Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

No. 48 July 2008

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

ISSN 1011-2529

Contents

Buffalo wallowing in River in Sri Lanka (courtesy of Oswin Perera).

To Our Readers

Dear Colleagues,

The first six months of this year have been a busy time for all personnel in the subprogramme. Apart from our regular Coordinated Research Project (CRP) activities and our technical support given to ongoing national and regional Technical Cooperation (TC) projects, we were also involved in the formulation (together with our Member State counterparts and TC Country Officers) of projects for the 2009/11 TC project cycle. In addition to this, when carrying out our 2007 programme of work and budget performance evaluations, we could identify the areas where good performance was achieved as well as areas where further improvements are needed. It is hoped that our inputs will serve the best interests of our Member States. The focus of our activities is on enhancing food security by supporting sustainable livestock production systems in developing countries. This is to be achieved by strategic and applied research, technology transfer and capacity building. The three principal components of the subprogramme are animal nutrition, reproduction and breeding and animal health. Within these three components, problems are identified and solutions developed through the use of strategically applied nuclear-based tools, in conjunction with conventional technologies.

It is a fact that the world continues to demand more and healthier animals and animal products produced in an 'environmentally safe, clean and ethical' way. This is imposing new challenges for animal scientists whose primary concern has been improving livestock productivity. Improving understanding and technologies in animal nutrition, animal reproduction and breeding, and animal health is critically important for food security, poverty alleviation and environment protection on a global scale. It is well accepted that nuclear applications spearhead modern biotechnological research. For example, the most used disease monitoring technology is the Enzyme Linked Immunosorbent Assay (ELISA). ELISA platforms were developed through serological research using radio active isotopes (Radioimmunoassay, Western Blot), and many still use gamma irradiated pathogens as safe antigens and irradiated control sera as references. Similarly, molecular diagnosis and characterization techniques were founded using radio isotopic applications. In fact, the most sensitive and cost effective pathogen detection and characterization applications (1-100 protein or nucleic acid molecules) still demand the use of isotopes. It is expected that the present day non-nuclear molecular biological applications will continue to build on nuclear scientific research contributions. The Animal Production and Health Subprogramme was instrumental (together with FAO, OIE and AU/IBAR) in the success of the global rinderpest eradication campaign made possible through the transfer of nuclear and nuclear related technologies, improvement in laboratory infrastructure and staff proficiency, and provision of methodology and operational guidance. The laboratory groundwork laid then, forms now the basis of the increasingly successful animal health control programmes in Member States such as the recent avian influenza (bird flu) and Rift Valley fever events.

I furthermore want to mention briefly the past and ongoing involvements, and future contributions, of nuclear applications within the area of Animal Production and Health. The importance of isotopes in livestock research is evident from the symposium held by the American Society of Animal Science (USA, 2005) titled 'Stable Isotope Tracer Techniques for Nonruminant Research and Their Practical Applications'. Isotopes have a unique and niche contribution to our Member States and to the international community at large:

- Use of $^{13/14}C$, ^{15}N, ^{125}I, ^{51}Cr, ^{3}H, ^{32}P, ^{35}S, ^{103}Ru, ^{68}Zn, ^{63}Cu, ^{98}Mo as tracers to evaluate nutritive value, mineral availability, passage rate and feed intake of locally available feeds and to develop feeding strategies with a focus on using alternative and unconventional feeds for enhancing livestock productivity whilst protecting the environment, conserving natural resources and enhancing biodiversity. In the last year (2007) the cost of conventional feeds has doubled due to their diversion to biofuel production and thus efficient use of such feeds is vital for food-feed security.
- The measurement of energy expenditure and body composition using doubly labelled water (^{18}O and ^{2}H labelled). In studies where the energy expenditure is not required, the use of deuterium oxide (D_2O) dilution for determination of lean body mass, fat content, body composition, water turnover, total body water in livestock, and milk intake suckling young.
- Feed-crop improvement (with desired traits, for example; high sulphur-containing amino acids, soluble carbohydrate and rumen un-degradable protein contents; low lignin and anti-nutrient contents; and for imparting stay-green, drought- and frost-resistance properties) through mutation breeding using gamma rays, ion beams and fast neutrons.
- Use of ^{125}I labelled Radioimmunoassays to monitor hormonal levels in female animals to optimize reproductive efficiency through natural conception and artificial insemination, and to assess nutritional and reproductive status.
- Use of ^{32}P and ^{35}S radio active isotopes to characterize and select desirable breeding traits (e.g. leaner meat, less fat, disease resistance, drought tolerance) for introgression.
- Use of irradiation for the sterilization of containers for the storage of genetic material such as semen in embryos in cryogenic banks for ex situ conservation and regeneration of indigenous livestock genetic resources.
- Use of $^{13/14}C$, ^{125}I, ^{3}H, ^{32}P, ^{35}S labelled protein and nucleic acid molecules for the early and sensitive detection, monitoring, and characterization of harmful pathogens (Radio-immuno Assay, Western Blot) and its critical contribution towards the implementation of non-isotopic, but nuclear related, applications such as ELISA.
- The use of ^{60}Co gamma irradiation of pathogenic viruses for use as antigen in ELISA platforms such as the Rift Valley fever IgG and IgM indirect ELISA's.
- Analysis of ratios of naturally occurring stable isotopes (for example of stable carbon ^{13}C and ^{12}C; and stable nitrogen ^{15}N and ^{14}N; and their trophic shifts) in potential animal feeds and animal body tissues to reconstruct movements between feed webs and dietary selection and to know dietary composition, without undergoing time-consuming behavioural observations. In addition, isotopic ratios could be used to distinguish organically and conventionally produced animal products, to detect abuse of synthesized naturally occurring hormone such as testosterone used as growth promoter, to determine origin of animal products, and to detect the presence of bone meal (causative agent for BSE) in feeds.
- The analysis of natural stable isotope compositions of carbon ($^{13}C/^{12}C$), nitrogen ($^{15}N/^{14}N$), sulphur ($^{34}S/^{32}S$), oxygen ($^{18}O/^{16}O$) and hydrogen ($^{2}H/^{1}H$) is one potential tool for the verification of the geo-

