Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

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To Our Readers

Technician working with COVIV 19 samples using equipment supplied by the IAEA

Dear colleagues,

The COVID-19 pandemic has affected work and personal activities around the world and the IAEA has certainly not been the exception. The IAEA and Austria in general spent several months in lockdown in early 2020. However, great efforts have been made to comply with the calendar of activities and the implementation of Technical Cooperation and Coordinated Research Projects. Virtual meetings with project counterparts, national and international authorities, as well as collaborative work with leading world scientists have become our routine and modus operandi. However, key activities such as the Symposium and coordination meetings had to be postponed to 2021 to allow researchers to move forward and complete their research work. Dates for these events have been scheduled between the second and fourth quarters of 2021, several of which we hope can be face-to-face.

As indicated on our website, we supported more than 120 Member States (MSs) in their efforts to diagnose and control COVID-19. The IAEA implemented the largest technical cooperation initiative since its foundation by using nearly 26 million euros kindly contributed by several MSs. The Animal Production and Health Section, in coordination with the Technical Cooperation Department, was able to provide equipment, diagnostic kits, primers, and personal protective equipment to establish and use molecular techniques (RT-PCR) to rapidly detect SARS-CoV-2. This successful initiative and 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 and zoonotic diseases, with the strong support and leadership of Director General of the IAEA, Mr Rafael Mariano Grossi, allowed the design of a major project called ZODIAC (**Zo**onotic **D**isease **I**ntegrated **Ac**tion). This project will operate under a holistic approach that ranges from identifying, monitoring, tracing, and early detection of zoonotic disease pathogens at the environment-animal-human interface, to participation in global intervention and response to a potential outbreak.

ZODIAC includes strong technical support, technology packages, guidance, training, and provision of equipment to MSs and a major research component led by the Animal Production and Health Laboratory in Seibersdorf. The project consists of five pillars: (a) Strengthening national detection, diagnostic and monitoring capabilities in MSs, in terms of prevention and response to zoonotic disease outbreaks, with surveillance in the field at the environment-animal-human interface; (b) Access by MSs to novel and fit-for-purpose technologies for the early detection of emerging zoonotic diseases (characterization of pathogens, monitoring their genetic drift and possible mutations, identifying animal hosts, reservoirs and carriers, tracing their circulation at the environment-animal-human interface, etc.); (c) Real-time decision-making support tools for timely interventions by MSs (development of IT tools to enable a dynamic interface between laboratory findings and field analysis); (d) Access to data on the impact of zoonotic diseases on human health; and (e) Access to an IAEA coordinated preparedness and response team in case of an outbreak of zoonotic disease of major significance or impact in MS, taking into consideration of other international organizations' (FAO, OIE, WHO, etc.) mandates and responsibilities, as well as national partners. The project has recently been approved by the Board of Governors and soon will initiate its activities including calls for interested MSs.

Besides its participation in this great project, the Animal Production and Health Subprogramme continues its focus 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 by 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 and communication technologies in the related fields. The FAO/IAEA Veterinary Diagnostic Laboratory (VETLAB) Network is instrumental for the development, validation and dissemination of technologies, know-how and expertise worldwide.

Stay healthy and safe. Several vaccines against COVID-19 will be available to MSs in the following months, which may allow the return to 'normal life'.

All the best in 2021.

Gerrit Viljoen

Head, Animal Production and Health Section

International Symposium on Sustainable Animal Production and Health: Current Status and Way Forward (Virtual Event) 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 sustain 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 be from one to a maximum of three single-spaced printed A4 pages in length (font size 11 or greater), including tables, figures and references. More than one synopsis per participant is allowed. All communications and papers must be written 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.

Companies and organizations willing to exhibit their business will have a dedicated link to their portfolio.

Please contact the event organizer for further details:

APHSymposium2021@iaea.org

Deadlines

15 January 2021: Submission of synopses (including Forms A and B*)

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.

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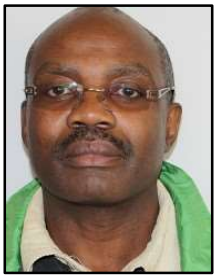
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Joint FAO/IAEA Programme

VETLAB Network Bulletin

01/2021

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VETLAB is an initiative of the Joint FAO/IAEA Division

To the readers

In 2020, the Animal Production and Health (APH) Subprogramme and the VETLAB Network have been extremely active in organizing and providing support to partner laboratories challenged by the COVID-19 pandemic. At present, 126 countries requested for IAEA technical support for their laboratories conducting COVID-19 tests. At present, the support was provided to 281 laboratories, of which 50 are national veterinary laboratories. In this issue of the bulletin, we are pleased to share with you the COVID-19 experience and activities of one of these laboratories in Ethiopia. To date, APH is receiving more requests for COVID-19 laboratory support. Please note that, to get the requested support, it is important that veterinary laboratories submit the official request through the NLO or the Permanent Mission of the Member State. To note: the veterinary laboratory should be officially assigned by their national competent authorities for testing human samples for COVID-19.

The last semester of 2020 was not only focused on COVID-19. VETLAB partners conducted several research and outbreak investigations on transboundary animal diseases that continued to spread in new regions or re-emerge, for example Lumpy Skin Disease and African Swine Fever in South Asia or the Rabbit Hemorrhagic Disease in West Africa and highly pathogenic avian influenza. For more information please consult the current issue of the bulletin and the Newsletter.

The Team in APH wish you all the best for the coming New Year, and always keep yourself and your families safe and healthy throughout this challenging period.

VETLAB Highlights

Spreading of RHDV2 in West Africa

In 2020, several West Africa countries experienced mortality in domestic rabbits. Senegal reported RHDV-2 followed by Nigeria, as a result LNERV and NVRI collaborated sharing methods and experience. To date, the VETLAB network assisted these countries plus Burkina Faso with SOPs, reagents and the characterization of the local RHD viruses.

Lumpy skin disease (LSD) in Asia

Since 2019, several Asian countries are experiencing the emergence and spread of LSD virus. Bangladesh, India, Nepal, China, China Taipei, Bhutan, and Vietnam have confirmed the infection. APHL, through the VETLAB network has supported infected and at-risk countries with laboratory material and the molecular characterization of the local LSD virus isolates. Hence, APHL has sequenced the full genome or targeted multiple genes for Bangladesh and Vietnam and is working with the others.

Detection of highly pathogenic H5N6 in Mongolia

In April 2020, samples were collected after a report on mortalities in whooper swan and swan goose in two Mongolian provinces. The State Central Veterinary Laboratory in Ulaanbaatar applied real-time PCR and partial gene sequencing to detect and confirm highly pathogenic avian influenza H5N6 and promptly reported it to OIE. The VETLAB network assisted in the whole genome sequencing for confirmation and the complete genetic characterization of the virus.

Molecular diagnosis of ASF in recent outbreaks in Nigeria

An outbreak of ASF started in May 2020 in a pig farm in Nigeria and spread across ten states. The farm settlement is the largest pig farm in West Africa. Over 70,000 pigs reportedly died in the outbreak. The National Veterinary Research Institute received about 204 blood and tissue samples. With the support of the APHL, it provided confirmatory diagnosis using RT-PCR leading to the control of the disease.

A Zambian scientist of the CVRI awarded for her work on pseudocowpox

Dr. Maureen Wakwamba Ziba, Central Veterinary Research Institute (CVRI) received a Science and Technology Research Merit award 2020 by the National Science and Technology Council for her work pseudocowpox in Zambia. The reference and summary of this work are available in the current issue of the APH Newsletter

01/2021

VETLAB
Network Bulletin

VETLAB Capacity Building Initiatives

On-line Preparatory Course on Proficiency tests organisation and management

The VETLAB Network is collaborating with Enhancing Research for Africa Network (ERFAN) to organize an on-line preparatory course on this topic. This course aims to introduce the basic concepts and prepare participants to the on-site course expected to be held as soon as COVID-19 restrictions allows. The on-line course is expected to start in March 2021.

VETLAB Networking Activities

Interlaboratory test for the diagnosis of PPR and rabies

The VETLAB Network has organized the yearly interlaboratory comparison (ILC) exercise to assess countries' diagnostic capacity for the accurate detection of PPR. The ILC serology panel was developed in collaboration with IZSAM in Teramo (Italy), which is here gratefully acknowledged. Thirty-nine laboratories in 34 countries confirmed their participation in the 2020 ring trial.

In collaboration with FAO, the VETLAB network supported the participation of BNVL, Gaborone (Botswana) to the international ILC for rabies organized by the FAO Reference Centre in IZSVe, Padova (Italy).

The VETLAB Network Laboratories:

The National Veterinary Institute (NVI) supports testing COVID-19 in Ethiopia

With the occurrence of the COVID-19 pandemic crisis worldwide, veterinary laboratories in many parts of the world have been taking part in the diagnosis of COVID-19 using the technical expertise and the diagnostic facilities they have through One-Health coordinated approaches.

The NVI of Ethiopia supports public health services by testing human samples for the confirmation of SARS-CoV-2. The public health professionals collect the samples, and the virus detection by real-time RT-PCR is conducted by well-trained, experienced staff at NVI. Testing is performed daily, including weekend days, and the team involved is hosted at the institute guest house facilities.

The Government of Ethiopia has launched the Community-Based Activity and Testing (ComBAT) Campaign. A massive number of human samples are being tested from the community to assess infection level, and NVI is fully taking part in this campaign. Testing samples from suspect and contact history individuals and hospitalized follow-up patients is ongoing.

The NVI sincerely acknowledged the Animal Production and Health Laboratory (APHL) of the Joint FAO/IAEA Division for the significant support and for supplying the CFX96 Touch™ RT-PCR Detection System in 2013, now used for COVID-19 testing at NVI.

NVI is highly interested in contributing to the global efforts targeting the development of a safe and effective COVID-19 vaccine .

"Serving the Nation, and beyond"

COVID-19 testing team at NVI, Ethiopia (24 AUGUST 2020). Courtesy © Esayas Gelaye

Technician testing COVID-19 samples. Source: IAEA-APH photo collection)

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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 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.

Owing to the COVID-19 pandemic, the meeting that was organized from 30 September to 2 October 2020 was postponed. Tentatively, the meeting is planned for March 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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 (VETLAB) Network to discuss diagnosis gaps and collaborative research opportunities.

Owing to the COVID-19 pandemic, the event scheduled at the IAEA Headquarters in Vienna, Austria, from 30 September to 2 October 2020 was postponed. Tentatively, the meeting is planned for March 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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

Charles Lamien and Giovanni Cattoli

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

Owing to the COVID-19 pandemic the meeting planned to take place in Gaborone Botswana 1 to 5 March 2021 was postponed, new dates will be communicated as soon as possible. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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 discuss the transport issues, quality assurance and quality control issues and dissemination to veterinary laboratories. The meeting was initially planned at the IAEA Headquarters in Vienna, Austria, from 22 to 26 June 2020. However owing to the COVID-19 pandemic, the meeting was postponed. Tentatively, the meeting is planned for August 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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

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

Ivancho Naletoski

The meeting, whose purpose is to review the samples collected for analyzing avian influenza and other diseases transmitted by migratory birds, as well as the feather samples collected for determining birds' origin, was planned for the week from 22 to 26 June 2020 at the IAEA Headquarters in Vienna, Austria. However, owing to the COVID-19 pandemic, the meeting was postponed. Tentatively, the meeting is planned for August 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions. Project partners should discuss the current achievements, as well as the future workplans.

