, and lumpy skin disease). Capripox, ASF and PPR have recently spread into new areas, expanding their geographical range to Europe and Asia. To establish suitable diagnostic methods, VETLAB partners must stay up-to-date on laboratory algorithms for differential diagnosis for each of these diseases.

The training involved lectures, hand-on training on laboratory techniques, and computer sessions on bioinformatics. The lectures presented general information on the diseases, their diagnosis and control strategies, the principle of the diagnostic methods, and a short introduction to bioinformatics. The hands-on training covered serological and molecular techniques, including multi-parametric detection and gene amplification for sequencing. The computer sessions examined the comparative sequence analysis and phylogenetic reconstructions. The first week covered PPR and capripox, and the second week entirely focused on ASF.

The trainers were experts from the French Agricultural Research Centre for International Development (CIRAD), the Universidad Complutense de Madrid and the Joint FAO/IAEA Division. Twenty-six staff of VETLAB laboratories in twenty-three African and Asian countries attended the training course, held from 4 to 15 November 2019, at the IAEA Laboratories in Seibersdorf, Austria.

The knowledge gained shall enable the respective laboratories to contribute better to their own national and regional control strategies for PPR, capripox and ASF. This training shall also promote networking among the participants.

Participants at the training course from 4 to 15 November 2019

Training Course on Transboundary Animal Disease Diagnoses: Validation, Implementation, Monitoring and Quality Control for Molecular Assays

Charles Lamien and Giovanni Cattoli

The purpose of this training was to strengthen laboratories' capacities in introducing, validating, and monitoring diagnostic assays for routine use.

Veterinary Diagnostic Laboratory (VETLAB) Network partners are committed to implementing a Quality Management System and accrediting diagnostic tests. Such accreditation increases the trust in the test results delivered by laboratories. It plays an essential role in removing technical barriers to international trade. Hence, the specific objectives of this training were to improve the participants' knowledge of the various steps of assay implementation and validation and to discuss diagnostic and epidemiological concepts of test validation and result interpretation.

The training comprised lectures and the principle and critical concepts of diagnostic assays development and validation and statistical methods. The participants also received practical hands-on training on assay optimization, validation, implementation and verification, and the relevant statistical approaches.

The trainers were international experts from the Australian Animal Health Laboratory, Sciensano (Belgium), the Friedrich-Loeffler-Institute (Germany), and the Joint FAO/IAEA Division.

Participants at the training course from 18 to 29 November 2019

Twenty-eight participants from VETLAB partner laboratories in twenty-five African and Asian countries attended this training course, held from 18 to 29 November 2019, at the IAEA Laboratories in Seibersdorf, Austria.

The gained knowledge shall foster their capacity to support the implementation and maintenance of Quality Management Systems and the accreditation of diagnostic tests in their respective laboratories.

Final Coordination Meeting of the Regional ARCAL Technical Cooperation Project on Decreasing the Parasite Infestation Rate of Sheep (RLA5071)

Mario Garcia Podesta

The meeting was held from 2 to 6 December 2019 in Buenos Aires, Argentina, at the Instituto Nacional de Tecnología Agropecuaria. Ten national coordinators of the 12 participating countries (Argentina, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Peru, Paraguay, Uruguay and Venezuela), five observers and two IAEA staff members attended the meeting.

Gastrointestinal parasitic infestations impose severe constraints on sheep production in all Latin American countries, especially in low input production systems. These parasites inflict heavy financial losses, including body weight loss of animals, direct costs of anthelminthic drugs, and animal mortality. Parasite resistance to anthelminthic drugs is common in the region and has further complicated the management of parasitic diseases in small ruminants.

The main purpose of the project was to decrease infestation rate of sheep in the region by identifying animals resistant to helminth infections and using them in breeding programmes. Experts from Uruguay and Argentina shared their knowledge in selecting resistant males and females through protocols based on parasite egg counting, haematocrit values and FAMACHA score coupled with DNA technology. Research results from the coordinated research project (D31026) on "Genetic Variation on the Control of Resistance to Infectious Diseases in Small Ruminants for Improving Animal Productivity" provided the technical input to the project.

The project launched a process to implement technologies and good management practices in sheep farms and for identifying and selecting animals that resist gastrointestinal parasites and are best adapted to the local environment. The use of more resistant animals as parents is resulting in the formation of flocks with greater resistance.

Participants of the final coordination meeting of RLA5071 in Argentina

Recording productive data and obtaining genotypic data were initiated in some countries and expanded in others, in some cases with generation of genetic merit estimators for males and females according to their level of parasite resistance. Techniques and procedures were incorporated into local laboratories during the development of research for phenotypic and genotypic selection of animals resistant to gastrointestinal parasites. The foundations have been laid to employ the use of selected animals in genetic improvement programmes in each country. This requires sustainability actions that facilitate producers' access to animals, increase diversity and achieve genetic advances that are cumulative within the flock. Assisted reproduction biotechnologies will be very useful for this purpose.

In conclusion, the four-year project showed that the infestation rate decreases in the medium term with the use of breeding animals resistant to gastrointestinal parasitism under conditions of commercial sheep flocks.

Stories

Uganda's Veterinary Service Excels through its Reinforced Provincial Laboratory Network

The challenge

The high prevalence of animal diseases greatly affects trade in livestock and livestock products. Diseases such as foot and mouth disease (FMD), avian influenza (AI), contagious bovine pleuropneumonia (CBPP), African swine fever (ASF), peste des petits ruminants (PPR) and brucellosis affect livestock. Without diagnostic tools, investigation and surveillance are delayed, leading to more affected animals. These shortcomings are often further linked to insufficient human capacity and skills to carry out the correct tests and to produce timely and reliable results. Uganda not only faces all of these common obstacles, but is also challenged by resistance of ticks to acaricides, a problem attributed to lack of professional advice during charging of cattle dips and incorrect concentrations in spray applications. Moreover, communication on outbreaks and procedures for sample collection, packaging and shipment are frequently substandard. In the past, many of the samples submitted to the Central Veterinary Laboratory for analysis had to be rejected for poor quality, improper packaging or lack of information.

The gap analysis

The National Animal Disease Diagnostics and Epidemiology Centre (NADDEC) laboratories had already received major assistance from the IAEA from 2010 to 2015 to upgrade their technology base and operations. However, the regional veterinary services were submitting reduced numbers of samples. Based on an FAO consultant report in 2016 covering six provincial veterinary laboratories, the major shortcomings were analyzed. Lack of reagents, non-functional cooling and freezing capacity, frequent power cuts, limited number of computers and printers, old laboratory equipment and a severe shortage of trained staff were the most limiting factors found.

The improvement

The full implementation of the project took 4 years. The provincial governments invested heavily in renovations and additional staff were recruited. The equipment provided by the IAEA was installed and tested and modern diagnostic techniques were introduced and adapted to the local conditions. All of these interventions took time, but it was a fruitful learning experience.

Among the equipment received were 12v DC power-based fridge/freezers, incubators, centrifuges, water purification system, ELISA readers, microscope and computers. Moreover, four national training courses on sampling, serology and bacteriology were carried out for NADDEC and technical staff of the regional veterinary laboratories. The courses, in some cases supported by IAEA experts, were held in Entebbe, where where all the new equipment was set up and training on the new techniques were carried out. Besides, individual training was arranged for key personnel covering PCR protocols, advanced bacteriology, antibiotic resistance analysis and dip testing were arranged. A transport service was arranged to deliver an ice box with all required reagents to each lab every 4-6 weeks and to transport samples back to the Central Veterinary Laboratory during the return trip.

Technical personnel during a training course on bacteriology laboratory techniques

The impact and/achievements

Since early 2018, most laboratories have been equipped and operational. The national laboratory network has enhanced capacity for animal diseases diagnostics to the extent that the number of samples tested at the national referral laboratory has increased from 30,000 to more than 65,000 per year. The nine regional and satellite laboratories set up by the Ministry of Agriculture with financial and technical support from the IAEA have greatly raised awareness

amongst livestock farmers. Only in 2018, 42,000 samples were tested with minimal referrals to the Central Veterinary Laboratory. Moreover, the new high-performance liquid chromatography (HPLC) equipment in Entebbe has allowed to increase the evaluation of acaricide potency and the testing of dip samples from the original 200 samples to more than 800 per month.

Before the inception of project, the high prevalence of animal diseases such as FMD, CBPP, ASF, AI, brucellosis, Rift Valley Fever and mastitis, as well as antibiotic resistance and tick resistance to acaricides were hampering trade of livestock and livestock products. However, this is no longer the case as the quality of samples submitted to the laboratory has improved, rapid and reliable laboratory tests are performed, and results are correct and trusted. As a consequence, these improvements have enhanced trade both within and across borders.

Training both at national and regional level has largely improved the knowledge and skills of the laboratory staff, samples no longer need to be sent abroad for confirmation of results and local laboratory performance in proficiency tests and inter laboratory comparisons have improved.

The current situation

A questionnaire sent out to the provincial labs in 2019 produced good feedback. The Central Veterinary Laboratory was previously overloaded with samples arriving from all over the country and had difficulty coping with the analysis and reporting prior to the refurbishment of the regional laboratories and training of the technical personnel took place. Currently, the nine provincial laboratories are carrying out most of the testing and only special samples, for instance for HPLC analysis or molecular testing, are sent to Entebbe. Furthermore, and more importantly, farmers awareness about the availability and efficiency of veterinary services has increased. Unfortunately, the Department of Animal Health of the Ministry of Agriculture, Animal Industry and Fisheries does not have the capacity to sustain the continuous support required by the veterinary services without external assistance.