graphic origin and feeding history of the animal. The products from animals reared in one region could be isotopically different from the other region, mainly because of contrasting proportion of plants with C_3 and C_4 photosynthetic pathways in the animal diet. Stable isotopic signatures have also potential for determining whether the animal wastes enter the stream food webs within a region.

- Use of Dual Energy X ray Absorptiometry (DEXA) and Computer Tomography, as non-invasive techniques, for determination of body composition for use in animal breeding programmes and in the study of nutrition-reproduction interactions.
- The stable isotopic signatures of the feathers of the birds (for example ^{13}C, ^{2}H, ^{34}S and ^{87}Sr) and those of the feather and food residues in nests and of water near the nests could be used to determine the migratory path of birds. This could be exploited in determining the contribution of migratory birds towards spread of diseases, for example of avian flue from endemic to uninfected areas. This approach of isotope tracking based on the knowledge of the distribution of isotope abundance across the geographical range of the target organism has potential in determining the possible roles the wild animals play as carriers of animal diseases. The information will play a vital role in developing strategies for controlling transboundary diseases.
- Exciting developments have also taken place in the development of isotope labelled immunoassays without radiation waste. This has been achieved using long-life ^{14}C label in the immunoassays and accelerator mass spectrometer as the detection system. Radioimmunoassys developed for atrazine and 2,3,7,8-tetrachlorodibenzo-p-dioxin had <1 dmp (0.45 pCi) of labelled compound, which is below the limit of disposal (50 nCi per g) as nonradioactive waste. Development of such immunoassays could be invaluable in disease diagnostics, monitoring and control.
- After the administration of a ^{13}C-labelled compound, the recovery of ^{13}C in exhaled breath of animals could be used to diagnose metabolic, inflammatory and infectious diseases.
- Irradiation of reagents and solutions for enhancing shelf life of diagnostic kits. Furthermore, integration of irradiation in the production chain of genetically engineered vaccines could enhance the immunity of the vaccines and also provide information on the primary and secondary structures required for efficient vaccine production.
- Targeted killing of virally infected cells by radiolabelled antibodies to viral proteins. This approach has been used for targeting and eliminating HIV-1-infected cells with radiolabelled antibodies specific to viral proteins in vitro and in vivo. Antibodies to HIV-1 envelope glycoproteins gp120 and gp41 labelled with radioisotopes bismuth 213 (^{213}Bi) and rhenium 188 (^{188}Re) selectively killed chronically HIV-1-infected human T cells and acutely HIV-1-infected human peripheral blood mononuclear cells (hPBMCs) in vitro. The results have been encouraging in vivo as well. Viral infecting agent-targeting radioimmunotherapy may provide a novel treatment option, both for humans and farm animals.

As is evident from the above, the Animal Production and Health Subprogramme has a strong nuclear component and it is planned to strengthen it further through the International Symposium on 'Advances in Applications of Nuclear Techniques in Animal Production and Health' that will be held under the auspices of IAEA in 2009. This Symposium will provide an opportunity to further identify nuclear technologies having comparative advantages over conventional techniques and having potential to address issues of relevance to developing countries and providing solutions to their problems.

Both past and future activities are described in further detail in this newsletter and are also accessible at our website (http://www-naweb.iaea.org/nafa/aph/index.html). Please contact us if you have any further ideas, comments, concerns or questions. As discussed in previous newsletters, the Animal Production and Health Subprogramme will continue to move progressively forward and in pace with developments within the livestock field so as to optimally serve our Member States. We will therefore continue to encourage project teams to keep abreast of current technological developments and to promote their implementation where feasible. This would allow a better positioning of our Member States with respect to international trade and other livestock-related issues. In turn, this would promote improved quality assurance of animal husbandry and health practices, and also lead to a greater autonomy for Member States.