Second Research Coordination Meeting on Improvement of Diagnostic and Vaccine Tools for Emerging and Re-emerging Animal Health Threats (D32035)

Hermann Unger and Viskam Wijewardana

The aim of the mid-term RCM is to present the first results of the formulation techniques for each candidate vaccine and is tentatively scheduled to take place at the IAEA Headquarters in Vienna, Austria, from 6 to 10 September 2021. The coordinated research project (CRP) is evaluating different formulations to allow for a mucosal application of vaccines to elicit an IgA immune response against the respective pathogen.

Different approaches for the delivery of vaccine candidates against PPR, mastitis, influenza, sheep and goat pox and fowl cholera are under investigation. An interesting approach employing chitosan derivates is included. The first group in Pakistan has already achieved promising results with their ocular PPR vaccine and it's hoped that all participants will have early results of their formulation for this meeting.

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

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

The 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.

Owing to the COVID-19 pandemic, the meeting planned to take place in Seibersdorf, Austria, from 22 to 26 June 2020 was postponed. Tentatively, the meeting is planned for August 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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 Podesta

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

Tentatively, the meeting is planned for September 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed taking into consideration prevailing COVID-19 conditions.

Third Research Coordination Meeting on Irradiation of Transboundary Animal Disease (TAD) Pathogens as Vaccines and Immune Inducers (D32033)

Hermann Unger and Gerrit Viljoen

The final RCM, the purpose of which is to present results obtained under the coordinated research project (CRP) and to discuss the knowledge gained and the preparation of the final research documents, will take place at the IAEA Headquarters in Vienna, Austria, from 4 to 8 October 2021. Despite severe challenges owing to the COVID-19 pandemic, the CRP is moving forward, and experimental vaccinations against *Hemonchus contortus* and influenza are progressing. It is hoped that all experimental vaccinations can be accomplished, and immunity or resistance can be shown before the final RCM.

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

Victor Tsuma and Mario Garcia Podesta

The purpose of the meeting is to present the final research reports of individual and technical contract holders, to identify the pertinent achievements of the coordinated research project (CRP), and to deliberate on potential topics and opportunities for research that could be supported by a new CRP.

Tentatively, the meeting is planned for November 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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 Veterinary Diagnostic Laboratory (VETLAB) Network partner laboratories in selecting and applying suitable algorithms and nuclear-derived/molecular assays for the detection of major pathogens causing transboundary and zoonotic diseases.

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.

Owing to the COVID-19 pandemic, the meeting planned to take place in Seibersdorf, Austria, from 15 to 26 June 2020 was postponed. Tentatively, the meeting is planned for the third quarter 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

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.

Owing to the COVID-19 pandemic, the meeting planned to take place in Seibersdorf, Austria, from 22 June to 3 July 2020 was postponed. Tentatively, the meeting is planned for the third quarter 2021. The venue of the meeting and/or mode of delivery (virtual or face-to-face) will be confirmed based on prevailing COVID-19 conditions.

Online Preparatory Course on Proficiency Tests Organization and Management

The VETLAB Network is collaborating with the Enhancing Research for Africa Network (ERFAN) to organize an online preparatory course on organization and management of proficiency tests. This course aims to introduce the basic concepts and prepare participants to the on-site course expected to be held as soon as COVID-19 restrictions allow. Tentatively, the online course is planned for March 2021.

Past Events

TC Sponsored Participation on Biosafety/Security Webinars (RAF5082)

Hermann Unger

The first three virtual training courses for RAF5082 were held in cooperation with the European Biosafety Association (EBSA). This EBSA had announced three training courses on bio-risk assessment, training course designs and an introduction into the bio-risk management standard ISO35001.

All three courses were very well prepared and presented and gave the participants a chance to understand the approaches to implement biosafety and security standards in view of the new WHO manual on biosafety (4th Edition, to be published early 2021) and the new ISO standard on bio-risk management.

The cooperation with EBSA will be maintained and expanded to the African Biological Safety Association (AfBSA) and Africa Centres for Disease Control and Prevention (Africa CDC).

First Regional Coordination Meeting on Using Nuclear Derived Techniques in the Early and Rapid Detection of Priority Animal and Zoonotic Diseases with Focus on Avian Influenza (RAS5085) (Virtual Event)

Ivancho Naletoski

The coordination meeting was organized as a web-conference/virtual event from 24 to 28 August 2020. Fifty-one participants from 26 Member States of the IAEA Asian region attended the meeting (Bangladesh, Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lao People's Democratic Republic, Lebanon, Malaysia, Mongolia, Myanmar, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Sri Lanka, T.T.U.T.J of T. Palestinian A., Thailand, United Arab Emirates, Vanuatu and Viet Nam).

The meeting started with country presentations, prepared by the national teams, on the existing diagnostic capacities in the officially designated veterinary laboratories, priority diseases in each of the countries and the technologies needed to upgrade the existing diagnostic scopes.

The meeting was supported by three experts who presented multiple presentations on: i) existing and upcoming diagnostic platforms for detection and characterization of animal and zoonotic pathogens, ii) capture and sampling multiple wildlife species (wildlife mammals, rodents and bats) and capture and identification of arthropod vector carriers of animal and zoonotic diseases.

Considering the number of participating countries, as well as the scope of priority diseases, the project implementation will follow through technology oriented training courses (diagnostic settings, diagnostic techniques and advanced molecular technologies in characterization of pathogens) and disease oriented workshops to discuss specific diseases and diagnostic technologies applicable for them.

As per the project workplan, the participants have received the planned quality control materials and minor equipment for maintenance of the existing diagnostic techniques at the national laboratories.

Screenshot of the virtual meeting held using MS Teams

Preparatory Coordination Meeting on Improving Early Detection and Rapid Response to Potential Outbreaks of Priority Animal and Zoonotic Diseases (RAS5085)

Ivancho Naletoski

The coordination meeting was organized as a web-conference/virtual event on 9 September 2020. Thirty-four participants from 27 Member States attended the meeting (Albania, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Estonia, Georgia, Greece, Hungary, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Montenegro, North Macedonia, Poland, Portugal, Romania, Russian Federation, Serbia, Slovenia, Tajikistan, Turkey, Ukraine and Uzbekistan).

The discussions were focussed on the continuation of the project activities under the existing restrictions owing to the COVID-19 pandemic and priority activities under the project.

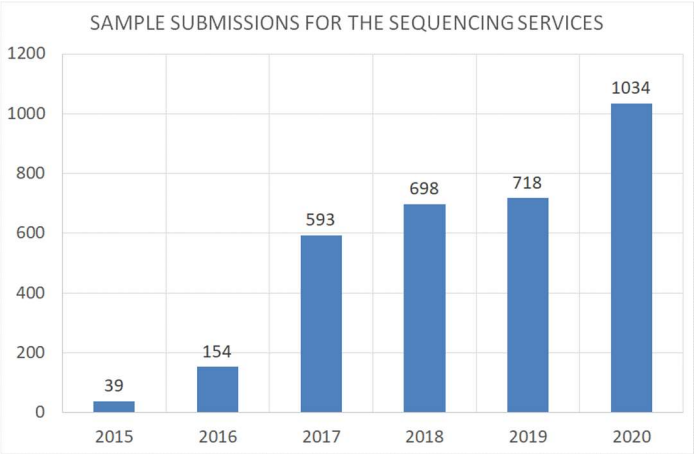
Counterparts agreed to postpone the planned events (training courses and workshops) until the middle of 2021. Instead, it was agreed that each of the participating laboratories will submit a request on the priority diseases proposed in the project and priority equipment/consumables needed for 2020/2021, in accordance with the project workplan. Priority items were selected by individual laboratories. All items are currently under delivery (partly already delivered) to the recipient laboratories.

Progress of the Sanger Sequencing Service for the Counterparts of the Animal Production and Health Subprogramme

Ivancho Naletoski, Charles Lamien and Bharani Settypalli

The Sanger sequencing service was introduced by APH as support to the VETLAB Network partners in the access to advanced molecular characterization of animal and zoonotic pathogens (more details in our Newsletter No.70; July 2019 on following Link). The service is currently used in 22 Member States (16 in Africa, 1 in Asia, 4 in Europe and 1 in Latin America) with continuously increasing sample submissions. As of November 2020, more than 3200 submissions were recorded, out of which 1034 were during 2020. Between 2016 and 2020, the users of the sequencing service have already published 23 publications in peer-reviewed journals (Table 1), out of which 7 in 2019 and 4 in 2020.

APH is working on establishing a workflow for free-of-charge access to Whole Genome Sequencing (WGS) in selected Member States (targeted at the most frequent and successful users of the Sanger sequencing service) which will be based on the Nanopore MinION platform, as well as on the service based WGS, similar to the Sanger sequencing service. APH has already organized 2 training courses on the use of the Nanopore MinION platform and two of our trainees have already performed WGS independently in their laboratories (see Stories page 15). APH will continue to support Member States veterinary laboratories in the dissemination and use of the advanced molecular technologies for pathogen characterization. In the near future, we expect to significantly increase the number of laboratories, capable of using and interpreting these technologies locally.



Number of samples submitted for sequencing under the APH Sanger sequencing service.

Year	Authors	Title	Publication
2016	Gelaye E, Achenbach JE, Ayelet G, Jenberie S, Yami M, Grabherr R, Loitsch A, Diallo A, Lamien CE.	Genetic characterization of poxviruses in Camelus dromedarius in Ethiopia, 2011-2014.	Antiviral Res. 2016 Oct;134:17-25. doi: 10.1016/j.antiviral.2016.08.016. Epub 2016 Aug 18.
2017	Demeke B, Jenberie S, Tesfaye B, Ayelet G, Yami M, Lamien CE, Gelaye E.	Investigation of Marek's disease virus from chickens in central Ethiopia.	Trop Anim Health Prod. 2017 Feb;49(2):403-408. doi: 10.1007/s11250-016-1208-1. Epub 2016 Dec 14.
2017	Mapaco LP, Lacerda Z, Monjane IVA, Gelaye E, Sussuro AH, Viljoen GJ, Dundon WG, Achá SJ.	Identification of Clade E Avipoxvirus, Mozambique, 2016.	Emerg Infect Dis. 2017 Sep;23(9):1602-1604. doi: 10.3201/eid2309.161981.
2017	Mekuriaw A, Bitew M, Gelaye E, Mamo B, Ayelet G.	Infectious bursal disease: outbreak investigation, molecular characterization, and vaccine immunogenicity trial in Ethiopia.	Trop Anim Health Prod. 2017 Aug;49(6):1295-1302. doi: 10.1007/s11250-017-1328-2. Epub 2017 Jun 15.
2017	Molini U, Aikukutu G, Khaiseb S, Cattoli G, Dundon WG.	First genetic characterization of newcastle disease viruses from Namibia: identification of a novel VIIk subgenotype.	Arch Virol. 2017 Aug;162(8):2427-2431. doi: 10.1007/s00705-017-3389-y. Epub 2017 May 3.
2017	Mulumba-Mfumu LK, Achenbach JE, Mauldin MR, Dixon LK, Tshilenge CG, Thiry E, Moreno N, Blanco E, Saegerman C, Lamien CE, Diallo A.	Genetic Assessment of African Swine Fever Isolates Involved in Outbreaks in the Democratic Republic of Congo between 2005 and 2012 Reveals Co-Circulation of p72 Genotypes I, IX and XIV, Including 19 Variants.	Viruses. 2017 Feb 18;9(2). pii: E31. doi: 10.3390/v9020031.
2017	Twabela AT, Okamatsu M, Tshilenge GM, Mpiana S, Masumu J, Nguyen LT, Matsuno K, Monne I, Zecchin B, Sakoda Y.	Molecular, antigenic, and pathogenic characterization of H5N8 highly pathogenic avian influenza viruses isolated in the Democratic Republic of Congo in 2017.	Arch Virol. 2020 Jan;165(1):87-96. doi: 10.1007/s00705-019-04456-x. Epub 2019 Nov 9.

