Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

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

ISSN 1011-2529

No. 72, July 2020

Contents

International Symposium on

Sustainable Animal Production and Health

28 June to 2 July 2021

Cattle herded to the corrals for routine health control (Honduras)

To Our Readers

Dear colleagues,

This year has undoubtedly been quite different from past years due to the COVID-19 situation that has disrupted life worldwide. The IAEA and Austria in general started the quarantine process by mid-March and to date we are working both in the office and from home. As you know the IAEA, in partnership with the FAO, has been developing and transferring diagnostic tests for transboundary animal and zoonotic diseases, including those with biothreat potential, for many years. So far this year, on their request we have supported more than 120 Member States in their efforts to diagnose and control COVID-19. We have been providing equipment, diagnostic kits, primers and PPEs to establish and use molecular techniques (RT-PCR) to rapidly detect SARS-CoV-2. For this emergency assistance several Member States and private companies have pledged nearly 26 million euro as a contribution to the IAEA's efforts in helping to tackle the pandemic. This is the IAEA's largest technical cooperation initiative since it was founded in 1957.

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; and
- 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 that owing to the COVID-19 outbreak, the 'International Symposium on Sustainable Animal Production and Health - Current Status and Way Forward' planned for June 2020 at the IAEA's Headquarters in Vienna, Austria has been postponed to 28 June to 2 July 2021. Further details will be circulated in due time.

Stay healthy and safe. We are all working in support of the global effort to control the pandemic in the shortest possible time.

Gerrit Viljoen

Head, Animal Production and Health Section

International Symposium on Sustainable Animal Production and Health: Current Status and Way Forward 28 June – 2 July 2021

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 recognized early 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 way forward 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 participation of 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:

APHSymposium2021@iaea.org

Deadlines

30 November 2020: Submission of synopses (including Forms A and B*)

30 November 2020: Submission of grant application (Forms A and C*)

28 February 2021: 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/aphs2021

Participants who have already submitted their participation via their national authority, for the postponed 22-26 June 2020 symposium are not required to resubmit forms. Designations already received will remain valid.

Staff

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

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

Animal Production and Health Section

Name	Title	Email	Extension	Location
Gerrit J. VILJOEN	Section Head	G.J.Viljoen@iaea.org	26053	Vienna
Ivancho NALETOSKI	Veterinarian, Serologist	I.Naletoski@iaea.org	26054	Vienna
Hermann UNGER	Veterinarian, Virologist	H.Unger@iaea.org	21644	Vienna
Victor TSUMA	Livestock Reproductionist Breeder	V.Tsuma@iaea.org	21619	Vienna
Paul BOETTCHER	Livestock Geneticist Breeder	P.Boettcher@iaea.org	26843	Vienna
Mario GARCIA PODESTA	Veterinarian, Theriogenologist	M.Garcia-Podesta@iaea.org	26048	Vienna
Fabia BAPTISTA	Programme Assistant	F.Baptista@iaea.org	26051	Vienna
Belinda WESTMACOTT	Team Assistant	B.Westmacott@iaea.org	26052	Vienna
Giovanni CATTOLI	Laboratory Head	G.Cattoli@iaea.org	28355	Seibersdorf
Charles E. LAMIEN	Biochemist	C.Lamien@iaea.org	28314	Seibersdorf
Kathiravan PERIASAMY	Livestock Geneticist Breeder	K.Periasamy@iaea.org	28358	Seibersdorf
Viskam WIJEWARDANA	Immunologist	V.Wijewardana@iaea.org	28380	Seibersdorf
Richard KANGETHE	Molecular Parasitologist	R.T.Kangethe@iaea.org	28385	Seibersdorf
Rudolf PICHLER	Livestock Geneticist	Rudolf.Pichler@iaea.org	28378	Seibersdorf
Bharani SETTYPALLI	Molecular Biologist	T.B.K.Settypalli@iaea.org	28252	Seibersdorf
Francisco BERGUIDO	Immunologist	F.Berguido@iaea.org	28356	Seibersdorf
William DUNDON	Molecular Microbiologist	W.Dundon@iaea.org	28379	Seibersdorf
Luca PORFIRI	Immunologist	L.Porfiri@iaea.org	28385	Seibersdorf
Dingrong XUE	Intern	D.Xue@iaea.org	28321	Seibersdorf
Joanna MLETZKO	Team Assistant	J.Mletzko@iaea.org	28362	Seibersdorf

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

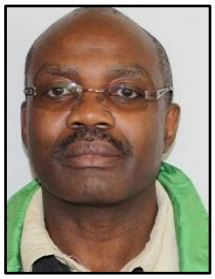
The Animal Production and Health Laboratory, in Seibersdorf, is an OIE Collaborating Centre for ELISA and molecular technologies in animal disease diagnosis

Animal Production and Health Section


G. VILJOEN


I. NALETOSKI


H. UNGER


V. TSUMA


P. BOETTCHER


M. GARCIA


F. BAPTISTA


B. WESTMACOTT


G. CATTOLI


C. LAMIEN


K. PERIASAMY


V. WIJEWARDANA


R. KANGETHE


R. PICHLER


B. SETTYPALLI


F. BERGUIDO


W. DUNDON


L. PORFIRI


D. XUE


J. MLETZKO

Joint FAO/IAEA Programme

VETLAB Network Bulletin

02/2020

VETLAB is an initiative of the Joint FAO/IAEA Division

In this issue:

To the readers

Despite the serious challenge imposed by the global spread of the COVID-19 disease, the VETLAB Network has continued to support its laboratory partners through several initiatives, some of which are highlighted in this bulletin.

The Network has so far provided emergency support to veterinary and human public health laboratories, in four continents, for the on-going COVID-19 pandemic including 37 national veterinary laboratories appointed by the respective national health authorities to conduct COVID-19 testing. The emergency support organized in collaboration with the IAEA departments of Human Medicine and Technical Cooperation consisted in packages containing all needed reagents, consumables and major equipment to safely run the recommended diagnostic tests. Through the iVetNet database, COVID-19 guidelines and diagnostic SOPs were shared with over 200 laboratory scientists of the network and beyond.

New outbreaks of African Swine Fever and the emergence of African Horse Sickness have been reported. Another acute, deadly viral disease, the Rabbit Haemorrhagic Disease, emerged and spread in West Africa. The VETLAB Network provided technical support to partners to rapidly confirm the disease diagnosis.

We are pleased to announce that the Animal Production and Health Laboratory (APHL) has moved to a new facility, the Yukia Amano Laboratories. Thanks to the IAEA Member States contributions, it represents a big step forward for APHL and VETLAB Network activities, enabling the expansion and strengthening of research, capacity building and technology transfer of APHL and the whole Joint Division. We look forward to host you and continue to work together in the new facility.

VETLAB Highlights

The Indonesian Research Center for Veterinary Science in Bogor at the front line for rapid detection of African swine fever (ASF) virus

Subsequent to the emergence of ASF in Indonesia in September 2019, the institute has implemented diagnostic tests for disease confirmation and surveillance. Those include ASF-specific and multiplex (hemorrhagic disease panel) RT-PCR and virus isolation in primary cell cultures. As a national reference laboratory for animal infectious diseases they provide diagnostic support to local district authorities and the quarantine service.

First detection and notification of RHDV2 in Senegal

Since March to to mid-April 2020, the country recorded 26 outbreaks with high mortality in domestic rabbits near Dakar and Thiès. The Laboratoire National d'Elevage et de Recherches Vétérinaires (LNERV), thanks to the emergency support of the VETLAB network, analysed samples using PCR techniques and confirmed the infection as rabbit hemorrhagic diseases virus 2 (RHDV2), a lethal virus infection cause by calicivirus. As a follow-up, LNERV is undertaking an in-depth analysis of the virus by sequencing, while the veterinary authorities officially notified the outbreaks of RHD to OIE.

First molecular characterization of avian paramyxovirus-1 (Newcastle disease virus) in Botswana

NDVs have never been characterized in Botswana. The Botswana National Veterinary Laboratory in collaboration with APHL analysed samples collected in 2014, 2018 and 2019 and all 14 samples belonged to genotype VII.2 and were shown to be related to viruses from South Africa and Mozambique indicating that transboundary movement of infected poultry or fomites plays an important role in the spread of NDV in the region. This study has been accepted for publication in Virus Genes.

Molecular characterization of ASF virus in Central Burkina Faso

In October 2018, substantial pig deaths occurred in Ouagadougou and two neighbouring areas in central Burkina Faso. The Laboratoire National d'Elevage analysed samples by RT-PCR and confirmed ASFV DNA in 22 of 69 blood samples. Recent phylogenetic studies revealed that ASFVs genotype I and serogroup 4 caused these outbreaks. Also, data suggested a common source of contamination.

02/2020

VETLAB Network Bulletin

VETLAB Capacity Building Initiatives

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

Two Training Courses for Veterinary Diagnostic Laboratory Network Partners

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. Because of the current situation with COVID-19, the course will be rescheduled in 2021.

A: Early Diagnosis and Pathogen Characterization

B: Sequencing and Bioinformatics

These two courses were planned to take place at IAEA Seibersdorf Laboratories, Austria in June 2020 and were postponed due to the current situation with COVID-19. The new dates will be communicated as soon as possible.

VETLAB Networking Activities

Support missions

The VETLAB laboratory in Indonesia was visited by APHL staff in February 2020. The visit aimed at transferring novel protocols and technologies including multiple pathogen detection techniques.

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

The coordination meeting will take place 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. Because of the current situation with COVID-19 and travel restrictions and/or quarantine requirements in participants' countries, the meeting planned from 22 to 26 June 2020 will be rescheduled. The new dates will be communicated as soon as possible. The meeting is organized in parallel with the FAO/IAEA International Symposium on Sustainable Animal Production and Health.

Interlaboratory test for the diagnosis of PPR

The VETLAB Network will organize the yearly interlaboratory comparison (ILC) exercise to assess countries' diagnostic capacity for the accurate detection of PPR in the last quarter of 2020. As for previous years, the ILC will focus on the serological and PCR-based detections.

The VETLAB Network Laboratories:

The NAHDIC supports testing COVID-19 in Ethiopia

The COVID-19 epidemic provides evidence that the public health laboratories and veterinary laboratories can efficiently cooperate to deliver the most efficient and high turn around testing capacity for a country, enabling better and timely management of disease outbreaks.

The National Animal Health Diagnostic and Investigation Center (NAHDIC) is significantly supporting the response to COVID-19 by testing human samples for diagnosis and surveillance. NAHDIC does not receive samples directly from patients, but instead, performs tests commissioned by the Ethiopian Public Health Institute (EPHI) and reports back to the EPHI. The NAHDIC can test over 300 COVID-19 suspected samples within 24 hours, increasing the overall testing capacity for the country.

Using well-trained signatory personnel with extensive experience and expertise, the NAHDIC has also joined different collaborative national research efforts on the vaccine and drug developments for COVID-19.

As a partner of the VETLAB network, NAHDIC is working closely with the Animal Production and Health Laboratory (APHL) on the investigations of SARS-CoV-2 and other zoonotic viruses in animals for diseases surveillance and better understanding of the susceptibility of different animal species.

Entrance view of the Yukia Amano Laboratories, the new facility built at Seibsersorf's Laboratories and officially inaugurated by IAEA Director General Mr Rafael Mariano Grossi and the Austrian Minister of Foreign Affairs, Mr. Alexander Schallenberg on 5 June 2020. The Animal Production and Health Laboratory (APHL) has moved in to provide better greater support to FAO and IAEA Member States.

COVID-19 testing team at NAHDIC, Ethiopia

Impressum VETLAB Network Bulletin No. 09 • Edited and designed by the Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture • International Atomic Energy Agency • Vienna International Centre, PO Box 100, 1400 Vienna, Austria • Printed by the IAEA in Austria, July 2020.