Concerning news from the subprogramme , we had to say goodbye to Paul Boettcher. Paul joined us in 2005 as Geneticist/Breeder and was responsible for the subprogrammes activities in animal production. He is, however, not completely lost to the subprogramme as he took a position as Animal Production Officer at the Animal Production and Health Division of FAO in March 2008 and I am looking forward to work with him in that capacity. I want to thank him for his dedicated and hard work and want to wish him, Alexandra and Theo only the best for the future.

We want to welcome Oswin Perera, Tony Luckins, Kathrin Schaten and Mario Garcia. Oswin Perera joined the Animal Production and Health group at the end of February 2008 from Sri Lanka as a consultant in animal reproduction and breeding. He has worked at the IAEA as a Technical Officer on two separate occasions, from 1988 to 1995 and from 1997 to 2004. In 2005 he returned to Sri Lanka and was appointed Professor of Farm Animal Production and Health at the University of Peradeniya. Tony Luckins joined our Animal Production Unit Laboratories in Seibersdorf at the end of December 2007 from the Centre for Tropical Veterinary Medicine, (CTVM) Edinburgh as parasitologist with research experience mainly in the animal trypanosomoses. His

research interests have focused mainly on the animal trypanosomoses including fundamental studies on host-parasite relationships, the immunological response to infection in various livestock species, and the pathogenic effects of infection. Kathrin Schaten, a Junior Professional Officer from Berlin, Germany, joined our subprogramme in February 2008 to learn more about the animal health challenges we face. Mario Garcia Podesta joined us in May 2008 as reproduction and breeding consultant. Mario is the Head of the Animal Husbandry Department of the Universidad Peruana Cayetano Heredia in Lima, Peru. Mario's main focus is on the development and implementation of reproduction and breeding strategies.

We want to welcome all as members of the subprogramme and wish them a pleasant and productive time with us.

Gerrit Viljoen,
Head, Animal Production and Health Section

Staff

Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture,

Headquarters: Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria; Telephone: (+43 1) 2600+ Extension; Fax (43-1) 26007;

email: Official.Mail@iaea.org

Name	Title	email	Extension
Qu LIANG	Director, NAFA	Q.Liang@iaea.org	21610
Gerrit J. VILJOEN	Molecular biologist, Head, Animal Production & Health Section (APHS)	G.J.Viljoen@iaea.org	26053
Mario GARCIA PODESTA	Consultant Reproduction, APHS	M.Garcia-Podesta@iaea.org	26048
John R. CROWTHER	Virologist, APHS	J.Crowther@iaea.org	26054
E. Nicholas ODONGO	Nutritionist APHS As of Summer 2008		26845
Oswin PERERA	Consultant Reproduction, APHS until May 2008	B.M.Perera@iaea.org	26048
Kathrin SCHATEN	Junior Professional Officer, APHS	K.M.Schaten@iaea.org	21618
Anthony SCHLINK	Consultant Nutrition, APHS	A.Schlink@iaea.org	26845
Hermann UNGER	Veterinarian, APHS	H.Unger@iaea.org	21644
Roswitha SCHELLANDER	Project Assistant, APHS	R.Schellander@iaea.org	26052
Svetlana PIEDRA CORDERO	Project Assistant, APHS	S.Piedra-Cordero@iaea.org	26051

FAO/IAEA Agriculture and Biotechnology Laboratory, A-2444 Seibersdorf, Austria

Name	Title	email	Extension
Erik BUSCH-PETERSEN	Head, FAO/IAEA Agriculture and Biotechnology Laboratory	E.Busch-Petersen@iaea.org	28267
Andrew CANNAVAN	Analytical Chemist, Head, Agrochemical Unit	A.Cannavan@iaea.org	28395
Caroline Melanie ADOMBI	Biochemist (Consultant), APU	C.M.Adombi@iaea.org	28380/28323
Charles Euloge LAMIEN	Biochemist (Consultant), APU	C.Lamien@iaea.org	28379
Mamadou LELENTA	Veterinarian, Laboratory Technician, APU	M.Lelenta@iaea.org	28321
Antony LUCKINS	Consultant, APU	A.Luckins@iaea.org	28355
Massoud MALEK	Geneticist, APU	M.Malek@iaea.org	28358
Ericka PESTANA DELGADO	Geneticist, Laboratory Technician, APU	E.A.Pestana-Delgado@iaea.org	28378
Eva-Maria WINGER	Parasitologist, Laboratory Technician, APU	E.M.Winger@iaea.org	28303/28424
Kyoko MAKOVICKY	Clerk, APU	K.Makovicky@iaea.org	28362

The Animal Production Unit, Seibersdorf, is a collaborating Centre
for ELISA and molecular technologies in animal disease diagnosis for the OIE.