However, the farmers organizations through their umbrella organizations such as the “National Agricultural Advisory System” and “Operation Wealth Creation” have shown their appreciation for the services rendered by the diagnostics division, both at national and regional level, by rewarding each laboratory worker with an in-calf heifer. They lauded the expansion of diagnostic services and that diagnosis is now in real-time and more accurate. Additionally, more and more cattle traders embrace the system of testing animals for infectious diseases prior to shipment to their new destinations.

Capacity Building Improvement of the Central Veterinary Laboratory in Mozambique through the Veterinary Diagnostic Laboratory (VETLAB) Network

The Veterinary Diagnostic Laboratory (VETLAB) Network supported the Central Veterinary Laboratory (CVL) in Mozambique to set-up a fully functional molecular PCR laboratory for the early and rapid diagnosis of transboundary animal and zoonotic diseases. This included support missions, training of scientists and fellows trainings, equipment, consumables and reagents.

This has created serological and molecular diagnostic capacity, by ELISA, PCR, real time PCR and sequencing, for several diseases of economic importance, such as African swine fever (ASF), lumpy skin disease (LSD), Rift Valley fever (RVF), brucellosis, contagious bovine pleuropneumonia (CBPP) and peste des petits ruminants.

From a very basic laboratory CVL has evolved to a modern laboratory, which is able to undertake both routine activity and research, as testified by the five peer-reviewed papers in international journals, including three in collaboration with the IAEA Animal Production and Health Laboratory.

CVL also trains local scientists, hosting students of the Eduardo Mondlane University for their practical course work, using the nuclear and nuclear-related molecular and immunological technological platform for the early and rapid diagnosis of animal diseases.

The capacity of the diagnostic laboratory is now well over 10,000 samples per year. The diagnostic work of the CVL is improving the livelihoods of many communities through the rapid identification and prevention of the most important and strategic animal diseases and zoonoses. One of the many examples is the intervention on FMD outbreaks. The timely detection by ELISA of FMD antibodies in the sera of affected animals helps to control the spread of the disease to other animals and to other areas and had eliminated the need to samples abroad for testing.

Equipment being installed in the Central Veterinary Laboratory

Radiation in Veterinary Medicine

The use of radiation in veterinary medicine is increasing worldwide. The IAEA provides guidance to veterinarians on how to use nuclear techniques safely.

Click here to watch the video

To Fight Fatal Animal Disease, Vets in Asia Turn to Nuclear Technology

Veterinarians are joining forces in the fight against the African swine fever (ASF), an animal disease that has recently hit seven countries in Asia with devastating effects on the pig market in a region where pork is a major source of food. Nuclear and nuclear-derived techniques are central to combatting the spread of the disease, rapidly and accurately detecting the virus before more animals are affected. The IAEA, in partnership with FAO, is supporting national laboratories in their diagnostic efforts with equipment, expertise, advice and training.

"The disease is difficult to control in Viet Nam. The outbreak has spread to 62 of our 63 provinces," said Bac Van Ngo, Director of the Department of Animal Health at Viet Nam's National Center for Veterinary Diagnosis. (Editor note: ASF has since spread to all 63 provinces.) "We need to control it if we are to protect our livestock industry."

Click here to read more

Irradiated Animal Vaccines Keep Ethiopia's Animals Healthy, Helping Exports and Food Security

Ethiopia exports over a million cattle per year, and none of this would be possible without nuclear techniques. To prevent epidemics, all the livestock destined for export, as well as domestic consumption, need to be vaccinated against animal diseases such as foot and mouth disease, Sheep and goat pox, Peste des petits ruminants, lumpy skin disease, contagious caprine pleuropneumonia and others. The vaccines are developed and produced at the National Veterinary Institute in central Ethiopia. The IAEA, in cooperation with FAO, supports both aspects of this work: vaccines are developed to fight evolving pathogens and then produced for use both domestically and in neighbouring countries.

"Livestock exports are vital to our economy and the contribution of NVI to the livestock sector is immeasurable," said Wondemagegn Tufa, a Director at the country's Ministry of Agriculture in charge of ensuring seamless export procedures for cattle. The ministry buys vaccines from NVI and then distributes them among farmers, including pastoralists in the eastern part of the country, whose animals are most exposed to disease because they roam across a large area and mingle with wild animals.

Click here to read more

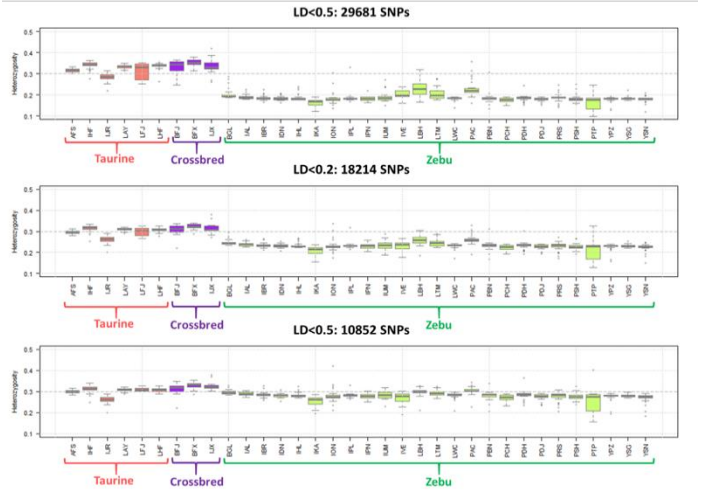
Research Activities of the Animal Production and Health Laboratory

Animal Genetics

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

Validation of a bovine array for genome-wide typing of Asian zebu and crossbred cattle

Improvement of zebu cattle for increased milk production occurs mainly through crossbreeding with highly selected commercial taurine cattle. However, in the absence of pedigree records under small holder production systems, it has been extremely difficult to determine the optimal taurine inheritance in crossbred cattle. With recent advances in molecular technologies, it is now possible to estimate taurine-zebu admixture levels in crossbreds by using genome-wide DNA marker data. At the Animal Production and Health Laboratory (APHL), commercially available 50K bovine SNP (single nucleotide polymorphism) arrays from Affymetrix (Axiom Ovicap Array) were tested for their suitability to evaluate zebu cattle and their crossbreds. More than 1000 zebu, taurine and crossbred cattle belonging to 34 different populations were included for testing and validation. Variability at genome-wide markers revealed significant ascertainment bias in zebu cattle. To reduce the effect of ascertainment bias, a methodology was devised to remove markers that are in linkage disequilibrium (LD) and identify those markers that pre-date zebu-taurine divergence. When the data was pruned for LD, the effect of ascertainment bias diminished linearly with the decreasing LD threshold (see graphic below).



Heterozygosity of markers after pruning for different LD thresholds

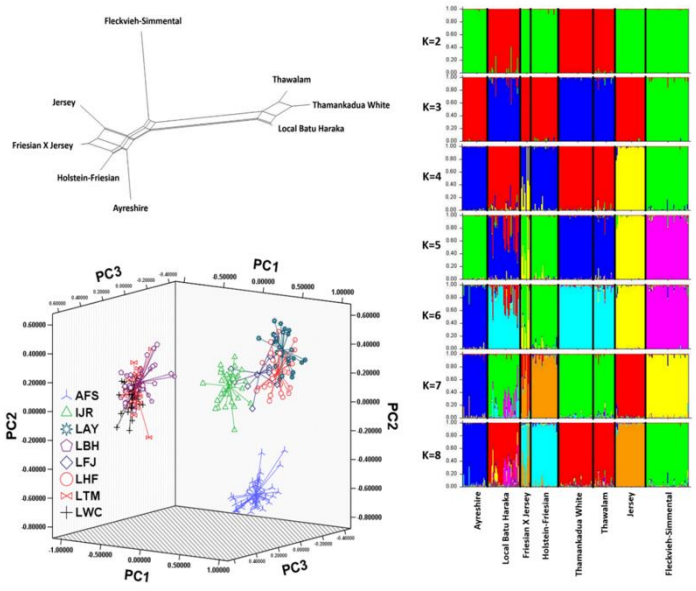
With LD<0.1, more than 10000 markers were found to be efficient and free of ascertainment bias in Asian zebu cattle. These markers can be safely used by member states for genomic evaluation of zebu cattle and estimation of the level of taurine inheritance in crossbred cattle.

Implementing Global Action Plan on Animal Genetic Resources

In continuation of Joint FAO/IAEA efforts towards implementing Global Action Plan on Animal Genetic Resources, APHL supported member states in at least three major strategic priority areas: characterization, sustainable use and development and capacity building.

Molecular genetic characterization of Sri Lankan native cattle breeds

Technical support was provided to Sri Lanka to perform the first-ever genetic characterization of indigenous cattle breeds in the country. Three indigenous cattle breeds (Sri Lankan White cattle, Local Batu Haraka and Thawalam cattle) were evaluated and compared with five commercial taurine cattle breeds (Holstein-Friesian, Ayrshire, Jersey, Fleckvieh-Simmental and Friesian x Jersey crossbred) to understand population structure and levels of genetic admixture. Substantial genetic diversity was observed in Sri Lankan native cattle breeds. Between breed differences varied from 1.5 to 2.7% indicating low genetic differentiation among them.