Forthcoming Events

Consultancy Meeting on Peste des Petits Ruminants (PPR) Serological Assays for Wildlife and Livestock Species: Laboratory Tests Comparison and Validation

Charles Lamien and Giovanni Cattoli

The purpose of the event is to compare the performances of the serological tests currently available as well as some of the newest tests in order to select the most appropriated assays to be validated on both livestock and wildlife species and then transferred to Member States. The event will take place at the IAEA Laboratories, Siebersdorf, Austria, from 21 to 29 September 2020. The outcome of this consultancy meeting will contribute to the purpose of the Technical Meeting on the Use of Laboratory Techniques to Support the Peste des Petits Ruminants Global Eradication Programme (EVT1905271) which is organized from 30 September to 2 October 2020.

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

Charles Lamien and Giovanni Cattoli

The purpose of the event is to identify and select laboratory tests that will contribute to the implementation of the Peste des Petits Ruminants Global Eradication Programme and to enable partners of the Veterinary Diagnostic Laboratory Network (VETLAB Network) to discuss diagnosis gaps and collaborative research opportunities. The event will be held at the IAEA Headquarters in Vienna, Austria, from 30 September to 2 October 2020.

Training Course for Veterinary Diagnostic Laboratory (VETLAB) 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 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.

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.

Because of the current situation with COVID-19 and travel restrictions and/or quarantine requirements in participants' countries, the meeting planned to take place in Seibersdorf, Austria, from 15 to 26 June 2020 will be rescheduled. The new dates will be communicated as soon as possible.

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.

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

Because of the current situation with COVID-19 and travel restrictions and/or quarantine requirements in participants' countries, the meeting planned to take place in Seibersdorf, Austria, from 22 June to 3 July 2020 will be rescheduled. The new dates will be communicated as soon as possible.

Coordination Meeting of the Veterinary Diagnostic Laboratory (VETLAB) 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 VETLAB Network and to discuss the main challenges and gaps in implementing animal and zoonotic diseases diagnosis.

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.

Because of the current situation with COVID-19 and travel restrictions and/or quarantine requirements in participants' countries, the meeting planned to take place in Seibersdorf, Austria, from 22 to 26 June 2020 will be rescheduled. The new dates will be communicated as soon as possible.

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 purpose of the meeting is to review the serological and molecular standards produced for the priority diseases covered by the project, and, if necessary, adjust the project work plan. The meeting was initially planned at the IAEA Headquarters in Vienna, Austria, from 22 to 26 June 2020. However due to the movement restrictions imposed by the COVID-19 outbreaks, the meeting will be rescheduled. The new dates will be communicated as soon as possible.

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

Training Courses on the Use of Nuclear Derived Techniques for the Detection of SARS-CoV2/COVID-19

Giovanni Cattoli and Ivancho Naletoski

The purpose of the training courses is to disseminate theoretical knowledge and practical skills in biosafety and the detection and characterization of the novel coronavirus (SARS-CoV2/COVID-19) to medical and veterinary professionals from the affected (or at risk) Member States.

A series of training courses are planned to take place at the IAEA Laboratories in Seibersdorf, Austria, and in Member States at the earliest possible time depending on travel and movement restrictions. The dates will be announced as soon as possible.

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 was planned for the week from 22 to 26 June 2020 at the IAEA Headquarters in Vienna, Austria. However due to the movement restrictions imposed by the COVID-19 outbreaks, the meeting will be rescheduled. The new dates will be communicated as soon as possible.

Project partners should 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 purpose of the meeting is to present the final reports of individual and technical contract holders, identify the most relevant achievements of the coordinated research project (CRP) and discuss possible topics and opportunities for research that could be supported by a new CRP.

Because of the current situation with COVID-19 and travel restrictions and/or quarantine requirements in participants' countries, the meeting planned to take place in Seibersdorf, Austria, from 22 to 26 June 2020 will be rescheduled. The new dates will be communicated as soon as possible.

Past Events

Group Scientific Visit of Scientists from Counterpart Laboratories in Bosnia and Herzegovina to USA Veterinary Institutions (Project BOH5002)

Ivancho Naletoski

During the project cycle 2018-2019 Bosnia and Herzegovina was awarded an IAEA TC project aimed to upgrade the existing and introduce new nuclear related technologies for early detection of priority animal and zoonotic diseases in the country. Counterparts in the project were the officially designated laboratories at the Faculty of Veterinary Medicine in Sarajevo (FVMSa) and the Veterinary Institute from Banja Luka (VIBL), Bosnia and Herzegovina (BOH).

Counterparts of the project BOH/5/002 during the visit of the Colorado State Veterinary Laboratory. From left to right Dr Violeta Santrac (VIBL), Dr Teufik Goletic (FVMSa), Dr Tiffany Brigner, Laboratory Manager at the Colorado State Veterinary Laboratory

Part of the project was dedicated to the integration of the newly obtained technologies through the BOH5002 project, into the official disease monitoring and control programmes of the country. For this reason, four senior scientists from the counterpart institutions in BOH visited Cornell University, College of Veterinary Medicine in Ithaca, New York, USA and Colorado State University/USDA-APHIS services located at Fort Collins, Colorado, USA from 3 to 14 February 2020. Through numerous visits with the US scientists and officials, the counterparts had a chance to familiarize themselves with the structure of the veterinary education system, the system for official control of animal and zoonotic diseases, the organization and the functions of the US veterinary laboratory networks, as well as with the system for epidemiological monitoring, planning and decision making for animal and zoonotic diseases. According to the counterpart's reports, multiple components of the veterinary system in the USA can be transposed into the veterinary service of BOH. The hosts and the visitors agreed to deepen the collaboration in the very near future and organize official visits from the USA to support the upgrade of the veterinary service in BOH.

Training Course on the Use of the Nanopore MinIon Platform for Whole Genome Sequencing of Animal and Zoonotic Pathogens (Project RAF5073)

Ivancho Naletoski

The regional training course on the use of the Nanopore MinIon Platform for Whole Genome Sequencing (WGS) of animal and zoonotic pathogens was organized at the National Animal Health Diagnostic and Investigation Centre, in Sebeta (Addis Ababa), Ethiopia from 3 to 7 February 2020. Thirteen participants from Congo DRC (2), Ethiopia (6), Namibia (2), Niger (2) and Senegal (1) took part at the event. Four experts from the Istituto Zooprofilattico Sperimentale from Teramo, Italy led the course. The topics covered comprehensive theoretical and practical classes in sample preparation, sample barcoding, practical runs using the MinIon WGS platform and the necessary bioinformatic analyses used for interpretation of the samples. The participants of the event brought DNAs and cDNAs from their own laboratories and had the chance to run the samples, perform WNS and carry out the complex bioinformatic analysis independently.

Participants at the regional training course during the practical classes on WGS.

More than 20 different pathogens were examined during the one-week training and the bio-informatic procedure for each of them was demonstrated and discussed with the experts. Because of the necessary basic knowledge, required to start using the WGS platforms, the participants were selected based on their activity in the use of the Sanger sequencing service of APH, the number of samples processed independently and their publication records of

pathogen sequencing data. The midterm goal of the training course was to establish veterinary laboratories with functional WGS in Africa which will serve as training centres for other African member states (training of trainers) for further dissemination of the WGS technology.

National Training Course on Cattle Artificial Insemination in Togo (TOG5001)

Victor Tsuma

The national training course was held in Lome, Togo from the 4 to 15 November 2019, attended by 40 participants consisting of veterinary students, veterinarians, para-veterinarians, and livestock field officers, from Université de Lome, Ecole Supérieure d'Agronomie (ESA), Institut Supérieure des Métiers d'Agricole (ISMA), Université de Kara, Institut National de Formation Agricole (INFA), and Artificial Insemination Centre of Institut Togolais de Recherche Agronomie (ITRA), Avetonou. Professor Moumouni Issa from Universite Abdou Moumouni, Niamey, Niger, was the expert trainer, providing guidance, material and skills to all trainees.

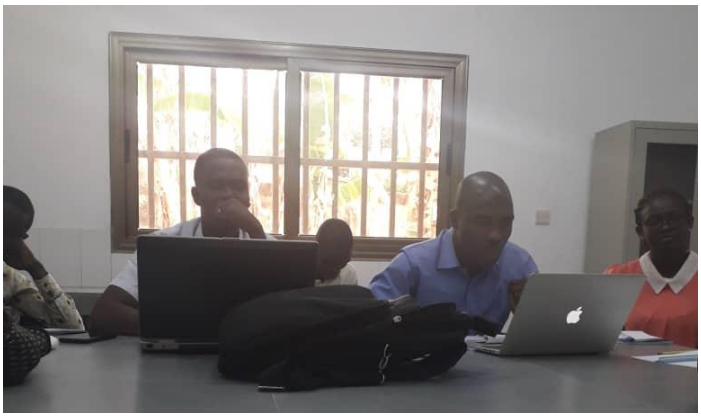
Using abattoir organs to appreciate female reproductive anatomy for artificial insemination.

During the 10-day training course, lectures, practicals, demonstrations and hands-on artificial insemination practice in cattle were conducted. The course content included an 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.

National Training Course on Genetic Evaluation of Livestock (TOG5003)

Victor Tsuma

The training workshop was conducted from 9 to 13 March 2020, at the University of Lome, Togo, bringing together 16 participants from different relevant Togolese organizations involved in the animal industry (Université de Lome, Ecole Supérieure d'Agronomie (ESA), Institut Togolais de Recherche Agronomie (ITRA), and Artificial Insemination Centre of ITRA, Avetonou).



Training session in Togo on livestock genetic characterization

Lectures were conducted on DNA technologies, namely, DNA extraction techniques and quality control, molecular markers for genetic characterization, PCR and genotyping, molecular data analysis and, the complete workflow for molecular genetic analysis.

The course was conducted by Dr. Amadou Traore, an expert from the Laboratoire de Biologie et santé animale, Ouagadougou, Burkina Faso.

Initiation of a CRP 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 first research coordination meeting, whose purpose is to discuss and design workplans of individual institutions participating in the CRP was planned to take place in June 2020 at the IAEA's Headquarters in Vienna, Austria. Due to travel restrictions this initial RCM was held online from 1 to 5 June 2020.

Read more about the scope of this CRP on page 28 of this edition.

International Atomic Energy Agency Support of Veterinary Laboratories in the Early Detection of COVID-19 Infections in Animal and Human Populations (Project INT0098)

Ivancho Naletoski

During December 2019, the population of the Wuhan municipality in China was affected by a severe acute respiratory syndrome that rapidly spread to other regions of China, and later to other regions of the world. Soon after the initial outbreaks, the Chinese authorities detected that the causative agent of the disease is a corona virus, which is different from the coronaviruses (CoVs) causing Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS). The novel coronavirus was never previously observed in human populations and was named SARS-CoV-2 and the disease associated with the virus, COVID-19.

Genetic sequences obtained from the 2019-nCoV have shown similarities with CoVs isolated from bats but were distinct from the previously isolated SARS and MERS viruses.

Considering the historical presence of CoVs in domestic and wild animals, as well as their tendencies towards genetic adaptation (i.e. genetic shift and drift), the WHO, together with FAO and OIE have recommended monitoring the possible animal-to-human interfaces as part of a one-health approach.

From these reasons the IAEA through the Joint FAO/IAEA Division, the Division of Human Health and the Technical Cooperation Department of IAEA is organizing emergency support to the affected, and at-risk Member States to enable timely and accurate detection of the virus, if possible before it enters into non-affected areas.

