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To Our Readers

Suffolk ewe selected for parasite resistance

Dear colleagues,

We have completed 2018 with plenty of challenges, as well as successes, in our day to day activities and in our long-term work plan. Certainly, our support to you and the resulting achievements could not have been obtained without the valuable inputs and interactions of institutions, experts and project counterparts to enhance animal production and health in general and to improve livelihoods.

Food security and livelihoods of livestock farmers in several Member States (MS) have been at risk due to the continuous threats posed by animal infectious diseases. In 2018, potentially devastating animal diseases such as African swine fever (ASF) and pest des petites ruminants (PPR)

spread rapidly and emerged in countries and regions previously unaffected. This was the case of ASF in China, the world biggest producer of pigs, and for the first time ever in Europe, PPR in Bulgaria. The Animal Production and Health Subprogramme has maintained its commitment in strengthening capacity building of MS laboratories through research, training, and technology transfer for preparedness, early detection and control of zoonotic and transboundary animal diseases (ZTADs), especially through the Veterinary Diagnostic Laboratory (VETLAB) Network. In 2018, 55 laboratory personnel from African and Asian veterinary laboratories were trained at the Animal Production and Health Section's Laboratory in Seibersdorf, Austria, on advanced nuclear and nuclear-derived techniques for the diagnosis of ZTADs and the detailed characterization of the causative agents. Through the VETLAB Network, our staff validated and transferred rapid diagnostic tests to cost-effectively differentiate PPR and ASF from other diseases causing similar clinical signs in small ruminants and pigs, respectively.

Immediately after the emergence of PPR in Bulgaria, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture trained two Bulgarian scientists on the laboratory tests for PPR detection and transferred the protocols, the reference material and the necessary test reagents to the local laboratories to efficiently diagnose and confirm the disease. In parallel, a PPR interlaboratory test with the participation of 27 laboratories from 25 MS world-wide was organized to verify their competency in PPR diagnostic laboratory tests.

Avian influenza epidemics continue to threaten public health and hamper poultry production in several countries. Countries like Myanmar and Ghana are implementing surveillance systems to reduce economic losses due to the emergent H9N2 avian influenza virus subtype. In collaboration with FAO, we supported their surveillance efforts by providing reference reagents to be used in the large scale national serological surveys.

Goats in Madagascar

Eleven national and regional training courses and workshops were implemented throughout 2018 and nearly 300 laboratory personnel and animal health officers were trained at various locations on advanced laboratory techniques for detection and differentiation of multiple pathogens and for addressing disease outbreaks.

MS continue to strive for increasing livestock-based food production to improve rural livelihoods and to ensure food security. Technical support was provided to 28 MS to identify locally available animal resources and develop baseline information for genetic improvement and increased productivity. To assist MS in the process, a computer database application called Genetics Laboratory Information and Data Management System (GLIDMaS) was developed and transferred to enable better and efficient management of local livestock breeds. Modern animal breeding technologies related to improvement of sheep productivity through enhanced resistance to parasitic diseases were transferred to 13 countries. Further, to address the challenges in camel rearing, particularly those maintained by resource poor pastoralists in Africa and Asia, a nuclear technology called radiation hybrid mapping was utilized to establish much required genomic resources for camel production improvement. These resources were transferred to the International Camel Genome Consortium to stimulate development of DNA based tools for genetic evaluation and breeding of this important species. MS's efforts on sustainable improvement of livestock production was supported through five fellowships and national/regional trainings of 64 professionals from 15 countries.

Reproduction activities from our group continued to enhance the expertise and performance of livestock semen laboratories, artificial insemination (AI) field services and hormonal analysis by radioimmunoassay in 33 MS. Training on-site, or through national and regional training courses, was provided to 61 livestock professionals and technicians from 16 MS.

Tanzania successfully extended their AI programme from Arusha to Tanga widening the rural area benefitting from AI. Benin has developed a central semen laboratory in Parakou and another laboratory at the University of Abomey Calavi. Furthermore, Argentina, Brazil, Costa Rica, Paraguay and Uruguay have introduced sheep and goat breeding programmes with special focus on genetic resistance against gastrointestinal parasites. Argentina is already monitoring the performance of the offspring of 'resistant' rams. Indonesia introduced a community-based programme called 'Farmer School' for the applications of improved farming management based on results obtained through the application of nuclear and nuclear-derived technologies. The 'Farmer School' system currently has more than 1000 members.

Near-infrared spectroscopy (NIRS) was introduced in Benin, Ethiopia, Madagascar and Togo and on-station training was provided to 40 professionals. This technique facilitates the determination of the chemical composition of forages, grains, and other agricultural products. It is highly accurate, reliable, rapid, and can replace the tedious and time-consuming wet chemistry procedures in animal nutrition laboratories. Gas chromatography for analysis and mitigation of greenhouse gas emissions was introduced in Myanmar. Protocols for analysing plant markers (n-alcane) and their compound specific carbon-13 isotope for the estimation of intake, digestibility and diet selection were introduced in 8 MS. This technology will facilitate management decisions on the selection of compatible animals for pasture, on the selection of plant species for reseeding degraded pastures and on the design of appropriate supplementation strategies.

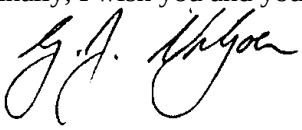
In relation to APH Section staff, I would like to welcome Mr Luca Porfiri who will start as Junior Professional Officer in January 2019 at the Animal Production and Health Laboratory. Mr Porfiri will support the team in the activities related to irradiated vaccines and development of laboratory assays to evaluate the immune response to vaccines and infections.

We have to say goodbye to Mohammed Shamsuddin who has been a valuable team member to all of us since 2012. Under his leadership the animal reproduction and breeding programme flourished to what it is today, and we thank him for his dedication, loyalty, commitment and friendship. Mohammed is not completely lost to us as he will take up the position of Livestock Officer at the Technical Cooperation Department of FAO and we look forward to working with him in his new capacity. We wish him and his family only the best for the future.

Also, let me say goodbye to Mario Barbato and Elena Lucia Sassu who ended their activities on animal genetics and animal health at our laboratories in Seibersdorf. I wish them a bright future and a successful 2019.

Last, but not least, I am glad to inform that we are hosting an international symposium on ‘Sustainable Animal Production and Health – Current Status and Way Forward’ in 2020. Read more about it on page 9.

Finally, I wish you and your families all the best in 2019.



Gerrit Viljoen
Head, Animal Production and Health Section

Milking zebu cattle in Brazil

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Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

VETLAB Network Bulletin

01/2019

In this issue:

VETLAB is an initiative of the Joint FAO/IAEA Division

To the readers

Infectious diseases have no borders. In June 2018, Peste des Petites Ruminants (PPR) emerged for the first time in Europe; causing seven outbreaks in Bulgaria. In August, African Swine Fever virus (ASFV) was notified in China for the first time. It spread throughout several Chinese provinces and now threatens bordering countries in South East Asia. ASFV-contaminated products were detected during border inspection controls in South Korea and Japan. Meanwhile, ASFV is spreading in Europe with cases in domestic pigs and wild boars and continues to cause high mortalities in sub-Sahara Africa.

In September 2018, Classical Swine Fever (CSF) re-emerged in Japan 26 years after the last outbreak. Poultry losses caused by the H9N2 avian influenza (AI) virus were reported for the first time in several countries in West Africa. In 2018, human cases of zoonotic AI, Ebola and MERS-CoV were reported in East Asia, Central Africa and the Gulf Area, respectively.

Luckily, 2018 also brought some good news: DR Congo did not have any more cases of highly pathogenic AI H5N8 virus. Also, human infections by the AI H5N1 virus were no longer reported in 2018 and no clinical cases of Lumpy Skin Disease were notified in Eastern and Central Europe.

These examples indicate the importance of working collectively, to share data and information, to build capacities and preparedness in a harmonised manner. In a simple word: networking! It is the global position of the VETLAB Network that make it special for countries, providing unique opportunities for lab managers and scientists to work together, exchange information and transfer capacities. We all are certain that our contributions to the VETLAB will continue and even increase in the year to come and we look forward to working with you in 2019.

VETLAB Highlights

The National Veterinary Institute (NVI), Ethiopia strengthens its Peste des petits ruminants vaccine production capacity

NVI has increased its capacity to produce 50 million doses of thermo-tolerant Peste des petits ruminants (PPR) vaccine per year. The recent donation by the Food and Agriculture Organization of the United Nations (FAO) and the European Union (EU) of a modern lyophiliser has strengthened the institute's contribution to the control of PPR.

VETLAB Networking in action I: trainings in LANAVET, Cameroon

Training of four colleagues from DR Congo took place in LANAVET Garoua and Yaounde. They have been trained in PCR, bacteriology and the implementation of quality assurance in the laboratory.

VETLAB Networking in action II: supporting ASF diagnosis in Chad

Following an outbreak of ASF in Chad last September, LANAVET Garoua was contacted by colleagues of the Institut de Recherche en Élevage pour le Développement (IRED), Chad to test samples collected from the outbreak. The tissues samples were positive by PCR while the serum samples were negative by ELISA. Results were immediately sent to IRED.

The Central Veterinary Research Institute (CVRI), Zambia, detected Pseudocowpox disease for the first time in a cattle herd

Pseudocowpox is an infection of cattle caused by pseudocowpox virus (PCPV) of the genus parapoxvirus, family Poxiviridae. Using an HRM assay for the differentiation of poxviruses, CVRI scientists detected PCPV in skin nodules, submitted on suspicion of lumpy skin disease virus infection. This first description of PCPV virus in Zambia illustrates the usefulness of multiple pathogens detection for differential diagnosis of pox diseases.

African Swine Fever (ASF) epidemic in China

According to the updates reported by FAO (21 December 2018), since the China Ministry of Agriculture and Rural Affairs (MARA) confirmed its first ASF outbreak in Liaoning Province in August 2018, 98 ASF outbreaks have been detected in 23 Provinces/Autonomous Region/Municipalities. More than 706,000 pigs have been culled in an effort to halt further spread. Updated information can be found on the FAO-EMPRES website http://www.fao.org/ag/againfo/programmes/en/empres/ASF/situation_update.html

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VETLAB Network Bulletin

VETLAB Capacity Building Initiatives

Training in Seibersdorf

A training course on "Sequencing and Bioinformatics Analysis of Animal Pathogen Genomes" was held in Seibersdorf on 10-21 September 2018 and attended by 22 participants from 17 and 4 African and Asian VETLAB countries, respectively.

From October 5 to November 2, Seibersdorf hosted 8 fellows from Cambodia, Laos, Myanmar and Vietnam. Fellows were trained on basic and advanced laboratory tests for animal and zoonotic diseases.

A 2-week advanced training on molecular diagnosis and molecular epidemiology was organized from 5 to 16 November 2018. Nine participants from African (6) and Asian (2) VETLAB countries attended the course.

Training in VETLAB Countries

In total, 81 VETLAB laboratory staff members were trained in Bangladesh (12), Botswana (14), Ethiopia (9), Kenya (5), Sudan (20) and Zambia (21). The trainings focused on molecular diagnosis and molecular epidemiology of animal and zoonotic diseases, test validation and troubleshooting, multiplexing and differential diagnosis.

VETLAB Networking Activities

Interlaboratory test for the diagnosis of PPR

The Animal Production and Health Section organized the yearly PPRV proficiency test focusing on its serological and PCR-based detection. This year the number of participating laboratories increased to 30 from 26 countries in Africa, Asia and Europe.

Support missions

Twelve VETLAB laboratories were visited by APH staff during the last semester of 2018. The visits aimed at strengthening the VETLAB activities and network among the different laboratories as well as transferring novel protocols and technologies.

3rd Coordination Meeting with Directors of Veterinary Laboratories of Africa and Asia

The meeting took place from 6 to 10 August 2018 in Vienna, Austria. It was the third joint technical meeting of the VETLAB network with directors of veterinary laboratories in Africa and Asia. Twenty-two participants from 15 African and 5 Asian countries attended the meeting and were updated on joint and individual countries activities in 2017-2018. They formulated workplans to address challenges such as the implementation of Quality Management System, including the organisation of interlaboratory trials and training courses.