Genetic relationship, population structure and genetic admixture in Sri Lankan native cattle breeds

The level of taurine admixture in Sri Lankan cattle was minimal, indicating the farmers are maintaining high level of purity in these animals. Among the three breeds evaluated, Thamankadua White cattle had small traces of taurine admixture, while Local Batu Haraka cattle showed admixtures that differed from that of taurine ancestry. This could probably be due to introduction of dairy type Indian zebu cattle breeds (e.g. Sahiwal, Red Sindhi, etc.) in the

region, which needs further confirmation by comparison with relevant genotypes. To further understand genomic regions of functional significance for production and adaptability traits, more than 15 million genomic data points (single nucleotide polymorphic data) were generated. The bioinformatic analysis of genomic data on Sri Lankan cattle is currently underway. The baseline genetic information database and genomic evaluation report will play an important role in establishing a reference population for phenotype-genotype association studies and future implementation of genomic selection programmes for increased productivity in Sri Lankan cattle.

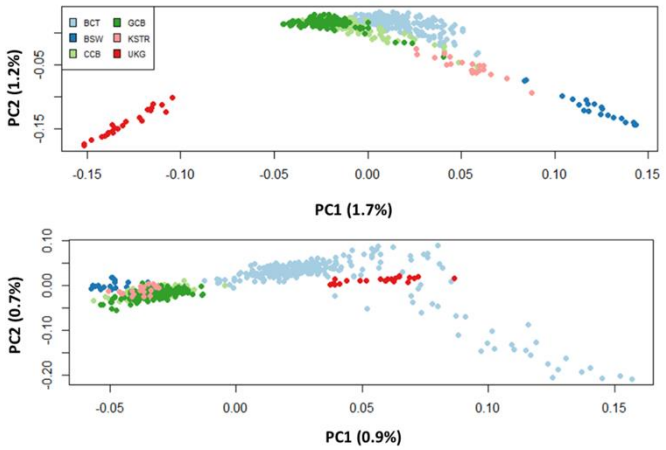
Development of baseline genetic information in Pakistani cattle

APHL supported genetic characterization and establishment of baseline genetic information on native cattle breeds of Pakistan. Nine indigenous cattle populations (Achai, Bhagnari, Cholistani, Dhani, Dajal, Red Sindhi, Sahiwal, Tharparkar and Local non-descript) were evaluated using nuclear and extra-nuclear DNA markers. A total of 325 samples from nine breeds were subjected to sequencing of mitochondrial DNA control region and multi locus genotyping of short tandem repeat markers. Additionally, all the samples were subjected to genome-wide typing of >50000 single nucleotide polymorphic markers to understand functional variations related to adaptability of local cattle. The data analysis is currently underway, and the results of molecular characterization will help to establish genetic admixture levels, population structure and demographic dynamics of Pakistani cattle. The genetic biodiversity information will be utilized in formulating effective strategies for the conservation and genetic improvement of Pakistani native cattle.

Genomic evaluation of Caucasian and Carpathian Brown cattle from Eastern Europe:

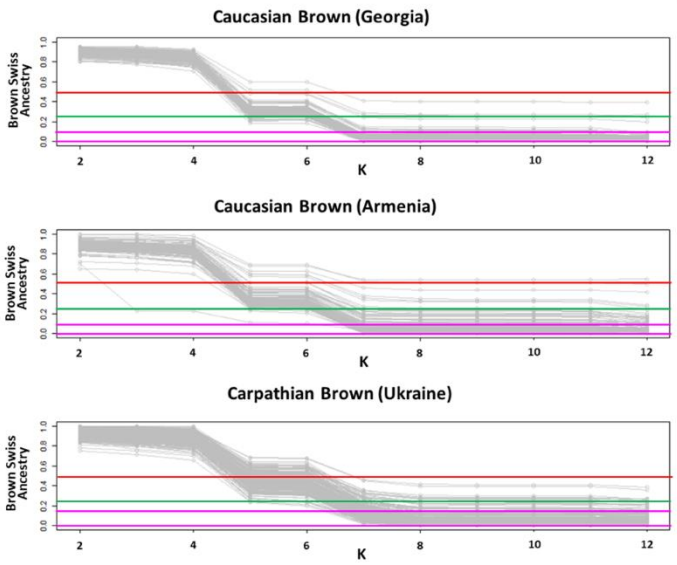
Under the FAO technical cooperation program RER3604 "Conservation of dual-purpose cattle in Eastern Europe in Armenia, Georgia and Ukraine", APHL provided technical support and services to implement "Genomic analysis of Caucasian and Carpathian Brown cattle". The objective of the work was to make genomics-enabled decisions on whether to manage Caucasian and Carpathian Brown cattle populations as a single genetic entity for conservation and breeding purposes. Further, genomic derived information on levels of exotic inheritance (e.g. Brown Swiss, Holstein-Friesian, Fleckvieh-Simmental) in Caucasian/Carpathian Brown cattle is expected to help formulate effective breeding strategies for developing a dual-purpose breed for increased milk and beef productivity. Under this project, APHL developed and supplied appropriate tool kits for sampling cattle in all the three member states. More than 500 hair samples were processed at APHL to extract DNA and perform state of the art genotyping for genomic evaluation. Caucasian Brown cattle from Armenia (CCB) and Georgia (GCB) and Carpathian Brown cattle from Ukraine (BCT) were compared with Brown Swiss (BSW), Holstein (HOL), Fleckvieh-Simmental (FLV), Jersey (JER), Ayrshire (AYR & FAY), Kostroma (KSTR) and Ukrainian Grey (UKG) cattle.

Genetic diversity was observed to be moderately high (0.338-0.354) among Caucasian and Carpathian Brown cattle breeds with low levels of inbreeding (1-4%). Estimates of effective population size were observed to be relatively higher (as compared to commercial European cattle) indicating possible absence of selection among breedable males and potentially very limited usage of artificial insemination technology.



Genetic relationship between Caucasian Brown (Armenia and Georgia) and Carpathian Brown cattle (Ukraine)

All three cattle populations are closely related with low genetic differentiation among them. However, BCT was found to be genetically distinct from both CCB and GCB. Population structure analysis also revealed that BCT have a distinct ancestry from Caucasian Brown cattle (K=8 onwards). Very limited BSW introgression was observed in Caucasian and Carpathian Brown cattle. This finding was very different from that of Kostroma cattle (used to develop Caucasian and Carpathian Brown cattle during Soviet times) that showed 50%-62.5% BSW inheritance. More than 90% of cattle from these three populations had less than 25% of BSW inheritance. Most CCB and GCB cattle had BSW inheritance ranging between 5-10% while it was slightly larger in BCT cattle (5-15%). Brown Swiss inheritance observed in CCB, GCB and CBT cattle might have been derived from Kostroma cattle rather than from grading up with BSW bulls. Genome-wide evaluation clearly showed BCT cattle must be treated as a genetically distinct entity for conservation and breeding purposes. Further, the data also indicated that crossbreeding has not reached all the regions of the three countries, with little evidence of usage of BSW bulls for genetic improvement. The results of genomic evaluation and the information generated will be utilized to improve the efficiency of conservation and genetic improvement programmes targeted for development of dual-purpose CCB, GCB and BCT.



Extent of Brown Swiss introgression in Caucasian Brown and Carpathian Brown cattle of Armenia, Georgia and Ukraine

Capacity Building

Strengthening laboratory infrastructure

APHL continued its efforts to improve the laboratory capacity of member states and enable implementation of advanced DNA based technologies for efficient management of locally available animal genetic resources. Institutional and technical support were provided to nine countries (Burkina Faso, Dominican Republic, Eritrea, Indonesia, Mexico, Pakistan, Papua New Guinea, Paraguay and Sri Lanka) for establishing/strengthening molecular genetic laboratories through provision of necessary equipment and laboratory supplies under the framework of national and regional technical cooperation projects. APHL provided technical support in setting up a new sequencing facility at Unite de Genetique Animale, Institut de l'Environnement et de Recherches Agricoles, Centre de recherches environnementales et de Formation (INERA-CREAF), Ouagadougou, Burkina Faso. This new facility has attracted the attention of neighboring West African countries and is playing an active role in providing training on application of DNA marker technology for characterization and improvement of local livestock breeds.

Regional Training Course on "Genetics of Parasite Resistance in Sheep and Goats: Bioinformatics analysis of genomic data to assess population structure, genotype-phenotype association and genomic prediction" from 1 to 12 July 2019 at the APHL in Seibersdorf, Austria. 19 participants from 10 countries attended the course.

National Training Course on "Automated sequencing and genotyping for animal genetic characterization" from 19 to 30 August 2019 at Institut de l'Environnement et Recherches Agricoles (INERA-CREAF de Kamboinsé,), Ouagadougou, Burkina Faso. 15 participants from 3 countries attended the course.

National Training Course on "Strategies for Data Collection and Animal Sampling related to Genetic Characterization of Livestock Breeds" from 24 to 28 June 2019 at Papua New Guinea University of Natural Resources and Environment (PNGUNRE), Kokopo, Papua New Guinea. 19 participants from Papua New Guinea attended the course.