The support comprises two components. The first one is diagnostic kits, consumable materials and equipment required for the detection of the SARS-CoV-2 virus. The second one is technical capacity, through organization of a regional training course for dissemination of theoretical knowledge and practical skills on biosafety during sampling and sample processing, as well as techniques for identification of SARS-CoV-2. The training course was initially scheduled for the 30 March to 9 April 2020 at the IAEA Laboratories in Seibersdorf, Austria However due to the global travel restrictions caused by the COVID-19 outbreaks, the course was rescheduled for later date.

As of 15 May 2020, IAEA has supported 24 veterinary laboratories of which 10 are in Africa (*Algeria, Egypt, Ethiopia, Ivory Coast, Kenya, Mauritania, Namibia, Nigeria, Zambia and Zimbabwe*), 6 in Asia (*Malaysia, Mongolia, Myanmar, Oman, Thailand, Viet Nam*) and 8 in Europe (*Bosnia and Herzegovina, Croatia, Georgia, Montenegro, North Macedonia, Romania, Serbia and Uzbekistan*). During the next support deliveries IAEA plans to include additional veterinary laboratories, especially those involved in the public health monitoring programmes of member states.

Stories

Nuclear Technologies Keep Morocco Free of Foot and Mouth Disease

Morocco has 29 million cattle, sheep, goats and camels, and its livestock sector contributes nearly 13% of agricultural GDP.

Moroccan veterinary authorities identified in 2019 a new strain of the Foot and Mouth Disease (FMD) virus, a highly contagious animal disease, by using nuclear derived technologies. The use of this technology led to successful vaccination campaigns in the country, and Morocco is now celebrating a year without any case of FMD. This was achieved with the support of the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO).

Clinical examination in a cow suspected of a zoonotic disease

In January 2019, Morocco experienced FMD outbreaks in several provinces. Herds were rapidly infected in five localities. For each case confirmed, all livestock within a three-kilometre radius was slaughtered, a surveillance zone with a radius of ten-kilometres was established, and the sales of animals and animal food products was blocked.

“The real challenge for national veterinary authorities was to know whether the outbreaks were caused by the same strain of the FMD virus as the one detected in 2015 during the previous outbreak,” said Ivancho Naletoski, Animal Health Officer at the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

In 2017, FAO/IAEA experts, with support from the IAEA Technical Cooperation Programme, trained 10 veterinary laboratory staff from Morocco and provided them with equipment and supplies to facilitate disease identification and guide control and response measures. The trainees included staff from the Regional Laboratory for Analysis and Research of Casablanca (LRARC), who subsequently successfully identified the new FMD strain in early 2019 by using their newly acquired skills and the genetic sequencing service established by the Joint FAO/IAEA Division.

Shortly after the January 2019 FMD outbreak, the specific virus genome was sequenced by the Moroccan veterinary laboratory and compared with the locally circulating strains. LRARC simultaneously sent samples for genetic sequence analysis to the Animal Health Laboratory (ANSES) in Maisons-Alfort, France, a reference institution for FMD identification, which confirmed LRARC’s diagnosis. Once the new strain and vaccine were identified, the Moroccan veterinary authorities implemented successful vaccination campaigns, which led to the rapid halting of the spread of the disease.

“The genome sequencing transferred by the IAEA to our lab enabled us to rapidly discriminate the circulating strains in the country and adjust the disease control plans accordingly,” said Fatiha El Mellouli, Head of Animal and Plant Health Service at LRARC.

Click here to read more.

Africa's Increased Capacity to Diagnose and Contain Ebola and other Zoonotic Diseases Using Nuclear-Derived Techniques

Nuclear-derived techniques have been well established as an important diagnostic tool to rapidly and reliably identify many diseases spreading from animals to humans, such as Ebola Virus Disease, Highly Pathogenic Avian Influenza, Middle East Respiratory Syndrome and others. While the focus these days is on COVID-19, authorities need to remain vigilant about other zoonotic diseases as well.

Biosafety and security workshop in Bangui, Central African Republic

Over 15,000 people have been killed by Ebola since its discovery in the Democratic Republic of Congo (DRC) in 1976, according to the World Health Organization (WHO). Since then, the virus has mainly taken its toll in 13 countries in Africa. Ever since the major outbreak in West Africa in 2014-2016, the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO) and in collaboration with the WHO, has supported Ebola diagnosis in African countries. With more veterinary officials now able to diagnose the disease rapidly and reliably, these countries are better prepared for early

detection to prevent major outbreaks and have advanced in tracing the molecular epidemiology of Ebola and other viral haemorrhagic fevers (VHFs) with the help of molecular genetic tools.

During the 2014-2016 Ebola outbreak, close to 30,000 people were infected in Sierra Leone, Liberia and Guinea. Three months had passed before the diagnosis could be made in Guinea, where the outbreak began. More than 2,500 people lost their lives because of the lack of diagnostic capacity and resources. At the end of 2014, the governments of Guinea and several other African countries requested the IAEA to support them in improving their capacities in Ebola diagnosis.

Through nuclear-derived techniques such as the enzyme linked immunosorbent assay (ELISA) and the real time reverse transcription-polymerase chain reaction (real time RT-PCR), scientists are able to diagnose Ebola much faster than with conventional methods.

The IAEA, through its Technical Cooperation Programme, provided assistance to experts from Africa on the use of these techniques. “We trained 142 local staff to carry out early diagnosis of zoonotic diseases under adequate bio-safety conditions and provided them with the equipment and the diagnostic kits needed to perform the assays,” said Ivancho Naletoski, Animal Health Officer at the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Click here to read more.

Enhancing the use of Local Resources for Sustainable Livestock Feeding in Togo (TOG5001)

Livestock is a key asset for the Togolese people, significantly contributing to their livelihoods. However, like in many other developing countries, high cost and seasonal fluctuation in availability and quality of feed are major challenges to livestock production. In Togo, the feed mostly available for livestock is natural grazing, including trees and shrubs, or crop residues, whose nutritive value is largely unknown. Ensuring animals receive sufficient quantity and quality of feed is essential for improving yields. Through the support of the Joint FAO/IAEA Division, a national livestock nutrition laboratory was established at the University of Lome, and capacity developed for mapping and accurate evaluation of the nutritive value of locally available livestock feed resources. Togo is now able to evaluate local resources (pastures/forages/browse and crop residues) for formulation of affordable livestock rations that will be recommended to farmers, in addition to better management of scarce feed resources using annual feed calendars, for sustainable livestock productivity.

Local plants (L) being evaluated (R) for nutritive value and potential as livestock feed resources

Alternative for the Sustainable Control of Gastrointestinal Parasites in Sheep

The Instituto Nacional de Tecnología Agropecuaria (INTA), Argentina, led the coordination of a project implemented by the IAEA to reduce parasitosis in sheep. "It has been sufficiently demonstrated that there are animals that are more resistant than others to gastrointestinal parasites and this is inheritable, therefore, the use of breeding animals with good productive abilities and also with greater genetic resistance to gastrointestinal parasites is a sustainable alternative for the medium and long-term control of parasitosis,” indicated Mario Poli, researcher at the ‘Ewald A. Favret’ Institute of Genetics (IGEAF), at INTA Castelar Center for Research in Veterinary and Agronomic Sciences.

Participants of the Final Coordination Meeting of ARCAL TC Project RA5071

The Technical Cooperation Project ‘Decrease in the rate of parasitic infestation in sheep’ (2015-2019) had the participation of 12 countries from the Latin America and the

Caribbean region (Argentina, Brazil, Bolivia, Costa Rica, Cuba, El Salvador, Mexico, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela). The initiative was implemented by the Joint FAO/IAEA Division of the IAEA and led by INTA.

Mario Poli, who coordinated this training, stated that during this 4-year period, 8 training courses were held, covering the following topics: sampling, data collection, management and analysis; animal breeding and selection practices; health management of small ruminants including parasite control; animal nutrition and livestock feed management; assisted reproduction techniques to improve the productivity of small ruminants; statistical analysis of data related to the management of the gastrointestinal parasite in sheep and goats; application of information on genomics and DNA markers to improve the rearing of small ruminants; and bioinformatic analysis of genomic data to assess population structure, genotype-phenotype association, and genomic prediction.

Bosnia and Herzegovina Veterinary Labs Equipped to Diagnose Animal Diseases Using Nuclear-Derived Techniques

Bosnia and Herzegovina veterinary authorities are better equipped to protect livestock from several animal diseases spreading in South-eastern Europe, thanks to the support of the IAEA in partnership with the Food and Agriculture Organization of the United Nations (FAO). This is an important step for food security in the country and for the export of animal products and food to the European Union market, local officials have said.

A scientist at the Veterinary Faculty of the University of Sarajevo analysing genome sequence

Brucellosis has been present on the Balkan peninsula for centuries as an endemic disease of livestock, while bluetongue (BT) and lumpy skin disease (LSD) have only emerged recently. Brucellosis is transmitted among animals through direct and indirect contact, while BT and LSD are transmitted by blood-sucking insects such as mosquitoes, ticks and fleas. All three diseases can have a significant effect on animal health and production, as well as on the economic output and international trade of a country.

In 2012-2014, the IAEA supported the efforts of Bosnia and Herzegovina to improve the diagnostic capacities and control of Brucellosis, a highly contagious disease. “Seven years later, due to the presence of the disease in the country, export of live animals is still not allowed by the EU. However, thanks to the milestone we have just reached in performing diagnostic tests quickly and reliably, we have now made a big step forward to fulfilling the standards of the EU,” said Toni Eterovic, research scientist at the Veterinary Faculty of the University of Sarajevo, who took part in the project.

The IAEA, through its Technical Cooperation Programme and the joint FAO/IAEA Division, provided advanced equipment and training to laboratory staff, enabling them to read entire genome sequences and identify virus strains.

Click here to read more.

Use of Stable Isotopes to Trace Bird Migrations and Molecular Nuclear Techniques to Investigate the Epidemiology and Ecology of the Highly Pathogenic Avian Influenza (D32030)

Influenza is one of the most common infectious diseases in animals and humans and is divided into three genera. Influenza B and C are mostly human pathogens whereas Influenza A can occur in both humans and domestic animals, poultry and wild waterfowl (WWF).

Wild waterfowl can harbour avian influenza and transmit it via the shredding of the virus and faecal contamination of the water. Therefore, it is important to have knowledge of their place of origin and intermediate stages of migration between breeding and non-breeding areas meaning that satellite positioning, geo-locators or external markers are no longer enough.

A new technique based on stable isotope ratios (SI) in tissues of birds, especially in metabolically inert tissues such as feathers, helps. Certain SIs are involved in important biological and ecological processes, and there is a strong correlation between the content of these SIs in the environment and the concentration of the same SIs in bird tissues.

The analysis of stool samples for simultaneous detection of bird species and carrier status of birds by non-invasive analysis of stool samples may establish the epidemiological link between migration pathways (obtained by SIs in feathers) and the transmission of the virus to a geographical area.

Red-Breasted Goose (Branta ruficollis)

DNA barcoding may be used to determine species from stool and feather samples taken, however, it has been optimized under this Coordinated Research Project (CRP).

By combining the above techniques, it is possible to determine the avian influenza virus (AIV) carrier status and species (DNA barcoding plus AIV presence in the faeces) as well as the type of randomly collected feathers and the origin of the specific wild waterfowl.

The relevance of the CRP D32030 is in the development and application of tools for tracing long range migrations of WWF and its linkages to the transmission and epidemiology of the AIV at national, regional and global levels.

Click here to read more.

Mobile Field Laboratory

Whether in the laboratory or in the field an unstable power supply disrupts workflows, which can result in costly impacts such as: wasted reagents; thermal damage to samples collected in the field, preventing proper testing; or even rendering the running of a PCR in the field impossible.