Forthcoming Events

Regional Training Course on the Molecular Diagnosis and Control of Animal Fascioliasis in the Latin America Region RLA5049

Technical Officer: Gerrit Viljoen

The Training Course is scheduled to take place from 23 to 27 June 2008 in Puebla, Mexico.

The purpose of the training course is to discuss the regional needs, the specific national needs and the common problems to address in the area for sustainable control of veterinary fascioliasis (keeping in mind that there is a human interface).

- To establish the best approaches and tools for the diagnosis, control and prevention of Fascioliasis, including theoretical and practical training in the diagnostic serological and molecular diagnostic tools and procedures.
- To determine the epidemiological spread of the disease, by classical and new generation techniques, and to identify areas at risk.
- To share scientific knowledge, information and other data about the characteristics of the disease in the different countries, to establish the baseline(s) of the individual countries to ascertain the present unknown situation and to establish contingency plans to react on them.
- The diagnostic treatment, surveillance and epidemiological characterization methods utilizing appropriate tools that are evaluated and validated.

The training course will be divided into theoretical and practical technology transfer units. This will consist of presentations by lecturers from local and participating countries with the aim to identify the main areas on interest (e.g. harmonized protocols and procedures for sample collection, extraction and diagnostic procedures, test analysis and result interpretation) within the frame of quality management activities and the implementation of appropriate technologies.

The Technical Officer and two experts from Spain will lecture and 19 participants from Argentina, Bolivia, Cuba, Ecuador, Honduras, Mexico, Peru, Uruguay and Venezuela will attend this regional training course.

Consultants Meeting to screen plants and/or plant products for impact on animal production, health and the environment

Technical Officer: Anthony Schlink

The consultants meeting will take place from 14 to 17 July 2007. The objective of the meeting will be to define the options for screening plants/or plant products for impact on livestock production and to develop strategies to progress this screening knowledge to the livestock industries.

Regional (AFRA) Training Course on Follow-up on Reproductive Performance and Production in AI Females and their Calves RAF5054

Technical Officer: Mario Garcia Podesta

This regional training course was originally titled as 'Molecular techniques and applications in artificial insemination' but has been renamed as above. It will be held in Botswana from 1 to 5 September 2008.

The main objective is to transfer skills that can be used to improve livestock production through applying reproductive management and selective breeding strategies. The course will deal with the following topics:

- Methods for the identification of animals and recording data on reproduction and production
- Assessing reproductive status and diagnosis of disorders (records and their analysis; rectal palpation of reproductive organs; ultrasonography; measurement of reproductive hormones; overview of radioimmunoassay (RIA) and enzymeimmunoassay (EIA) for measuring hormones and interpretation of results)
- Assessing production parameters (weighing and body condition scoring of dairy and beef cattle; milk production and milk quality)
- Breeding and selection (breeding objectives for dairy and beef cattle under African conditions; selection of female calves for use as bull mothers and replacements for breeding cows; selection of male calves for use as AI bulls).

Brucellosis 2008 International Research Conference

Technical Officer: Gerrit Viljoen

APHS is cooperating in the International Research Conference Brucellosis 2008, which will take place from 10 to 13 September 2008 in London, UK.

The conference is aimed at scientists, government and international regulators, veterinarians, and clinicians with an interest in brucellosis. The meeting should encourage the interface between the groups essential in the ongoing struggle against this global zoonosis.

The scientific programme will include a blend of fundamental and applied research as well as providing a forum for discussion of tools and procedures relevant to the control of brucellosis as well as reviews by eminent scientists within the brucellosis field covering current

understanding, and future prospective developments, in their areas of interest.
Registrants have the opportunity to submit titles for oral and poster presentations and participate in 'Question & Answer' sessions with leading brucellosis workers. This format should give all participants a broader understanding of the global nature of brucellosis and a framework to develop international solutions. It will enable professionals to exchange research data and ideas, while building ties with colleagues worldwide.
Full information on the conference, like registration details can be found on the conference web-page: http://www.defra.gov.uk/corporate/vla/aboutus/aboutus-bruce2008.htm.
To receive funding from the IAEA participants from countries eligible to receive Technical Coordination support should fill and submit a fellowship form. The forms and instructions are available on: http://www-tc.iaea.org/tcweb/participation/asfelloworvisitor/default.asp. A copy of the application should be sent to Mr. Viljoen (G.J.Viljoen@iaea.org).