National Training Course on "Artificial Insemination and Pregnancy Diagnosis in Cattle" from 30 September to 11 October 2019 at Papua New Guinea University of Natural Resources and Environment (PNGUNRE), Kokopo, Papua New Guinea. 40 participants from Papua New Guinea attended the course.

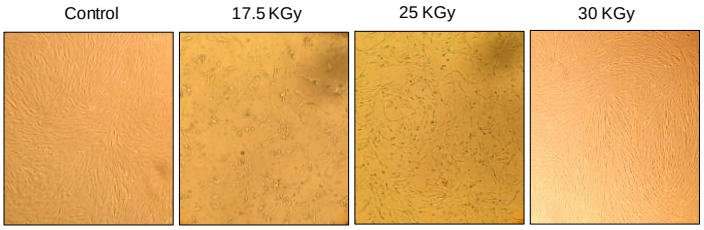
National Training Course on "Implementation of bioinformatics tools and techniques for breeding and management of Argentinian sheep" from 11 to 15 November 2019 at Institute of Genetics, Centro Investigación en Ciencias Veterinarias y Agronómicas (CICVyA), Instituto Nacional de Tecnología Agropecuaria (INTA), Buenos Aires, Argentina. 10 participants from Argentina attended the course.

Animal Health

Determining Irradiation Doses for Inactivation of Pathogen when Used as Vaccine Candidates

Irradiated pathogens have been explored as vaccine candidates since 1950s. However, only very few vaccines have been developed to market level using this technology. One of the main drawbacks in using irradiation to develop vaccines was the lack of proper understanding of the dose of irradiation that is needed to inactivate pathogens while preserving their antigenicity. The inactivation of pathogens, especially viruses, by gamma irradiation is achieved through two different mechanisms: 1) a direct effect on the genetic material of the virus by cleavage or cross linking and to a lesser extent on the viral proteins and envelope; 2) an indirect effect by the free radicals generated during the radiation process on the viral nucleic acids as well as proteins. For an ideal irradiated vaccine antigen, the requirement would be damage of genetic material and the preservation of protein and envelope as much as possible. The introduction of novel irradiators which can deliver precise doses and better understanding of immunology have paved the way to develop protocols to achieve such vaccine antigens. Current research done at APHL is focusing on determining irradiation doses and various formulations for vaccine development. The currently targeted pathogens include viruses such as avian influenza and lumpy skin disease (LSD). Experiments conducted have established that the minimum effective dose for inactivation of low-pathogenic H9N2 avian influenza virus is 60 kGy. At this dose, there is no residual infectivity following sequential

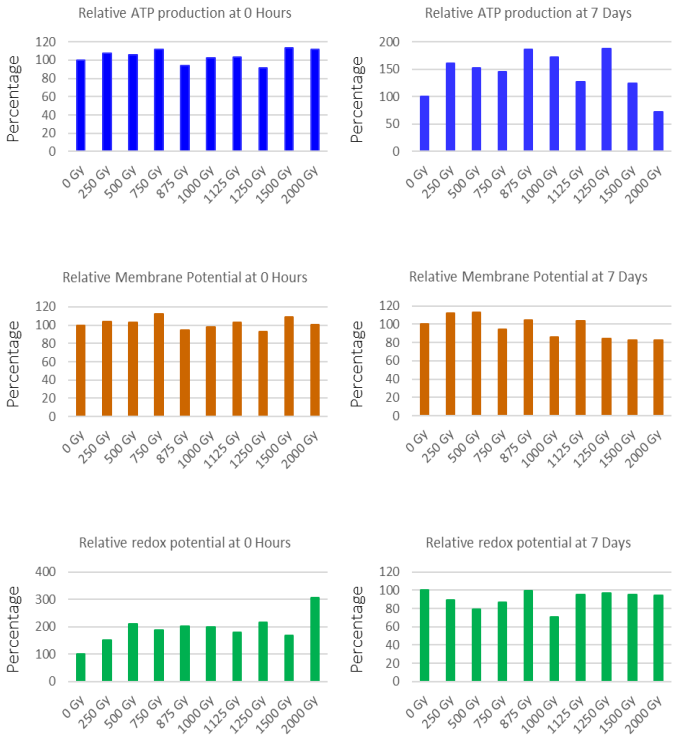
passaging the irradiated H9N2 virus in embryonated eggs, a very stringent assay. For LSD virus, the minimum effective dose for inactivation was established at 30 kGy. Inactivation was confirmed after three sequential passages in an ESH-L cell line (image below). As a standard procedure, APHL is using Trehalose during irradiation which is conducted under frozen conditions.



LSD virus inactivation following irradiation. *LSD virus was irradiated with various doses under frozen conditions with 25% Trehalose. The EHS-L cells were then infected with the irradiated virus solutions. Data shows images of the EHS-L cell cultures: control (without the addition of virus) or added with virus irradiated at 17.5 KGy, 25 KGy or 30 KGy*

Irradiation of Bacteria can Completely Inhibit the Replication but Preserve Metabolic Activity

Generating metabolically active-replication incompetent bacteria could be a very attractive approach as vaccine antigens, vaccine adjuvants and as immunostimulants in general to reduce the use of anti-microbials. Several recent reports suggest that low-dose irradiation can produce metabolically active-replication incompetent bacteria. Bacteria generated through irradiation potentially preserve their structural antigens and functional proteins as well as inducing immune responses in the host. The current irradiated vaccine IAEA coordinated research has three projects on developing irradiated bacteria as vaccine candidates: *Brucella, Salmonella and Pasteurella*. In addition, APHL is working on irradiated *E. coli* as a vaccine candidate in collaboration with the Veterinary Medical University of Vienna and irradiated *Lactobacilli* as vaccine adjuvants and immune modulators in collaboration with the BOKU University of Vienna. One of the key measures on the effect of irradiation is to evaluate the metabolic activity of irradiated bacteria to ensure replication incompetent bacteria still retain functional capacities to induce better immunity. In this regard, experiments were conducted to assess the metabolic activity of irradiated bacteria and develop standard operating procedures. In these experiments, *E. coli* was exposed to increasing gamma-irradiation doses and replicative capacity was determined by bacteriological cultures. Complete inhibition of replication was determined when no *E. coli* colonies appeared after overnight resuscitation in broth culture after irradiation at a dose over 1000 Gy. Irradiated bacteria were assayed for the metabolic activity immediately after irradiation and at Day 7. Three assays were applied to evaluate the metabolic activity: 1.) Resazurin (Alamar blue) based redox potential assay, 2.) ATP bioluminescence assay and 3.) Assay for membrane integrity using a fluorescent based live/dead dye. Results suggest that metabolic activity was preserved in irradiated *E. coli* even when replication was inhibited (over 1000 Gy) and remained up to seven days post-irradiation (image below). More interestingly, it is clear from our results that metabolic activity is even higher (immediately after irradiation) in the bacteria when their replication is inhibited (over 1000 Gy). This may be due to response by bacterial cells that are undergoing programmed cell death (PCD) due to irradiation. Therefore, such replication-incompetent irradiated bacteria could be better candidates as vaccine antigens and immune modulators since they not only provide the structural components but also some of the functional factors needed to induce a broader and stronger immunity. Current experiments are directed at exploring the longevity of preservation of metabolic activity in irradiated bacteria and the best window for replication inhibition and preservation of metabolic activity over the storage time.



Metabolic activity of irradiated E. coli immediately after irradiation and following refrigeration at 4°C*. Relative metabolic activity of E. coli irradiated with various doses as a percentage against non-irradiated (0 Gy) bacteria immediately after (left panels) or 7 days after (right panels) following refrigeration.*

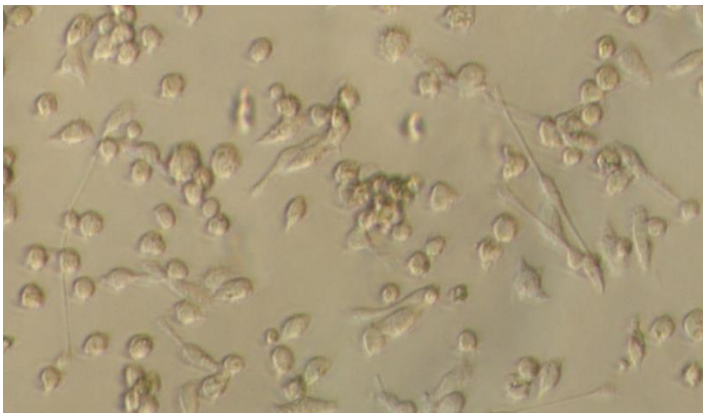
Generation of Swine Monocyte-Derived Dendritic Cells in Vitro for Studying the Interaction with Pathogens and Vaccine Efficacy

Several viral infections of swine are responsible for major economic losses and represent a threat to the swine industry worldwide, with African swine fever (ASF) virus currently causing an epidemic in East Asia. A better understanding of porcine immune responses to vaccines is needed to develop better tools to control viral diseases.

Dendritic cells (DC) play a central role in linking the innate and adaptive arms of the immune system and knowledge regarding their interaction with pathogens is necessary to reveal the mechanisms underlying disease pathogenesis and immune protection. Dendritic cells are the innate immune cells that first encounter vaccine antigens and thus play a relevant role in vaccine response development.