Small petrol driven generators can be problematic due to their bulk, running costs and need for regular maintenance. Recently, new and more portable power/inverter systems have been put on the market, based on lithium batteries with a charger capable of operating either with solar cells, a 12V plug in the car or a power pack from the mains. Unfortunately, most product descriptions are misleading and with a few calculations the majority of these systems are shown to be unfit for field working conditions. In the field, the system needs to be able to power a DC fridge box for 5 hours autonomously and additionally allow the running of a centrifuge, a laptop or printer or even a qPCR machine.

Thus, the prerequisites were defined: It must have a 220V output of about 400W; run a 12V mobile fridge (~ 40W) and be charged by a 100W solar panel or by the 12V cigarette lighter plug in the car. This means that the equivalent of a 12V car battery with 40Ah or 400Wh would be required. This is the first challenge, lithium-ion batteries operate with 3.6V cells. This means that a 14V cell needs 4 cells in parallel, thus a 120000mAh value for such a device means 120Ah/4, resulting in 30Ah for the full charge of 14V. Therefore, the devices have to be charged with roughly 14V. This is no problem for a solar cell (up to 18V) nor the charger (mostly based on 15V); but car battery charging power is mostly limited to 13V, which does not allow the power supply to be fully charged. However, connecting such a power supply in line with a mobile fridge via the cigarette lighter utilizing the cars generator still charges the instrument. Consequently, charging of such a device must be minimum 6A, this means the number of such power supplies is rather limited.

We tested a 400W Portable Camping Generator, Emergency Power Supply with Solar Charging. An Engel cool box at ambient temperature (12V; 32W; 40L volume) was connected to the power supply which was charged by a 100W solar panel for 8 hours on sunny day. After 1 hour it reached 0°C down from 24°C, 2 hours later -10°C and 4 hours later -18°C. The charge status remained the same and charging a laptop, using a printer or running a small centrifuge worked well.

In summary such portable power supply devices present a major advance in small solar powered energy solution for field work if attention is paid to the specifications and power requirements are well defined and correspond. AC equipment with compressors or high torque engines are not suitable.

Test set up for the portable power supply

IAEA to Support Countries in the Detection of Novel Coronavirus

Director General Rafael Mariano Grossi announced that the IAEA will provide diagnostic kits, equipment and training in nuclear-derived detection techniques to countries asking for assistance in tackling the worldwide spread of the novel coronavirus causing COVID-19.

The assistance, requested by 14 countries in Africa, Asia, Latin America and the Caribbean, is part of intensified global efforts to contain infections. The diagnostic

technique, known as real time reverse transcription–polymerase chain reaction (real time RT-PCR), can help detect and identify the novel coronavirus accurately within hours in humans, as well as in animals that may also host it.

"The Agency takes pride in its ability to respond quickly to crises, as we did in the recent past with the Ebola, Zika and African Swine Fever viruses," said Mr Grossi in a statement to the IAEA Board of Governors. "Contributing to international efforts to deal with the coronavirus will remain a priority for me as long as the outbreak persists."

The first training course in detection techniques will take place at the Joint IAEA/Food Agriculture Organization of the United Nations (FAO) Animal Production and Health Laboratory in Seibersdorf, Austria, and will include medical and veterinary experts from Cambodia, Republic of Congo, Cote d´Ivoire, Ethiopia, Kenya, Madagascar, Malaysia, Mongolia, Philippines, Sri Lanka, Thailand and Viet Nam. Additional regional courses will be organized for other countries, including from Latin America and the Caribbean.

The nuclear-derived diagnostic technique - real time RT-PCR- can help detect and identify the novel coronavirus accurately within hours

Participants will be trained in biosafety and biosecurity procedures to protect health and veterinary workers during sampling and analysis and to prevent further external contamination. They will immediately receive emergency toolkits with personal protection equipment, specific diagnostic reagents and laboratory consumables. A number of national laboratories will also receive additional equipment, such as biosafety cabinets and real time RT-PCR devices.

The training will include veterinary experts in an effort to increase countries' preparedness in the early detection of viruses that cause zoonotic diseases – those originating in animals that can spread to humans. They will be trained to test domestic and wild animals implicated in the transmission of coronaviruses, such as the new strain SARS-CoV-2 causing COVID-19, and others that cause Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).

The assistance to countries in tackling COVID-19 is delivered through the IAEA's Technical Cooperation Programme, which supports the peaceful application of nuclear technology in areas such as human and animal health. It is funded through the IAEA's Peaceful Uses Initiative, which was launched in 2010 to mobilize additional funding for such projects.

IAEA to Ship Vital Testing Equipment to Countries in the Fight against COVID-19

The IAEA is dispatching a first batch of equipment to more than 40 countries to enable them to use a nuclear-derived technique to rapidly detect the coronavirus that causes COVID-19. This emergency assistance is part of the IAEA's response to requests for support from around 90 Member States in controlling an increasing number of infections worldwide. Showing strong support for the initiative, several countries have announced major funding contributions for the IAEA's efforts in helping to tackle the pandemic.

Dozens of laboratories in Africa, Asia, Europe, Latin America and the Caribbean will receive diagnostic machines and kits, reagents and laboratory consumables to speed up national testing, which is crucial in containing the outbreak. They will also receive biosafety supplies, such as personal protection equipment and laboratory cabinets for the safe analysis of collected samples. Further deliveries of equipment to the growing number of countries seeking assistance are expected in the coming weeks.

"IAEA staff are working hard to ensure that this critical equipment is delivered as quickly as possible where it is most needed," said IAEA Director General Rafael Mariano Grossi. "Providing this assistance to countries is an absolute priority for the Agency."

The IAEA is using its own resources as well as extrabudgetary funding for its emergency COVID-19 assistance. Member States have so far announced more than €9.5 million in extrabudgetary financial contributions to the IAEA for this purpose, including US $6 million from the United States, CAD $5 million from Canada and €500,000 from the Netherlands. Australia has also made an important contribution. In addition, China has informed the IAEA about donations of detection equipment, kits, reagents and other medical materials worth US $2 million and provision of expert services.

After his telephone conversation last week with the Director General of the World Health Organization (WHO), Tedros Adhanom Ghebreyesus, Mr Grossi said the IAEA is taking concrete and coordinated action to support global efforts against the pandemic. The IAEA is now also part of the UN Crisis Management Team on COVID-19.

The first batch of supplies, worth around €4 million, will help countries use the technique known as real time reverse transcription–polymerase chain reaction (real time RT-

PCR). This is the most sensitive technique for detecting viruses currently available.

Click here to watch the video.

How is the COVID-19 Virus Detected Using Real Time RT-PCR?

As the virus that causes the COVID-19 disease spreads across the world, the IAEA, in partnership with the Food and Agriculture Organization of the United Nations (FAO), is offering its support and expertise to help countries use real time reverse transcription–polymerase chain reaction (real time RT-PCR), one of the most accurate laboratory methods for detecting, tracking, and studying the coronavirus.

Real time RT-PCR is a nuclear-derived method for detecting the presence of specific genetic material from any pathogen, including a virus. Originally, the method used radioactive isotope markers to detect targeted genetic materials, but subsequent refining has led to the replacement of the isotopic labelling with special markers, most frequently fluorescent dyes. With this technique, scientists can see the results almost immediately while the process is still ongoing; conventional RT-PCR only provides results at the end.

A sample is collected from parts of the body where the coronavirus gathers, such as a person's nose or throat. The sample is treated with several chemical solutions that remove substances, such as proteins and fats, and extracts only the RNA present in the sample. This extracted RNA is a mix of a person's own genetic material and, if present, the coronavirus' RNA.

The RNA is reverse transcribed to DNA using a specific enzyme. Scientists then add additional short fragments of DNA that are complementary to specific parts of the transcribed viral DNA. These fragments attach themselves to target sections of the viral DNA if the virus is present in a sample. The mixture is then placed in a RT-PCR machine to obtain around 35 billion new copies of the sections of viral DNA created from each strand of the virus present in the sample. As new copies of the viral DNA sections are built, the marker labels attach to the DNA strands and then release a fluorescent dye, which is measured by the machine's computer and presented in real time on the screen, which can confirm that the virus is present.

The IAEA, in partnership with the FAO, has trained and equipped experts from all over the world to use the real time RT-PCR method for over 20 years particularly through its VETLAB network of veterinary diagnostic laboratories. Recently, this technique has also been employed to diagnose other diseases such as Ebola, Zika, MERS-Cov, SARS-Cov1, and other major zoonotic and animal diseases.

Click here to watch the video.

IAEA Director General Rafael Mariano Grossi

IAEA Launches Initiative to Help Prevent Future Pandemics

The Director General of the International Atomic Energy Agency (IAEA), Rafael Mariano Grossi, launched an initiative today to strengthen global preparedness for future pandemics like COVID-19. The project, called ZODIAC, builds on the IAEA's experience in assisting countries in the use of nuclear and nuclear-derived techniques for the rapid detection of pathogens that cause transboundary animal diseases, including ones that spread to humans.

The IAEA Zoonotic Disease Integrated Action (ZODIAC) project will establish a global network to help national laboratories in monitoring, surveillance, early detection and control of animal and zoonotic diseases such as COVID-19, Ebola, avian influenza and Zika. ZODIAC is based on the technical, scientific and laboratory capacity of the IAEA and its partners and the Agency's mechanisms to quickly deliver equipment and know-how to countries.

The aim is to make the world better prepared for future outbreaks. "Member States will have access to equipment, technology packages, expertise, guidance and training. Decision-makers will receive up-to-date, user-friendly information that will enable them to act quickly," Mr Grossi told a meeting of the IAEA Board of Governors.

ZODIAC builds on the experience of VETLAB, a network of veterinary laboratories in Africa and Asia that was originally set up by the Food and Agriculture Organization of the United Nations (FAO) and the IAEA to combat the cattle disease rinderpest. VETLAB now supports countries in the early detection of several zoonotic and animal diseases, such as African swine fever and peste des petit ruminants (PPR).

ZODIAC will establish a global network to help national laboratories in monitoring, surveillance, early detection and control of animal and zoonotic diseases such as COVID-19 and Ebola

"About 70 per cent of all diseases in humans come from animals," said Gerrit Viljoen, Head of the Animal Production and Health Section of the Joint FAO/IAEA Programme for Nuclear Techniques in Food and Agriculture. ZODIAC aims to help veterinary and public health officials identify these diseases before they spread. "We have seen an increase in the number of zoonotic epidemics in the last decades: first Ebola, then Zika, and now COVID-19. It's important to monitor what is in the animal kingdom – both wildlife and livestock – and to act quickly on those findings before the pathogens jump to humans," Mr Viljoen said.

Following the One Health concept for a multidisciplinary collaborative approach between human and animal health authorities and specialists, ZODIAC will benefit from the unique joint FAO/IAEA laboratories and from partners such as the World Health Organization (WHO) and the World Organisation for Animal Health (OIE).

Click here to read more.

The IAEA Can Now Help More Countries Diagnose COVID-19 Cases

The IAEA can now help more countries diagnose COVID-19 cases thanks to a pledged donation of around 4.3 million euros from the Japanese biopharmaceutical company Takeda. So far, 119 countries have requested the IAEA's assistance to use a nuclear-based diagnostic technique, as part of the effort to contain the virus. Several have already received equipment packages, with many more on the way. This latest pledge will allow the agency to ramp up efforts to deliver the kits. IAEA Director General Rafael Mariano Grossi thanks Takeda for this important, generous contribution to the IAEA. Thanks to it the agency will be able to continue its work helping Member States combat and defeat coronavirus.

Giovanni Cattoli, Laboratory Head of the Animal Production and Health Laboratory, Seibersdorf, explaining the components of the COVID 19 diagnostic kit

The commitment from Takeda, one of the world's largest pharmaceutical firms, will add to the 22 million euro in funding that countries have already pledged for the IAEA's COVID-19 assistance programme.