Regional Training Course on the Diagnosis of Avian Influenza (Europe)

Technical Officer: Gerrit Viljoen

The regional training course on avian influenza for the European region will be held in Vladimir, Russia from 15 to 26 September 2008.
Highly pathogenic avian influenza (HPAI), commonly known as 'bird flu', is caused by the infection with certain strains of influenza A virus. The different strains of this virus are classified into subtypes on the basis of their two external proteins named haemagglutinin (H) and neuraminidase (N). Techniques that are implemented for the diagnosis of avian influenza aimed at demonstrating first the presence of the causal virus in pathological samples and then at assessing its pathogenicity. Indeed, only some HPAI strains of avian influenza, belonging to the H5 or H7 subtypes, are at the origin of outbreaks. The current avian influenza outbreak, which started in Asia in late 2003, is caused by a virus of H5 subtype and was further characterized as of the N1 subtype (HPAI-H5N1) which is able to cause deaths in humans.
Usually, from the pathological sample, the virus is first isolated in embryonated fowl eggs and takes 4–7 days to complete. The subtype of the isolated virus is then identified by a battery of specific antibodies raised against the different H (H1 to H15) and N (N1 to N9) proteins. This means of identification is carried out only in specialized laboratories. To confirm a subtype's pathogenicity, the isolate is then inoculated into 4–8 week-old susceptible chickens. For the World Organisation for Animal Health (OIE), strains are considered to be highly pathogenic if they cause more than 75% mortality in inoculated chickens within 10 days. An alternative way to demonstrate the presence and to characterize the influenza virus in the pathological samples is the specific detection of its RNA by nucleic acid amplification techniques (PCR and PCR sequencing, using either fluorescent or isotopic [^{32}P, ^{33}P or ^{35}S] markers). This molecular approach takes 1–2 days to complete. It is foreseen that this technology could be applied as an early warning tool.
Although the HPAI-H5N1 virus existed since 1996, the true crisis started in 2003 with the declaration that the disease was killing hundreds of thousand of chickens and ducks in ten countries. As of the end of 2007, there have been 278 human cases with 188 fatalities, and more than 320 million dead or culled birds. Economic losses to the Asian poultry sector are estimated as high as US $20 billion. Avian influenza, due to HPAI-H5N1 subtype, is threatening the livelihood of hundreds of millions of poor livestock farmers, jeopardizing smallholder entrepreneurship and commercial poultry production, and seriously impeding regional and international trade and market opportunities.
The IAEA, through the Joint FAO/IAEA Division, is part of a coordination mechanism established through the Senior United Nations System Coordinator for Avian and Human Influenza to make the international system as responsive as possible.
The two-week course aims at enhancing knowledge on highly pathogenic avian influenza (epidemiology, differential diagnosis of the virus subtypes involved (nuclear and nuclear related serological and molecular technologies), sampling and submission procedures (including shipment of pathological samples to the OIE/FAO Network of Expertise on Avian Influenza (OFFLU) and the FAO/OIE reference laboratories) and at providing practical training on current rapid techniques for disease diagnosis, in particular, the use of nuclear-based techniques for the identification and characterization of the pathogen(s) in a quality assured manner. The ultimate goal is to contribute to the early detection and early reaction capabilities in Member States.

The training courses held so far and planned are:

- Interregional Training course from 20 November to 1 December 2006 in Seibersdorf, Austria
- Regional Training Course for Africa from 26 August to 1 September 2007, Cairo, Egypt
- Regional Training Course for Asia from 19 to 30 November 2007, Geelong, Australia
- Regional Training Course for Europe from 15 to 26 September 2008 Vladimir, Russia

Regional (AFRA) Mid-term Coordination Meeting RAF5054

Technical Officer: Tony Schlink/Nicholas Odongo

The regional mid-term coordination meeting of the Technical Cooperation Project RAF5054 lmprovement of Livestock Productivity through an Integrated Application of Technologies (AFRA III-4) will take place from 6 to 10 October 2008 in Ghana.

Pan African Conference 'A centenary celebration of the founding of Onderstepoort, focusing on the impact of animal diseases on food security and the economic development of Africa'

Technical Officer: Gerrit Viljoen

APHS is cooperating in the conference, which will be held from 7 to 9 October 2008 in Pretoria, SAF.

3rd Consultants Meeting on Early Warning Devices and Tools to diagnose known and unknown emerging diseases

Technical Officer: Gerrit Viljoen

The meeting will be held from 13 to 16 October 2008 at the VIC, Vienna, Austria.

At the end of 2003, the Highly Pathogenic Avian Influenza type A, subtype H5N1, virus (HPAI/H5N1) re-emerged in Asia, provoking an avian influenza epidemic. From Asia, it spread rapidly to Europe, the Middle-East and Africa. The rapid spread of this virus was due to the uncontrolled poultry trade and infected migratory wild birds carrying the virus long distances. Because HPAI is a major zoonosis with a mortality of more than 60% in man, a possible global pandemic influenza constitutes a grave threat with severe implications for human and animal health; serious socioeconomic impacts and the complicated political repercussions. The consequences of Avian Influenza Type A epidemics are already known namely, the Spanish Flu pandemic of 1918, where more than 40 million people died and the more recent epidemics of 1957 and 1968 where 2 and 1 million people died, respectively. It is also important to appreciate that mortality in these pandemics was less than 5 percent compared with a mortality ten times greater with H5N1. Hence, in responding to the demands for help in the areas of detection; and control and surveillance; scientific and technological expertise will be seriously challenged. This is not the only threat to animals and humans as can be seen from the Rift Valley fever outbreak in Kenya in 2005/6, where more than 150 people died and in Sudan 20067/8, where about 200 people died. As 75% of new human diseases in the last 25 years were of animal origin, i.e., classified as zoonotic, a 'one medicine' approach to address the pressing needs of the world should now be taken further and realized.