However, the prevalence of DCs in blood and tissues is very low and studies on these important cells are often difficult to carry out. To solve this problem, immunologists have developed a tool in which DCs are generated *in vitro* from blood monocytes, which are more abundant and easier to obtain. The cells generated are referred to as "monocyte-derived DCs" (MoDC). At APHL, a MoDC assay for bovine cells was successfully developed and applied to evaluate bovine vaccine efficacy.
(https://doi.org/10.1016/j.vetimm.2018.01.009)

Building on this m achievement, the APHL team has recently developed a novel procedure to isolate peripheral blood mononuclear cells (PBMC) from swine blood and eventually separate the monocyte population by using magnetic beads conjugated with monocyte-specific antibodies. Once the monocytes were isolated, MoDC were generated *in vitro* by culturing monocytes in medium supplemented with recombinant GM-CSF and IL-4 (image below).



***Swine monocyte derived dendritic cells (MoDC) in culture**. Monocyte population seeded in a 24-well plate at a density of $2x10^6$ cells per well in 1ml of culture medium supplemented with 150 ng/ml GM-CSF and 100 U/ml IL-4. Monocytes at various differentiation stages: (A) Initial stage of differentiation into MoDC; (B) Stretching stage MoDC; (C) Stretched, mature-like MoDC.*

The APHL has already cloned these two cytokines for several alternative and useful applications. These results provide additional research tools to study the interaction between MoDC and ASF virus, for which an effective vaccine does not exist yet.

Potency of an Irradiated Vaccine Against Low Pathogenic Avian Influenza (H9N2) in Chicken

Low pathogenic avian influenza (LPAI) in chicken caused by influenza subtype H9N2 virus is the most common LPAI in chicken worldwide and causes massive economic losses to the poultry economy. At present, vaccination is the only method applied to limit the economic losses. Currently, commercially available avian influenza (AI) vaccines are inactivated and this has two major limitations: a) they do not provide optimal protection to heterologous virus infections (i.e. infections caused by AI viruses that are different from those present in the vaccine) and b) they do not induce protective immunity when administered at mucosal level (i.e. via aerosol or drinking water), a cost effective method for large scale poultry operations. Therefore, a study was designed to investigate if a novel irradiated H9N2 vaccine prototype could offer an alternative, cost-effective solutions. The study was conducted as a collaborative project with the international (FAO, OIE and EU) reference centre for avian influenza at the Italian veterinary institute for animal health and food safety (Istituto Zooprofilattico Sperimentale delle Venezie: IZSVe). The selected H9N2 vaccine strain was gamma-irradiated under frozen condition. To evaluate the immune response and vaccine protection in chickens, a challenge study was conducted at the IZSVe animal facility.

Preliminary results based on data related to the major virus antigen (the influenza haemagglutinin) demonstrated that the antigenicity of the virus was fully preserved following irradiation and that a strong humoral immune response was elicited in all the vaccinated groups. Importantly, mucosal application elicited strong serum protective antibody response. Data from the groups vaccinated subcutaneously indicated a significant reduction of virus shedding compared to the control group and the irradiated vaccine performed better than the formalin inactivated version. Altogether, the preliminary results suggest irradiation technology as a promising alternative to chemical inactivation in producing effective vaccines against avian influenza. Further analysis is currently running in APHL to evaluate candidate vaccine formulation and efficacy and to investigate the immunological mechanisms of the irradiated vaccine in chickens.

Molecular Epidemiology of Peste des Petits Ruminants and African Swine Fever

African swine fever (ASF) and peste des petits ruminants (PPR) are major transboundary animal diseases considered of high priority in several Member States. Both ASF and PPR virus infections can cause severe disease with high mortality in the targeted hosts which are domestic pigs and sheep and goats, respectively. The latter causes an estimated loss of US $1.5 to 2 billion annually. As sheep and goats contribute significantly to the cash income and nutrition of small farmers, particularly in low income countries, control of the disease is an essential element in the fight for global food security, poverty alleviation and increases small holder livelihoods. A PPR Global Control and Eradication Strategy (GCES) aiming at eliminating the virus worldwide by 2030 has been launched by OIE and FAO.

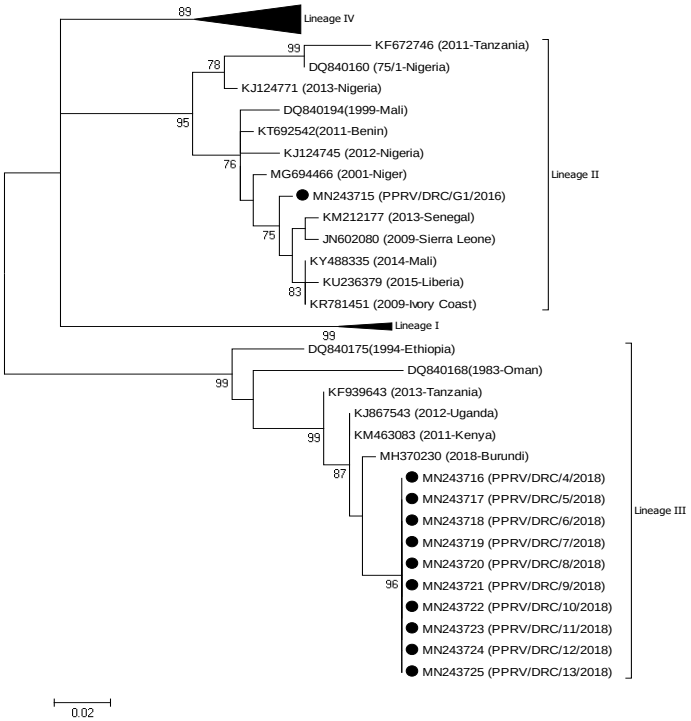
African swine fever was historically present in Sub-Saharan Africa, with occasional outbreaks in Europe (Iberian Peninsula and Sardinia) and Latin America (Caribbean - Haiti and the Dominican Republic, and Brazil in the 1970s, but never in the Asian region until late 2018, when it emerged in China for the first time. Since then, the disease has spread to several East Asian countries, resulting in the loss of dozens of millions of pigs either killed by the virus or culled to control disease, and causing huge economic losses to the local pork industries as well as to small holders.

In the last semester, APHL assisted several member states in their efforts to diagnose and characterize these viruses and conducted molecular investigations to trace their origin and circulation.

Peste des Petits Ruminants Viruses of Lineages II and III Identified in the Democratic Republic of the Congo (DRC)

Eleven lung and nasal swab samples from goats and sheep suspected of being infected by peste des petits ruminants viruses (PPRV) were collected from three provinces (e.g. Kinshasa, North Kivu and South Kivu) of the DRC in 2016 and 2018 were analysed together with the Central Veterinary Laboratory, Kinshasa (a Veterinary Diagnostic Laboratory Network partner). Sequence analysis identified two (i.e. II and III) of the four known lineages of PPRV in the country (see graphic below).

The study has provided the first sequence information and phylogenetic analysis of circulating PPRVs in the DRC. These data will be of assistance in the development of national and regional control programmes for PPR that will contribute to the global eradication of this disease.



Phylogenetic analysis based on the partial N gene of the PPR viruses identified in DRC (2016-2018)

Molecular Epidemiology of African Swine Fever in Tanzania

African swine fever (ASF) is an acute, highly contagious and deadly viral hemorrhagic disease of domestic pigs and wild swine. African swine fever is endemic in Africa and has recently emerged in several Asian and European countries.

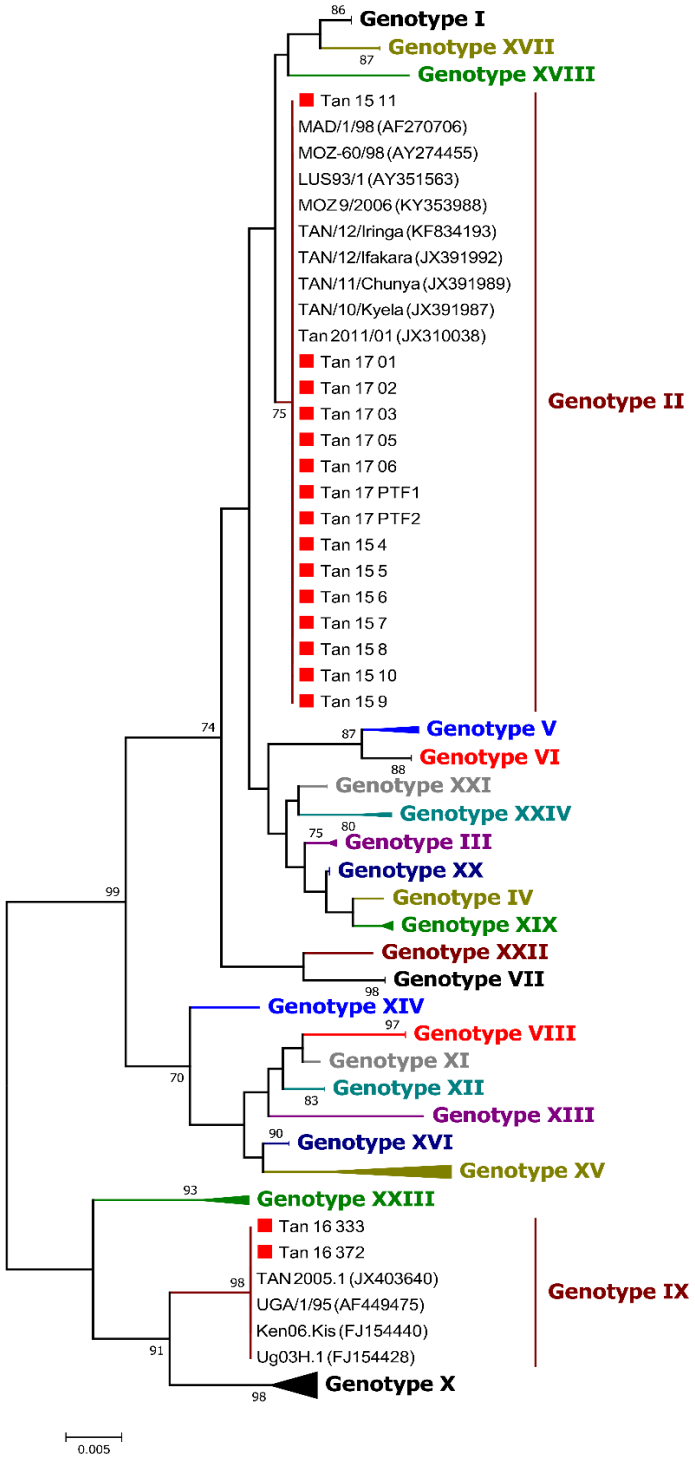
There is an increasing number of reports on the circulation of ASF virus strains causing a broad range of clinical symptoms in susceptible animals in disease-endemic countries. Africa swine fever is endemic in Tanzania; since 2001, Tanzania has recorded several outbreaks, including symptomatic and asymptomatic cases between 2015 and 2017.