Year	Authors	Title	Publication
2017	Twabela AT, Tshilenge GM, Sakoda Y, Okamatsu M, Bushu E, Kone P, Wiersma L, Zamperin G, Drago A, Zecchin B, Monne I.	Highly Pathogenic Avian Influenza A(H5N8) Virus, Democratic Republic of the Congo, 2017.	Emerg Infect Dis. 2018 Jul;24(7):1371-1374. doi: 10.3201/eid2407.172123.
2018	Stoimenov G, Goujgoulova G, Hristov K, Teneva A.	Outbreak of Influenza A Virus (H5N8) in Dalmation Pelicans Srebarna Reserve, Bulgaria, 2015. G.	Tradition and modernity in Veterinary Medicine. May 16. 2018
2018	Legesse A, Abayneh T, Mamo G, Gelaye E, Tesfaw L, Yami M, Belay A.	Molecular characterization of Mannheimia haemolytica isolates associated with pneumonic cases of sheep in selected areas of Central Ethiopia.	BMC Microbiol. 2018 Dec 5;18(1):205. doi: 10.1186/s12866-018-1338-x.
2018	Molini U, Aikukutu G, Khaiseb S, Cattoli G, Dundon WG.	Phylogenetic analysis of pigeon paramyxoviruses type-1 identified in mourning collared doves (Streptopelia decipiens) in Namibia, Africa.	Journal of Wildlife Diseases. Mar 29. Doi: 10.7589/2007-10-246
2018	Molini U, Aikukutu G, Khaiseb S, · Haindongo N.N, · Lilungwe AC, Cattoli G, Dundon WG, Lamien CE.	Molecular characterization of Lumpy Skin Disease virus in Namibia, 2017.	Archives of Virology. Jun 4. doi: 10.1007/s00705-018-3891-x.
2019	Bertram MR, Dickmu S, Palinski RM, Pauszek SJ, Hartwig EJ, Smoliga GR, Vierra D, Abdoulkadiri S, Arzt J.	Genome Sequences of Four Foot-and-Mouth Disease Virus SAT 1 Topotype X Isolates from Cameroon.	Microbiol Resour Announc. 2019 Dec 5;8(49). pii: e01243-19. doi: 10.1128/MRA.01243-19.
2019	Castro ER, Pérez SR, Negro R, Bassetti L, Rodríguez S.	Detection and Phylogenetic Analysis of the ORF Virus from Sheep in Uruguay.	Annals of Clinical Virology; 2019 | Volume 1 | Issue 1 | Article 10021
2019	Ehizibolo DO, Fish IH, Brito B, Bertram MR, Ardo A, Ularamu HG, Lazarus DD, Wungak YS, Nwosuh CI, Smoliga GR, Hartwig EJ, Pauszek SJ, Dickmu S, Abdoulkadiri S, Arzt J	Characterization of transboundary foot-and-mouth disease viruses in Nigeria and Cameroon during 2016.	Transbound Emerg Dis. 2019 Dec 27. doi: 10.1111/tbed.13461. [Epub ahead of print]
2019	Tshilenge GM, Walandila JS, Kikukama DB, Masumu J, Louison Katshay Balowa L, Cattoli G, Bushu E, Serge Mpiana Tshipambe S, Dundon WG.	Peste des petits ruminants viruses of lineages II and III identified in the Democratic Republic of the Congo.	Veterinary Microbiology; Volume 239, December 2019, 108493.
2019	Molini U, Aikukutu G, Khaiseb S, Kahler B, Van der Westhuizen J, Cattoli G, Dundon WG.	Investigation of infectious laryngotracheitis outbreaks in Namibia in 2018.	Trop Anim Health Prod. 2019 Sep;51(7):2105-2108. doi: 10.1007/s11250-019-01918-x. Epub 2019 May 18.
2019	Souley MM, Issa Ibrahim A, Sidikou D, Dundon WG, Cattoli G, Abdou A, Soumana F, Yaou B.	Molecular epidemiology of peste des petits ruminants in Niger:	An update. Transbound Emerg Dis. 2019 Dec 14. doi: 10.1111/tbed.13451. [Epub ahead of print]
2019	Molini U, Aikukutu G, Kabajani J, Khaiseb S, Cattoli G, Dundon WG.	Molecular characterization of Infectious Bursal Disease virus (IBDV) in Namibia, 2017.	Onderstepoort Journal of Veterinary Research. Accepted
2020	Diallo AA, Souley MM, Issa Ibrahim A, Alassane A, Issa R, Gagara H, Yaou B, Issiakou A, Diop M, Ba Diouf RO, Tall Lo FT, Lo Modou M, Bakhoum T, Sylla M, Seck MT, Meseko C, Shittu I, Cullinane A, Settypalli TBK, Lamien CE, Dundon WG, Cattoli G.	Transboundary spread of equine influenza viruses (H3N8) in West and Central Africa: Molecular characterization of identified viruses during outbreaks in Niger and Senegal, in 2019	Transbound Emerg Dis. 2020;00:1–10; DOI: 10.1111/tbed.13779
2020	Shegu D, Sori T, Tesfaye A, Belay A, Mohammed H, Degefa T, Getachew B; Abayneh T, Gelaye E.	Sequence-based comparison of field and vaccine strains of infectious bursal disease virus in Ethiopia reveals an amino acid mismatch in the immunodominant VP2 protein.	Archives of Virology, https://doi.org/10.1007/s00705-020-04622-6
2020	Molini U, Aikukutu G, Roux JP, Kemper J, Ntahonshikira C, Marruchella G, Khaiseb S, Cattoli G, Dundon WG.	Avian Influenza H5N8 Outbreak in African Penguins (Spheniscus demersus), Namibia, 2019.	J Wildl Dis. 2020 Jan;56(1):214-218. Epub 2019 Sep 4.
2020	Molini U, Mushonga B, Settypalli TBK, Dundon WG, Khaiseb S, Jago M, Cattoli G, Lamien CE.	Molecular characterization of African swine fever virus from outbreaks in Namibia in 2018.	Transbound Emerg Dis. 2020 Mar;67(2):1008-1014. doi: 10.1111/tbed.13399. Epub 2019 Nov 12.

Table 1: List of publications by the users of the sequencing service between 2016 and 2020

Stories

President Julius Maada Bio of Sierra Leone hails IAEA's support to Milton Margai College of Education and Technology (SIL5019)

Background

Milton Margai College of Education and Technology (MMCET) is a beneficiary of the IAEA Technical Cooperation Project SIL5019 entitled 'Strengthening capacities for the diagnosis and control of zoonoses to improve public health services and livestock production'. The project is aimed at enhancing the current institutional diagnostic laboratory technician programme as a shortage of trained people was a limiting factor during the Ebola crisis in Sierra Leone. Project activities started in October 2019, since then, MMCET has established two laboratories for disease diagnoses and has started running a national diploma course training diagnostic laboratory technicians. This is a two-year programme leading to the award of a national diploma by The National Council for Technical and Vocational and other Academic Awards (NCTVA), the body responsible for the award of national diplomas to Technical and Vocational Education and Training (TVET) institutions. This course is the first in the country that trains technicians to diagnose both zoonotic and human diseases. The first groups of trained technicians have completed the first year of study and are now in internships, placed in various laboratories across the country. Reports received so far are very encouraging; the students were ranked as the best in the country when tested against students from other institutions training laboratory technicians, including the College of Medicine and Allied Health Sciences (COMAS).

Since the start of the programme, MMCET has received a large quantity of laboratory supplies which has given a tremendous boost to the teaching of science. The intervention of IAEA means that MMCET can now produce graduates with practical experience, especially laboratory technicians, chemists and biologists. In addition to the laboratory support, IAEA has also played a significant role in staff development. Four technical staff were trained in bacteriology; two of them were trained in Ghana and two in Vienna. Besides this, the IAEA also supported a local training course conducted by Dr Luis Fischer (Labovet, Vienna, Austria) and implemented a second course, a virtual training event that was very successful and benefitted MMCET staff members. Furthermore, the IAEA organized the scientific visit of a technical staff member to the National Veterinary Research Institute in Vom and the University of Jos in Nigeria, with the aim to update the curriculum for the diagnostic technician course.

MMCET admitted 30 students into the Diagnostic Laboratory Programme for the 2019/2020 academic year (18 female and 12 male) including two physically challenged students. The institution has received over 100 applications for 2020/2021 academic year; only 30 will be accepted due to capacity limitations. This is an indication that there is an urgent need for expansion.

Laboratory technicians enrolled in the Diagnostic Laboratory Technician Programme

University status:

During an assessment visit to the college campus, the Tertiary Education Commission (TEC) rated the new laboratories highly. They said that the laboratories and other training facilities indicate that MMCET can run its own programmes and they recommended the transformation of MMCET to Milton Margai University of Education and Technology (MMUET). These recommendations were submitted to the Ministry of Higher Education, which forwarded them to the Cabinet of Sierra Leone. On Sunday 6 December 2020 President Julius Maada Bio pronounced the transformation of MMCET to MMUET. In his pronouncement speech, the president highlighted the role that MMCET has played in promoting education in Sierra Leone. He mentioned the training of diagnostic laboratory technicians as one of the most significant contributions MMCET has made to the health sector. He therefore expressed appreciation to IAEA for supporting such a programme. The President Bio said he "had been following reports in the media about the laboratory supplies IAEA had been sending to MMCET and the way MMCET has been utilizing these supplies". This change of status comes with a major funding line to continue renovations at the campus and help to improve the student hostel.

In 2021 the first lab technicians will graduate and there are already discussions to extend the curriculum to 3 years to allow for a limited master program. This programme would include laboratory management and additional technologies like molecular science.

Milking the power of nuclear technology to benefit women dairy farmers in Sri Lanka

When women's income and decision-making power rises, the benefits are manifold, trickling from families to communities and society, from one generation to the next. Investing in women's economic empowerment affects many of the UN Sustainable Development Goals (SDGs), from ending poverty and reaching gender equality to promoting more inclusive economic growth. Nuclear technologies can also play a role in supporting the economic empowerment of women, including dairy farmers in Sri Lanka, who expect their income to rise by 150% following an IAEA pilot technical cooperation project, delivered in cooperation with the Food and Agriculture Organization of the United Nations (FAO).

Women farmers with their calves obtained by embryo transfer

Scientists in Sri Lanka utilized reproductive biotechnologies bolstered by nuclear techniques to deliver superior female calves. By the end of 2020, the project team will have produced 500 quality calves for women in villages in Sri Lanka by using embryo transfer and artificial insemination techniques. The project, fully funded by the IAEA, provided equipment, technical know-how and training to local scientists. Hundreds of cattle embryos were produced in three months and stored in liquid nitrogen at - 196°C for future transplants.

Click here to read more.

Bosnia Herzegovina and Serbia Succeed in COVID-19 Virus Characterization with IAEA/FAO Support

Two laboratories where scientists have been trained by the IAEA and FAO are now able to use genome sequencing to characterize the virus that causes COVID-19. This technology, with further improvement, could allow them to see where the virus originated and support contact tracing efforts and transmission analysis. The veterinary laboratories in Bosnia Herzegovina and Serbia are helping health authorities in their efforts to localize and contain outbreaks.