Group photo of African and Asian Directors of Veterinary Laboratories and IAEA technical staff participating in the Third Coordination Meeting in Vienna, Austria (August 2018)

The VETLAB Network Laboratories: National Animal Health Diagnostic and Investigation Center (NAHDIC), Ethiopia

NAHDIC, under the Ministry of Livestock and Fishery, is mandated to undertake the following: diagnostic testing for international trade and disease investigation; conduct national surveillance plans for animal diseases; provide regional technical support for East African National Laboratories and build capacity. Specifically, it has been designated by FAO as the regional supporting laboratory in East Africa for Avian influenza and Newcastle disease.

NAHDIC has been implementing ISO/IEC 17025:2005 since 2008. Currently NAHDIC has reached 14 accredited test methods used for both serology and molecular diagnosis. The external quality assurance of test results is accomplished by regular participation in inter laboratory tests organized by international providers such as IAEA, CIRAD, the Pirbright Institute-UK, OVI-South African and IZSVe-Italy. The lab has new BSL-3, BSL-2 facilities for animal experiments and incinerator waste treatment.

The laboratory has a vision of becoming a FAO/OIE reference veterinary laboratory for the East African Region for the diagnosis of animal diseases and plans to increase the scope of accredited molecular tests for PPR, Capripoxvirus and FMD.

Headquarters of the National Animal Health Diagnostic and Investigation Center (NAHDIC) in Ethiopia

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Forthcoming Events

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

Hermann Unger

The research coordination meeting (RCM) will take place from 20 to 24 May 2019 in Vienna, Austria.

The purpose of the event is to review the achievements made so far and coordinate future activities. Special emphasis will be given to the understanding of cellular immune response analysis.

Second Research Coordination Meeting on Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pastures Using Compound Specific Stable Isotopes (D31029)

Kathiravan Periasamy and Mario Garcia

The research coordination meeting (RCM) will take place in June in Piracicaba, Brazil.

The purpose of the event is to conduct a midterm review of the project, record current achievements and coordinate and finalize the plan of future activities.

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

Ivancho Naletoski

The research coordination meeting (RCM) will take place from 19 to 23 August 2019 in Vienna, Austria.

The purpose of the event is to review the achievements that have been made so far under the coordinated research project entitled 'Early Detection of Transboundary Animal Diseases to Facilitate Prevention and Control through a Veterinary Diagnostic Laboratory Network' and to fine-tune the project.

The RCM will be held together with the meeting of the directors of the VETLAB Network.

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

Charles Lamien and Giovanni Cattoli

The coordination meeting will take place from 19 to 23 August 2019 in Vienna, Austria.

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

The purpose of this meeting will be to review the achievements for 2018–2019 and formulate new work plans for the participants' respective laboratories for 2019–2020. In addition, this meeting will be a forum for participants to share experience and knowledge, and to identify activities of common interest for enhancing capacity of veterinary laboratories in Africa and Asia.

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

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

Charles Lamien and Giovanni Cattoli

The training course will be held from 9 to 20 September 2019 at the Animal Production and Health Laboratory in Seibersdorf, Austria.

The purpose of the event is to strengthen the Member States' veterinary diagnostic and research laboratory capacities in introducing, validating and monitoring assays for routine use. This will facilitate the implementation and maintenance of quality systems in the Veterinary Diagnostic Laboratory (VETLAB) Network partners' laboratories.

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

Charles Lamien and Giovanni Cattoli

The training course will be held from 4 to 15 November 2019 at the Animal Production and Health Laboratory in Seibersdorf, Austria.

The purpose of the event is to strengthen the Member States' veterinary diagnostic and research laboratory capacities in using rapid multiplex serological and molecular assays for the differential diagnosis and syndromic surveillance of transboundary animal and zoonotic diseases.

International Symposium on Sustainable Animal Production and Health - Current Status and Way Forward

This symposium is planned to be held in 2020 at the Vienna International Centre, Austria.

The 'International symposium on sustainable animal production and health – current status and way forward' will draw on lessons learnt and the current status of animal nutrition, animal reproduction and breeding and animal health to provide clear guidance on the steps needed for the continuous and sustainable improvement of animal production while protecting the environment. The focus of the symposium will be on the contributions and impact of nuclear technologies and applications.

The objective of the event will be to provide information and to share knowledge on nuclear and related technologies in animal production and health, and their application to support sustainable livestock production systems; to discuss the constraints, opportunities and advantages for the effective transfer of nuclear and related technologies and the building of capacities, particularly but not exclusively, in developing countries; and to identify and address capacity and research needs and gaps and new opportunities for transferring and implementing nuclear and nuclear technologies in animal production and health for solving established and emerging problems.

Scope and issues to be addressed:

i) The use and application of atomic, nuclear, nuclear derived/related technologies in animal nutrition, animal reproduction and breeding and animal health;

ii) Feed resources and feeding strategies under grazing and cut-and-carry production systems in developing countries: what is being done and mechanisms for sustained improved productivity;

iii) Assisted reproductive technologies for enhanced fertility and offspring with greater productive indexes;

iv) Radiation hybrid mapping and gene-marker selection in animal characterization and breeding programmes: what do we know and what is missing in developing countries;

v) Early and rapid animal disease diagnostic tests in national and decentralized laboratories: staff proficiency, preparedness, emergency response to outbreaks, quality control and quality assurance, international standards (ISO 17025);

vi) Emerging and re-emerging transboundary and zoonotic animal diseases: threats to food security, public health and international trade;

vii) The FAO/IAEA Veterinary Diagnostic Laboratory (VETLAB) Network. Its role in capacity building, transfer of technology and sharing of knowledge and experience.

Irradiated vaccines. New approaches to inactivate or weaken animal pathogens to be used in the development of vaccines against animal and zoonotic diseases;

viii) Stable Isotope tracing: New approaches to trace and monitor migratory and transposed animals and their role in the introduction of emerging and re-emerging transboundary animal and zoonotic diseases.

Expected results are:

i) A better understanding of livestock production constraints and the role of nuclear, nuclear-derived and nuclear related techniques as tools for ameliorating the current problems affecting livestock production, farmers livelihoods and food security;

ii) Links between the IAEA in partnership with FAO, OIE and WHO and Member States on animal production and health will be strengthened;

iii) The IAEA, in partnership with FAO, will update its needs and focus for research and extension on animal production and health for solving Member States' needs;

iv) Participants will enhance their knowledge on modern technologies and farm practices for improving livestock production and health in their own countries;

v) Proceeding of the symposium will be published and made available to all in the public/veterinary/scientific community.

Details of the symposium will be announced in the July 2019 Newsletter.

Past Events

Third Research Coordination Meeting on Early and Rapid Diagnosis and Control of Transboundary Animal Diseases Phase II: African Swine Fever (D32031)

Herman Unger

The final RCM that took place from 11 to 14 June at the Friedrich Loeffler Institute (FLI) in Greifswald, Germany.

Meeting participant at the Friedrich Loeffler Institute (FLI) in Greifswald, Germany

The participants presented the results obtained in the last 12 months. In essence, the work programme, validation of the direct PCR kit for African swine fever (ASF) and the genotyping of the most recent ASF strains were finalized. Of note, Mr Wu presented the results of a loop amplification assay (LAMP) and recombinase polymerase amplification (RPA) which worked as well as PCR in their hands.

The Russian Federations reported on the progress on two ASFV proteins, CD2v (EP402R) and C-type lectin (EP153R) demonstrating serotype-specificity important for protection against homologous ASFV infections. Apparently, these viral proteins represent protective antigens for ASFV important for future vaccine design and development. Unfortunately, not enough virus isolates, and corresponding antisera are available to expand this work.

Progress in vaccine development had been met with a number of constraints, but nevertheless some good challenge virus isolates emerged. Analysis of virus persistence in ASF infected pigs in Europe gave a maximum of 100 days for molecular tests while isolation was only possible for 2 months. Therefore, the epidemiology of ASF in Europe leads to shorter chronic infections than seen in previous African studies which could be due to the lack of tick transmission. Finally, a new ASF challenge strain was isolated and expanded in Cameroun and the first results of trials showed the expected results.

The meeting was concluded with the decision to immediately run a ring trial on ASF diagnostics with reagents supplied by FLI and to start writing up the results for a number of publications as envisaged in the work plan.

Consultancy Meeting on Application of Isotope Technologies in Animal Nutrition

Mohammed Shamsuddin

The meeting was held at the IAEA Headquarters, in Vienna, Austria, from 26 to 29 June 2018. Five consultants from Belgium, China, Sweden, UK and USA and staff members from the Joint FAO/IAEA Division attended the meeting.

The objectives of the meeting were to:

i) Review and update the current knowledge and information available on the application of isotopes, other plant markers and near-infrared spectroscopy (NIRS) technologies in animal nutrition/livestock productivity;

ii) Identify information gaps and research needs to support R&D in animal nutrition and feeding in the context of a changing climate;

iii) Draft a document putting together available information highlighting research and technology development needs for the application of nuclear techniques in livestock production.

Participants of the meeting at the IAEA Heardquarters

The current knowledge and information available on the application of isotopes, other plant markers and NIRS technologies in animal nutrition and livestock productivity were reviewed and possible avenues of research relating to R&D support to IAEA Member States or through direct application in Technical Cooperation (TC) projects were discussed and the group agreed to prepare a review paper to publish in a peer reviewed journal.

The working protocol of the coordinated research project (CRP) D31029 ‘Quantification of intake and diet selection

of ruminants grazing heterogeneous pasture using compound specific stable isotopes' was reviewed based on current knowledge and CRP timeline, and found to be appropriate. Suitable channels for shipping the plant and faecal samples to the laboratories of Technical Contract holders in Belgium and UK were discussed in detail.

Applied research for improving animal nutrition and livestock productivity under grazing conditions in various ecological and production systems was discussed. The use of tools like mobile X-ray fluorescence (XRF) instruments for mineral determination together with NIRS to provide estimates of organic nutrients content in feeds and forages need to be investigated. Besides, the implementation of surveys combining the use of drones, satellite images, sampling of grasses and browse species and GPS equipment for better understanding of the pastoral and silvopastoral production systems.

The meeting agreed that a technical document on the feasibility of the use of mobile X-ray fluorescence (XRF) instruments and NIRS on nutritional studies in improving farm productivity will greatly benefit the Member States.

Third 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

Thirteen participants from eleven Member States took part in the meeting to review and discuss the coordinated research project (CRP) D32032, held from 6 to 10 August 2018 at the IAEA Headquarters in Vienna, Austria, parallel with the VETLAB Directors' meeting (26 participants from 24 Member States).

The presentations and discussions were focused on standardization and harmonization during dissemination of the early detection techniques in Member States (MS).

Upon request of the participants and advice of the invited experts, seven core recommendations were drafted:

i) Facilitate sharing and adaptation of approved Standard Operational Procedures (SOPs[1]) to counterpart laboratories in MS, through the iVetNet Information Platform;

ii) Facilitate production and distribution of standard reference materials for priority diseases, targeted by the IAEA's Animal Production and Health Subprogramme, as well as by the relevant reference laboratories;

iii) Facilitate verification of adopted SOPs for implementation by MS through the integration of verification procedures[2] in the training programmes of APH/IAEA;

iv) Encourage and provide technical support in preparation of secondary (national) standards, e.g. at least strong positive (C++) and negative (C-) controls, for experimental comparison and standardization of results and tertiary standards for use as internal controls in the day to day running of assays;

v) Support VETLAB partners in the organization of or participation in regional or national proficiency test (PT) rounds to assess reliability of the assays;

vi) Organize workshops and practical training on the preparation and implementation of standards, SOPs and ring trials among VETLAB partners;

vii) Support the implementation of ISO 17025 among VETLAB partners.

The VETLAB Directors and the partners of CRP D32032 will meet again in approximately one year to review the achievements and determine future priorities.

[1] Upon approval by the appropriate reference laboratories / developers of the SOPs
[2] Written verification procedures should be developed for use in MS laboratories

Participants of both meetings, the 3rd RCM of CRP32032 and the VETLAB Directors

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

Charles Lamien and Giovanni Cattoli

The third meeting of the Veterinary Diagnostic Laboratory (VETLAB) Network was held at IAEA Headquarters in Vienna, from August 06 to 10 2018.