This is the nuclear agency's largest technical cooperation initiative since it was founded in 1957.

Click here to watch the video.

Preparing the World for Future Pandemics

A new global initiative will use nuclear science to better manage pandemic threats, such as COVID-19.

The International Atomic Energy Agency has launched the Zoonotic Disease Integrated Action project, or ZODIAC. This will work to help countries control diseases that cross from animals to humans, and to respond quickly to any outbreaks.

Nuclear and nuclear-derived techniques are proven tools for detecting and understanding zoonotic diseases. They are currently being used to quickly and accurately test people for COVID-19 around the world.

Click here to watch the video.

Preparing the World for Future Pandemics

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)

Development of a multi-species array for breeding and improvement of camelids

Animal Production and Health Laboratory (APHL) in collaboration with the Institute of Wildlife, Vetmed University of Vienna initiated the development of a DNA microarray tool for camelids. Whole genome sequences from nine dromedary (*C. dromedaries)* and seven Bactrian (*C. bactrianus)* (NCBI BioProject PRJNA276064) were utilized to identify at least 60000 single nucleotide polymorphisms (SNPs) in each of these old world camelid species. Similarly, 56 whole genome sequences from Llama, Alpaca, Guanaco and Vicugna (14 from each species provided by Pablo Orozco-Terwengel, School of Biosciences, Cardiff University, United Kingdom) were utilized to identify ~60000 SNPs in new world camelid species. Additionally, >10000 SNPs predicted from Bactrian camel immune response genes were also included for the design and development of the array. The finalized multi-species camelid array (Figure 1) was developed on the Affymetrix-Axiom platform and consisted of ~200K SNPs with >60K from each of dromedary, Bactrian and New World camelid species. The process of fabrication of custom camelid array was completed and delivered to APHL, Seibersdorf for technical validation and further analysis. This array is the first of its kind for camelids and will be an important genomic tool to aid breeding and improvement of these important livestock species for increased productivity.

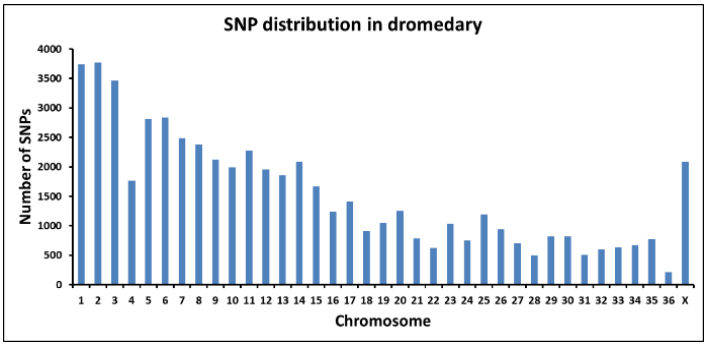


Figure 1: Chromosome-wise distribution of dromedary SNPs in the multi-species camelid array

Development of baseline information and genetic evaluation of West African cattle

Advanced nuclear and genomic technologies play an important role in improving efficiency of dairy cattle improvement programs for increased milk productivity. Genomic tools can help estimate levels of genetic admixture in crossbred cattle, verification of genetic purity in purebred cattle and match performance data with appropriate genetics to select superior stocks for breeding. Under CRP D31028, APHL embarked on developing baseline genetic information and evaluation of African cattle using classical and genome-wide DNA markers. More than 700 cattle from 17 breeds across West Africa (Benin, Burkina Faso, Mali and Niger) were genotyped and evaluated. The history of cattle breeding in West Africa involved the colonization of African taurine cattle followed by a wave of zebu introgression with varying levels of admixture in native cattle breeds. Hence, the investigated breeds included West African taurine, West African Zebu, their crossbreds, Asian Zebu and European taurine cattle types.

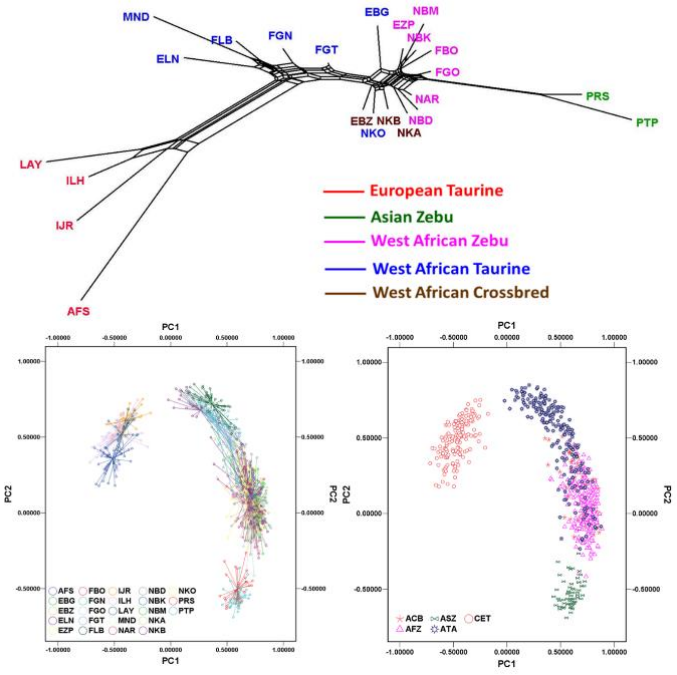


Figure 2: NeigborNet showing relationship among West African cattle (top) and Principal components analysis based genetic structure among West African zebu, taurine and crossbred cattle (a) Breed-wise (Bottom left) (b) Species-wise (Bottom Right)

The results, also illustrated in Figure 2, showed 5.4% of total genetic variation in West African cattle was due to between breed differences. Dynamic changes in demography and breed ancestry were observed in West African cattle with significant zebu introgression in Kouri cattle, a traditional West African taurine breed from Niger. Similarly, zebu admixture was significantly higher in Bourgou cattle from Benin and Gourounssi breed from Burkina Faso. Genetic purity was better maintained in Lagunaire and Lobi cattle (taurine) and Bororo Maaaoua (zebu) cattle. These findings point to the need of applying

appropriate breeding strategies, specific to the requirements of different regions for improving efficiency and productivity. Genotyping and genomic evaluation of purebred taurine and zebu cattle from other African countries are currently in progress.

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

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

Genetic characterization of Cambodian native cattle breeds

Livestock in Cambodia, including cattle, supports 1.4 million smallholder farmers and accounts for 20.9% of agricultural gross domestic product. Rearing of cattle is largely dominated by smallholders and animals are predominantly kept for draught power in agriculture activity, with recent interests focusing on market-oriented beef production. Cambodian cattle are predominantly zebu type *(Bos indicus)*, consisting mainly of an indigenous breed called Gor Srok, Gor Khmer or Gor Kdarm. Based on morphology and coat colour, two kinds of Cambodian native cattle are widely distributed: Gor Kdarm Red and Gor Kdarm White.

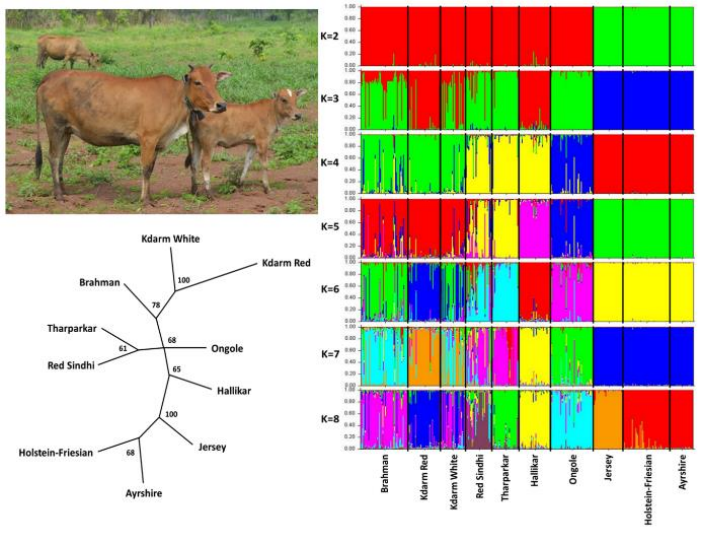


Figure 3: Gor Kdarm Red cattle of Cambodia (top left); genetic relationship (bottom left), population structure and genetic admixture (right) in Cambodian native cattle breeds

To improve beef production, native cattle are subjected to crossbreeding with imported breeds like Brahman and Hariana. This has resulted in varying levels of genetic admixtures and dilution of indigenous germplasm. Improving native cattle breeds through genetic selection and artificial insemination would ensure native breeds retain their adaptability to local environment and tolerance to local diseases. The International Atomic Energy Agency, through its Technical Cooperation program (KAM5003: Supporting Sustainable Livestock Production) collaborated with the Animal Production and Research Institute of Cambodia to launch a national artificial insemination and genetic evaluation program for improvement of Cambodian cattle. APHL provided technical support to generate baseline genetic information and evaluate population structure, admixture and genetic relationships among Cambodian native and imported cattle breeds. The results (Figure 3) showed high levels of genetic variability in Cambodian native cattle as compared to other zebu cattle breeds located near the center of domestication. Genetic structure analysis revealed significant introgression of Brahman into native Gor Kdarm White cattle, while limited genetic admixture levels was observed in Gor Kdarm Red cattle. The findings will play an important role in formulating effective strategies for breeding and improvement of Cambodian cattle.

Neutral genetic variability and population structure in Eastern European cattle

Under the FAO technical cooperation project 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'. In continuation of this, APHL conducted assessment of neutral genetic variability in Caucasian Brown, Carpathian Brown and Bulgarian cattle breeds. A total of 182 cattle from six breeds (Bulgarian rhodope, Rhodope shorthorn (Bulgaria), Bulgarian Brown (Bulgaria), Caucasian Brown (Armenia), Caucasian Brown (Georgia) and Carpathian Brown (Ukraine) cattle) were genotyped and evaluated.

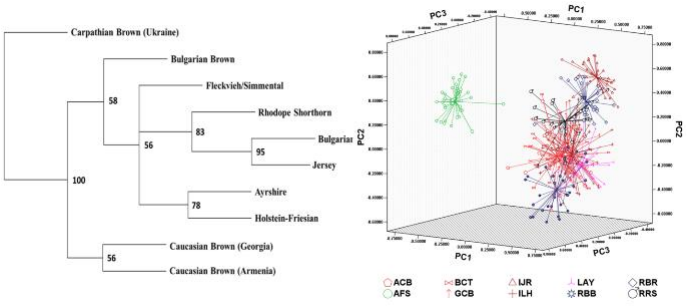


Figure 4: Phylogeny and genetic relationships among East European cattle breeds (Right: Neighbor Joining tree derived from pairwise Cavalli-Sforza and Edwards chord distance; Left: principal compoenents based genetic structure analysis)

All six breeds were compared with commercial European taurine cattle that included Jersey, Holsteins, Fleckvieh-Simmental and Ayrshire cattle (Figure 4). The Bulgarian native cattle were closely related to Jersey and Fleckvieh-Simmental breeds as compared to Caucasian Brown and Carpathian Brown cattle. Significant gene-flow was observed among the six Eastern European cattle breeds. The results on evaluation of neutral genetic variability will be utilized to further improve the efficiency of conservation and genetic improvement programs targeted for development of cattle in Armenia, Georgia, Ukraine and Bulgaria.

Electronic documentation of international genetic repository

APHL is maintaining an international livestock genetic repository to promote collaborative animal genetic research and development activities across member states. All the samples and related information on nucleic acids available at IAEA Seibersdorf laboratories is being documented electronically on the platform called 'Genetics Laboratory Information and Data Management System'. More than 5000 samples belonging to >40 breeds of indigenous cattle located in more than 15 countries were entered into the system. Further documentation of samples from other livestock species is currently under progress.