The real time reverse transcription–polymerase chain reaction, (RT-PCR) is a nuclear derived technology which has been widely used in the detection of the virus that causes COVID-19. With this method, fluorescent dyes are used to detect the presence of specific genetic material and provide scientists with nearly immediate results on the presence of a virus. Building on this technology, whole genome sequencing is used to find out more about the virus, such as which cluster it belongs to, which enables experts to understand when it was contracted and where. This is done through what is called the phylogenetic tree, which shows the evolutionary relationships of the virus in a patient to known strains.

Real time RT-PCR is the most accurate method to detect the COVID-19 virus

With support from the IAEA through the network of national veterinary laboratories known as VETLAB, the Veterinary Faculty of the University of Sarajevo and the Veterinary Specialized Institute in Kraljevo, Serbia are now able to perform whole genome sequencing of the COVID-19 virus. The IAEA's support, delivered through its technical cooperation programme, included training courses, support of fellowships in other laboratories already familiar with the necessary techniques, as well as COVID- 19 support materials.

At the Veterinary Faculty in Sarajevo, whole genome sequencing from two COVID-19 outbreak area samples in the country were completed. The phylogenetic tree constructed from this information, combined with other results, led scientists to conclude that there had been multiple lines of virus introductions – suggesting that there are separate infection hubs coming from outside the country.

At the Veterinary Specialist Institute in Kraljevo, more than 13,000 human samples were tested for the COVID-19 virus. RNA was taken and analyzed with whole genome sequencing at the beginning of the COVID-19 pandemic. So far, 17 whole genomes were obtained. The whole genome sequencing of current COVID-19 positive cases is under way to determine if the virus has changed. Through

analysis from the first testing, scientists were able to find that there were multiple lines of COVID-19 viruses in Serbia, originating from several countries.

The data from whole genome sequencing is uploaded into the National Center for Biotechnology Information database, a bioinformatics website, allowing further research by scientists around the world. When scientists perform whole genome sequencing and upload this information onto the database, connections can be made globally, resulting in more in-depth and accurate phylogenetic trees. This way, the introduction of a virus can be traced to a certain place and strain.

Click here to read more.

Commemorating World Zoonoses Day – and the Role Nuclear and Nuclear-Related Techniques Play in Fighting Zoonotic Diseases

The global COVID-19 pandemic has been a harsh reminder of the age-old threat posed by zoonoses or zoonotic diseases, infectious diseases transmitted from animals to humans. Sixty percent of human pathogens come from animals, while 75% of new, emerging and re-emerging diseases are zoonotic. Globally, it is estimated that every year, around 2.6 billion people suffer from zoonotic illnesses and around 2.7 million succumb to these.

"The COVID-19 global pandemic hit the world unprepared and has shown us all the damaging impact zoonotic diseases can have," said Najat Mokhtar, Deputy Director General at the IAEA. "By continuing to strengthen scientific R&D on zoonotic pathogens, including with nuclear and nuclear-derived techniques, at the environment-animal-human interface, we can pre-empt these diseases and better protect human health and world economies in the future."

Nuclear and nuclear-derived techniques play an important role in the diagnosis of zoonotic diseases

The 6 July 2020, was World Zoonoses Day to highlight the importance of the ongoing work worldwide to prevent, detect, and pre-empt the spread of zoonotic pathogens, such as viruses. Detecting zoonotic pathogens in animal or human samples using techniques such as real time reverse transcription–polymerase chain reaction (RT-PCR) offers a unique, accurate, sensitive and timesaving advantage compared to other methods for detecting viruses in animal or human samples. They can also be used to identify exposure to disease pathogens.

Ebola

During and after the Ebola outbreak in West Africa in 2014, researchers trained by the IAEA, in cooperation with FAO, discovered bats suspected to be infected with the Ebola virus near villages in the Democratic Republic of the Congo and Sierra Leone. By testing the bats using nuclear-derived techniques, they confirmed the presence of the virus. This information helped the authorities issue and implement measures to protect villagers from the illness, such as relocation or restrictions on forest use.

These testing capacities were developed through support from the IAEA, in partnership with FAO and in collaboration with WHO and OIE.More than 140 African veterinary and public health experts from 39 countries were trained through regional training courses to carry out early diagnosis of zoonotic diseases using appropriate biosafety measures. They were also provided with the equipment and the diagnostic kits needed to perform diagnostic testing, such as RT-PCR tools, detection kits, biosecurity gear namely personal protective equipment. More than 250 African experts were also trained through national training courses to carry out safe and secure field and laboratory inspections of infected livestock and wildlife and collect samples for analysis.

Capacity to prevent, detect, pre-empt

With its expertise in nuclear science, the IAEA is uniquely placed to support veterinary and public health experts worldwide. Since the outbreak of COVID-19, for example, the IAEA has provided technical assistance to more than 312 medical and veterinary laboratories. To support testing, the IAEA has also provided equipment and laboratory supplies to 209 laboratories in 121 countries.

In June 2020, the IAEA launched the ZODIAC (**Zo**onotic **D**isease **I**ntegrated **Ac**tion) initiative in light of the COVID- 19 pandemic, as a way to further strengthen countries' capabilities for early detection, diagnosis, prevention and control of zoonotic disease outbreaks. The initiative is designed as an integrated approach across sectors and disciplines, for addressing new and existing zoonotic pathogens. ZODIAC aims to help countries prepare for, pre-empt and prevent zoonotic disease outbreaks, as well as protect the wellbeing, livelihoods and socio-economic status of billions of people worldwide and integrates emergency assistance measures, including a response team.

The IAEA's assistance to countries through ZODIAC builds on its proven track record of supporting countries with efficient and timely response to other outbreaks of zoonotic diseases such as the Highly Pathogenic Avian

Influenza H5N1 (2003-ongoing); SARS, or the Severe Acute Respiratory Syndrome-SARS-CoV-1 (2003); MERS, or the Middle East Respiratory Syndrome (2016); Ebola (2014, 2018); and Zika (2016).

ZODIAC is part of the Agency's support in combatting COVID-19, through its applied research and development laboratories, its collaboration with and coordination of networks of laboratories worldwide and its technology and knowledge transfer through technical cooperation and coordinated research projects.

To support capacity building and information exchange, the IAEA, in cooperation with the FAO, coordinates the VETLAB Networks in Africa and Asia. These networks are funded through the IAEA's Peaceful Uses Imitative and the African Renaissance Fund. The networks comprise national laboratories that provide countries with support in detecting and controlling animal and zoonotic diseases and share experience and best practices. ZODIAC aims to create a global network on the basis of the regional ones.

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Improving Productivity of Local Cattle in Zanzibar (URT5031)

Like in many developing countries, livestock supports the livelihood of thousands of people in Zanzibar as a source of food and household income. However, productivity, especially of cattle is low, with a huge potential that is yet to be optimized. Farmers rely on local indigenous breeds that take longer to mature and produce very little meat and milk. Some improved crossbreds are available, but they are too few for the market, and expensive for most farmers. To meet the increasing demand for foods of animal origin in Zanzibar there is a need to avail and efficiently deliver affordable improved cattle genotypes to farmers. Artificial insemination (AI), is an efficient, cost-effective reproductive technology that has had the greatest impact in dissemination of desired cattle breeds in many herds across the world.

Through support from the IAEA, Zanzibar has been able to acquire improved cattle genetics and efficiently deliver AI services to farmers for upgrading local indigenous breeds. In a period spanning less than a year (October 2019 to August 2020), 1,538 cattle were inseminated using high genetic value semen. A conception rate of 66% was achieved as a result of using appropriate breeding strategies. Between June and August 2020, 208 (113 female and 95 male) upgraded calves were born from AI.

Trained service providers breeding local cattle using artificial insemination (AI)

This support will assist Zanzibar meet its food security needs and improve the livelihoods of the population through provision of household meat and milk products and income from sale of animals and animal products.

Research Activities of the Animal Production and Health Laboratory

Comparison of Commercially Available Molecular Diagnostic RT-PCR Reagents and Kits for SARS-CoV-2 Detection

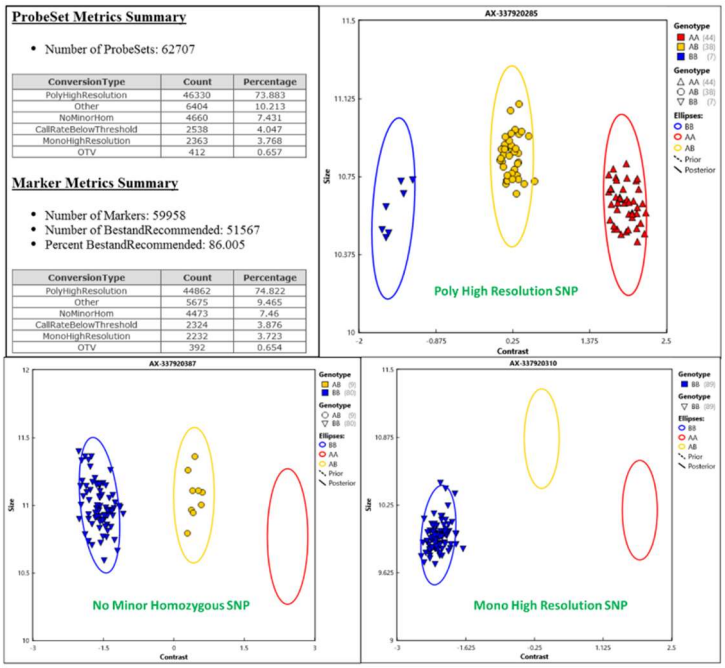
Mitigation of SARS-CoV-2 infection spread requires the availability of accurate and sensitive detection methods. There are several commercial *ad hoc* molecular diagnostic kits currently on the market, many of which have been evaluated by different groups. However, in low resource settings, the availability and cost of these commercial kits can be limiting factors to many diagnostic laboratories. In such cases alternative and cheaper reagents need to be identified. With this in mind, eight commercial PCR master mixes were evaluated using the same commercial primer and probe mix for SAR-CoV-2 E-gene detection. In addition, three *ad hoc* molecular diagnostic kits were also evaluated. The limit of detection was calculated for each assay using serial dilutions of a synthetic RNA control and a defined clinical sample. Clinical sensitivity was determined against a panel of 178 clinical samples and specificity against a panel of human betacoronaviruses. Inter assay agreement was assessed and compared with the results obtained using reagents and the protocol recommended by the WHO for SARS-CoV-2 RT-PCR tests. The study was conducted in close collaboration with the AGES Laboratory in Moedling, Austria. The results of this study will be made publicly available through a scientific publication.

Animal Genetics

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

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

Camel is one of the most popular domestic species in regions experiencing harsh climatic conditions. Camels are raised for milk, meat, fiber (wool and hair), transport and work. There is growing recognition of the value and benefits of camel products that provide a rich source of income to nomadic herders in Asia and Africa. During 2020, Animal Production and Health Laboratory (APHL) in collaboration with the Veterinary Medical University (Austria) and International Camel Genome Consortium, developed a multi-species camelid DNA chip for selection and breeding of high producing camel and to increase productivity. This novel multi-species chip contains ~200,000 single nucleotide polymorphic (SNP) markers, with >60K from each of dromedary, Bactrian and new world camelid species. As a first step of validation, the array was tested on a panel of 96 dromedary camel samples to generate library files that can convert signal data into genotypes.