Twenty-two directors of VETLAB partners laboratories from Bangladesh, Botswana, Burkina Faso, Cameroon,

Chad, Côte d'Ivoire, Ethiopia (2 participants), Ghana, Kenya, Lao P.D.R, Morocco, Mozambique, Myanmar, Namibia, Nepal, Senegal, Thailand (2 participants), Tunisia, United Republic of Tanzania and Zambia participated in the meeting. A representative of the World Organisation for Animal Health (OIE) was also present. The partners from the Democratic Republic of the Congo, Mali and Mongolia were unable to attend the meeting.

Participants of the 3rd RCM of the CRP D32032 and the VETLAB Directors meeting at the IAEA Headquarters in Vienna, Austria

The objectives of the meeting were to update partners on the activities in 2017–2018; discuss the 2018–2019 common and individual country plans; address the production and sharing of reference material, validated procedures, interlaboratory testing and external quality assessment (EQA); review and refine the VETLAB CRP objectives and 2018–2019 work plan; facilitate exchange of experience, knowledge and information between the Asian and African Laboratories; and formulate strategies for strengthening information sharing among VETLAB network partners through the VETLAB bulletin and the future VETLAB website.

As in previous years, the VETLAB directors gathered together with the VETLAB research coordination meeting of the research project D32032.

The meeting participants were updated on joint and individual countries activities in 2017–2018. They formulated work plans to address challenges such as the implementation of Quality Management System in 2018– 2019, including the organization of proficiency tests, interlaboratory assays and training courses. There were fruitful interactions among the laboratory directors and between the directors and experts from references laboratories. They suggested ideas to improve the VETLAB bulletin and on the future website.

The participants reached an agreement on the VETLAB CRP plan including the use of the iVetNet platform for SOPs sharing and the production of additional secondary reference material.

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

Ivancho Naletoski

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

The first RCM on the CRP D32034 was held at lake Chany, in the Russian Federation, a stop-over location for most global migratory wild bird pathways. The aim of the meeting was to fine tune the project work plan to improve the accuracy of origin assignments using stable isotopes.

Capturing of wild migratory birds at lake Chany

The project team during the first phase of the project designed basic algorithms for origin assignments and the possibility to link the locations of origins with the transmission of avian influenza and/or other animal and zoonotic pathogens. Moreover, with support of the project an online software was developed which should be able to directly draw origin probabilities for birds' samples collected at any location. Such software is very welcome, as it may potentially enable scientists from third sectors (other than stable isotope science) to use raw data and automatically (online) receive probabilities of origins for their samples.

To further improve the accuracy of stable isotope assignments, the activities in the second phase of the project will focus on determination of origins of only positive birds (those which carry pathogens), on the support to enrich the Global Network of Isotopes in Precipitation (GNIP) datasets of IAEA and to match stable isotope data with geographic information service (GIS) sensors, permanently installed on selected migratory birds.

11th International Congress of Veterinary Virology (ESVV 2018)

Gerrit Viljoen and Giovanni Cattoli

The 11th International Congress for Veterinary Virology (ESVV 2018) was held jointly with the 12th Annual Meeting of EPIZONE from 27 to 30 August 2018 at the University of Veterinary Medicine, in Vienna, Austria, under the theme 'Challenges in Veterinary Virology 2018'. This combined meeting is held once in every three years and covers all aspects of animal and zoonotic viruses, from basic virology to applied control measures.

A podium discussion during the inaugural session on the first day with representatives of the joint FAO/IAEA Division, the World Organisation for Animal Health (OIE), the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) started with a short presentation of each representative of his/her institution, followed by a podium discussion on 'How do international organizations involved in animal heath deal with the challenges in veterinary virology' (viral diseases of animals, e.g., African swine fever).

Mr Gerrit Viljoen, head of the Animal Production and Health (APH) Section, represented the joint FAO/IAEA Division at this podium discussion outlining the role and actions by FAO/IAEA in restraining disease outbreaks. Furthermore, he stressed the need for constant proactive preparedness for anticipated outbreaks so that early diagnosis and rapid response can take place.

Giovanni Cattoli, head of the APH Section's Laboratory (APHL), played an important role in this meeting as a member of the scientific committee and chairing a session on "Viral infections of Ruminants".

Mr William Dundon gave a talk on the identification of Peste des petits ruminants (PPR) and Mr Viskam Wijewardana on testing immunogenicity of viral vaccine candidates. Both Dundon and Wijewardana are APHL staff members.

Posters on pathogen detection using multiplex assays, differentiation of sheep poxvirus vaccines from field isolates and Capripoxvirus surface proteins as antigens for the detection of antibodies were presented by Bharani Settypalli, Tesfaye Chibssa and Francisco Berguido, all from the APHL. In addition, Charles Lamien, as a senior author, and Richard Kangethe, Elena Sassu and Rudolf Picher as co-authors, all from APHL, contributed to these research presentations.

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

Charles Lamien and Giovanni Cattoli

The training course was held from 10 to 21 September 2018 at the IAEA Laboratories, in Seibersdorf, Austria. Twenty-two participants from VETLAB partner laboratories in Africa and Asia attended the meeting.

The purpose of the training was to strengthen African and Asian Member States' capacity in genomic sequence data analysis for the diagnosis and identification of pathogens causing zoonotic and transboundary animal diseases.

The analysis of pathogen sequences can provide information on their pathogenicity, sensitivity to antimicrobials, genotypes, as well as their transmission and spread, including the potential source of introduction within a population in a specific geographical location.

As sequencing cost drops, the technology becomes more accessible to Member State laboratories which are increasingly using it to improve disease diagnosis. To further promote the use of gene-based identification and tracking of animal pathogens, the Joint FAO/IAEA Division is facilitating the access to sequencing services for veterinary laboratories in several countries around the world.

Participants of the training course at the IAEA/APH Laboratories

The training course was designed to improve the participants' skills in sequence analysis and bioinformatics and prepare them to better work with sequencing service providers.

The training consisted of lectures on the principles and practical sessions on the application of bioinformatics for animal pathogens During the first week, the training participants learnt to perform sequence quality assessment, editing and assembly, sequence similarity searches, multiple sequence alignments and phylogenetics.

Through the second week, they applied the skills acquired on the first week to analyse animal pathogens such as highly pathogenic avian influenza virus, Newcastle disease virus, foot and mouth disease, Capripoxvirus and peste des petits ruminant virus.

The trainers were experts from the Istituto Zooprofilattico Sperimentale delle Venezie (Italy), Sciensano (Belgium) and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

The participants acquired knowledge on the use of sequencing services and the analysis of sequencing data. The skills learnt empower them in their duties in controlling disease outbreaks.

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

Kathiravan Periasamy and Mohammed Shamsuddin

Gastro-intestinal (GI) parasitic infection is a major constraint for sheep rearing in Latin America, particularly with increasing concerns of anthelmintic resistance among parasites. Integrated parasite management practices including breeding programs that enhance the genetic potential for host resistance will help to alleviate this problem in the long term.

To facilitate this, the IAEA Technical Cooperation Department initiated a new regional project in Latin America to implement breeding programs that focus on improving genetic potential of locally available sheep for enhanced parasite resistance characteristics. As part of the project, a regional training course on Genetics of Parasite Resistance in Sheep and Goats: Application of Genomics and DNA Marker Information to Improve Small Ruminant Breeding was organized from 24 September to 5 October 2018, in Seibersdorf, Austria.

Course participants working with DNA samples

A total of 20 participants from 12 countries (Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, El Salvador, Mexico, Paraguay, Peru, Uruguay and Venezuela) were provided with hands-on training on genotyping workflow using real time PCR and microarray platforms, genetics laboratory information and data management system, bioinformatics analysis of large sets of genomic data, implementing pedigree free animal models using molecular information and genome-wide association analysis related to parasite resistance in sheep.

Each of the participants was provided with a package of different software tools for the analysis of genetic data. It is expected that the training will help the ongoing national efforts in the Latin American countries in the control of gastro-intestinal nematode parasites in sheep.

OPEC Funds for International Development (OFID) Training Course on Early Detection and Differentiation of Animal and Zoonotic Diseases

Charles Lamien, Ivancho Naletoski and Giovanni Cattoli

A group training on Early Detection and Differentiation of Animal and Zoonotic Diseases was held from 8 October to 2 November 2018, at the IAEA Laboratories in Seibersdorf, jointly organized by the Animal Production and Health Section (APH) and the Department of Technical Cooperation (TC) Division for Asia and the Pacific and conducted by 7 staff members of the APH Laboratory. Eight trainees from four target countries (Cambodia, Laos, Myanmar, Vietnam) attended the training. The purpose of this training course was to strengthen and advance the competencies of the participants on the application of rapid and accurate laboratory procedures for the detection and the characterization of the agents causing transboundary animal and zoonotic diseases.

To this regard, classic and advanced approaches for the detection of livestock pathogens using nuclear-derived technologies (i.e. polymerase chain reaction (PCR)-based platforms) were the focus of the first two training weeks.

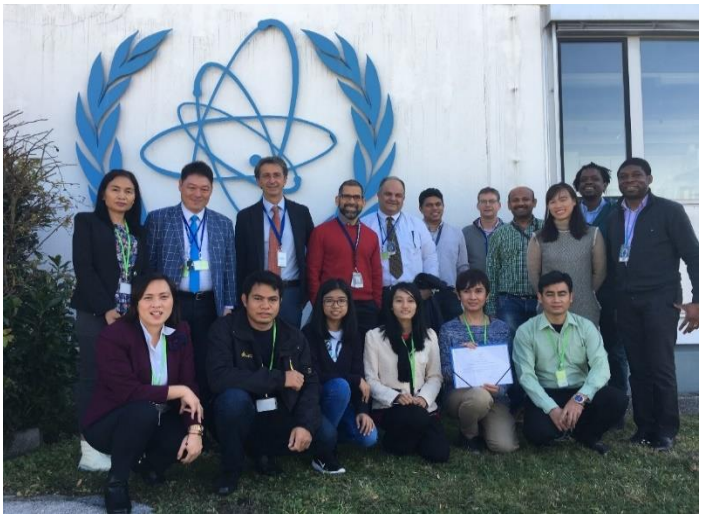
Practical sessions were extremely important as the trainees could autonomously set up the assay and run the tests with the supervision of experts. Trainees were also instructed on the design and validation of the PCR-based assays. In addition, participants had the possibility to apply new PCR-based testing protocols for small ruminants and swine diseases enabling the detection of distinct pathogens in one single run (so-called multiplex assay).

Practical sessions were extremely important as the trainees could autonomously set up the assay and run the tests with

the supervision of experts. Trainees were also instructed on the design and validation of the PCR-based assays. In addition, participants had the possibility to apply new PCR-based testing protocols for small ruminants and swine diseases enabling the detection of distinct pathogens in one single run (so-called multiplex assay).

Classic and advanced assays for the detection of antibodies specific to the targeted diseases in the sera of animals were the specific topic of one week of the training. Techniques such as enzyme-linked immunosorbent assay (ELISA), luciferase immunoprecipitation system (LIPS) and enzyme-linked immunospot (ELISPOT) were presented to the participants, who familiarized themselves with the theory and practice of the serological laboratory protocols.

Another week of the training course was dedicated to gene sequencing, data analysis and phylogeny. At the end of the training period, standard operating procedures (SOPs) describing in detail the diagnostic assays were distributed to participants together with laboratory reagents to enable the immediate implementation of the assays in their respective laboratories.



Participants of the training course at the APH laboratory

Federal President of Austria, HE Mr Alexander Van der Bellen, Visited the Animal Production and Health Laboratory

On his tour of the IAEA Laboratories in Seibersdorf, Austria, on 10 October 2018, the President of Austria, HE Mr Alexander Van der Bellen, visited the Animal Production and Health (APH) Section's Laboratory. President Van der Bellen was briefed on the activities and research projects this laboratory is conducting to improve livestock productivity and animal health by promoting the peaceful use of nuclear energy and technologies worldwide.