To understand the genetic diversity of the ASF virus involved in those outbreaks, APHL in collaboration with the Veterinary Diagnostic Laboratory (VETLAB) Network partner in Tanzania, has analyzed 35 clinical samples from four outbreaks and sequenced four genomic targets in seventeen of those samples: the partial B646L (p72), the full E183L (p54) gene, the central variable region of the B602L gene and the intergenic region between the I73R and I329L genes.

The p72 gene tree and the complete p54 (E183L) gene tree revealed that the ASF viruses in samples from symptomatic pigs are of genotypes II and those in samples from asymptomatic pigs belong to genotype IX. The central hypervariable region (CVR) profiles of the genotype II and genotype IX isolates differed between each other and from previously published Tanzanian sequences. The sequence analysis of the intergenic region between the I73R and I329L for the 2017 genotype II isolates showed the absence of one GGAATATATA motif in those isolates.

This study showed the simultaneous circulation of two different ASF virus genotypes with different levels of pathogenicity in Tanzania. Because the existence of sub-clinically infected pigs may contribute to the persistence of the virus, our findings suggest continuous surveillance and characterization of ASF virus isolates in disease-endemic regions.

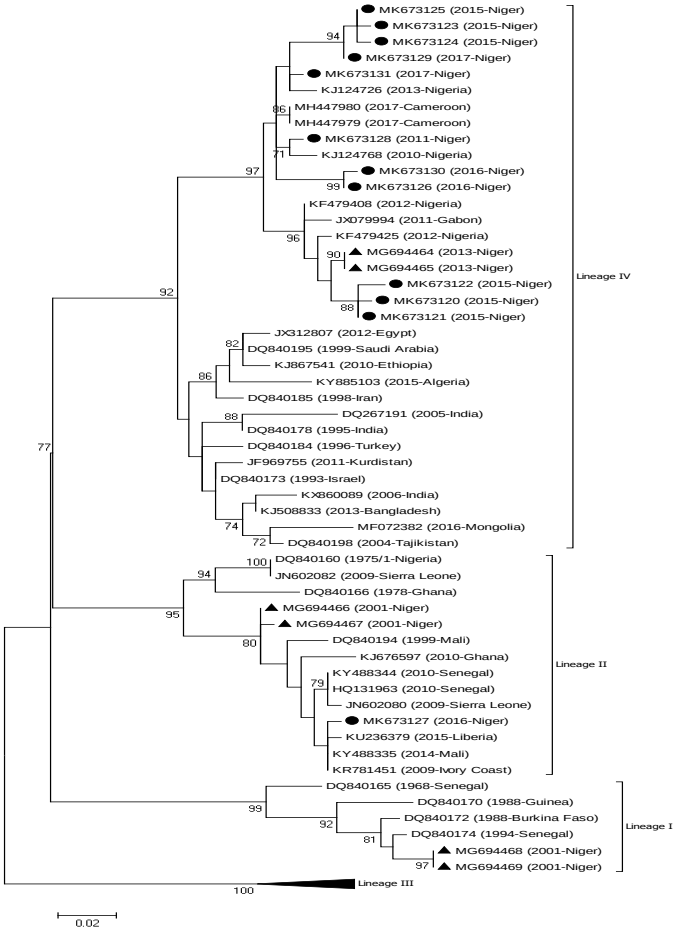
A paper describing these findings is available in the journal Transboundary and Emerging Diseases, (https://doi.org/10.1111/tbed.13298).



Neighbour-joining tree, of the partial p72 gene, depicting genetic relationships of the Tanzanian, 2015-2017 ASF outbreak isolates with representatives of the 24 known ASFV genotypes

Molecular Epidemiology of Peste des Petits Ruminants in Niger: an Update

Samples were collected from goats and sheep in locations throughout Niger between 2011 and 2017. The samples (n = 35), comprising ocular, nasal and oral swabs and lung tissues from sheep (n = 4) and goats (n = 17) suspected of being infected by peste des petits ruminants virus (PPRV) were transported on ice to the Laboratoire Central de l'Elevage (LABOCEL), Niamey (a VETLAB partner) for confirmatory diagnosis. The samples originated from seven of the eight regions of Niger (i.e. Tahoua, Tillabéri, Maradi, Zinder, Dosso, Diffa, and Niamey). Twelve of the samples were positive for PPRV and were further characterized by the sequencing of a segment of the nucleocapsid protein (N) gene. Phylogenetic analysis of the sequences identified viruses from lineages II and IV and indicated a shared origin of the viruses from Niger with PPRVs from neighbouring countries suggesting transboundary movement.



Phylogenetic analysis based on the partial N gene of the PPR viruses detected in Niger (2011-2017)

African Swine Fever in Namibia

As for most African swine fever (ASF) endemic countries, every year ASF causes sporadic outbreaks throughout Namibia. Because the ASF virus continually evolves and diversifies genetically in most endemic countries in Africa, a continuous monitoring of the virus is essential

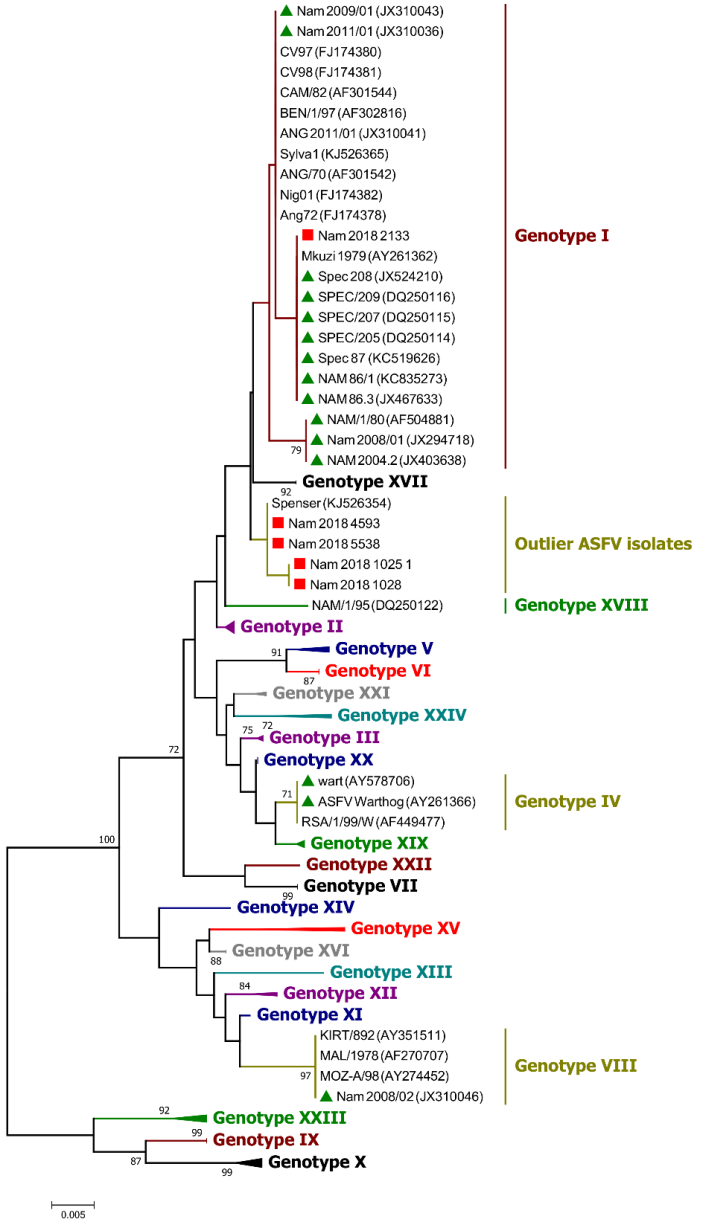
The APHL collaborated with the Veterinary Diagnostic Laboratory (VETLAB) Network partner to genetically characterize ASF virus involved in outbreaks in 2018.