Probe and marker metric summary with sample SNP cluster plots (Poly High Resolution, No Minor Homozygous & Mono High Resolution) for dromedary camel

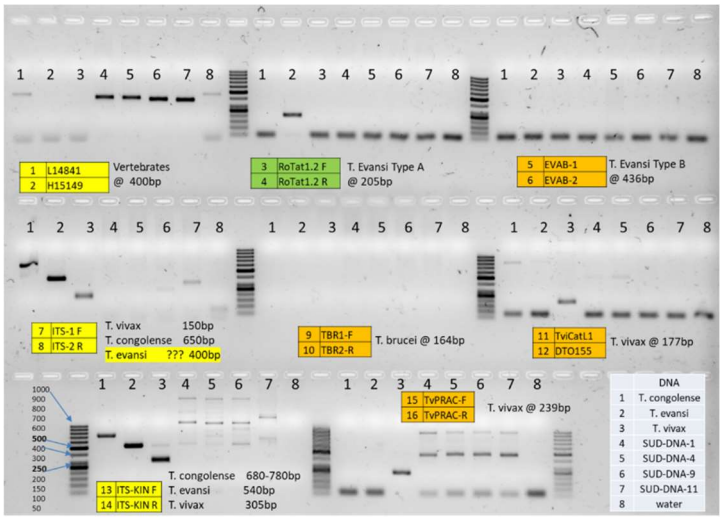
The process of validation of 60K dromedary SNP was successful with extraction of genotypes at ~86% loci under highly stringent thresholds of quality control parameters (DQC> 0.82, SNP QC call rate >97%, Average call rate for passing samples ≥ 98.5 and percent passing samples ≥ 95). The array consisted of 62,707 probe sets covering 59,958 genome wide SNP markers specific to dromedary camel. Of these, a total of ~51,500 markers were successfully genotyped that included ~44,860 PolyHigh Resolution (presence of both homozygotes and heterozygotes), 4660 NoMinor Homozygotes (absence of minor allele homozygotes) and ~2360 MonoHigh Resolution (monomorphic) SNPs. The successful validation of 60K dromedary SNPs has now enabled genetic and genome wide evaluation of dromedary populations. The process of validation and field testing is being continued for other camelid species (Bactrian camel, Alpaca, Llama) and the array will be rolled out in 2021 for the use by camel breeders across Africa, Asia and Latin America.

Genome-wide evaluation of cattle to estimate genetic admixture and association with milk production traits

Improvement of cattle for increased milk production occurs mainly through selective or cross breeding schemes. Genome wide evaluation using SNP microarray can help in improving the efficiency of both of these breeding schemes. The Animal Production and Health Laboratory (APHL) provided technical support to Argentina, Bangladesh, Peru, Serbia, Sri Lanka and Uruguay in performing genome wide evaluation of their respective local cattle. An Axiom bovine (BovMDv3) array consisting of 63,648 markers was used to genotype more than 1900 samples from these six countries (~180 from Argentina, ~370 from Bangladesh, ~290 from Sri Lanka, ~570 from Peru and ~360 from Serbia and ~). The purpose of genomic evaluation was to (i) perform genome wide association of genotypes with milk production traits (Serbia), (ii) estimate genetic admixture and assess the level of taurine inheritance in crossbred cattle (Bangladesh, Sri Lanka) and, (iii) identify selection signatures related to high altitude adaptation (Peru) and assess genetic biodiversity in local cattle (Argentina and Uruguay). Upstream analysis of genome-wide data was completed to generate data on SNP genotypes for each marker loci, chromosome number, strand, dbSNP ID, flanking region sequence, reference allele, associated gene or genomic region, etc. Further downstream bioinformatic analysis of genotype dataset is currently underway.

PCR based phenotyping of Trypanosomosis in dromedary camel

Camel is relatively less susceptible to many devastating diseases that affect livestock species, such as rinderpest, contagious pleuropeumonia and foot and mouth disease. However, Trypanosomosis, predominantly caused by *Trypanosoma evansi* is a major threat to dromedary camels. The protozoan pathogen is transmitted mechanically by biting and sucking insects although vertical, horizontal, iatrogenic, or per-oral transmission are also possible depending on the host and the geographical area. There has been anecdotal evidence on differences in susceptibility to infection among dromedary populations located in different regions, possibly having an inherent genetic basis for disease resistance. During 2020, APHL initiated a study on genetics of resistance to Trypanosoma infection in dromedary camel and to evaluate genome-wide association with relevant phenotypes. Several phenotypes (PCR based detection of Trypanosoma species, clinical signs, packed cell volume, red blood cell count, differential count of white blood cells and immunoglobulins) were identified to assess the susceptibility, resistance and/or tolerance to disease. As a first step, the process of PCR (polymerase chain reaction) based phenotyping of Trypanosoma infection in dromedary camel was initiated. A battery of PCR primers that are conventionally used for molecular epidemiological screening were tested to optimize a panel of markers for detection and differentiation of Trypanosoma species infecting dromedary camel. Three major species of Trypanosomes were targeted that included *T.evansi, T.vivax* and *T.congolense.* PCR markers were identified for (i) first level screening to detect Trypanosoma infection; (ii) differentiating *T.evansi* subtypes; and (iii) confirmatory diagnosis of *T.vivax* and *T congolense*. Further optimization is currently underway following the initial results obtained.



Optimization of PCR for detection and differentiation of Trypanosoma infections in dromedary camel

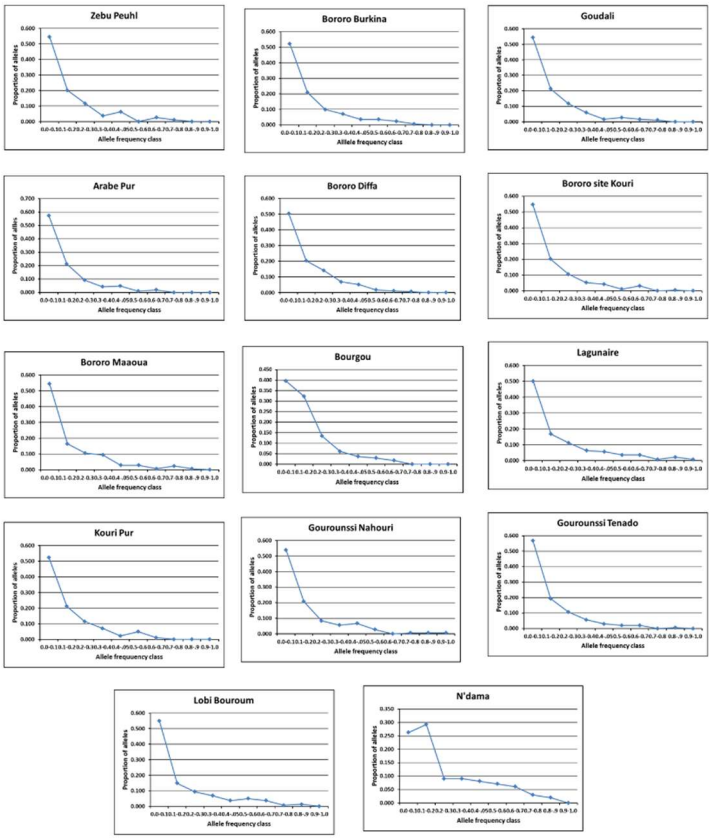
Implementing Global Action Plan on Animal Genetic Resources (AnGR)

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

Evaluation of mutation drift equilibrium to detect cryptic genetic bottleneck in indigenous West African taurine and zebu cattle populations

West African cattle display a unique genetic feature of adaptation to the prevailing climate and livestock production system in the region. Several factors are threatening West African cattle breeds, particularly declining population size, unsupervised crossbreeding and the prevailing harsh environmental conditions. The decline in effective population size can affect within breed genetic variability and could lead to loss of many rare alleles. Reduced genetic diversity and increased inbreeding are bound to affect the viability of small populations due to their inability to withstand extreme selective pressures. Therefore, an investigation was carried out to assess West African cattle breeds for evidence of recent genetic bottleneck by using multi-locus short tandem repeat markers. A total of 453 samples belonging to seven taurine and seven zebu cattle breeds located across four West African countries (Benin, Burkina Faso, Niger and Mali) were investigated. Among all the investigated breeds, at least three (Arabe Pur, Kouri Pur, Gourounssi Nahaouri)

showed statistically significant (P<0.05) heterozygosity excess when tested with at least one of the three statistical methods under the assumption of the infinite alleles model of microsatellite mutation. However, such a heterozygosity excess was not observed in these populations when assumed under stepwise or two-phase mutation models. The qualitative graphical test for distorted distribution of allele frequencies revealed all West African cattle populations except N'dama showing a normal L shaped distribution. The study thus revealed no concrete evidence for the occurrence of a recent genetic bottleneck in West African taurine and zebu cattle populations.



Qualitative test of mode shift for the detection of recent genetic bottleneck in West African Zebu and taurine cattle breeds

Animal Health

Supporting Member States on Research and Development of Irradiated Veterinary Vaccines

Indonesia – Development of an irradiated vaccine against bovine mastitis

The National Nuclear Agency of Indonesia (BATAN) is conducting experiments to develop an irradiated vaccine against mastitis in cattle. Mastitis is the inflammation of the udder mainly caused by bacterial infections that leads to massive losses in milk production. Group B Streptococcus (GBS) is mainly responsible for mastitis in dairy cattle. In 2019, two fellows from the Center for Isotopes and Radiation Application (CIRA) of BATAN were trained at APHL on methods of how to use gamma-irradiated bacteria as vaccine candidates against mastitis. Upon return to their home institute, these scientists have been conducting experiments to develop the vaccine under the guidance of the APHL and have recently revealed the irradiation dose that inhibits the replication of GBS but preserves the metabolic activity of bacteria. A dose of 9 KGy of gamma irradiation was determined from these experiments and will be used to produce a GBS vaccine prototype against mastitis. This work is supported through Technical Cooperation Project INS5042.

A scientist working in a biosafety environment to develop the irradiated GBS vaccine at the Center for Isotopes and Radiation Application, National Nuclear Agency of Indonesia.

Sri Lanka – An irradiated vaccine against goat and sheep stomach worms

At the University of Peradeniya, Sri Lanka, scientists are developing an irradiated vaccine against the nematode worm *Haemonchus contortus*, a parasite causing massive production losses in goats and sheep. *H.contortus* infections in goats and sheep occurs in many parts of the world. The current control method of drenching animals with anti-parasitic agents has become less effective due to the development of drug resistance in the parasites. Previous studies carried out through an IAEA funded CRP resulted in the development of a vaccine candidate which is now under efficacy testing in goats. In fact, additional experiments are required to measure the protective immunity induced by this vaccine. In this regard, flow cytometry is used as an effective tool for detecting very rare types of immune cells that are raised against parasites during vaccination. Under the newly implemented TC

project SRL5049, IAEA donated a flow cytometer to the University of Peradeniya where the vaccine study is based. APHL, with the help of the equipment supplier, was able to organize a virtual training program on how to use the flow cytometer. Experimental protocols developed at APHL were also shared with the scientists from Sri Lanka in order to effectively measure vaccine immunogenicity using both flow cytometer and qPCR.

Scientists from University of Peradeniya, Sri Lanka attending virtual training conducted by APHL and onsite training on the use of the flow cytometer.