The Joint FAO/IAEA Division can be seen as the technical laboratory arm of the FAO. To this effect, the Animal Production and Health Subprogramme supports the Member States of the FAO and the IAEA through the transfer of technologies; training and laboratory infrastructure and quality assurance management guidance. Fundamental questions are addressed such as which test equipment and consumables should be used and under what circumstances; what can be expected from this test; how are results interpreted and reported? The development, evaluation and validation of 'fitness for purpose' diagnostic tools to support the rapid and early detection of emerging diseases; for example; foot and mouth disease, avian influenza, Rift Valley fever is essential and continuous. The developed tools have to be transferred directly to Member States (both IAEA and FAO) to assist with their national disease control programmes and their Millennium Development Goals. This development should be coordinated by international organizations (IAEA, FAO, WHO and OIE) with participation from the private sector and scientific community.

Which technologies are we talking about?

The detection and characterization of specific nucleic acids and proteins of medico- veterinary pathogens have proven invaluable for diagnostic purposes. Apart from hybridization and sequencing techniques, ELISA and PCR and numerous other methods have contributed significantly to this process. The integration of amplification and signal detection systems including on-line real-time devices, has increased speed and sensitivity and greatly facilitated the quantification of target proteins and nucleic acids. Rugged portable real-time instruments for field use and robotic devices for processing samples are already available commercially.

Nucleic acid based-technologies are making considerable contributions to the field of diagnostics. PCR-based assays are being utilized routinely by many laboratories and developments are refining as well as expanding their capabilities. The use of real-time PCR and automated sample processing devices has already made significant contributions in reducing contamination, whilst improving test consistency, rapidity, sensitivity and throughput. Improving the sensitivity of detection would also obviate the need to perform amplification reactions and any requirement to have suitable primers to amplify the target sequence. Several alternative target, probe and signal amplification systems have been described (LCR, SDA, RCA, bDNA, invasive cleavase). In addition, technologies to enhance separation and detection of nucleic acids have been developed (capillary electrophoresis, mass spectrometry). Labelling and detection methods other than radioactivity are also making important contributions (enzymatic, fluorescence, chemiluminescence, and nanoparticle label-

ling). Nevertheless, conventional microbiological assays should be maintained to validate and guide further developments with the newer diagnostic approaches. Commercial kits for the molecular detection of the most important pathogens are increasingly becoming available. There is also a need to standardize nucleic acid assays through ring tests and the establishment of suitable guidelines and quality control programmes. The availability of lyophilized standards will assist in this process. The need for suitably trained staff to perform and evaluate nucleic acid- and protein-based assays, as well as the costs associated with many modern technological platforms, is an important consideration and can be a large obstacle for their wider dissemination and application. There is a need now for centralized facilities to perform such tests, but in the medium term, developments in integrated systems are likely to allow point-of-care testing. Rapid progress in biosensors development is producing more effective biological recognition molecules, as well as transducers. Many of these have the potential of generating signals following the detection of single molecules. Microarray technologies have the potential of parallel testing large numbers of pathogens simultaneously, and this can have significant contributions to the diagnostic capabilities of laboratories. Developments on the integration of sample processing; amplification and analysis and the eventual production of effective commercial testing devices would herald an important achievement in allowing for point-of-care testing. Advances in nanotechnology have potentially important contributions to make in this process, with the likelihood that test results could be obtained within minutes. Suitable wireless communication systems with centralized data banks and access to decision making tools, will allow for speedy management of therapeutic and prophylactic decision making, a desirable achievement in any effective diagnostics programme.

The IAEA, in collaboration with the FAO, OIE and WHO are aware of the dynamic changes in technologies and equipment and therefore organized this technical consultants meeting regarding 'Early warning devices and tools to diagnose known and unknown emerging diseases'.

The topics for discussion will include:

Early Warning Devices and Systems - the technology; Amplification systems ('back-pack' lightcycler, self sustainable devices, on-line real-time PCR devices, hand held devises, 'lab on a chip', 'on-the-spot diagnosis'); On-site types (dipsticks, non amplification systems); biosensors, remote sensing (e.g. infra red detection); nano-equipment; communications technologies (GPRS/mobile phone-IR-laptop-satellite-information centre etc, bioinformatics, electronics etc), administrative, logistical set-ups,(networks, partnerships etc) and other items.