HE Mr Van der Bellen with Mr Aldo Malavasi, Mr Gerrit Viljoen and Mr Giovanni Cattoli at the APHL in Seibersdorf, Austria

The President showed high interest in the efforts and successes made by the APH Subprogramme to support Member States in the prevention and control of animal and zoonotic infectious diseases such as avian influenza, African swine fever and lumpy skin disease that are currently threatening several countries, including Austria.

Very much appreciated by Mr Van der Bellen was the close collaboration and joint activities the APH laboratory is conducting with Austrian institutions, such as the Austrian Agency for Health and Food Safety (AGES) and Universities. The research activities on pathogen characterization and irradiated vaccines run in collaboration with AGES were also described by Professor Friedrich Schmoll, head of Division of Animal Health-AGES.

President Van der Bellen praised the capacity building activities that the IAEA/APH Subprogramme is conducting internationally. He also visited the teaching laboratory where fellows from Southeast Asia were receiving training on transboundary animal disease diagnoses.

Advanced Training on Transboundary Animal Diseases Diagnoses and Molecular Epidemiology

Charles Lamien and Giovanni Cattoli

The training course was held from 5 to 16 November 2018 at the Seibersdorf Laboratories, in Seibersdorf, Austria. Ten participants from the Veterinary Diagnostic Laboratory (VETLAB) Network in Africa and Asia attended it.

The purpose of this training was to provide in-depth training to selected staff from the VETLAB Network partner laboratories that are serving or will serve as trainers for other VETLAB Network member countries. The emergence and re-emergence of transboundary and zoonotic animal diseases increases the need to steadily adapt diagnostic tools and stay up to date with the evolution of technologies.

It is crucial to continuously support member states with moderate resources to cope with rapid technological advances in disease diagnosis and control by transferring and backing the implementation of updated technologies. The increasing need for training in various regions in Africa and Asia, demands the establishment of a pool of trainers with up to date knowledge of laboratory technologies. The advance train-the-trainer course, organized by the Joint FAO/IAEA Division, intended to prepare the potential trainers in better fulfilling their task of training other veterinary laboratory scientists.

Participants of the training course at the APH Laboratory

During the first week, the participants received training on how to implement diagnostic strategies and troubleshoot molecular diagnostic test issues.

In the second week, they studied the steps involved and the methods for phylogenetic reconstructions as well as the interpretation of phylogenetic trees. Additionally, they learnt the basics and practised scientific writing in English. The trainers were experts from Sciensano (Belgium), the University of Iowa, the Medical University of Vienna and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Ministerial Conference on Nuclear Science and Technology: Addressing Current and Emerging Development Challenges

The Animal Production and Health (APH) Section in collaboration with the Austrian Agency for Health and Food Safety (AGES) contributed to the IAEA Ministerial Conference, which took place from 28 to 30 November 2018 at IAEA Headquarters.

The conference focused on developments and innovations in nuclear science, technology and applications for peaceful uses, and mechanisms for their delivery to Member States.

A broad range of topics was covered in the fields of improving the quality of life, addressing climate change, and sustaining, enabling and empowering the safe use of nuclear technology in Members States. To this regard, Mr Friedrich Schmoll, director of the Division of Animal Health in AGES, presented on the "Influences of climate change on emerging and re-emerging animal and zoonotic diseases".

The presentation highlighted the importance of infectious disease preparedness, early detection and control and how climate changes may influence the spread of transboundary animal and zoonotic diseases at a regional and global scale. This is particularly relevant for diseases transmitted by arthropods, the most recent examples being lumpy skin disease and blue tongue in ruminants or West Nile virus in birds, horses and humans. The role and the importance of nuclear and nuclear derived technologies in the implementation of rapid diagnostic platforms, developments of novel vaccines and control of insect vectors was described.

For more information about the conference, visit https://www.iaea.org/events/ministerial-conference-on-nuclear-science-and-technology-2018

Regional Training Course on Animal Nutrition, Feeding and Management (RLA5071)

Mario Garcia Podesta and Mohammed Shamsuddin

The training course was held from 3 to 8 December 2018 at the Universidade Estadual Paulista (UNESP) in Araçatuba, Brazil.

The course director was Dr Fernando Garcia, Director of the Animal Biochemistry and Molecular Laboratory (LBBMA), which is the IAEA Collaborating Centre on Animal Genomics and Bioinformatics, at UNESP, Araçatuba.

Participants of the training course in a Suffolk farm in Araçatuba, Brazil

The 5-day course comprised lectures and practical work on metabolism of carbohydrates, proteins and lipids, energy balance, digestion in ruminants (the role of microbes and enzymes), management of pastures, fertilization, cultivated pastures and control of gastrointestinal parasites, use of ammonification, silage, hay and agricultural and industrial by-products, nutritional requirements of sheep, formulation of rations, consumption, methane production and food digestibility, and use of growth promoters (prebiotics and probiotics). In addition, a field-day visit to two sheep farms, where the management and the rigorous genetic selection of Suffolk animals were impressive, was done.

Twelve professionals from eight Latin American countries plus six local participants attended the course. Lectures, demonstrations and practical work were conducted by local staff and the IAEA expert Dr Atmir Romero from the Universidad Nacional Autónoma de México. This was the sixth training course implemented under the Regional ARCAL Technical Coop Project RLA5071.

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

Mohammed Shamsuddin and Mario Garcia Podesta

The meeting took place from 10 to 14 December 2018 in Vienna, Austria.

Nine of 10 research contract holders (RCH), three agreement holders (AH), two observers and five staff from the Joint FAO/IAEA Division attended the meeting. The meeting included a one-day workshop on DNA-based laboratory work at Seibersdorf laboratories.

Important conclusions of the meeting were:

i) Most RCH demonstrated good progress in the direction set by the workplan during the first RCM.

ii) Challenges were to collect data from a sufficient number of daughters and contemporary cows in the same farm to estimate breeding values (EBV) with sufficient accuracy, to gather the complete set of data involving production and fertility traits on every animal and to identify sires in a fashion that would allow retrieving information on genomic breeding values from international sires.

iii) It was agreed to continue collecting phenotypes and associated data for associating genotypes with environmental variables; to link cows to sires and vice versa; to have data on a sufficient number of daughter per sire (minimum 10); collect phenotypes on all cows in the farms visited or at least on contemporaries of the target cows; and to retrieve any previous record on animals irrespective of their presence or absence in the farm.

iv) New deadlines were set for the completion of phenotypic data collection and sampling for molecular analysis by the RCH and for provision of data template and database application by the Agency. The first set of phenotypic data is to be sent to IAEA by 31 May 2019, the second and the 3rd sets by October and December 2019, respectively. The CIMA (cattle information management) template will be distributed to RCH by 31 January 2019 and the CIMA database application will be distributed by February 2019 by the Agency.

v) Individual country objectives were revised and set to estimate heritability of traits, genetic correlations between traits, sire and dams ranking on EBVs, sire rank correlation with US genomic estimates and genetic by environmental estimation using genomic similarity in the case of no connection between sires across countries.

The lines of research works were revised based on the progresses made:

- Countries practicing in selective breeding (Argentina, China, Peru-Holstein, Serbia, Tunisia) will do a genomic EBVs comparison.
- Countries conducting crossbreeding (Bangladesh, China - subset of data, Peru-Brown, Sri-Lanka, Swiss in coast and altitude) will conduct admixture analyses and related productivity with the level of genetic admixture between indicine and taurine cattle.

The meeting agreed that the future research and development in the field of livestock genetics and breeding needs to address robustness of animals, involving adaptability and resistance to diseases in the context of climate change and development of tools like landscape genomics and ICT for on-farm data capture will bring substantial benefits to farmers.

The meeting recommended that the IAEA support should continue to build R&D and service capacities, involving the development of laboratory and human resources, in Member States to support animal performance recording, genetic evaluation and the maintenance of biodiversity, especially where nuclear and nuclear-derived molecular techniques add significant benefits.

Participants of the meeting at the IAEA Headquarters in Vienna, Austria

Stories

Using Nuclear Science to Control Animal Diseases

Sick animals can threaten the health of people. Diseases such as avian influenza, Ebola and rabies are becoming more frequent. But nuclear-derived techniques can detect the virus in 24 hours allowing farmers to isolate and treat infected animals quickly.

Watch here: https://www.iaea.org/newscenter/multimedia/videos/using-nuclear-science-to-control-animal-diseases

Climate-Smart Agriculture: How Nuclear and Isotope Techniques Help

The impacts of climate change are expected to worsen farming conditions, especially in developing countries that will need to produce more from limited land resources while using less efficient technologies. The IAEA, in cooperation with FAO, supports Member States in their efforts to implement climate-smart agriculture that targets national and local specificities and priorities. Climate change has both direct and indirect effects on agricultural productivity, including through changing rainfall patterns; drought; flooding; geographical expansion and the redistribution of animal and plant pests and diseases; and adaptability challenges for animals and plants in harsh environments. Making global agricultural systems resilient to these changes is critical to efforts to achieve global food security.

What nuclear technologies can do: In animal production and health, compound specific stable isotope techniques are used to estimate the intake and diet selection of livestock grazing in heterogeneous pasture to better manage pasture and prevent its degradation. Nuclear and nuclear-derived immunological and molecular techniques are used for the early and confirmed detection, diagnosis, control and prevention of livestock diseases, and the irradiation of pathogens for the development of animal vaccines. Stable isotope techniques trace and monitor the spread of animal diseases and their carriers to better manage and prevent pasture degradation. Techniques such as radioimmunoassay and nuclear-derived immunoassay are used to analyze hormone profiles in animals for the application of assisted reproductive techniques, such as artificial insemination and embryo transfer, and the development of breeding strategies.

https://www.iaea.org/sites/default/files/18/09/climate-smart-agriculture.pdf

Detecting Vector Borne Disease: IAEA and FAO Help Enhance Capacity in Europe

Mosquitoes, ticks, flies, lice, aquatic snails have a particular feature in common: they can transmit disease to animals and humans. These diseases are called ‘vector-borne’ as their transmission occurs via a vector (a mosquito, tick, etc.) that carries and transmits the infectious pathogen into another living organism. In recent decades, due in part to global warming and increased global travel and trade, the risk of transmission of vector borne diseases has significantly increased in regions where these were previously unknown. Recent examples of animal diseases, such as bluetongue disease, lumpy skin disease and African swine fever in Northern Europe, as well as Rift Valley fever in Africa are demonstrating these trends.

Twenty-one European specialists working in the field of veterinary diagnostics met in Tbilisi, Georgia, as part of an IAEA Regional Technical Cooperation project, at a meeting organized collaboratively by the IAEA, FAO and Georgia’s National Food Agency of the Ministry of Environmental Protection and Agriculture to develop strategies for enhancing capacities to detect and differentiate vector borne diseases and to identify host vector carriers. The primary focus was on techniques for the early and rapid detection of animal and zoonotic (transmissible from animals to humans) vector borne diseases. Nuclear and nuclear derived techniques are used to detect, monitor and trace these vectors borne pathogens and their carriers. The most commonly used nuclear and nuclear derived techniques are radioimmunoassay (RIA), enzyme linked immunosorbent assay (ELISA), polymerase chain reaction (CR) and genetic sequencing.

The regional IAEA technical cooperation project was initiated in January 2018, in partnership with FAO. It is expected to substantially improve the preparedness and response capacities of national veterinary laboratories in early and rapid detection, and of veterinary services in the timely response to priority vector borne diseases in the European region, using nuclear and nuclear-derived technologies for pathogen detection, differentiation and characterization. The countries participating in the project are IAEA Member States with officially designated veterinary laboratories responsible for the diagnosis of animal and zoonotic diseases, with a special focus on vector borne diseases. The workshop was attended by representatives from Albania, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Montenegro, Portugal, Romania, Serbia, Slovakia, Slovenia, Tajikistan and Turkey.

https://www.iaea.org/newscenter/news/detecting-vector-borne-disease-iaea-and-fao-help-enhance-capacity-in-europe

Improving Animal Production and Health: How Nuclear Techniques Help

Animal diseases have increasingly become a global problem and pose a serious challenge to food security. The diseases that have the potential to spread across borders (transboundary diseases) or from animals to humans (zoonotic diseases) or are considered a biothreat that not only kill animals and impact their productivity but also have serious public health consequences. Poor animal genetics and scarcity of feed in the tropics are major causes that limit animal productivity (quality and quantity of milk or meat). Global climate change and the increased movement of animals and people are creating conditions for the emergence and re-emergence of transboundary animal diseases, especially those with zoonotic potential that pose a threat to humans.