Development of In-vitro Assay that Measure Vaccine Immunogenicity in Porcine Samples Through the Use of Quantitative PCR (qPCR)

To technically support the on-going scientific projects on development of irradiated vaccines, APHL is developing experimental protocols to measure the performance of porcine immune markers during vaccine trials. The panel under development uses cytokine expression analysis by qPCR. Seventeen interleukins, and one calibrator gene have so far been optimized using cells stimulated in-vitro for interleukin production. To develop this assay, the use of peripheral blood mononuclear cells (PBMCs) isolated from pigs (thanks to the collaboration with the Veterinary Medicine University Vienna) and subsequently incubated the cells with phorbol 12-myristate 13-acetate (PMA) and Ionomycin, a strong stimulator of immune cells. Control cultures were maintained in the same conditions as treated cells. RNA was subsequently extracted from cells and used in a qPCR assay using SYBR green that measures the targeted interleukins. This assay has been designed to use sets of primers that amplify the targeted interleukin in both Bovine and Ovine samples thus reducing cost and increasing efficiency. Activated cells displayed signature melting curves (Figure 1). This assay has subsequently been used for measuring interleukin expression Porcine samples from a vaccine animal trial (PRRSV, AGES) and in measuring the adjuvant effect of *Lactobacillus* spp. in animal vaccine formulations.

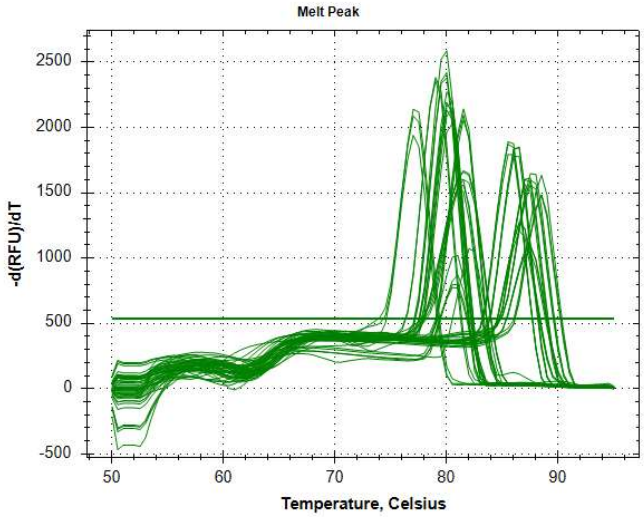


Figure 1: Melt curve analysis of 17 Porcine interleukin targets and beta-actin from a qPCR reaction carried out on Porcine PBMCs stimulated using PMA (phorbol 12-myristate 13-acetate) and Ionomycin. The single peaks confirmed that the designed primers amplified specific single products.

Immunological Responses to the Porcine Reproductive and Respiratory Syndrome Virus (PRRSv) in an Irradiated Vaccine Animal Trial

APHL, together with partners in AGES, Austria and Fraunhofer Institute, Germany, conducted a vaccine trial against Porcine Reproductive and Respiratory Syndrome virus. Although modified live and inactivated vaccines are commercially available, the efficacy and safety of such vaccines are below expectations and there is a great demand to develop an inactivated, safe and efficacious vaccine against this important swine disease present world-wide.

The APHL, in addition to the preparation of the gamma irradiated vaccine candidate and final formulation of vaccine preparations, carried out several immune assays to evaluate the immune response of vaccinated pigs. The results of these assays provide important information to guide future approaches in vaccine experiments. It is known that neutralizing antibodies (NA) do not appear immediately after PRRSv vaccinations, but later upon virus

challenge. Furthermore, clearance of viremia can occur without NA, and viremia and viral replication can persist even in the presence of NA. On the other hand, IFN-γ may be associated with viral clearance in the absence of NA. Thus, cell mediated immunity (CMI) could be responsible for limiting the duration of viremia and the spread of the virus to the tissues when NAs are not present. Measurement of CMI following vaccination and challenge is therefore very important to assess the outcome of vaccination. In the experiments conducted in the AGES facility, 5 groups of 5 piglets each were used. Group 1 was vaccinated with a gamma irradiated prototype vaccine, group 2 with an e-beam irradiated prototype vaccine and group 3 with a chemically killed vaccine. Group 4 was not vaccinated. Groups 1-4 were challenged with a homologous virus while group 5 was used as a naïve control. Viral loads, antibody response, CMI and pathology (at the end of the experiment) were assessed. At APHL, CMI and memory B cell response through B-cell ELISPOT from the blood samples that were collected on the day of the challenge and 14 days after the challenge were assessed. Our findings can be summarized as below:

1. Prior to challenge there was a variable vaccine induced CMI response in the gamma group. This is shown by the increased (not significant though due to variance) mRNA expression of Th1 type markers such as IL-12b.
2. The chemical inactivated group showed an increased expression of IL-2 (which is a global activation marker) that coincides with TLR-2 and TLR-9. However, it also upregulates IL-10, which negatively regulates the adaptive immunity.
3. Higher IL-2, Rig-I and TLR-2 expressions prior to challenge seemed to relate to lower viral loads later. These relationships are stronger in the gamma vaccinated group.
4. After challenge, the gamma vaccinated group showed the highest CMI response. This is evident by significantly higher cytokine responses both in CD4 and CD8 response.
5. Among these cytokine responses, CD8 cells producing IFN-g and TNF-a seem to negatively correlate with the average viral loads. When observed closely, again, these relationships are much more evident in the gamma vaccinated group (Figure 2).
6. In terms of B-cell-ELISPOT for antibody response, both the gamma and the E-beam groups had significantly higher responses following challenge compared to the control group. However, there was a pattern of increased response prior challenge which was not significant (Figure 3).

These results taken together indicate that irradiated vaccine candidates, especially gamma irradiated vaccine antigens did induce interesting and promising CMI specific responses against PRRSv. Moreover, both gamma and E-beam groups may have induced or could have the ability to induce antibodies against viral surface proteins, as indicated by B-cell ELISPOT.

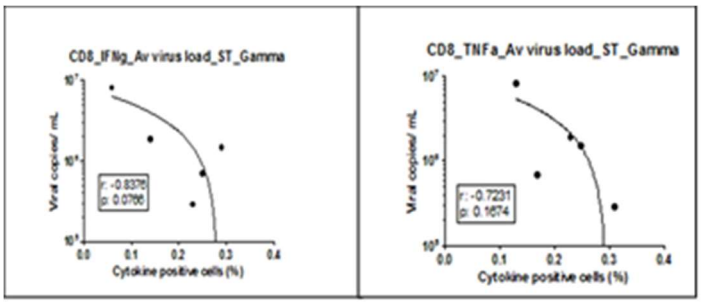


Figure 2: Correlation of cytokine positive cells of the gamma vaccinated group on day 14 of the challenge with average viral load

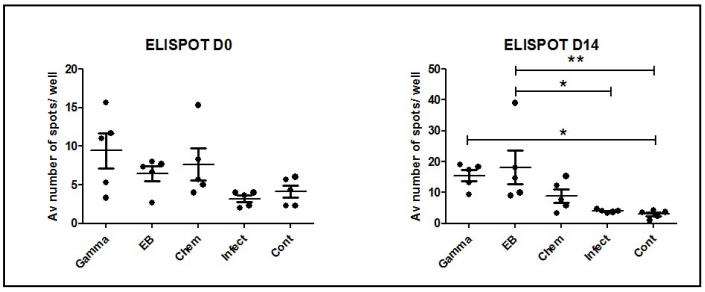


Figure 3: Cell ELISPOT showing the number of cells that produce IgG that binds to the challenge virus (on D0 and D14 of the challenge)

Epidemic of Rabbit Hemorrhagic Disease 2 (RHD-2) in West Africa

From March 2020, several countries in West Africa experienced mortality in domestic rabbits. Following an initial request from Senegal for support, APHL collaborated with the OIE reference laboratory for Rabbit Hemorrhagic Disease (RHD), and the Istituto Zooprofilattico Sperimentale Della Lombardia E Dell'Emilia Romagna, Italy, to gather and share Standard Operating Procedures (SOPs). APHL also updated its capacity for support in the virus's characterization. With the supply of SOPs and reagents, LNREV in Senegal could detect the virus, allowing notification of RHD to OIE. The LNERV also received further support for RHD Virus (RHDV)-2 characterization through the partial sequencing of the VP60 protein gene. This has put the laboratory in Senegal in a better position to support countries in the region for diagnosis confirmation.

Meanwhile, coordinated by the VETLAB Network, Senegal assisted Nigeria by sharing its updated SOPs, enabling Nigeria to detect the RHDV-2 and notify the disease to OIE on 13 October 2020. Meanwhile, Burkina Faso also requested support for the detection of suspected cases of RHDV-2. All three countries further asked APHL to assist in a more comprehensive characterization of their local isolates. APHL successfully sequenced the full genome of 2 RHDV-2 samples collected during Senegal's outbreaks by using the Ion S5 sequencing platform. Following the assembly against a reference genome, a quick comparison

of the assembled RHDV-2 genomes to publicly available sequences showed that the Senegalese RHDV-2 were most related to European RHDV-2 viruses collected between 2016 and 2018 in Poland, Germany, and the Netherlands. APHL is currently working on the full genome sequencing of RHDV in samples collected in Nigeria and the confirmation and characterization for suspected clinical samples from Burkina Faso.

First Detection and Molecular Characterization of Pseudocowpox Virus in a Cattle Herd in Zambia

Pseudocowpox virus (PCPV) causes pseudocowpox in cattle worldwide and presents a zoonotic concern. Because various poxviruses produce diseases of similar clinical signs in affected animals, it is vital to use molecular assays to rapidly identify the causative agents of poxvirus infections. In a previous issue, we had reported the first detection of PCPV in a cattle herd in Zambia, initially suspected to be infected with Lumpy Skin Disease virus. Here we report on the final findings on investigating these cases using a High-Resolution Melting (HRM) analysis assay and sequencing the major envelope protein (B2L gene) for comparative sequence and phylogenetic analysis.

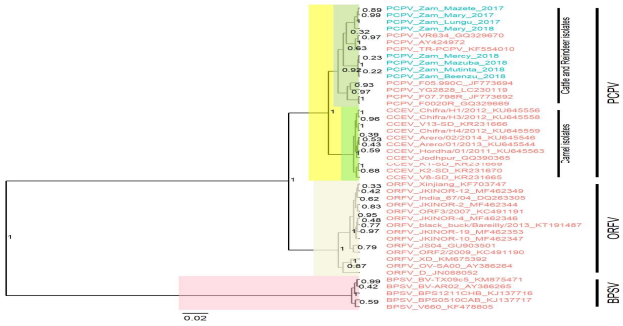
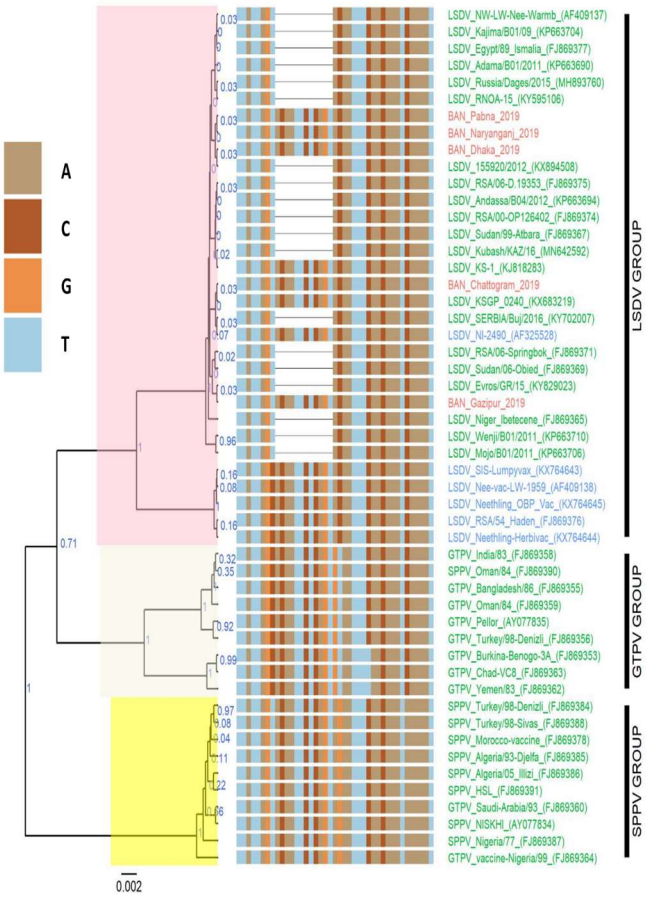


Figure 4: Maximum clade credibility (MCC) tree based on the partial B2L gene sequences of parapoxviruses including cattle PCPV sequences from Zambia (blue color).