The big question for discussion is: 'Where is the technology now, how can we use it maximally and what does the future promise?'

If you are interested in attending this consultants meeting please contact Mr. Viljoen.

CM on Training and capacity building for research workers in animal production and health in developing countries

Technical Officer: John Crowther

The meeting will be held from 13 to 17 October 2008 at the VIC, Vienna, Austria.

The development of a web-based teaching package dealing with 'research' under researcher-training.org was started over 2 years ago and unfortunately, although a good deal of material was put into the package, was not followed up to completion. The package is now being taken up to develop the theme. It is hoped that the teaching package will be available from 2009 onwards. The importance of making good research is still paramount and the package will allow distance learning in groups as well as for the individual to be made.

Regional training course on the molecular diagnosis, epidemiology and control of animal Fascioliasis in the Latin American Region (RLA5049)

Technical Officers: Gerrit Viljoen/Kathrin Schaten

The regional training course will be held from 10 to 14 November 2008 in Havana, Cuba.

The objective of the training course is to harmonize and implement the best approaches and tools for molecular epidemiology, diagnosis, control and prevention of Fascioliasis, including theoretical and practical training and to determine the epidemiological spread of the disease, by classical and new generation techniques, and to identify areas at risk.

Early and rapid diagnosis of emerging diseases (focus on Avian Influenza) 2006-2012 D3.20.25

Technical Officer: John Crowther

The second RCM will be held in the Institute of Animal Science and Veterinary Medicine, Chinese Academy of Agricultural Sciences Beijing, China; from 24 to 28 November 2008.

The RCM will review the work made in the counterpart laboratories since the last RCM and make work plans utilizing modern developments in rapid diagnosis involving variations of rt-PCR, as well as instant reporting possibilities, to allow systems of instant testing and reporting.

The CRP is seen as an excellent body for validating such systems to allow field side testing and reporting advantages to allow better control of livestock diseases.

It is envisaged that at the time of the meeting a commercial detection technology will be validated sufficiently in the laboratory to allow its dissemination into

the laboratories of the research contract holders to allow field validation.

International Symposium on Sustainable Improvement of Animal Production and Health

Technical Officers: Gerrit Viljoen/Kathrin Schaten
The International Symposium will be held from 8 to 11 June 2009 in Vienna, Austria

1. BACKGROUND

The on-going 'Livestock Revolution', a demand-driven increase in livestock production, especially in developing countries, presents both opportunities and risks. The shift in the human diet from plant-based protein sources to animal-based protein sources, consumer demand for safe and quality animal products, and expanding markets for livestock products have raised several challenges such as; cost-effective production of safe and quality animal products, control of emerging and zoonotic diseases, and efficient management of impact of livestock on the environment. However, these changes have also provided many opportunities to benefit the local economy and producers, and reduce poverty. New challenges and opportunities demand innovative ideas and approaches, and mechanisms to take this knowledge to potential users. Many of the approaches will be multidisciplinary in nature and require collaboration with specialists in areas other than animal scientists.

Livestock production in developing countries is constrained by low genetic potential of animals, poor nutrition, poor husbandry and infectious diseases. Nuclear techniques, when applied in conjunction with conventional methods, can identify critical points in these areas that can be targeted for cost-effective improvements and interventions. Thus the challenge is to use such technologies to enhance food security and alleviate poverty by supporting sustainable livestock production systems in developing countries through strategic and applied research, technology transfer and capacity building.

2. MAIN TOPICS

- Interactions among nutrition, reproduction and genotype
- Livestock-environment interaction / productivity/ climate (water/ land/ plants/ heat/ altitude)
- Detection and control of transboundary animal diseases, including zoonoses
- Animal product safety and food quality

3. TARGET AUDIENCE

- Scientists from developing and developed countries
- Policy makers — Governmental and International Organizations
- Donor agencies — International/National Organizations, International/National Foundations and Trusts

4. EXHIBITS

Limited space will be available for commercial vendors' displays/exhibits during the symposium. Interested parties should contact Ms. Kathrin Schaten, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture IAEA, at email: K.M.Schaten@iaea.org

5. CONTRIBUTED PAPERS AND POSTERS

Concise papers on issues falling within the topics outlined in Section 2 above may be submitted as contributions to the symposium.

(a) Submission of synopses

Persons who wish to present a paper or poster at the symposium must submit an extended synopsis (in English) of 800 words maximum (i.e. two A4 format pages of single spaced typing or the equivalent, including any tables or diagrams and a few pertinent references) on one of the topics listed under Section 2. The extended synopsis should be submitted together with the completed Form for Submission of a Paper/Poster (Form B), and the Participation Form (Form A) to the competent national authority for official transmission to the IAEA in time for them to be received by the IAEA by 15 November 2008. In addition, the synopsis must be sent electronically to the IAEA scientific secretariat, email: APHS-Symposium2009@iaea.org

Authors are urged to make use of the Synopsis Template in Word on the symposium web page (see Section 15). The synopsis should give enough information on the contents of the proposed paper to enable the selection committee to evaluate it. Introductory and general matters should not be included. The synopsis — if accepted — will be reproduced in unedited form in the Book of Extended Synopses; the original must therefore be submitted as a camera-ready copy in a form in which the author will wish to have the work presented.