Nuclear and nuclear-derived immunological and molecular techniques are essential tools in the early, rapid and accurate diagnosis and control of diseases and are used for genetic characterization, improving reproductive performance and for optimizing locally available feed resources to enhance animal productivity. The IAEA, in partnership with the FAO through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture supports the use of nuclear and related technologies, in conjunction with conventional approaches, that contribute substantially to improving livestock production and health.

Capacity building includes:

i) R&D support, technology transfer and capacity building in the use of nuclear and nuclear derived techniques for accurate diagnosis of animal and zoonotic diseases and enhancing animal productivity;

ii) Improving immunological and molecular diagnostic techniques using isotopic labelling to trace, monitor and characterize transboundary animal and zoonotic diseases;

iii) Using irradiation to weaken or inactivate pathogens for the development of vaccines against animal and zoonotic diseases;

iv) Using isotopic techniques to investigate migratory routes of birds to help understand the potential risks of spreading transboundary animal and zoonotic diseases;

v) Developing radioimmunoassays to measure and trace hormones that control the reproductive cycle and thus enhance artificial insemination, embryo transfer and breeding strategies;

vi) Using isotopic techniques to estimate intake and diet selection by grazing animals, which enable appropriate management of pasture, grasslands and ranch lands to help reduce environmental degradation;

vii) Delivering individual and group capacity building through training courses and workshops;

viii) Transferring technologies and knowledge through scientific visits, expert services and the provision of diagnostic emergency toolkits and equipment to Member States, with a direct impact on farmers' lives and their livelihoods

https://www.iaea.org/sites/default/files/19/01/improving-animal-production-and-health-how-nuclear-techniques-help.pdf

Strengthening Laboratory Network for Early and Rapid Diagnosis of Transboundary Animal and Zoonotic Diseases in Botswana

Zoonotic and transboundary animal diseases (TADs) threaten livestock in Botswana. Disease detection, prevention and control require reliable and fast laboratory services. The Botswana National Veterinary Laboratory (BNVL), the only veterinary laboratory in the country, receives 60 000 samples annually for analysis from around the country. BNVL conducts testing for all diseases, a workload that was beyond the capacity of the lab, resulting in longer turnaround time and slower disease diagnosis.

An IAEA technical cooperation project has helped to transform BNVL from a national veterinary laboratory requiring the support of international reference laboratories to a laboratory self-sufficient in first line diagnoses and diagnostic confirmations. In addition, BNVL is serving as a reference and confirmatory diagnostic laboratory for the SADC region. The IAEA, in partnership with FAO, assisted with the transfer of technology, providing training and supporting the implementation of nuclear and nuclear-derived immunological (enzyme-linked immunosorbent assay and radioimmunoassay), molecular (polymerase chain reaction (PCR) and real-time PCR) and atomic technologies (irradiation and stable isotopes), quality assurance management and the accreditation of diagnostic tests according to ISO/IEC 17025 standard.

The project also supported the establishment of two satellite laboratories that can perform first line diagnoses in key agricultural areas of the country. The Jwaneng Satellite laboratory (about 200 km west of Gaborone) became operational in 2016 and is now providing first line parasitic disease diagnoses which will be expanded to include virological and bacteriological diagnoses by the end of 2018.

The Maun Satellite Veterinary Laboratory (about 1000 km north of Gaborone) will become fully operational in 2018, focusing mainly on foot and mouth disease.

https://www.iaea.org/sites/default/files/18/10/bot5015_success_story_2018.pdf

Nuclear and Genomic Techniques for the Selection of Parasite Resistant Sheep and Goats for Breeding

CRP D31026: Genetic Variation on the Control of Resistance to Infectious Diseases in Small Ruminants for Improving Animal Productivity (2010-2016)

Sheep and goats constitute an important livestock resource in most developing countries and are essential for the livelihood of millions of smallholder farmers. Gastrointestinal parasites (GIP) impose severe constraints on animal production in pastoral systems worldwide. Losses occur through death of animals, reduced production and costs associated with parasite control. Widespread and indiscriminative use of anthelmintic drugs resulted in the emergence of drug-resistant parasites. Further, chemical anthelmintic leaves residues in meat, milk, and pasture, causing public health threats. In response to requests from Member States, the Joint FAO/IAEA Animal Production and Health Subprogramme aimed to develop, validate and transfer tools and technologies to Member States for the genetic selection and breeding of sheep and goats to improve productivity while enhancing their resistance to GIP.

The most highlighted result of the CRP is the whole genome sequencing of a goat for the first time in the world by the research contract holder from China. The results were published in Nature Biotechnology (Yang Dong, et al. 2013. Nat Biotechnol 31: 135-141). For this, a radiation hybrid (RH) panel for the goat was constructed by the Joint FAO/IAEA Division through a technical contract as a resource for rapid and large-scale physical mapping of the goat genome to facilitate the resolution of the genetic and physical distances prior to designing strategies for positional candidate cloning of the gene(s) that are involved in economically important traits. This nuclear technology provided the tool for identifying genetic markers for resistance/susceptibility of small ruminants to GIP – a step forward to implementing marker assisted breeding to enhance animal resistance to infectious disease.

In the CRP, 4416 sheep and 1938 goats were phenotypically characterised through faecal egg count, packed cell volume, body weight, FAMACHA scores as animal traits for resistance to parasites. Besides, 320 novel sheep and goat markers (single nucleotide polymorphism [SNP]) were developed and information was given away to Member States for genomic characterisation of sheep and goats. In addition, 9 out of 10 research contract holders reported individual variations in resistance to GIP infections among sheep and goats, which means that a genetic evaluation and breeding programme is likely to benefit farmers identifying resistant animals for breeding. Six countries identified sheep and goat breeds or populations in their countries which are more resistance than others.

Protocols and guidelines were developed for animal identification and collection of data and samples and analysis of DNA. A database application called Genetic Laboratory Data Management System (GLIDMaS) was developed and is being distributed among scientists in Member States.

Results of the CRP are being implemented through in 12 Latin American and Caribbean countries through a Regional Technical Cooperation Project (RLA5071) to increase small ruminant resistance to parasites and enhance productivity.

Researchers from Argentina, Bangladesh, Brazil, Burkina Faso, China, Ethiopia, Indonesia, ILRI, Iran, Italy, Nigeria, Sri Lanka, UK and USA participated in this CRP.

http://www-naweb.iaea.org/nafa/aph/crp/aph-improving-animal-productivity.html

Exogenous Enzymes to Improve the Digestibility of Fibrous Feeds for Ruminants

CRP D31027: The Use of Enzymes and Nuclear Technologies to Improve the Utilization of Fibrous Feeds and Reduce Greenhouse Gas Emission from Livestock (2010-2016)

Livestock production in developing countries has been challenged by the scarcity, fluctuating quantity and poor quality of feeds and forages, which are composed of fibrous tropical grasses and crop residues. Scientists and farmers have used various treatments and supplements to increase the digestibility of low-quality forages with variable results. Fibrolytic enzymes, such as cellulase and zylanase were reported to increase fibre degradation in ruminant feeds and help increasing the availability of nutrients, especially energy and protein to animals. In response to requests from Member States, the Joint FAO/IAEA Animal Production and Health Sub-programme aimed to develop, validate and transfer tools and technologies to Member States for the optimal utilisation of locally available feed resources to enhance animal productivity while protecting the environment through the inclusion of exogenous enzymes as in the diet.

Enzyme treatments, despite individual variability, generally increased the nutrient availability from fibrous poor-quality forages and crop residues to animals. In this CRP, 8 out of 10 research contracts reported increased digestibility of feeds. The improved feed utilisation was manifested by increased feed intake, fibre degradation, dry matter digestibility, as well as microbial protein synthesis and production of gas and volatile fatty acids at *in vitro* and *in vivo* studies. Seven contract holders reported increased animal body condition and productivity, e.g. more and better-quality milk and meat.

In vitro laboratory studies were instrumental in screening 10 enzymes and finally identifying four (endoglucanase, exoglucanase, cellulase and xylanase) best bet enzymes and appropriate doses and incubation times. The main forages and crop residues were rice straw, maize stover and tropical grasses.

Two to four best-bet candidate enzymes at optimum dose ranges were identified for *in vivo* studies through feed digestibility using protocols and methodologies previously standardised for the treatment of feeds and forages with these enzymes.

Methane production varied up on enzyme supplementation of feeds depending on the experimental methods (*in vitro* vs. *in vivo*) and feeds and forages used. There was a general trend of reduced methane emission when the total dry matter digestibility was considered. The CRP has resulted in the development of tools and methodologies for developing exogenous enzyme supplementation strategies to improve animal nutrition and productivity.

The use of nitrogen-15 stable isotope proved of value to estimate increased gastrointestinal tract microbial protein synthesis. Similarly, carbon-13 was successfully used to identify methanogenic bacteria in the gastrointestinal tract as an important step in greenhouse gas mitigation from livestock farming.

Researchers from Argentina, Australia, Brazil, Canada, China, Mexico, Mongolia, Peru, South Africa, Spain, Sri Lanka, USA and Zambia participated in this CRP.

The CRP resulted in 45 publications in peer reviewed journals and proceedings and 20 MSc/PhD students used the projects results to complete their thesis works.

http://www-naweb.iaea.org/nafa/aph/crp/aph-greenhouse-gas-emission.html

Coordinated Research Projects (CRPs)

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

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

Mohammed Shamsuddin and Mario Garcia Podesta

The CRP aims at enabling Member States in the application of genetic evaluation and selection involving genomic tools in artificial insemination 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 planned, one for those who target crossbreeding and the other for those who keep purebred taurine populations. The crossbreeding group aims at admixture analysis to assess the distribution of genetic groups of crossbreds, evaluate their performance and identify suitable genotypes for the prevailing production systems. The group with purebred taurine populations will estimate predicted transmitting ability (PTAs) of sires under local conditions, which will be correlated with genomic PTAs of sires at their origin.

Most research contracts holders completed the works planned for the first two years, i.e., collection, recording and analysis of phenotypic, performance and pedigree data from a minimum of 1000 cows/heifers and sires whose semen was used to breed those animals. The technical contract on early pregnancy diagnosis has completed the laboratory works and identified candidate conceptus derived proteins and the results of animal works will be presented in the 2nd RCM in Dec 2018. Regarding the technical contracts on sequencing dromedary whole genome using radiation hybrid (RH) technology, DNA has been extracted from 95 selected hamster-dromedary RH clones and is being sequenced using next generation sequencing.

The second research coordination meeting was held from 10 to 14 December 2018. Read more about the outcomes of the meeting on page 17.

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

Mohammed Shamsuddin and Mario Garcia Podesta

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

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

Most research contract holders completed their animal trials and collected samples for the estimation of dry matter intake and diet composition of cattle/yak grazing on pasture/natural grass lands 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 results will be presented for review and planning future R&D in the second RCM planned to be held in Brazil in June 2019.

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

Herman Unger and Gerrit Viljoen

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

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

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

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

The final research coordination meeting took place from 11 to 14 June at the Friedrich Loeffler Institute in Greifswald, Germany. Read more about the results of the final meeting on page 10.

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, diagnostic approaches for specific disease outbreaks, thus facilitating emergency preparedness and response to animal health emergencies. The concept of networking proved very successful during the rinderpest eradication campaign. Nowadays, this concept has resulted in great successes in some of the Member States where diagnostic laboratories have received the ISO 17025 accreditation. Additionally, several other laboratories in this network are in advanced phases of implementation of the ISO 17025 standard and expect accreditation soon.

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

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

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

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

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

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

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

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

The third research coordination meeting took place from 6 to 10 August 2018 in Vienna, Austria. Read more about the outcomes of the meeting on pages 11 and 12.