The laboratory diagnosis based on the HRM assay revealed PCPV DNA in the samples. Phylogenetic (Figure 4) and comparative sequence analyses confirmed PCPV in the samples and revealed genomic differences between samples collected in 2017 and 2018 from the same farm. This work shows the strength of molecular methods to diagnose pox-like infections in cattle and discriminate between diseases causing similar clinical signs. This work was recently published in the Virology Journal (17, 152, 2020, doi: https://doi.org/10.1186/s12985-020-01426-7).

Emergence of a NI240-like Lumpy Skin Disease Virus (LSDV) in Bangladesh

Lumpy skin disease (LSD) is a contagious viral disease of cattle caused by lumpy skin disease virus (LSDV). Since 2019, LSDV has emerged in several new geographical areas in Asia, such as Bangladesh, India, Nepal, China, China Taipei, Bhutan, and Vietnam.



Maximum clade credibility (MCC) tree based on the complete GPCR gene sequences of Capripoxviruses, plotted together with multiple sequence alignment. Only the portion of the alignment between positions 80 and 120 is shown. LSDVs from Bangladesh are highlighted in red and reference sequences are represented with their accession numbers.

As part of the support to the VETLAB network partners, APHL assisted the Central Veterinary Laboratory of Bangladesh to characterize their local LSDV isolates. Samples collected from 6 different districts in Bangladesh (Chottogram, Dhaka, Gazipur, Narayanganj, Pabna, and Satkhira) were characterized by analyzing the full RPO30, GPCR and EEV glycoprotein genes. The phylogenetic analysis and a detailed investigation on multiple sequence alignments revealed that Bangladesh isolates differ from common LSDV field isolates encountered in Africa, the Middle East, and Europe. Interestingly, the field virus sequenced from clinical diseased animals were closely related to LSDV strain Neethling NI-2490, a historical LSDV isolated in a cattle Kenya in 1958, and LSDV KSGP 0240, an attenuated virus isolated from a sheep in Kenya and used as a vaccine in many countries in Africa and the Middle East.

These results show the usefulness of the multi-target approach in detecting LSDV variants and the need for continuous monitoring of the genetic evolution of the virus

to understand LSDV outbreak epidemiology and to implement tailored vaccine strategies.

Porcine Circoviruses 2 (PCV2) Identified in Namibia for the First Time

Porcine circovirus 2 is the causative viral pathogen of porcine multisystemic wasting syndrome (PMWS) and since its discovery in the early 1990s it has become of great economic importance to the global pig industry. As the virus has never been reported in Namibia, a study was undertaken to determine whether PCV2 was present in samples collected from commercial pigs (n=46) and wild warthogs (n=42) in three regions of Namibia between 2019 and 2020. Twenty-three of the collected samples were positive by PCR (n=13 from pigs and n=10 from warthogs) and a phylogenetic analysis of the ORF2/Capsid gene identified three genotypes (e.g. PCV2b, PCV2d in pigs and PCV2c in warthogs, Figure 5). This is both the first characterization of PCV2 in warthogs and the first characterization of PCV2 in Namibia.

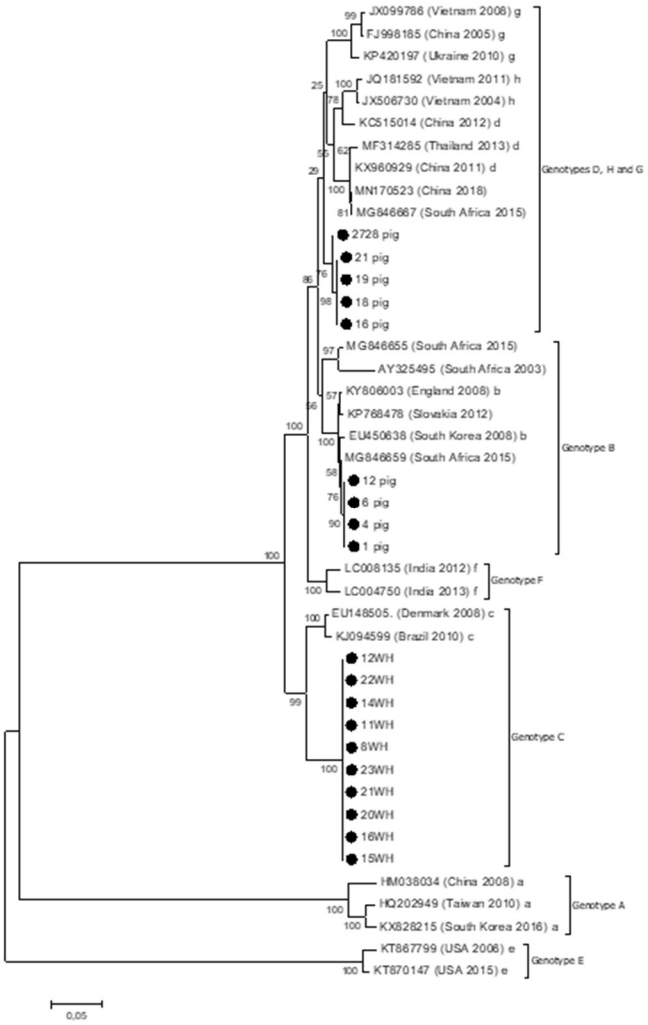


Figure 5: Neighbour-joining phylogenetic tree employing the p-distance model of nucleotide substitution and 1000 bootstrap replications of the ORF2 gene sequence from PCV2s sampled in Namibia combined with similar sequences available in GenBank. The sequences from this study are shown by filled black circles.

Co-circulation of Genotypes XIV.2 and XVIII.2 of Avian Paramyxovirus-1 (Newcastle Disease Virus) in Backyard Poultry in Niger

Like many other countries, Newcastle disease caused by avian paramyxovirus-1 (also commonly known NDV) is endemic in Niger and has a significant economic impact on commercial and backyard poultry production. NDVs were characterized in Niger between 2006 to 2008 and shown to belong to genotypes XIV and XVII. In order to determine the current situation regarding the virus in Niger, tracheal and cloacal swabs (n=384) were collected for the detection of NDV in backyard poultry in 2019 from two regions (i.e. Maradi and Tillabéri). Of these samples (n=42) were positive for NDV by classical RT-PCR. Sequencing of the fusion protein gene and phylogenetic analysis revealed that the viruses belonged to either genotype XIV.2 or XVIII.1. No NDVs of genotype XIV.1 or XVII were identified, highlighting the dynamic nature of NDV circulation in Niger and the region (Figure 6).

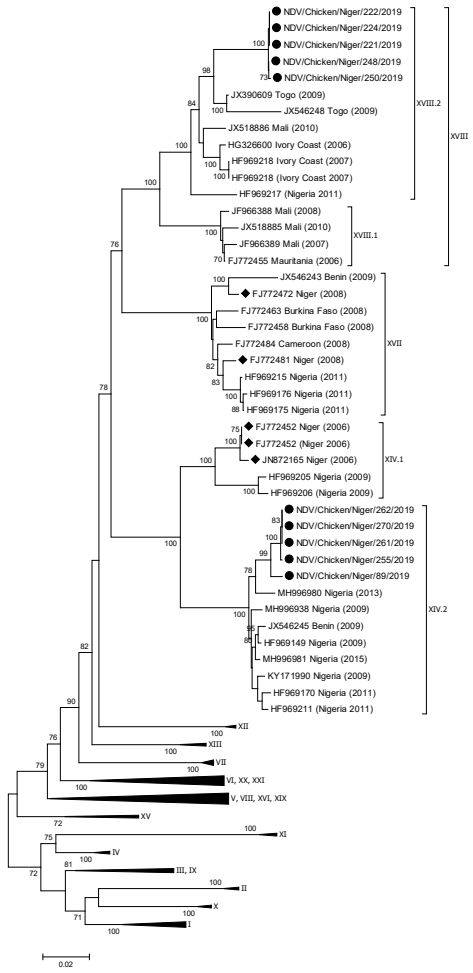


Figure 6: ML phylogenetic tree employing the Kimura-2 parameter model of nucleotide substitution and 500 bootstrap replications of the complete F gene sequence (1662 bp) gene sequence from APMV-1s sampled in Niger combined with similar sequences available in GenBank. The sequences from this study are shown by filled black circles while NDVs characterized in 2006 and 2008 are shown with black diamonds

Fellows, Interns and Consultants

Ms Sneha Datta joined the APHL as a Molecular Biologist on 1 December 2020. She will work with the APHL team to create innovative metagenomics approaches for pathogen detection and discovery, including user-friendly data analysis pipelines. Her previous experience in Next-Generation Sequencing, including whole-genome sequencing, RNA sequencing, exome sequencing, shell scripting, and python programming, will help her to prepare easy-to-go and automated recipes for MS scientists in the framework of the PUI and ZODIAC projects.

Ms Hanifati Subki joined the APHL as an intern on 1 October 2020. She will work on integrating the APHL activities and workflows with the iVetNet platform. Her activities will be essential to the record-keeping and implementing of a quality management system at the APHL for better serving MS.

Mr Federico Verly joined the APH as an intern on 2 November 2020. Holding a master's degree in International Relations, Mr Verly will assist in the organization of the International Symposium on Sustainable Animal Production and Health – Current Status and Way Forward by liaising with the contributors, formatting documents, compiling information and updating the Section's database.

Mr Norbert Nowotny joined the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture as a consultant on 5 October 2020. He supports the team in developing and fine-tuning the ZODIAC project. He comes from the University of Veterinary Medicine, Vienna, where he is the head the Viral Zoonoses, Emerging and Vector-Borne Infections Group.

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	Improvement of Diagnostic and Vaccine Tools for Emerging and Re-emerging Animal Health Threats	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 in their country of origin.

Most research contract holders have completed the work 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 of 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 third research coordination meeting was scheduled to take place in Vienna, Austria, from 22 to 26 June 2020, had to be postponed owing to the COVID-19 pandemic has now been rescheduled the second week of October 2021.

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

The third research coordination meeting is tentatively scheduled for the second week of November 2021.

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 aims to 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) Procedures for easy access, free-of-charge genetic sequencing services for pathogens of the priority diseases among the partners of the VETLAB Network; and

v) 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 is tentatively rescheduled for August 2021.

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 2017 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.

During the second research coordination meeting in May 2019 in Vienna, Austria, a training course in cellular immunology and approaches to test immune cell activation was held at the APHL, Seibersdorf. Immune cell culture, their stimulation and testing of responses from differentiation to cytokine assays was carried out and all Research Contract Holders (RCH) could perform their assays with guidance from the immunology team. Specific packages or reagents were prepared for each RCH to allow the transfer of technique immediately after return.

Results presented by the counterparts are encouraging, but owing to the COVID-19 pandemic, the larger field trial planned for 2020 is postponed to allow for safer working conditions.