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 four countries (Cameroon, Nigeria, Burkina Faso and Mongolia) 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/genotyping facility at the Veterinary Services Division, Asmara, Eritrea.

Animal Health

Irradiation of Lactobacilli for Use as Vaccine Adjuvants

While vaccines can theoretically provide complete protection against infectious diseases, many vaccines that are currently available on the market are suboptimal. This is more prevalent with livestock vaccines as the number of infectious diseases present in numerous species are large. It seems the antigens used for the vaccines are appropriate in providing protection against the disease pathogens, but the breadth and depth of the immunity induced is not enough to provide a long lasting effect. This phenomenon is evident in killed vaccines as the vaccine antigens do not stimulate the local vaccination environment sufficiently to attract antigen presenting cells. Therefore, many killed vaccine formulations are supplemented with molecules called 'vaccine adjuvants' that augment the vaccine response. Throughout the history of vaccine development, a handful of vaccine adjuvants have been produced and added into commercial vaccine preparations. Ultimately, using such adjuvants adds to the price of vaccines, increasing the cost of a vaccine dose.

Bacterial products have been shown to provide excellent properties of vaccine adjuvants. Some scientists have used whole bacteria as vaccine adjuvants. Among them, Lactobacilli, a group of bacteria that has been used as pro-biotics to provide health benefits, has shown to be effective. However, concerns have been raised about using live bacteria in vaccine preparations due to uncontrolled or unpredictive effects. Thus, killed Lactobacilli were used but then the immunity induced was different to the live bacteria. To provide a solution for this, we are now investigating the potential of irradiated Lactobacilli as vaccine adjuvants. Our previous work showed that gamma irradiated *E. coli* are replication deficient but metabolically active, a property that would be better than killed bacteria to be used as vaccine adjuvants. In the current experiments, which, were conducted in collaboration with the BOKU university, we determined the irradiation dose that is needed to stop the replication of four strains of Lactobacilli; *L. casei, L. acidophilus, L. paracasei and L. plantarum*. This was done by examining the D10 value for each strain. D10 value is the dose of irradiation needed to lower the concentration of an organism by one log (Figure 5).

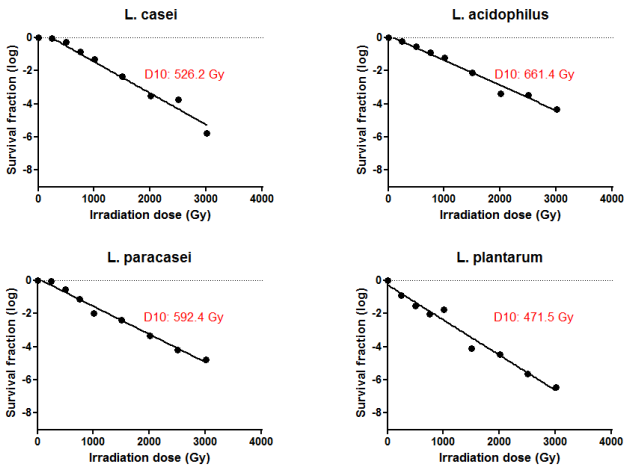


Figure 5: Determination of D10 values for lactobacilli. L. casei, L. acidophilus, L. paracasei and L. plantarum were formulated with 50% trehalose and gamma-irradiated (Co60 source) under frozen conditions. Then, they were plated in MRS agar to find the microbial cell count. D10 value, the dose of irradiation that lowers the cell count by one log is shown in red.

Immunophenotyping of Cells in the Chicken Harderian Gland

Mucosal delivery of vaccines is a very much sought-after strategy in livestock animals and especially in the poultry industry. Mucosal vaccines can be applied extensively, for example, though drinking water or as an aerosol spray, which is logistically feasible and economically profitable. Mucosal vaccines, especially eye drop vaccines, have the big advantage of only requiring small volumes as the vaccine dose. Besides, these vaccines can be applied by village vaccinators and the cold chain can be relatively easy

to maintain. These vaccines can be applied by farmers or extension workers and do not require the service of highly trained technicians. Delivery of vaccines through a mucosal route induces immunity in the mucosae such as the respiratory tract, which is the entry point for many pathogens. Hence the pathogens will be encountered with the induced immunity as the pathogens enters. Therefore, it is very important to measure the immunity induced by mucosal vaccines at mucosal surfaces.

One of the popular routes of mucosal delivery of vaccines in chickens is through eye-drops. The Harderian gland (HG), which is located inside the eye socket behind the eyeball plays an important role in adaptive immune responses upon ocular exposure to pathogens and vaccine antigens. Experiments have shown the main source of immunoglobulin A (IgA) in the tears is the HG. Secretory IgA at mucosal surfaces prevent the binding of pathogens to epithelial cells, thus preventing any entrance and replication. Therefore, study of immune parameters in the HG is very important. Flow cytometry is a cutting-edge technology that is used to phenotype immune cells and assay the functional properties of those cells. We have now optimized a protocol to isolate single cells from HG and to phenotype the immune cells that reside within this compartment (Figure 6). Further experiments are currently being conducted to evaluate the functional properties of these cells.

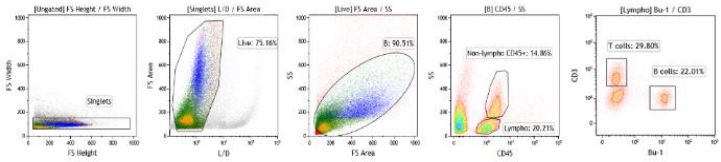


Figure 6: Various immune cell subtypes residing within the HG. Single cell suspensions were made from a fresh HG obtained from chicken and stained with various fluorescence dye conjugated antibodies against chicken immune markers and analysed through a flow cytometer. Dot plots shows fractions of total white blood cells (CD45+), total lymphocytes and percentage of T and B lymphocyte fraction within lymphocyte fraction.

Evaluation of Commercially Available PCR-Based Detection Kits for African Swine Fever

African swine fever (ASF), a lethal viral haemorrhagic disease of pig caused by African swine fever virus (ASFV) is endemic in most sub-Saharan African countries. ASF has recently re-emerged in Europe and spread into Asia, threatening the most substantial part of the world pig industry and global food security. As the expansion of ASF increases the need for testing, there is a growing number of commercial ASFV detection kits on the market. These kits offer an excellent and stable alternative to in-house tests; however, there is a lack of information that enables the end-users to compare their performance and decide which one would fit their needs better.

APHL conducted a study to compare the sensitivity of the commercial kits (Thermo#A28809 Indical#VT281905 and IDVET#IDASF-100) with the OIE recommended protocol (King et al. 2003).

All four tests detected the ASFVs DNA successfully in the samples of a panel consisting of ten viruses from five genotypes (I, II, IX, XVI, and XXIII). For each of the samples tested, the IDVET kit showed the lowest Cq values, and the Thermo kit had the highest ones (Figure 7). Nevertheless, the Thermo kit allows for more amplification cycles, with the highest cut-off value (Cq < 45), as compared to the two other kits and the in-house assay (Cq < 40), therefore, it would efficiently detect ASFV in samples with low viral loads as well. The limits of detection were: 10.87 (9.04–14.41), 9.83 (8.18-13.05), 8.28 (6.68-11.80), and 13.54 (11.05–18.67) copies per reaction for IDVet, Indical, Thermo, and reference qPCR assay (King et al., 2003) respectively. The commercially available kits present the advantage of including an internal control to assess the nucleic acid extraction step and the quality of the sample.

Although at the individual levels, the IDVET kit showed the smallest Cq values, there was no substantial difference in the sensitivity (the LODs) of these assays and their ability to detect the five genotypes of the panel.

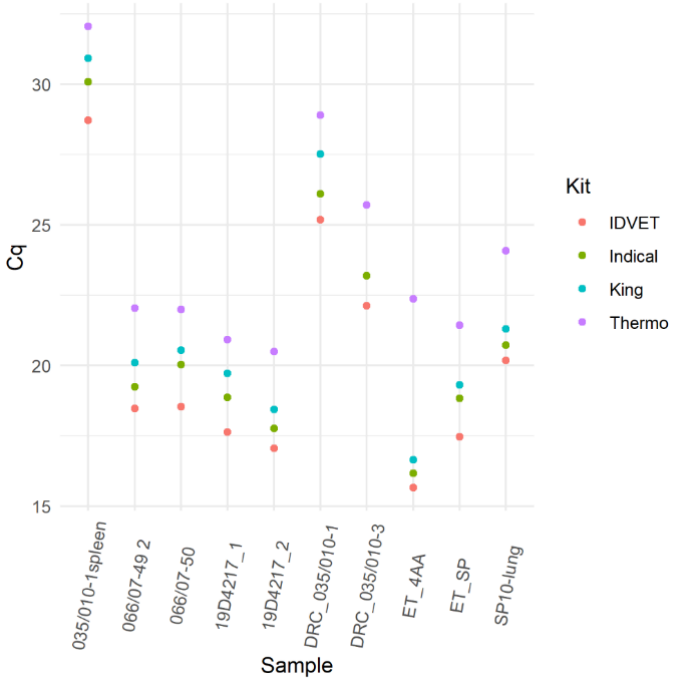


Figure 7: Comparison of the Cq from different kits

Clostridium botulinum in Dead Shellduck in Mongolia

Following considerable mortality of Shellduck in Mongolia, the State Central Veterinary Laboratory (SCVL) requested APHL to help investigate the possible infectious agents that could have affected the birds. A metagenomics approach based on the analysis of the 16S RNA gene was employed to analyze pools of samples. The Ion 16S Metagenomics kit was used according to the manufacturer protocol to amplify and sequence seven hypervariable regions: V2, V3, V4, V6-7, V8, and V9 of the 16S RNA in the samples. The samples were sequenced on an Ion S5 sequencer. The analyses and taxonomic assignments were performed using the ion Reporter software v5.2, and the MicroSEQ ID 16S Reference Library v2013.1 and Greengenes v13.5 databases. The result revealed the presence of *Clostridium botulinum* in pooled samples comprising intestine, faeces, and stomach (Figure 8). Further analysis is currently being conducted to determine the presence of specific neurotoxin and confirm the cause of the observed mortality in the ducks.

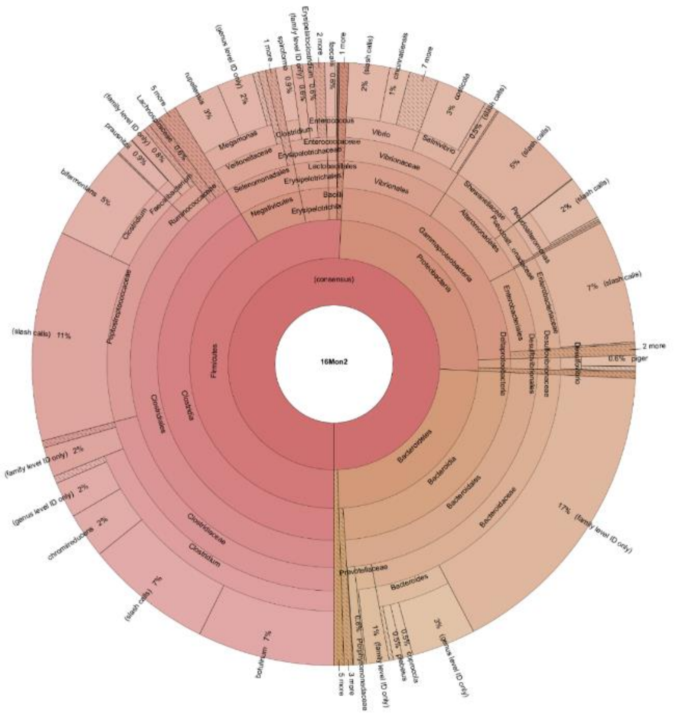


Figure 8: Species distribution of the of microbial profile derived from sequencing the 16s rRNA gene of a metagenomics library obtained from organs of dead wild ducks

Full Gene Sequencing of Rift Valley Fever Virus from Botswana

Rift Valley Fever (RVF) is a mosquito-borne zoonotic viral disease caused by the RVF virus (RVFV). RVFV is an arbovirus in the genus *Phlebovirus* within the family *Bunyaviridae*. RVFV possesses a single-stranded, segmented RNA comprising a large (L), medium (M), and small (S) segments.