Five samples from four suspected outbreaks of ASF in Namibia in 2018 were sequenced and analyzed. The analysis involved the following targets: The C-terminus of the B646L gene (p72 protein), the central hypervariable region (CVR) of the B602L gene, the full E183L gene (p54 protein), and the partial CD2v gene. Phylogenetic analyses

of the B646L (p72) revealed that one of the samples belonged to genotype I while the remaining samples could not be assigned to any currently known genotype. In contrast, by using the E183L gene, three of the samples were shown to belong to genotype Id and only two were of unknown genotype. Based on the analysis of the partial CD2v amino acid sequences of four of the samples, one of the viruses clustered with serogroup 2 while the other three did not cluster within any of the eight known serogroups. Examination of the CVR identified three variants with 8, 18 and 24 tetrameric tandem repeat sequences.

At least three genetically distinct ASF viruses are present in Namibia, stressing on the need for a continuous monitoring.

A paper describing these findings has recently been accepted for publication in the journal Transboundary and Emerging Diseases (https://doi.org/10.1111/tbed.13399).



Neighbour-joining tree, of the partial p72 gene, depicting genetic relationships between the Namibian 2018 African swine fever outbreaks isolates and representatives of the 24 known African swine fever virus genotypes

Molecular Epidemiology of African Swine Fever in Asia

Following China, in 2018, African swine fever (ASF) has emerged in several other countries in Asia, starting in Mongolia in January 2019 and arriving in several countries in Southeast Asia as the year progressed.

The APHL has worked with Veterinary Diagnostic Laboratory (VETLAB) Network partners in Mongolia, Lao, and Vietnam, to characterize further their local ASF virus isolates collected during 2019 outbreaks. The C-terminus of the B646L gene (p72 protein), the central hypervariable region (CVR) of the B602L gene, the full E183L gene (p54 protein), the partial CD2v gene and the intergenic region between the I73R and I329L genes were sequenced and analyzed for each sample.

The analysis revealed that all the ASF virus isolates from those countries belonged to genotype II, Serogroup 8. The isolates from all three countries had only a single variant of the CVR with the tandem repeat sequence (TRS) profile "BNDBNDBNAA". Likewise, the intergenic region between the I73R and the I329L genes showed 100% similarity among all genotype II ASF viruses from Mongolia, Lao and Vietnam, with the insertion of an additional motif of the (TRS) "GGAATATATA" motif. This study shows that the African swine fever virus genotype II in Asia is highly conserved.

Fellows, Interns and Consultants

Mr Menghak Phem from the National Animal Health and Production Research Institute, Phnom Penh, Cambodia, was at APHL for a fellowship training on "Genetic characterization of Cambodian native cattle using DNA markers" for three months (16 September to 13 December 2019) under Technical Cooperation project KAM5003.

Ms Maphoka Mary Letseka from the Department of Livestock Services, Maseru, Lesotho, was at APHL for a fellowship training on "Genomic evaluation and establishment of baseline information on local livestock" for three months (16 September to 13 December 2019) under Technical Cooperation project LES5007.

Ms Hiracema De Jesus Inacio from the Agrarian Institute of Research, Maputo, Mozambique, was at APHL for a fellowship training on "Genetic characterization of Cambodian native cattle using DNA markers" for three months (2 September to 27 November 2019) under Technical Cooperation project MOZ5008.

Mr Koffi Ganyo Somenutse from Institut Togolais de Recherche Agronomique, Lome, Togo, was at APHL for a fellowship training on "Genomic evaluation and establishment of baseline information on local livestock" for three months (16 September to 13 December 2019) under Technical Cooperation project TOG5001.

Mr Apri Irianto from Institut Pertanian Bogor (IPB) University, Bogor, Indonesia, was at APHL for a fellowship training on "Genomic evaluation and establishment of baseline information on local livestock" for three months (16 September to 13 December 2019) under Technical Cooperation project INS5042.

Ms Betty Kenny Uranoli from Papua New Guinea University of Natural Resources and Environment, Kokopo, Papua New Guinea, was at APHL for a fellowship training on "Genomic evaluation and establishment of baseline information on local livestock" for 2.5 months (24 October to 30 December 2019) under Technical Cooperation project PAP5003.

Ms Marcela Mora from Cayetano Heredia University, Lima, Peru, was at APHL for training on "Real-time PCR based genotyping of DNA markers associated with parasite resistance in sheep" for one month from 15 July to 09 August 2019.

Ms Boitumelo Modise from Botswana National Veterinary Laboratory, Gaborone, Botswana, was at the APHL for 3 months (10 June to 6 September 2019) for a fellowship training on the development and validation of multiplex qPCR assay targeting zoonotic pathogens causing abortion in domestic ruminants.

Mr Mabusetsa J Makalo from the Department of Livestock Service, National Veterinary Laboratory in Lesotho, was trained in APHL for 3 months (1 September to 29 November 2019) on molecular diagnosis, sequencing and molecular epidemiology of transboundary animal diseases under Technical Cooperation project LES5007.

Mr Dadang Priyoatmojo from the National Nuclear Energy Agency (BATAN), Jakarta, Indonesia, was trained for 1 month (3 November to 2 December 2019) on characterization of cell-mediated immune response using flow-cytometry under Technical Cooperation project INS5042.

Ms Tri Handayani Suhono from the National Nuclear Energy Agency (BATAN), Jakarta, Indonesia, was trained for 1 month (3 November to 2 December 2019) on characterization of cell-mediated immune response using flow-cytometry under Technical Cooperation fellowship (FS-INS5042-1902738).

Ms Kago Kumile from Botswana National Veterinary Laboratory, Gaborone, Botswana, was at the APHL for 3 months (2 September to 1 December 2019) for a fellowship training on the development and validation of nuclear-derived technologies for the early and rapid detection of transboundary animal diseases.

Mr Kedumetse Mogwera from Botswana National Veterinary Laboratory, Gaborone, in Botswana, was at APHL for 3 months (2 September to 1 December 2019) for a fellowship training on the development and validation of nuclear-derived technologies for the early and rapid detection of transboundary animal diseases.

Ms Arphaphorn Dokphut from the National Institute of Animal Health, Thailand, conducted a scientific visit at APHL for 2 weeks (2 to 13 December 2019) focused on molecular and serological applications of liquid microarray technology.

Mr Arnaud Stephane Rayangnewende from University of Ouagadougou, Ouagadougou, Burkina Faso, was at APHL for a PhD Consultancy on "Assessment of genetic diversity, population structure and phylogeography of African zebu and taurine cattle using genome-wide markers" for 9 months (26 March to 31 December 2019) under FAO- Technical Cooperation project RER3604: Conservation of dual-purpose cattle in Eastern Europe.

Mr Abdallah Beyit from the Office National de Recherches et de Développement de l'Elevage (ONARDEL), Mauritania, was at APHL for 3 months (2 September to 30 November 2019) for a fellowship on the application of nuclear related techniques and molecular biology to the diagnosis of animal diseases.

Coordinated Research Projects (CRPs)

Project Number	Ongoing CRPs	Project Officers
D31028	Application of Nuclear and Genomic Tools to Enable the Selection of Animals with Enhanced Productivity Traits	V. Tsuma M. Garcia Podesta
D31029	Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pasture Using Compound Specific Stable Isotopes	V. Tsuma M. Garcia Podesta
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
D32035	Novel Animal Vaccine Formulations Enhancing Mucosal Immunity	H. Unger V. Wijewardana

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

Victor Tsuma and Mario Garcia Podesta

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

Two major lines of research work are being undertaken, one for those who target crossbreeding and the other for those who keep purebred taurine populations. The crossbreeding group employs 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 will estimate predicted transmitting ability (PTAs) of sires under local conditions, which will be correlated with genomic PTAs of sires at their origin.

Most research contract holders completed the works planned for the first two years, i.e., collection, recording and analysis of phenotypic, performance and pedigree data from a minimum of 1000 cows/heifers and sires whose semen was used to breed those animals. The technical contract holder on early pregnancy diagnosis has completed the laboratory work and identified candidate conceptus-derived proteins. Regarding the technical contracts on sequencing dromedary whole genome using radiation hybrid (RH) technology, DNA has been extracted from 95 selected hamster-dromedary RH clones and is being sequenced using next generation techniques.

The third research coordination meeting is scheduled to take place in Vienna, Austria, from 22 to 26 June 2020.

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

Victor Tsuma and Mario Garcia Podesta

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

Most research contract holders completed their animal trials and collected samples for the estimation of dry matter intake and diet composition of cattle/yak grazing on pasture/natural

grasslands using n-alkanes and their compound specific stable carbon-13 isotope in feeds and faeces. Two technical contract holders developed protocols and guidelines, which were distributed to research contract holders. A 'ring test' is being conducted with support from agreement holders from the USA and Sweden to review the proficiency of research contract holders' laboratories.

The second research coordination meeting took place from 12 to 16 August 2019 in Brazil. Read more about it on page 12 of this edition.

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 Diagnosis Laboratory (VETLAB) Network currently integrates 45 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 and 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 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 project targets 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; and

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

The project team comprises 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 fifth research coordination meeting will take place from 22 to 26 June 2020 in Vienna, Austria.