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

Hermann Unger and Gerrit Viljoen

This CRP kicked off in early 2016 to continue exploring the possibilities of using irradiation in the development of vaccines. A major stimulus for this was the noteworthy results obtained from the previous CRP on this subject, especially yielding strong outcomes on irradiated intestinal and haemo-parasites as vaccine candidates. However, a major short coming of the initial CRP was the lack of proper immunological tools to define the immune response elicited. This issue was addressed by establishing immunology R&D at the Animal Production and Health Laboratory in Seibersdorf, Austria, 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.

Now, CRP counterparts are using the protocols, assays and reagents developed at APHL immunology program and resulted in a big thrust in irradiated vaccine research. An additional task of this CRP is the evaluation of irradiated pathogen preparations as immune enhancers for conventional vaccines. These immune enhancers or "adjuvants" are sought in the vaccine market as the traditional solutions lead to sever inflammations and are to be abolished due to the side effects. Already, APHL has started working on this and synthetic lyposome adjuvants are irradiated and evaluated for their efficiency, to develop a platform for adjuvant research.

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

The next research coordination meeting will take place in Vienna, Austria, from 20 to 24 May 2019. A three-day workshop will be held in parallel to give hands-on experience in handling new immunological assays.

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

Ivancho Naletoski and Gerrit Viljoen

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

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

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

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

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

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

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

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

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

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

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

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

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

The first research coordination meeting took take place from 27 to 31 August 2018 in Novosibirsk, Russia. Read about the outcomes of the meeting on page 12.

Submission of Proposals

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

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

Research Activities of the Animal Production and Health Laboratory

Animal Genetics

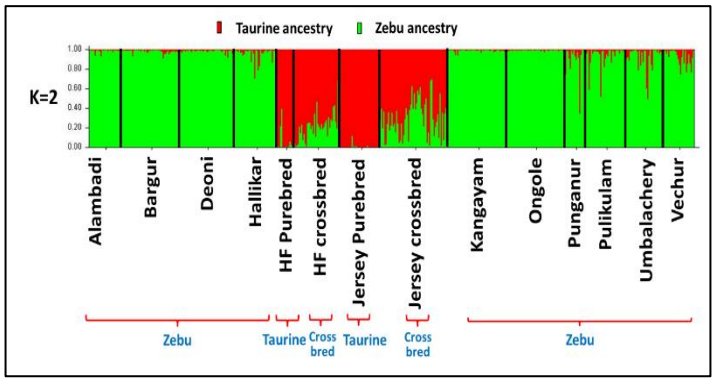
Application of Nuclear and Genomic Tools to Enable for the Selection of Animals with Enhanced Productivity Traits (CRP D31028)

Radiation hybrid (RH) mapping for dromedary camel

Genomic resources are scarce for genetic improvement of dromedary camel, an important livestock for nomadic pastoralists in Africa and Asia. During 2018, the Animal Production and Health Section's laboratory (APHL) completed genotyping of a 5000 RAD panel with more than 160 markers to develop the first-generation radiation hybrid map, targeting chromosome 16 of camel. APHL in collaboration with the International Camel Genome Consortium also completed a whole genome survey sequencing of camel radiation hybrid panels. The data will be used to construct a whole genome map and reference genome assembly to facilitate the development of DNA based tools for breeding and improvement of camels.

Development of genetic tools for marker assisted dairy cattle improvement

Improvement of dairy cattle for increased milk production in tropical countries occurs mostly through crossbreeding using commercial taurine cattle. One of the major limitations of crossbreeding programs is stabilization of exotic inheritance and lack of information on crossbred genotypes optimal to the existing production system. To address the issue, APHL initiated the development of low cost genomic tools for genotype detection in crossbred cattle. As a first step, baseline genetic differentiation of Asian Zebu, European taurine cattle and their crossbreds was established using classical microsatellite and genome-wide markers. A total of 19872 genotype data were generated from 736 cattle at 27 short tandem repeat marker loci. Bayesian structure analysis without prior population information clearly established the zebu-taurine divide and also indicated the level of genetic purity among zebu cattle breeds. Based on these results, more than 350 purebred zebu cattle were identified and typed for genome-wide single nucleotide polymorphic markers along with 54 purebred taurine and 48 crossbred cattle.



Deriving ancestry information to determine genetic admixture levels in indigenous zebu and crossbred cattle from Asia

A custom designed pipeline for bioinformatics analysis of genomic data was established to perform biodiversity and genetic admixture analysis. Analysis of data resulted in the identification of two novel low-density marker panels (60 and 100 markers respectively) to estimate genetic composition of crossbred cattle. These marker panels were able to assign the level of taurine introgression in crossbred cattle. Further testing and validation of panels using pedigreed crossbred cattle are currently under progress.

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

In continuation of Joint FAO/IAEA efforts towards implementing the Global Plan of Action on Animal Genetic Resources (AnGR), APHL supported genetic characterization of 12 livestock breeds including 10 from India and 2 from Burkina Faso. Furthermore, APHL continued its efforts in improving the laboratory capacity of member states for the management of animal genetic resources. Institutional and technical support were provided to three countries (Burkina Faso, Cambodia and Nigeria) to establish/strengthen molecular genetic laboratories through the provision of necessary equipment and laboratory supplies under the framework of national technical cooperation projects.

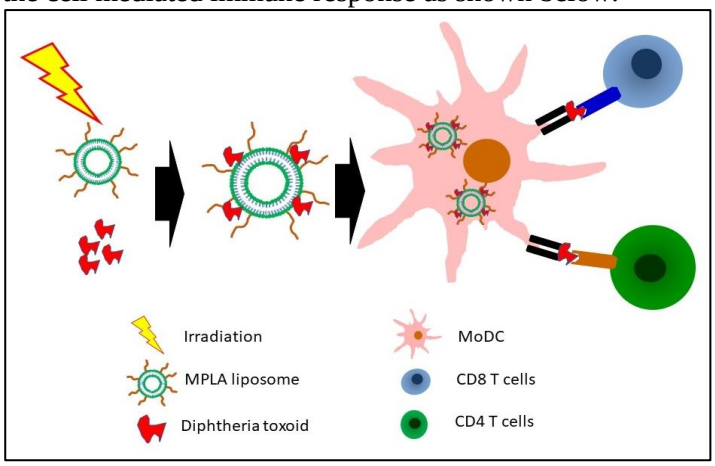
New Protocol for DNA Based Evaluation and Characterization of Backyard Chicken in Africa

Backyard chicken play an important role in ensuring food security among rural areas of Africa. Developing baseline information on local chicken ecotypes is an essential step to understand and exploit the available genetic potential for better productivity. APHL designed and developed multiplex panels to genotype microsatellite markers recommended by FAO for biodiversity evaluation and characterization. A validated protocol of six novel marker panels containing 29 markers was developed and the manual is ready for transfer to member states.

Animal Health

Irradiated Vaccine Adjuvant Liposomes Can Augment Cell Mediated Immune Responses in Vaccines

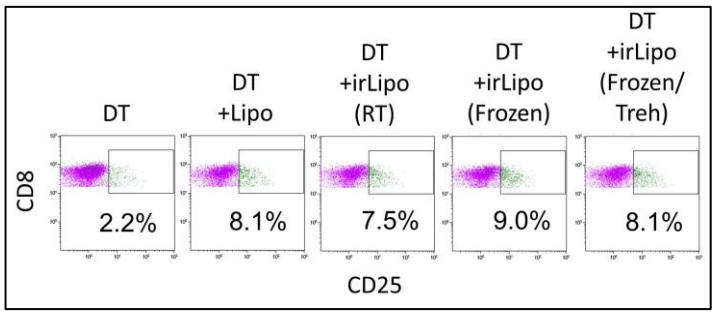
APHL started a collaborative project with Polymun Scientific Immunbiologische Forschung GmbH on irradiating vaccine adjuvant liposomes. The goal of this project was to assess the feasibility of using irradiation to sterilize liposomes and then to assess their functions as adjuvants in vaccine. As the first step of this investigation we assessed various irradiation protocols and the effect of them on the structure and primary function liposomes containing monophosphoryl lipid A (MPLA), a vaccine adjuvant. We showed results from these experiments in the past suggesting irradiation (25 kGy) indeed could be used to sterilize MPLA-liposomes without affecting their chemical properties or primary functions such as antigen uptake or activation of monocyte derived dendritic cells (MoDC). Encouraged by these results, we wanted to investigate further, if such irradiated adjuvant MPLA liposomes could indeed augment vaccine induced immunity. On the other hand, APHL recently developed an *in-vitro* MoDC based assay to investigate vaccine induced immunity. This assay could be used in place of animal studies to measure cell mediated immunity as a preliminary measure. Therefore, we used the *in-vitro* MoDC assay to investigate the irradiated adjuvant MPLA liposomes. During the current experiment, we used diphtheria toxoid (DT) as an antigen and investigated if addition of MPLA liposomes could augment the cell mediated immune response as shown below:



Experimental protocol to investigate the effect of irradiation on MPLA liposomes in the augmentation of cell mediated immunity. Diphtheria toxoid (DT) was either adsorbed with irradiated (room temperature, frozen or frozen with trehalose) MPLA liposomes or not prior to pulsing with MoDC. Then such MoDC were culture with naïve lymphocytes to investigate the activation

In this experiment, we explored the possibility of irradiation of MPLA liposomes at room temperature (RT), under frozen conditions or irradiating under frozen conditions but with the addition of trehalose, a sugar compound. DT was either adsorbed with irradiated (under above mentioned conditions) MPLA liposomes or not prior to pulsing with

MoDC. Then such MoDC were culture with naïve lymphocytes for 7 days. Then, MoDC were produced again as treated before and added to lymphocyte-MoDC co-cultures. After two days, the activation of lymphocytes was measured by expression of CD25 on CD4 and CD8 lymphocytes. Results suggest that indeed addition of MPLA liposomes do increase the cell mediated immunity. Interestingly, the activation of lymphocytes was confined to CD8 lymphocytes (graphic below).



Irradiated MPLA liposomes augment the cell mediated immunity similar to non-irradiated liposomes. Representative flow cytometry dot plots showing the CD25 expression by CD8 lymphocytes arising from cultures where MoDC were only pulsed with diphtheria toxoid (DT) or MoDC pulsed with DT adsorbed with non-irradiated liposomes [DT+Lipo] or irradiated at room temperature [DT+irLipo(RT)] or irradiated frozen with trehalose [DT+irLipo(Frozen)] or irradiated frozen [DT+irLipo(Frozen/ Treh)]

The irradiation of liposomes under various conditions did not affect the augmentation of immunity. Moreover, irradiation under frozen conditions slightly increased the augmentation of immunity compared to non-irradiated liposomes. These results suggest that irradiated liposomes could be used to enhance vaccine immunity and could be used along with irradiated vaccines to eradicate/prevent from transboundary animal diseases.