Nevertheless, the first experiments with the irradiated Influenza vaccine show immune profiles correlated to protection, *Hemonchus contortus* trials are under implementation, Pasteurella trials are ongoing. The final

RCM is under planning and will most likely be held in Vienna in September 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 is tentatively rescheduled for August 2021.

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 the 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. We plan 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 Number	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
Bangladesh BGD5030	Building Capacity to Improve Dairy Cows Using Molecular and Nuclear Techniques	V. Tsuma
Belize BZE5010	Strengthening national capacities to control animal diseases	G. Viljoen
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
Bulgaria BUL5017	Enhancing the National Diagnostic Capabilities for Detection of Hepatitis E Virus in Pigs and Pig Products	I. Naletoski
Burkina Faso BKF5021	Improving Local Poultry Production Through Incorporation of Nutraceuticals in Feeds and Genetic Characterization	V. Tsuma
Burundi BDI5002	Improving Animal Production Through Enhanced Application of Nuclear and Related Techniques	I. Naletoski V. Tsuma
Cameroon CMR5022	Controlling Transboundary Animal diseases with Special Emphasis on Peste des Petits Ruminants	H. Unger
Cameroon CMR5024	Improving Goat and Sheep Productivity in Rural Areas Using Nuclear-Derived Techniques for Genetic Marker Identification, Reproduction Harnessing and Feed Analysis	V. Tsuma
Cambodia KAM5003	Supporting Sustainable Livestock Production	M. Garcia Podesta
Central African Republic CAF5009	Controlling Contagious Bovine Pleuropneumonia and Peste de Petits 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
Congo, Rep PRC5001	Monitoring Livestock Diseases and Certifying Animal Health	H. Unger

Country TC Number	Description	Technical Officer(s)
Congo, Rep PRC6002	Contributing to the Epidemiological Surveillance of Neglected Tropical Diseases	H. Unger
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
D.R. Congo ZAI5027	Developing Early and Rapid Diagnosis and Control of Transboundary and Zoonotic Diseases	H. Unger
Eritrea ERI5010	Increasing Small Scale Dairy Production Through Improved Feeding, Cattle Management and Higher Conception Rates, Thereby Improving Rural Livelihood and Contributing to Food Security	V. Tsuma
Ethiopia ETH5020	Enhancing the Livelihood of Rural Communities through Addressing Major Zoonotic and Economically Important Small Ruminant Diseases	H. Unger C. Lamien
Indonesia INS5042	Improving Cattle Productivity Through Improved Feeding and Enhanced Reproduction	V. Tsuma
INT5155	Sharing Knowledge on the Sterile Insect and Related Techniques for the Integrated Area-Wide Management of Insect Pests and Human Disease Vectors	I. Naletoski
INT5157	Supporting National and Regional Capacity in Integrated Action for Control of Zoonotic Diseases	G. Viljoen I. Naletoski
Kenya KEN5038	Using Nuclear Techniques to Evaluate and Improve the Impact of Mutated Forages on the Performance of Smallholder Dairy Cows	M. Garcia Podesta V. Tsuma
Kingdom of Eswatini SWA5001	Reducing the Incidence and Impact of Transboundary Animal and Zoonotic Diseases	G. Viljoen
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
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
Mali MLI5029	Upgrading Capacities to Differentiate Priority Animal and Zoonotic Diseases Using Nuclear Related Molecular Techniques	I. Naletoski

Country TC Number	Description	Technical Officer(s)
Mauritania MAU5007	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases - Phase II	M. Garcia Podesta
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	V. Tsuma
Pakistan PAK5052	Improving Livestock Productivity Using Nuclear and Related Techniques by Exploiting Indigenous Feed Resources while Reducing Enteric Greenhouse Gas Emissions	M. Garcia Podesta
Palestine PAL5007	Upgrading Animal Feeding Laboratory in Terms of Human Capacity Building and Infrastructure	I. Naletoski
Papua New Guinea PAP5003	Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding - PHASE-II	V. Tsuma
Paraguay PAR5011	Improving the Conservation of Germplasm of High Performance Livestock and Native Cattle	M.Garcia Podesta
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

Country TC Number	Description	Technical Officer(s)
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
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)	V. Tsuma M. Garcia Podesta
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
Serbia SRB5004	Strengthening of National Reference Laboratories Capacities for Early Detection, Epidemiological Surveillance and Control of Transboundary Animal Diseases in Emergency Situations	I. Naletoski
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
Sri Lanka SRL5046	Improving Livelihoods Through Dairy Cattle Production: Women Farmers' Empowerment	M. Garcia Podesta
Sri Lanka SRL5049	Supporting Control of Stomach Worm Infection in Goats	H. Unger
Syrian Arab Republic SYR5025	Enhancing the Nutritive and Reproductive Characteristics of Small Ruminants by Means of Nuclear and other Related Techniques Using Locally Available Unconventional Feed Resources	M. Garcia Podesta
Tajikistan TAD5006	Applying Nuclear and Molecular Techniques for Diagnosis and Control of Transboundary Animal Diseases	I. Naletoski

Country TC Number	Description	Technical Officer(s)
Togo TOG5001	Improving and Promoting Bovine Milk Production through Artificial Insemination	V. Tsuma M. Garcia Podesta
Togo TOG5003	Improving Livestock Production and Milk Quality Using Artificial Insemination	V. Tsuma M. Garcia Podesta
Tunisia TUN5030	Enhancing Feed and Food Safety by Appropriate Management of Livestock Feed Resources for Safer Products	M Garcia Podesta
U.R. of Tanzania URT5031	Improving Indigenous Cattle Breeds through Enhanced Artificial Insemination Service Delivery in Coastal Areas	G. Viljoen V. Tsuma M. Garcia Podesta
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
Zimbabwe ZIM5024	Establishing an Artificial Insemination Center to Enhance the Rebuilding of the National Herd	V. Tsuma M. Garcia Podesta

Publications

Publications in Scientific Journals

Jores J, Baldwin C, Blanchard A, Browning GF, Colston A, Gerdts V, Goovaerts D, Heller M, Juleff N, Labroussaa F, Liljander A, Muuka G, Nene V, Nir-Paz R, Sacchini F, Summerfield A, Thiaucourt F, **Unger H**, Vashee S, Wang X, Salt J. 2020. Contagious Bovine and Caprine Pleuropneumonia: a research community's recommendations for the development of better vaccines. NPJ Vaccines 5: 66. doi: 10.1038/s41541-020-00214-2

Diallo AA, Souley MM, Issa Ibrahim A, Alassane A, Issa R, Gagara H, Yaou B, Issiakou A, Diop M, Ba Diouf RO, Tall Lo FT, Lo Modou M, Bakhoum T, Sylla M, Seck MT, Meseko C, Shittu I, Cullinane A, **Settypalli TBK, Lamien CE, Dundon WG, Cattoli G.** 2020. Transboundary spread of equine influenza viruses (H3N8) in West and Central Africa: Molecular characterization of identified viruses during outbreaks in Niger and Senegal, in 2019. Transbound Emerg Dis. DOI: 10.1111/tbed.13779

Deng J, Xie X-L, Wang D-F, Zhao C, Lv F-H, Li X, Yang J, Yu J-L, Shen M, Gao L, Kantanen J, Mwacharo JM, Hanotte O, Bruford MW, Ciani E, **Periasamy K**, Amills M, Lenstra JA, Han J-L, Zhang H-P, Li L and Li M-H (2020). Paternal origins and migratory episodes of domestic sheep. Current Biology**,** 30: 1-11. (https://doi.org/10.1016/j.cub.2020 .07.077)

Sassu EL, **Kangethe RT**, **Settypalli TBK**, Chibssa TR, **Cattoli G**, **Wijewardana V**. Development and evaluation of a real-time PCR panel for the detection of 20 immune markers in cattle and sheep. Veterinary Immunology and Immunopathology 227, 110092. 2020. https://doi.org/10.1016/j.vetimm.2020.110092

Souley MM, Issa Ibrahim A, Souley Kouato B, Abdou A, Issa R, Yaou B, Amadou H, Hama H, Adakal H, Abdou N, **Cattoli G**, **Dundon WG**. Co-circulation of genotypes XIV.2 and XVIII.2 of avian paramyxovirus-1 (Newcastle disease virus) in backyard poultry in Niger. Virus Genes. 2020 Oct 31. doi: 10.1007/s11262-020-01804-x

Ziba MW, Chitala C, **Settypalli TBK**, Mumba M, **Cattoli G**, Fandamu P, **Lamien CE**. First detection and molecular characterisation of pseudocowpox virus in a cattle herd in Zambia. Virol J. 2020 Oct 9;17(1):152. doi: 10.1186/s12985-020-01426-7

Mbuyi GT, Kawaya EK, Twabela AT, **Cattoli G**, Walandila JS, **Naletoski I**, Masumu J, **Dundon WG**. Molecular characterization of rabies viruses from two western provinces of the Democratic Republic of the Congo (2008-2017). Virus Genes. 2020 Oct;56(5):651-656. doi: 10.1007/s11262-020-01784-y. Epub 2020 Jul 21

Dundon WG, Diallo A, **Cattoli G**. Peste des petits ruminants in Africa: a review of currently available molecular epidemiological data, 2020. Arch Virol. 2020 Oct;165(10):2147-2163. doi: 10.1007/s00705-020-04732-1. Epub 2020 Jul 11

Kuhn JH, **Dundon WG**, et al. 2020 taxonomic update for phylum Negarnaviricota (Riboviria: Orthornavirae), including thelarge orders Bunyavirales and Mononegavirales. Arch Virol. 2020 Dec;165(12):3023-3072. doi: 10.1007/s00705-020-04731-2. Epub 2020 Sep 4

Kgotlele T, Modise B, Nyange JF, Thanda C, **Cattoli G**, **Dundon WG**. First molecular characterization of avian paramyxovirus-1 (Newcastle disease virus) in Botswana. Virus Genes. 2020 Oct;56(5):646-650. doi: 10.1007/s11262-020-01770-4. Epub 2020 Jun 20

Javan S, Motamedi-Sedeh F, Dezfoolian M, **Wijewardana V**. Evaluation of Immune Responses and Histopathological Effects against Gamma Irradiated Avian Influenza (Sub type H9N2) Vaccine on Broiler Chicken. Braz. arch. biol. technol. vol. 63 2020. Epub Sep 30, 2020. https://doi.org/10.1590/1678-4324-2020200094

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 is a global network of national veterinary laboratories 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). To date, the network comprises 71 laboratories in 45 African and 19 Asian countries and is now working to expand to Central and Eastern Europe, the Caribbean and Latin America. The laboratories work with each other and experts from the Joint FAO/IAEA Division to use nuclear, nuclear-derived and other methods for monitoring, early detection, diagnosis and control of diseases.

During the past six months, the VETLAB Network has been instrumental to technically supporting partner laboratories in countries affected by COVID-19 pandemic. Indeed, in some of these countries, VETLAB laboratories are supporting medical laboratories for SARS-CoV-2 RT-PCR testing. Through the network, emergency support was delivered to the national veterinary laboratories appointed by the respective national health authorities to conduct COVID-19 testing. To date, 42 national veterinary laboratories in three continents were directly supported. The emergency packages delivered to these laboratories contained all needed reagents, reference material, consumables as well as major equipment to safely run recommended diagnostic tests based on RT-PCR, including biosafety cabinets and real time PCR platforms. Support was also provided to MS laboratories for the detailed and rapid characterization of SARS-CoV2 isolates by genetic sequencing.

In addition, transboundary animal diseases continue to cause severe losses, such as African Swine Fever (ASF) and Lumpy Skin Disease (LSD) epidemics in 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.

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