The virus affects both wild and domestic ruminants, especially sheep, cattle, and goats, and humans. In susceptible animals, RVFV infection induces high fever, abortion storms, and high mortality in new-born animals.

The disease is widespread in sub-Saharan Africa, with outbreaks also reported in Egypt and the Arabian Peninsula. Botswana reported its first case of RVFV in livestock in 2010, with subsequent outbreaks in 2013 and 2017. To better understand the diversity of RVFV involved in outbreaks in Botswana, the APHL, in collaboration with the VETLAB partner in Botswana, the Botswana National Veterinary Laboratory, is undertaking the molecular characterization of the isolates recovered from outbreaks occurring between 2013 and 2017 in Botswana.

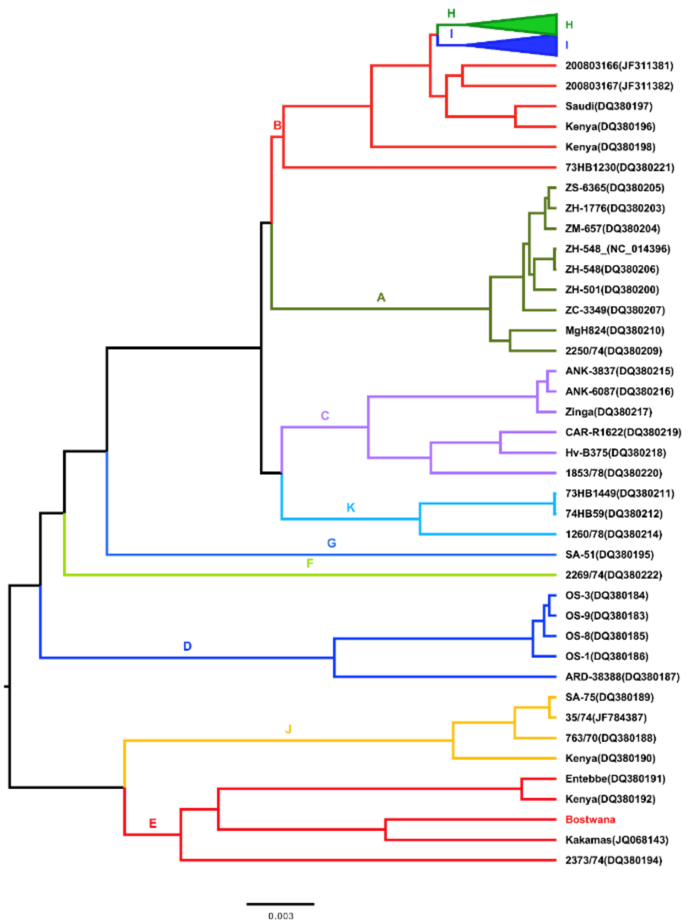


Figure 9: Maximum clade credibility (MCC) tree based on the M segment RVFVs

Out of fourteen RVFV positive samples, three segments, of a 2018 isolate from goats were amplified and sequenced using the Ion S5 sequencer.

The comparative analysis showed that the virus is closely related to RVFVs recovered from sheep and cattle in South Africa between 2009 and 2018.

The phylogenetic reconstructions showed that the Botswana virus belongs to viral lineage E based on all the three segments (Figure 9).

Further analysis and sequencing are ongoing to assess the diversity of RVF viruses in Botswana.

First Molecular Characterization of Avian Paramyxovirus-1 (Newcastle Disease Virus) in Botswana

Avian paramyxovirus-1 (APMV-1), the causative agent of Newcastle disease (ND) in domestic and wild avian species, has recently been reported and characterized in five southern African countries (Mozambique, Namibia, South Africa, Zambia and Zimbabwe). Since APMV-1s have never been characterized in Botswana, this study was undertaken to determine the genotype circulating in the country.

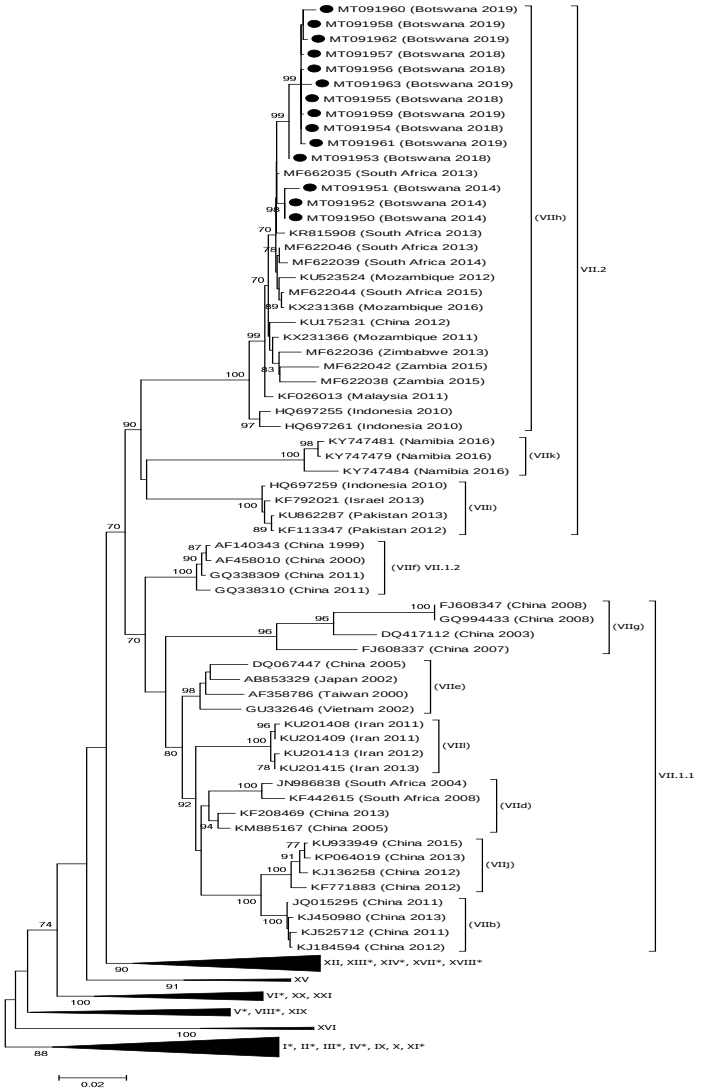


Figure 10 ML phylogenetic tree employing the Kimura-2 parameter model of nucleotide substitution and 500 bootstrap replications of the complete F gene sequence (1662 bp) gene sequence from APMV-1s sampled in Botswana combined with similar sequences available in GenBank.

Fourteen samples were collected between 2014 and 2019 from outbreaks in chickens from different regions of the country.

An analysis of the amino acid sequence of the F protein identified a cleavage site motif of ^{112}RRRKFR^{117} confirming the virulence of the viruses, while a phylogenetic analysis revealed that all of the viruses from Botswana clustered in genotype VII.2 (VIIh) (Figure 10) together with viruses from South Africa, Mozambique, Zambia and Zimbabwe. However, the viruses identified in Botswana in 2014 were more similar to viruses from South Africa, Mozambique, Zambia and Zimbabwe than those identified in 2018 and 2019. The results from this present study have confirmed the presence of genotype VII.2 (VIIh) and suggests that the ND outbreaks in Botswana in 2014 were most likely caused by transboundary movement of infected poultry or fomites between South Africa and Botswana or *vice versa*.

Molecular Characterization of Rabies Viruses from Two Western Provinces of the Democratic Republic of the Congo (2008 to 2017)

Although rabies is enzootic in the Democratic Republic of the Congo, there is very little molecular epidemiological information about the viruses circulating in animals. For this study samples were collected by both public and private veterinary services from two western provinces of the DRC namely Kongo Central and Kinshasa City between 2008 and 2017. Brain tissue was collected during necropsy by the Central Veterinary Laboratory (CVL) of Kinshasa and confirmation of the presence of rabies virus (RABV) was undertaken by the direct fluorescent antibody (DFA) test and RT-PCR.

The DFA test was used according to the recommendations of the OIE Terrestrial Manual 2018.

For RT-PCR analysis, brain tissue (1g) from each DFA positive smear was homogenized in 5ml of sterile PBS, pH 7.2 using a mortar and pestle. The homogenate was clarified in a refrigerated centrifuge at 5000 x g for 10 minutes. Total RNA was then extracted from 200µl of supernatant using the QIAamp Viral RNA Mini kit (Qiagen, Germany) following the manufacturer's instructions. RT-PCR for N gene detection was performed to screen the samples for the presence of Lyssa virus.

Twenty-one positive DFA test samples were processed to detect the RABV N gene and generated the expected 603bp amplicons. The amplicons were sent for sequencing using standard Sanger methods at LGC genomics (Berlin, Germany). Sequences have been deposited in GenBank under accession numbers MN264691 to MN264711.

The sequences generated were highly similar to each other (99.3 to 100% identity) and clustered together with a single sequence from a rabies virus obtained from a canine brain sample collected in the Republic of Congo in 2014.

This study was confined to the western part of the DRC. Therefore, little is still known about the distribution of RABV in the rest of the country. Gathering representative samples from various provinces throughout the country could result in a more complete understanding of the RABVs circulating in the DRC.

Fellows, Interns and Consultants

Ms Marcela Mora from Cayetano Heredia University, Lima, Peru was at APHL for training on 'Genomic evaluation of Peruvian cattle using DNA microarray technology' for one month from 10 February 2020 to 13 March 2020.

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 genomes by 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 second research coordination meeting was scheduled to take place in Vienna, Austria, from 22 to 26 June 2020, however due to the movement restrictions imposed by the COVID-19 outbreaks, the meeting will be rescheduled for later dates (still undetermined).

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 estimate pasture intake of ruminants grazing heterogeneous pastures and rangeland by using stable isotopes, which will 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.

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, North 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 was planned for the week from 22 to 26 June 2020 in Vienna, Austria, however due to the movement restrictions imposed by the COVID-19 outbreaks, the meeting will be rescheduled for later dates (still undetermined).

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 CRP, several important steps 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 strengthen 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 was planned for the week from 22 to 26 June 2020 in Vienna, Austria, however due to the movement restrictions imposed by the COVID-19 outbreaks, the meeting will be rescheduled for later dates (still undetermined).

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.

Deadline for applications for this CRP was 1 February 2020.

Invited were research institutions currently working on the development of novel veterinary vaccines that can be applied on mucosal tissues. Five institutions successfully applied focusing on the mucosal application of vaccines against, PPR, Goat and Sheep Pox, irradiated Mastitis bacteria and fowl pox.

The first RCM in June had to be cancelled and was held via an internet conference. It is planned to reschedule the next meeting at a later date (still undetermined) in Vienna.

As this CRP was planned for 8 participants, the call for applications is still open. Prerequisites are a fundamental proof of concept for the specific vaccine 'antigen' delivering an immune response in the target species and an established technology platform for the experimental formulation. An 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.