Trehalose Protects Antigenic Proteins of Vaccine Candidates During Irradiation

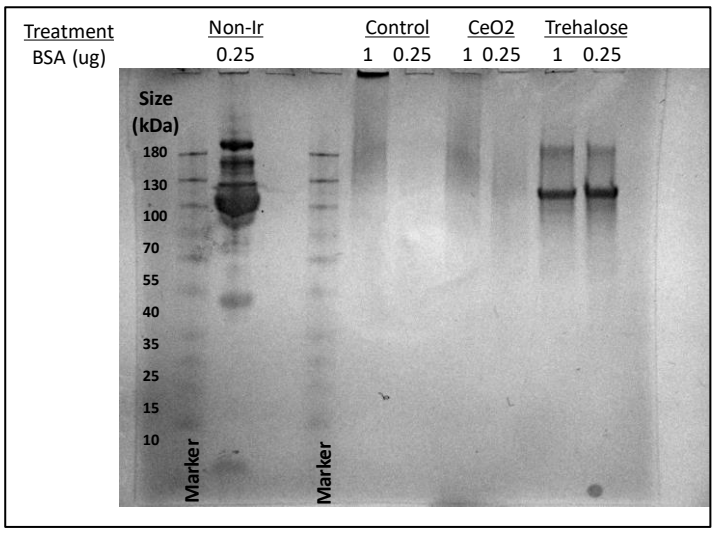
Pathogen inactivation by gamma radiation is an attractive approach for whole-organism vaccine development. This is a comparatively old method which is now re-explored with the addition of novel irradiators that can deliver precise doses of radiation and profound understanding of the immune system. The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture of the IAEA is currently conducting a CRP with six Member States to develop irradiated vaccines for transboundary animal diseases. APHL is providing technical improvements for these vaccine projects and APHL is also conducting research develop irradiated vaccines. Typically, there are two types of irradiated vaccines: 1. Killed vaccines, a higher dose of radiation is used to kill the pathogens, 2. Metabolically active non-replicative vaccines: a lower dose of radiation is used only to inhibit the pathogen to stop the virulence but to induce immunity. In both approaches, it is expected to preserve the epitopes that would induce a protective immunity in the host. However, especially with killed irradiated vaccines, the radiation doses could destroy the proteins (epitopes) of the pathogen that is responsible for the immunity. It is believed such destruction could be caused by free radicals that are produced during irradiation. Various irradiation protocols are currently in use to minimize such damages including irradiation under frozen conditions. Another approach has been the addition of radiation-protective compounds such as radio- protective Mn2+-Peptide complex from Deinococcus. However, synthesis of these peptides could be very expensive and commercial viability of such vaccines remains low. Therefore, APHL investigated low cost methods to protect antigenic proteins during gamma irradiation.

Two compounds were evaluated in these experiments:

i) Cerium dioxide nano-particles (CeO_2), proven for their highly anti-oxidant properties,

ii) Trehalose (α-D-glucopyranosyl-(1→1) -α-D-glucopyranoside), a sugar compound that is commonly used for vaccine stabilization.

Bovine serum albumin (BSA) was used as the protein compound for the assay and it was irradiated at 25 kGy at room temperature with or without the addition of CeO_2 or trehalose. Following irradiation BSA was visualized by bands resolved by protein gel electrophoresis (SDS-PAGE). The results suggest that trehalose preserve proteins after irradiation at 25 kGy. The irradiation without protective compounds or addition of CeO_2 destroyed almost all of the BSA proteins (graphic below).



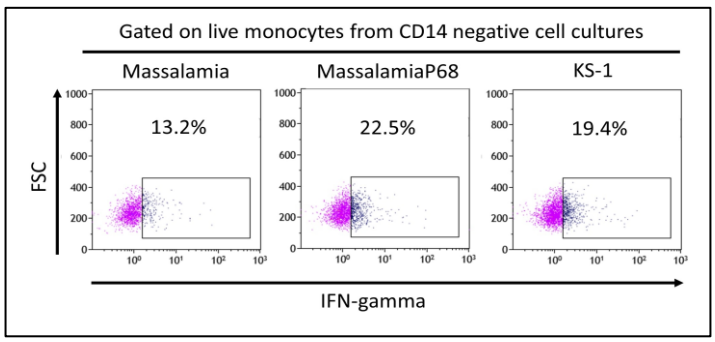
Irradiation with trehalose protects BSA. BSA (1ug and 0.25 ug) was irradiated at room temperature at a dose of 25 kGy. Following irradiation BSA was visualized by bands resolved by protein gel electrophoresis (SDS-PAGE).

We also conducted further investigations on the use of trehalose as a radiation-protective compounds in an irradiated vaccine against porcine reproductive syndrome virus and obtained results that showed higher antigenicity of the virus if irradiated with trehalose. The irradiation protocols with trehalose was transferred to Iran and Egypt and currently used during irradiation of vaccine candidates.

Lumpy Skin Disease (LSD) Virus Innate Immune Responses Can be Used to Differentiate Vaccine vs Wild Type Virus

The desired immune responses to a vaccine is broadly protective and long-lasting one. This type of immunity is induced by the adaptive immune system which involves humoral (antibody) and cell mediated responses. The method to measure such vaccine induced immunity is through vaccinating and investigating response in the host (animal or human). However, the innate immunity which takes place before adaptive immune responses, is a key regulator in the latter. Innate immunity not only regulates the depth of the adaptive immunity but also determines the type of adaptive immune response. Therefore, it is important to investigate the innate immune responses of vaccine candidates.

At APHL, this concept was used to differentiate wild type viruses and vaccine viruses of lumpy skin disease (LSD) and a novel assay was developed for this purpose. Bovine peripheral blood mononuclear cells (PBMC) were obtained by density gradient centrifugation. Then CD14+ monocytes were depleted from PBMC using magnetic beads that were conjugated with anti-bovine CD14 monoclonal antibody. The remaining CD14(-) cells were incubated with various LSD viruses [Massalamia, wild type virus and Massalamia passage 68 (MassalamiaP68) and KS-1 two vaccine viruses] for four days and blocking the transport of cytokines during the last 16 hours. Then, cells were harvested and stained for cell surface markers and interferon gamma (IFN-gamma). Next, cells were analysed by a flow cytometer. The results suggested that vaccine viruses induce the production of large amount of IFN-gamma by many immune cell types in the CD14(-) cell fraction. Further analysis suggested this was most prominent in the remaining monocytes in the CD14(-) cell fraction (Fig 1).



IFN-gamma production by CD14 negative cells in the presence of LSD virus. Representative flow cytometry dot plots showing IFN-gamma positive monocytes from CD14(-) cells that are cultured with Massalamia, MassalamiaP68 or KS-1 viruses for four days

Moreover, the IFN-gamma gene expression in this experiment in the CD14(-) cell fraction was measured through real-time PCR and confirmed the divergent response in vaccine and wild type viruses. Following these outcomes, several other viruses have been investigated through this assay and similar results have been obtained. In future, it is planned to use this assay to investigate various vaccine candidates that are also generated through irradiation and measure their fitness.

Molecular Epidemiology of ASF in Cameroon

African swine fever (ASF) is a highly lethal haemorrhagic disease of domestic and wild swine, endemic in southern Cameroon since 1982. Since February 2010, the disease has expanded to the northern and far-northern regions of the country.

To understand the evolution of ASF virus within the countries, APHL in collaboration with the Veterinary Diagnosis Laboratory (VETLAB) partner in Cameroon has analysed samples collected from sick pigs between 2010 and 2018.

The analysis of the partial B646L gene and the full E183L gene showed that all isolates belong to ASFV genotype I. Nevertheless, the analysis of the central variable region (CVR) demonstrated that 3 different variants of ASFV genotype I with 19, 20 and 21 tetramers repeat sequence (TRS) were involved in the 2010–2018 outbreaks in Cameroon.

This study proved that the three variants of the Cameroonian ASFV isolates are similar to those of neighbouring countries, suggesting a cross-border movement of ASFV strains, and highlighting the need for integrated control measures in affected regions.

A paper describing these findings has recently been accepted for publication in The Journal of Microbiology.

First Report and Characterisation of Pseudocowpox in Zambia

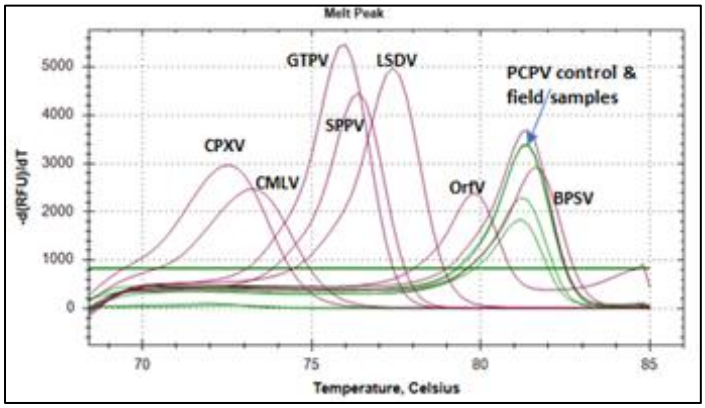
Pseudocowpox is a pox disease for cattle caused by Pseudocowpox virus (PCPV) within the genus parapoxvirus, family Poxiviridae. PCPV causes morbidity and loss of productivity in cattle and can infect human working in close contact with infected animals. Clinically, due to the similarity of the clinical signs to those of lumpy skin disease in cattle, PCPV infections are often misdiagnosed.

In December 2017, the Central Veterinary Research Institute (CVRI) in Zambia received samples consisting of skin nodules on suspicion of lumpy skin disease infection. The samples were from cattle of a mixed dairy and beef herd located in the Central Province of Zambia. An HRM assay for the simultaneous detection and differentiation poxviruses of medical and veterinary importance, developed at APHL and transferred to CVRI during a field mission in April 2018, was used to screen the suspected samples.

The analyses revealed the presence of PCPV in the samples. Additionally, the presence of PCPV was confirmed on samples collected during a follow-up mission in the same farm. Furthermore, the sequencing of the full B2L gene and

phylogenetic analysis of these samples established the presence of PCPVs, closely related, but distinct from publicly available PCPV B2L sequences.

This first report of PCPV virus in Zambia illustrates the usefulness of multiple pathogens detection for differential diagnosis of pox diseases.



Melting curve analysis of the eight poxviruses standard and samples collected from cattle in Zambia. The Zambian field samples indicated in green colour are matching with pseudocowpox virus

Evaluation of an Indirect ELISA for Detection of Capripoxvirus Antibodies in Goat, Sheep and Cattle Sera

Lumpy skin disease (LSD), sheeppox (SPP) and goatpox (GTP) are contagious diseases of ruminants with a devastating impact on the livestock industry and trade. LSD, SPP, GTP were mainly confined to Africa, the Middle East and Asia, with some sporadic incursions of SPP in Greece and Bulgaria. However, in 2015 the first incursions of LSD occurred in the European Union. Due to their potential for rapid spreading, a highly sensitive and specific serological method is needed for the surveillance of SPP, GTP and LSD and for post-vaccination monitoring.

During 2018, the Animal Production and Health Laboratory worked on the expression, purification and evaluation of CVSP, a surface protein of the capripox virion as a candidate antigen for the development of an iELISA for detection of capripox virus antibodies. Preliminary results were presented at the International Congress of Veterinary Virology held in Vienna last August. The iELISA in its present form has been tested in more than 200 positive and negative sera samples collected from cattle and small ruminants. The test showed to be highly sensitive and specific and it is currently under analytical and clinical validation.

Fellows, interns and consultants

Ms Maheshika Kurukulasuriya from University of Peradeniya, Peradeniya, Sri Lanka was trained on 'Bioinformatics analysis of molecular genetic data for characterization of indigenous Sri Lanka sheep' for two weeks (8 to 19 October 2018).

Ms Atanaska Todorova Teneva from University of Forestry, Sofia, Bulgaria was at APHL for a scientific visit on 'Nuclear and nuclear related molecular technologies for genetic evaluation and characterization of livestock' for one week (3 to 7 December 2018) under TC fellowship (FS-RER0044-1804401).

Ms Krasimera Antonova Zaharieva from Executive Agency of Selection and Reproduction in Stock Farming, Sofia, Bulgaria was at APHL for a scientific visit on 'Nuclear and nuclear related molecular technologies for genetic evaluation and characterization of livestock' for one week (3 to 7 December 2018) under TC fellowship (FS-RER0044-1804401).