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

Hermann Unger and Gerrit Viljoen

This coordinated research project (CRP) kicked off in early 2016 to continue exploring the possibilities of using irradiation in the development of vaccines. A major stimulus for this was the noteworthy results obtained from the previous CRP on this subject, especially yielding strong outcomes on irradiated intestinal and haemo-parasites as vaccine candidates. However, a major shortcoming of the initial CRP was the lack of proper immunological tools to define the immune response elicited. This issue was addressed by establishing immunology research and development at the APHL in 2015. Since then, efforts have been made to develop assays and reagents to monitor the immune responses induced by irradiated vaccines, especially on cellular immunology an area that has been neglected in livestock immunology but of immense importance.

The CRP counterparts are using the protocols, assays and reagents developed by the APHL immunology program and resulted in a big thrust in irradiated vaccine research. An additional task of this CRP is the evaluation of irradiated pathogen preparations as immune enhancers for conventional vaccines. These immune enhancers, or 'adjuvants', are sought in the vaccine market as the traditional solutions can lead to severe inflammation and are to be abolished due to the side effects.

The vaccines currently being experimented cover major livestock diseases that need immediate solutions: brucellosis, *haemonchus contortus*, *Mannheimia*, influenza and *Salmonella gallinarum*.

The second research coordination meeting took place in Vienna, Austria, from 20 to 24 May 2019. The third meeting will take place in 2021.

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 project 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 a labelled bird with specific characteristics (disease carrier) using conventional methods is negligible. Knowledge and experience obtained through the previous project (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) 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 has attracted the attention of the scientific community; however, this technique can also be used in epidemiological studies that target long-range transmission 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 SI ratios in the environment (especially open waters).

During the first phase of the, several important fragments in the linking of SI ratios of feather samples (bird migrations) with the epidemiology of AI were established.

Achievements of project 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: detecting birds that carry avian influenza viruses and eventually other dangerous pathogens and evaluating stable isotope ratios in feathers of these birds (only the pathogen carriers) to understand their origins and migration pathways.

The second research coordination meeting is scheduled to take place in Vienna, Austria, from 22 to 26 June 2020.

Novel Animal Vaccine Formulations Enhancing Mucosal Immunity (D32035)

Hermann Unger and Viskam Wijewardana

Background:

Vaccination has proven to be the best preventive measure against infectious diseases. Despite significant successes, there are several limitations to the currently practiced approaches. In veterinary medicine, the application of vaccines by injection limits their use for small ruminants in rural areas. This practice requires well-trained staff taking care to practice the utmost hygiene and maintain a cold chain for the vaccines. It is also not easy to inject individual birds in poultry rearing. Additionally, injected vaccines rarely induce production of specific mucosal antibodies (IgA) covering the mucosal tissues in nose, mouth and lungs which are the primary site of multiplication for bacteria or viruses before they provoke a systemic infection. Such IgA antibodies can efficiently be induced by "mucosal" vaccines, i.e. formulations that are applied to the nose, mouth or eyes. These mucosal vaccines, especially eye drop vaccines, have the big advantage in requiring small volumes as the vaccine dose. Therefore, the application can be done by village vaccinators and the cold chain will be relatively easy to maintain. Recent experiments on formulating such mucosal vaccines for ruminants have presented a number of challenges: low viscosity leading to spills, unsuitable components for freeze drying or the process of formulating the components appropriately. Additionally, the measurement of IgA is still done by a "research tool" and existing general laboratory tools must be adapted to allow their measurement in standard laboratories.

The expected outcome of this project is the development of several different mucosal vaccine formulations against viral diseases like peste des petits ruminants or influenza or against bacterial diseases like Mycoplasmas or Pasteurella. In parallel, the tools to measure specific IgA induced in the mucosae will be developed and applied. Experimental combinations of live attenuated viruses together with killed bacterial preparations will be tested to evaluate an enhancing effect of such combinations. A maximum of ten vaccine research institutions can be supported by this project with a maximum of 8000 €/year

Participation:

Invited are all research institutions currently working on the development of novel veterinary vaccines that can be applied on mucosal tissues. A fundamental proof of concept for the specific vaccine “antigen” delivering an immune response in the target species must be included in the application. The technology on experimental formulation and the application strategy of the mucosal vaccine must be described and should be supported by scientific evidence. Tests envisaged to prove protection other than animal

challenge studies are desirable. The participating institutions must be capable of producing a minimum of 1000 doses of a prototype vaccine in their own laboratories. In addition to the culture technology, the participating institutes should possess basic equipment for immunology (i.e. ELISA, Fluorescence microscopy; quantitative PCR). Previous experiments and experiences with mucosal applications is an advantage.

Selection will be based on feasibility and technological applicability as well as unmet need. Applications can be accepted until 1 February 2020. For further information, please contact the Project Officers.

Submission of Proposals

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

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

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	I. Naletoski V. Tsuma
Bangladesh BGD5030	Building Capacity to Improve Dairy Cows Using Molecular and Nuclear Techniques	V. Tsuma
Burkina Faso BKF5021	Improving Local Poultry Production through Incorporation of Nutraceuticals in Feeds and Genetic Characterization	G. Viljoen
Bosnia and Herzegovina BOH5002	Strengthening State Infrastructure for Food and Animal Food Control and Protecting Animal Health	I. Naletoski
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 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

Country TC Project	Description	Technical Officer(s)
Central African R CAF5010	Building National Capacities for the Diagnosis and Control of Animal Diseases and for Increasing Animal Production	H. Unger
Cameroon CMR5019	Using Nuclear Techniques to Improve Milk Production	H. Unger K. Periasamy M. Garcia Podesta
Cameroon CMR5022	Controlling Transboundary Animal Diseases with Special Emphasis on Peste des Petits Ruminants	H. Unger
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	K. Periasamy V. Tsuma
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	K. Periasamy V. Tsuma
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	C. Lamien H. Unger
Cambodia KAM5003	Supporting Sustainable Livestock Production	M. Garcia Podesta
Kenya KEN5038	Using Nuclear Techniques to Evaluate and Improve the Impact of Mutated Forages on the Performance of Smallholder Dairy Cows	M. Garcia Podesta V. Tsuma
Lao P.D.R. LAO5004	Enhancing National Capability for Crop Production and Controlling Trans-Boundary Animal Diseases	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	K. Periasamy
Malaysia MAL5031	Establishing an Environmentally Sustainable Food and Fodder Crop Production System	G. Viljoen
Mauritius MAR5025	Improving the Productivity of Dairy Cattle through On-Farm Application of Achieved Research Information on Feeding Practices	G. Viljoen
Mauritania MAU5007	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases – Phase II	M. Garcia Podesta

Country TC Project	Description	Technical Officer(s)
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 MON5023	Enhancing Livestock Production through the Improved Diagnosis and Prevention of Transboundary Animal Diseases (TADs)	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 MYA5026	Improving the Livelihoods of Smallholder Livestock Farmers by Developing Animal Feeding Strategies for Enhanced Food Security	G. Viljoen
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
Palestine PAL5007	Upgrading Animal Feeding Laboratory in Terms of Human Capacity Building and Infrastructure	I. Naletoski
Papua New Guinea PAP5002	Genetically Characterizing and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding	K. Periasamy
Papua New Guinea PAP5003	Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding – Phase II	K. Periasamy

Country TC Project	Description	Technical Officer(s)
Peru PER5032	Conducting Genetic Characterization of Alpacas for Resistance to Diseases	K. Periasamy
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 H. Unger
RAF0051	Supporting Specific Needs in the African Region Due to Emergencies	I. Naletoski H. Unger
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)	K. Periasamy
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	H. Unger G. Viljoen
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. 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	G. Viljoen

Country TC Project	Description	Technical Officer(s)
Togo TOG5001	Improving and Promoting Bovine Milk Production through Artificial Insemination	V. Tsuma
Tunisia TUN5028	Supporting Watering Strategies to Help Livestock Raised in Semiarid and Arid Regions Coping with Climate Change	M. Garcia Podesta I. Naletoski
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. Garcia Podesta V. Tsuma
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 V. Tsuma
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
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	V. Tsuma

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VETLAB Network

The Veterinary Diagnostic Laboratory (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 by the USA and Japan Peaceful Uses Initiative (PUI), consists of national veterinary diagnostic laboratories located in 45 African and 19 Asia and Pacific Member States.

During the past six months, the VETLAB Network has provided strong support to partner laboratories in Asia facing African Swine Fever (ASF) epidemics to strengthen their diagnostic capacity, preparedness and rapid response actions. Efforts concentrated on procuring reference material such as positive controls, equipment and reagents for the rapid implementation and expansion of ASF diagnosis and confirmation.

The VETLAB Network has organized the yearly interlaboratory trial for the serological and molecular detection of Peste des Petites Ruminants (PPR) virus. Thirty-one laboratories of 29 countries in Africa, Asia and Europe participated to the exercise. Countries at-risk for PPR virus introduction were also supported for their laboratory preparedness plan.

The fourth VETLAB Directors meeting took place in Vienna, Austria from 19 to 23 August 2019. Directors from Asian and African countries participated to this meeting together with experts from international reference laboratories and international organizations.

VETLAB partners also attended two training courses on animal disease detection using multiplex assay platforms and laboratory test validation organized by the network with contributions of international experts from reference laboratories worldwide. Fifty-three participants attended these two events.

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 highlights of the VETLAB Network bulletin can be found on pages 6 and 7 of this edition.

Impressum

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