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)
Albania ALB5008	Improving and Enhancing National Capabilities for Early Detection of Vector Borne Diseases through the Application of Conventional and Molecular Methods	I. Naletoski
Angola ANG5016	Recovering the Vaccine Production Unit and Monitoring Active Animal Immunity	H. Unger V. Wijewardana
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	K. Perisamy
Botswana BOT5016	Developing the Application of Immunological and Molecular nuclear and Nuclear Derived Early and Rapid Diagnosis and Control of Trans-boundary Animal and Zoonotic Diseases	G. Viljoen
Botswana BOT5018	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen C. Lamien
Botswana BOT5021	Improving Reproductive and Productive Performance of Crossbred Dairy Cattle	G. Viljoen K. Perisamy
Bulgaria BUL5017	Enhancing the National Diagnostic Capabilities for Detection of Hepatitis E Virus in Pigs and Pig Products	I. Naletoski
Belize BZE5009	Establishing Early and Rapid Diagnoses and Control of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Belize BZE5010	Strengthening national capacities to control animal diseases	G. Viljoen
Central African Republic CAF5009	Controlling Contagious Bovine Pleuropneumonia and Peste de Petit Ruminants	H. Unger
Central African Republic CAF5010	Building National Capacities for the Diagnosis and Control of Animal Diseases and for Increasing Animal Production	H. Unger
Chad CHD5008	Improving Bovine Productivity Using Artificial Insemination	V. Tsuma
Chad CHD5010	Eradicating Pests in Small Ruminants Using Nuclear Technology	H. Unger
Cameroon CMR5022	Controlling Transboundary Animal diseases with Special Emphasis on Peste des Petits Ruminants	H. Unger

Country TC Project	Description	Technical Officer(s)
Cameroon CMR5024	Improving Goat and Sheep Productivity in Rural Areas Using Nuclear-Derived Techniques for Genetic Marker Identification, Reproduction Harnessing and Feed Analysis	K. Perisamy
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	V. Tsuma K. Perisamy
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	V. Tsuma K. Perisamy
INT5155	Sharing Knowledge on the Sterile Insect and Related Techniques for the Integrated Area-Wide Management of Insect Pests and Human Disease Vectors	I. Naletoski
Côte d'Ivoire IVC5038	Studying Small Ruminant Respiratory Diseases	H. Unger C. Lamien
Côte d'Ivoire IVC5039	Improving Maize Production in Savannah Areas with Severe Pedoclimatic Degradation in the North of Côte d'Ivoire through the Cultivation of Induced Mutants Adapted to these Areas	H. Unger
Cambodia KAM5003	Supporting Sustainable Livestock Production	M. Garcia
Kenya KEN5038	Using Nuclear Techniques to Evaluate and Improve the Impact of Mutated Forages on the Performance of Smallholder Dairy Cows	M. Garcia V. Tsuma
Lao P.D.R. LAO5003	Using Nuclear and Molecular Techniques for Early and Rapid Diagnosis and Control of Transboundary Animal Diseases in Livestock	G. Viljoen
Lao P.D.R. LAO5004	Enhancing National Capability for Crop Production and Controlling Trans-Boundary Animal Diseases	G. Viljoen
Lao P.D.R. LAO5005	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Lesotho LES5007	Enhancing Livestock Production and Health	G. Viljoen
Lesotho LES5010	Using Nuclear and Molecular Technology to Improve Livestock Production and Health	G. Viljoen
Madagascar MAG5024	Applying Nuclear and DNA-Based Techniques to Improve Productivity of Local Livestock	V. Tsuma
Mauritania MAU5007	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases - Phase II	M. Garcia
Mali MLI5029	Upgrading Capacities to Differentiate Priority Animal and Zoonotic Diseases Using Nuclear Related Molecular Techniques	I. Naletoski

Country TC Project	Description	Technical Officer(s)
Malawi MLW5002	Strengthening Capacity for the Diagnosis, Prevention and Control of Animal Diseases of Public Health Importance	H. Unger
Malawi MLW5004	Strengthening Capacity for the Diagnosis and Control of Mastitis in Dairy Cattle	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	G. Viljoen H. Unger
Mongolia MON5025	Improving Breed Characterization of Cashmere Goats to Facilitate the Establishment of Strategic Breeding Programmes	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
Mozambique MOZ5009	Strengthening National Capacity to Control the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Myanmar MYA5026	Improving the Livelihoods of Smallholder Livestock Farmers by Developing Animal Feeding Strategies for Enhanced Food Security	G. Viljoen
Myanmar MYA5028	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Namibia NAM5018	Strengthening Animal Health and Food Safety Control Systems	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
Nigeria NIR5041	Improving Livestock Productivity through Enhanced Nutrition and Reproduction Using Nuclear and Molecular Techniques	K. Perisamy
Palestine PAL5007	Upgrading Animal Feeding Laboratory in Terms of Human Capacity Building and Infrastructure	I. Naletoski

Country TC Project	Description	Technical Officer(s)
Papua New Guinea PAP5003	Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding - PHASE-II	K. Perisamy
Paraguay PAR5011	Improving the Conservation of Germplasm of High Performance Livestock and Native Cattle	M. Garcia Podesta
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	I. Naletoski H. Unger
RAF5082	Enhancing Veterinary Diagnostic Laboratory Biosafety and Biosecurity Capacities to Address Threats from Zoonotic and Transboundary Animal Diseases (AFRA)	I. Naletoski H. Unger
RAS0081	Supporting Human Resource Development and Nuclear Technology Including Emerging Needs	G. Viljoen
RAS5078	Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	G. Viljoen
RAS5085	Using Nuclear Derived Techniques in the Early and Rapid Detection of Priority Animal and Zoonotic Diseases with Focus on Avian Influenza	G. Viljoen I. Naletoski
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
RER5025	Improving Early Detection and Rapid Response to Potential Outbreaks of Priority Animal and Zoonotic Diseases	I. Naletoski
RER9137	Enhancing National Capabilities for Response to Nuclear and Radiological Emergencies	G. Viljoen I. Naletoski
RLA5071	Decreasing the Parasite Infestation Rate of Sheep (ARCAL CXLIV)	K. Perisamy M. Garcia
RLA5084	Developing Human Resources and Building Capacity of Member States in the Application of Nuclear Technology to Agriculture	I. Naletoski
Senegal SEN5036	Controlling Mycoplasma Mycoides Infection — Contagious Bovine Pleuropneumonia (CBPP) and Contagious Caprine Pleuropneumonia (CCPP)	H. Unger
Senegal SEN5042	Using Nuclear and Related Techniques in Improving the Productivity of Domestic Ruminants	V. Tsuma

Country TC Project	Description	Technical Officer(s)
Seychelles SEY5008	Building Capacity for Diagnosis of Animal Diseases using Nuclear and related Techniques (Phase I)	G. Viljoen H. Unger
Sierra Leone SIL5019	Strengthening Capacities for the Diagnosis and Control of Zoonoses to Improve Public Health Services and Livestock Production	H. Unger
Serbia SRB5004	Strengthening of National Reference Laboratories Capacities for Early Detection, Epidemiological Surveillance and Control of Transboundary Animal Diseases in Emergency Situations	I. Naletoski
Sri Lanka SRL5046	Improving Livelihoods Through Dairy Cattle Production: Women Farmers' Empowerment	M. Garcia
Sri Lanka SRL5049	Supporting Control of Stomach Worm Infection in Goats	H. Unger
Kingdom of Eswatini SWA5001	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
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	D. Battaglia
Tajikistan TAD5006	Applying Nuclear and Molecular Techniques for Diagnosis and Control of Transboundary Animal Diseases	I. Naletoski
Togo TOG5001	Improving and Promoting Bovine Milk Production through Artificial Insemination	V. Tsuma M. Garcia
Togo TOG5003	Improving Livestock Production and Milk Quality Using Artificial Insemination	V. Tsuma M. Garcia
U.R. of Tanzania URT5031	Improving Indigenous Cattle Breeds through Enhanced Artificial Insemination Service Delivery in Coastal Areas	G. Viljoen V. Tsuma M. Garcia
U.R. of Tanzania URT5036	Enhancing Artificial Insemination Services and Application of Radioimmunoassay Techniques to Improve Dairy Cattle Productivity	V. Tsuma
Vietnam VIE5023	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Yemen YEM5014	Improving Management of Small Ruminants	H. Unger V. Tsuma
D.R. Congo ZAI5027	Developing Early and Rapid Diagnosis and Control of Transboundary and Zoonotic Diseases	H. Unger
Zimbabwe ZIM5024	Establishing an Artificial Insemination Center to Enhance the Rebuilding of the National Herd	V. Tsuma M. Garcia

Publications

Publications in Scientific Journals

Li X, Yang J, Shen M, Xie XL, Liu GJ, Xu YX, Lv FH, Yang H, Yang YL, Liu CB, Zhou P, Wan PC, Zhang YS, Gao L, Yang JQ, Pi WH, Ren YL, Shen ZQ, Wang F, Deng J, Xu SS, Salehian-Dehkordi H, Hehua E, Esmailizadeh A, Dehghani-Qanatqestani M, Štěpánek O, Weimann C, Erhardt G, Amane A, Mwacharo JM, Han JL, Hanotte O, Lenstra JA, Kantanen J, Coltman DW, Kijas JW, Bruford MW, **Periasamy K,** Wang XH, Li MH.2020. Whole-genome resequencing of wild and domestic sheep identifies genes associated with morphological and agronomic traits. Nature Communications 11: 2815. doi: 10.1038/s41467-020-16485-1

Alyas K, Wajid A, **Dundon WG**, Ather S, Batool T, Babar ME. 2019. Isolation and characterization of avian influenza H9N2 Viruses from different avian species in Pakistan 2016-17. Avian Dis 63: 721-726. doi: 10.1637/aviandiseases-D-19-00070

Souley MM, Issa Ibrahim A, Sidikou D, **Dundon WG, Cattoli G,** Abdou A, Soumana F, Yaou. 2020. Molecular epidemiology of peste des petits ruminants in Niger: An update. Transbound Emerg Dis 67: 1388-1392. doi: 10.1111/tbed.13451

Fine AE, Pruvot M, Benfield CTO, Caron A, **Cattoli G**, Chardonnet P, Dioli M, *et al*. 2020. Eradication of peste des petits ruminants virus and the wildlife livestock interface. Front Vet Sci. 7: 50. doi: 10.3389/fvets.2020.00050

Dellicour S, Lemey P, Artois J, Lam TT, Fusaro A, Monne I, **Cattoli G**, Kuznetsov D, *et al*. 2020. Incorporating heterogeneous sampling probabilities in continuous phylogeographic inference - Application to H5N1 spread in the Mekong region. Bioinformatics 36: 2098-2104. doi: 10.1093/bioinformatics/btz882

IAEA Publications

IAEA. 2020. Strategies and practices in the remediation of radioactive contamination in agriculture. Proceeding Series IAEA. 183 p

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 been instrumental to technically supporting partner laboratories in countries of Africa and Asia affected by COVID-19 pandemic. Indeed, in some of these countries, VETLAB laboratories are supporting medical laboratories for SARS-CoV-2 RT-PCR testing. In addition, transboundary animal diseases continue to cause severe losses, such as African Swine Fever (ASF) epidemics in South East Asia. Efforts concentrated on procuring reference material such as positive controls, equipment and reagents for the rapid implementation and expansion of ASF diagnosis and confirmation.

Every year the VETLAB Network organizes ring trials, training courses and one meeting of the Directors of African and Asian laboratories. In 2020, due to the COVID-19 pandemic and related sanitary restrictions, some of these events had to be postponed. More information can be found in other sections of this newsletter. We hope to fully resume all VETLAB training activities as soon as possible.

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 issue.

Impressum

Animal Production and Health Newsletter No. 72

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

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, July 2020

20-02071E