Technical Cooperation Projects

Country TC Project	Description	Technical Officer(s)
Angola ANG5013	Applying Nuclear and Molecular Techniques for Diagnosis and Control of Transboundary Animal Diseases	G. Viljoen I. Naletoski
Burundi BDI5002	Improving Animal Production through Enhanced Application of Nuclear and Related Techniques	H. Unger
Benin BEN5010	Using Nuclear Techniques for Better Utilization of Local Feed Resources and Improved Reproduction Practices to Enhance Productivity and Conserve Nature	G. Viljoen
Bangladesh BGD5030	Building Capacity to Improve Dairy Cows Using Molecular and Nuclear Techniques	G. Viljoen
Burkina Faso BKF5017	Using Modern Animal Breeding Methods, Nuclear and Genomic Tools to Improve Dairy Production in Smallholder Production Systems	K. Periasamy
Burkina Faso BKF5021	Improving Local Poultry Production through Incorporation of Nutraceuticals in Feeds and Genetic Characterization	G. Viljoen
Bosnia and Herzegovina BOH5002	Strengthening State Infrastructure for Food and Animal Food Control and Protecting Animal Health	I. Naletoski
Botswana BOT5016	Developing the Application of Immunological and Molecular nuclear and Nuclear Derived Early and Rapid Diagnosis and Control of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Belize BZE5007	Supporting Sustainable Capacity Building through Distance Learning for Laboratory Personnel of the National Agricultural Health Authority	G. Viljoen
Belize BZE5009	Establishing Early and Rapid Diagnoses and Control of Transboundary Animal and Zoonotic Diseases	G. Viljoen
Central African R CAF5009	Controlling Contagious Bovine Pleuropneumonia and Peste des Petit Ruminants	H. Unger
Central African R CAF5010	Building National Capacities for the Diagnosis and Control of Animal Diseases and for Increasing Animal Production	H. Unger
Chad CHD5005	Studying the Causes of Pulmonary Diseases in Small Ruminants	H. Unger C. Lamien
Cameroon CMR5019	Using Nuclear Techniques to Improve Milk Production	M. Garcia Podesta H. Unger K. Periasamy

Country TC Project	Description	Technical Officer(s)
Cameroon CMR5022	Controlling Transboundary Animal Diseases with Special Emphasis on Peste des Petits Ruminants	H. Unger
El Salvador ELS5012	Optimizing Livestock Production Systems through Cultivation and Efficient Use of Local Feed Resources, Monitoring of Performance and Reduction of Environmental Pollution through Solid Waste and Biogas Utilization	I. Naletoski
Eritrea ERI5010	Increasing Small Scale Dairy Production through Improved Feeding, Cattle Management and Higher Conception Rates, Thereby Improving Rural Livelihood and Contributing to Food Security	G. Viljoen
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	G. Viljoen
INT5155	Sharing Knowledge on the Sterile Insect and Related Techniques for the Integrated Area-Wide Management of Insect Pests and Human Disease Vectors	I. Naletoski
Côte d'Ivoire IVC5038	Studying Small Ruminant Respiratory Diseases	H. Unger G. Viljoen
Cambodia KAM5003	Supporting Sustainable Livestock Production	M. Garcia Podesta
Kenya KEN5038	Using Nuclear Techniques to Evaluate and Improve the Impact of Mutated Forages on the Performance of Smallholder Dairy Cows	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
Lesotho LES5006	Enhancing Animal Production and the Health of Sheep and Goats in Lesotho	G. Viljoen
Lesotho LES5007	Enhancing Livestock Production and Health	G. Viljoen
Madagascar MAG5024	Applying Nuclear and DNA-Based Techniques to Improve Productivity of Local Livestock Germplasm through an Efficient Artificial Insemination Programme	K. Periasamy
Malaysia MAL5031	Establishing an Environmentally Sustainable Food and Fodder Crop Production System	G. Viljoen
Mauritius MAR5025	Improving the Productivity of Dairy Cattle through On-Farm Application of Achieved Research Information on Feeding Practices	G. Viljoen

Country TC Project	Description	Technical Officer(s)
Mauritania MAU5004	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases	H. Unger
Mauritania MAU5007	Supporting Genetic Improvement of Local Cattle Breeds and Strengthening the Control of Cross-Border Diseases – Phase II	G. Viljoen
Mali MLI5026	Improving the Diagnosis of Livestock Diseases	I. Naletoski C. Lamien
Mali MLI5027	Using Nuclear and Molecular Techniques for Early and Rapid Diagnosis, Epidemiological Surveillance and Control of Transboundary Animal Diseases	I. Naletoski C. Lamien
Mali MLI5029	Upgrading Capacities to Differentiate Priority Animal and Zoonotic Diseases Using Nuclear Related Molecular Techniques	I. Naletoski
Malawi MLW5002	Strengthening Capacity for the Diagnosis, Prevention and Control of Animal Diseases of Public Health Importance	H. Unger
Montenegro MNE5003	Improving Diagnosis of Animal Diseases and Food Pathogens	I. Naletoski
Mongolia MON5022	Implementing Early Diagnosis and Rapid Control of Transboundary Animal Diseases, Including Foot-and-Mouth disease (FMD) and Peste des Petits Ruminants (PPR)	H. Unger G. Viljoen
Mongolia MON5023	Enhancing Livestock Production through the Improved Diagnosis and Prevention of Transboundary Animal Diseases (TADs)	H. Unger G. Viljoen
Morocco MOR5037	Enhancing Control of Chemical Food and Feed Contaminants, Animal Disease Diagnosis and Trade in Fresh Fruits	I. Naletoski
Mozambique MOZ5007	Enhancing Mutation Breeding of Sorghum and Pearl Millet to Develop High Yield, Disease Resistance and Drought Tolerance	G.Viljoen
Mozambique MOZ5008	Strengthening National Capacity for the Application of Nuclear and Related Techniques to Improve Animal Health and Production	G.Viljoen
Myanmar MYA5024	Supporting the National Foot-and-Mouth Disease Control Programme	G. Viljoen
Myanmar MYA5026	Improving the Livelihoods of Smallholder Livestock Farmers by Developing Animal Feeding Strategies for Enhanced Food Security	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

Country TC Project	Description	Technical Officer(s)
Nigeria NIR5040	Controlling Parasitic and Transboundary Animal Diseases to Improve Animal Productivity in Smallholder Farms Using Nuclear and Molecular Techniques	I. Naletoski
Pakistan PAK5050	Developing a Facility for the Diagnosis of Transboundary Animal Diseases and Vaccine Production	H. Unger V. Wijewardana
Palestine PAL5007	Upgrading Animal Feeding Laboratory in Terms of Human Capacity Building and Infrastructure	I. Naletoski
Papua New Guinea PAP5002	Genetically Characterizing and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding	K. Periasamy
Papua New Guinea PAP5003	Enhancing Genetic Characterization and Improving Productivity of Cattle by Enhanced Reproduction and Better Feeding – Phase II	G. Viljoen
Peru PER5032	Conducting Genetic Characterization of Alpacas for Resistance to Diseases	K. Periasamy
Congo, Rep. PRC5001	Monitoring Livestock Diseases and Certifying Animal Health	H. Unger
RAF0042	Promoting the Sustainability and Networking of National Nuclear Institutions for Development	I. Naletoski
RAF0051	Supporting Specific Needs in the African Region Due to Emergencies	H. Unger G. Viljoen
RAF5068	Improving Livestock Productivity through Strengthened Transboundary Animal Disease Control using Nuclear Technologies to Promote Food Security (AFRA)	H. Unger C. Lamien
RAF5073	Strengthening Africa's Regional Capacity for Diagnosis of Emerging or Re-emerging Zoonotic Diseases, including Ebola Virus Disease (EVD), and Establishing Early Warning Systems	H. Unger I. Naletoski
RAS5078	Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	G. Viljoen
RER5023	Enhancing National Capabilities for Early and Rapid Detection of Priority Vector Borne Diseases of Animals (including Zoonoses) by Means of Molecular Diagnostic Tools	I. Naletoski
RER9137	Enhancing National Capabilities for Response to Nuclear and Radiological Emergencies	I. Naletoski
RLA5071	Decreasing the Parasite Infestation Rate of Sheep (ARCAL CXLIV)	G. Viljoen
Senegal SEN5036	Controlling *Mycoplasma Mycoides* Infection – Contagious Bovine Pleuropneumonia (CBPP) and Contagious Caprine Pleuropneumonia (CCPP)	H. Unger

Country TC Project	Description	Technical Officer(s)
Seychelles SEY5008	Building Capacity for Diagnosis of Animal Diseases using Nuclear and related Techniques	H. Unger G. Viljoen
Sierra Leone SIL5018	Strengthening Artificial Insemination and Disease Diagnosis Services Coupled with Improved Feeding to Enhance the Productivity of Cattle	H. Unger
Sierra Leone SIL5019	Strengthening Capacities for the Diagnosis and Control of Zoonoses to Improve Public Health Services and Livestock Production	H. Unger
Sri Lanka SRL5045	Establishing a National Centre for Nuclear Agriculture	H. Unger C. Lamien
Sri Lanka SRL5046	Improving Livelihoods through Dairy Cattle Production: Women Farmers' Empowerment	M. Garcia Podesta
Sudan SUD5036	Improving Livestock Production for Enhanced Food Security through Genetic Improvement of Indigenous Animal Breeds Using Artificial Insemination, Improved Nutrition and Adequate Animal Disease Control Measures	I. Naletoski M. Garcia Podesta
Syrian Arab Republic SYR5025	Enhancing the Nutritive and Reproductive Characteristics of Small Ruminants by Means of Nuclear and other Related Techniques Using Locally Available Unconventional Feed Resources	G. Viljoen
Togo TOG5001	Improving and Promoting Bovine Milk Production through Artificial Insemination	G. Viljoen
Tunisia TUN5028	Supporting Watering Strategies to Help Livestock Raised in Semiarid and Arid Regions Coping with Climate Change	M. Garcia Podesta I. Naletoski
Uganda UGA5035	Improving Food Safety through Surveillance of Fish Diseases	H. Unger C. Lamien
Uganda UGA5038	Supporting National Animal Production and Productivity through the Establishment of Regional Animal Health Centres and Improving Disease Control at the National Animal Disease Diagnostics and Epidemiology Centre	H. Unger
U.R. of Tanzania URT5031	Improving Indigenous Cattle Breeds through Enhanced Artificial Insemination Service Delivery in Coastal Areas	G. Viljoen
Vietnam VIE5019	Applying Nuclear Related Techniques for Transboundary Animal Diseases (TADs) Diagnosis	G. Viljoen V. Wijewardana
Yemen YEM5012	Improving Diagnostic and Analytical Capabilities of the Central Veterinary Laboratory Including Residue Testing of Animal Products	H. Unger
Yemen YEM5014	Improving Management of Small Ruminants	H. Unger
D.R. Congo ZAI5023	Upgrading Laboratory Services for Capacity Building in Fish and Aquaculture Diseases as a Contribution to Sustainable Poverty Alleviation and Sanitary Security of Food	H. Unger

Country TC Project	Description	Technical Officer(s)
D.R. Congo ZAI5024	Upgrading Vaccine Production to Protect Livestock from Transboundary Animal Disease	H. Unger V. Wijewardana
D.R. Congo ZAI5027	Developing Early and Rapid Diagnosis and Control of Transboundary and Zoonotic Diseases	H. Unger
Zimbabwe ZIM5022	Establishing Molecular Epidemiology Methods, Tissue Culture and Production of Biological Reagents for the Surveillance of Livestock Diseases	I. Naletoski V. Wijewardana
Zimbabwe ZIM5024	Establishing an Artificial Insemination Center to Enhance the Rebuilding of the National Herd	G. Viljoen

Publications

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VETLAB Network

The Veterinary Diagnostic Laboratory (VETLAB) Network, coordinated by the Animal Production and Health Section (APH) and supported through IAEA and FAO programmatic activities as well as by South Africa through the African Renaissance Fund (ARF) and by the USA and Japan Peaceful Uses Initiative (PUI), consists of national veterinary diagnostic laboratories located in 45 African and 19 Asia and Pacific Member States.

In the second half of 2018, two advanced training courses on animal disease detection and genetic characterization of pathogens were organized and directly supported by the VETLAB network. Thirty-two participants from VETLAB laboratories attended the two courses held at the Seibersdorf laboratories. Furthermore, 81 VETLAB laboratory staff members were trained in Bangladesh (12), Botswana (14), Ethiopia (9), Kenya (5), Sudan (20) and Zambia (21).

The annual VETLAB Directors meeting was organized in August 2018 in Vienna, Austria. Twenty-three directors from 5 Asian countries and 15 African countries participated in the meeting. 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 capacity and quality in both diagnostic and R&D activities have been significantly improved in several network partner laboratories. Additionally, there was an increase in the number of laboratories able to perform advance pathogen detection techniques such as multiple pathogen detection assays and genetic sequencing.

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

Impressum

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