(b) Acceptance of Papers for Oral Presentation and Poster Presentation

Given the number of papers anticipated and the need to provide ample time for discussion, the number of papers that can be accepted for oral presentation is limited. Authors who would prefer to present their papers in a poster session are requested to indicate this preference on Form A with which they send the extended synopsis.

Authors will be informed whether their papers/posters have been accepted for presentation on the basis of the extended synopsis. Guidelines for the preparation of the papers and the deadlines for their submission will be provided at that time.

The IAEA reserves the right to decline to present or publish any paper that does not meet expectations based on the information in the extended synopsis.

Further details about the preparation of papers and oral presentation at the symposium will be sent to the authors of the papers accepted together with notification of acceptance.

6. EXPENDITURES

No registration fee is charged to participants.
As a general rule, the IAEA does not pay the cost of attendance, i.e. travel and living expenses, of participants. However, limited funds are available to help meet the cost of attendance of selected specialists mainly from developing countries with low economic resources. The grants awarded will be in the form of lump sums usually covering only part of the cost of attendance. Generally, not more than one grant will be awarded to any one country.
If governments wish to apply for a grant on behalf of one of their specialists, they should address specific requests to the IAEA to this effect. Governments should ensure that applications for grants are submitted by 1 November 2008 and are accompanied by a duly completed and signed Grant Application Form (as attached). Applications that do not comply with these conditions cannot be considered.

7. SYMPOSIUM PROCEEDINGS

The proceedings of the meeting will be published by the IAEA as soon as possible after the symposium.

8. DISTRIBUTION OF DOCUMENTS

A preliminary programme of the symposium will be sent to participants in advance. The final programme and the book of extended synopses will be distributed at registration.

9. WORKING LANGUAGE

The working language of the symposium will be English**.**

10. PARTICIPATION

All persons wishing to participate in the symposium are requested to register in advance online. In addition they must send a completed Participation Form (Form A) and if relevant, the Form for the Submission of a Paper (Form B) and the Grant Application Form (Form C) through the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee (FAO Country Representative, the relevant Regional or sub-Regional FAO Office), or the National Atomic Energy Authority) to the IAEA. A participant will be accepted only if the Participation Form is transmitted through the government of a Member State of the Sponsoring Organizations or by an organization invited to participate.
Participants whose official submissions have been received by the IAEA will receive further information on the symposium approximately three months before the meeting. This information will also be posted on the symposium web page.

11. ACCOMMODATION

Detailed information on accommodation and other symposium related information will be sent to all designated participants well in advance of the symposium. This information will also be available on the symposium website.

12. VISA

Designated participants who require a visa to enter Austria (Schengen State) should submit the necessary applications to the nearest diplomatic or consular representative of Austria or any other consular authority of a Schengen partner State representing Austria as early as possible (please note that it could take up to three weeks to obtain a visa).

13. CHANNELS OF COMMUNICATION

The Participation Form and as applicable, the Form for Submission of a Paper/Poster, and the Grant Application Form, should be sent to the competent national authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee, or national atomic energy authority) for official transmission to the IAEA.
Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on administrative matters to the IAEA Conference Services Section.

14. SYMPOSIUM SECRETARIAT

The address of the Secretariat is:
International Atomic Energy Agency
IAEA-CN-174
Vienna International Centre
P.O. Box 100
Wagramer Strasse 5
1400 Vienna, Austria
Telephone No.: +43 1 2600 (0) plus extension
Telefax No.: +43 1 26007
Email: APHS-Symposium2009@iaea.org

The Scientific Secretary of the symposium is Mr Gerrit Viljoen, Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (telephone extension 26053, email: G.J.Viljoen@iaea.org). Symposium organizer is Ms I.Orlova, Conference Services Section, Division of Conference and Document Services (telephone extension 21314, email: I.Orlova@iaea.org).

15. SYMPOSIUM WEB PAGE

Please visit the IAEA symposium web page regularly for new information regarding this symposium:
http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=35424

Past Events

Consultants Meeting on Foot and Mouth Disease (FMD) Research Being Undertaken

Technical Officer: John Crowther

The consultants meeting on FMD research currently undertaken was held in Vienna Austria from 4 to 7 December 2007.

The meeting was attended by experts invited from the FAO/IAEA Joint Division and the EU FMD and CSF Coordination Action group, as well as a wide range of observers from international organizations; government institutions and industry. The meeting illustrated the very large spectrum of research made and the groups involved. Most of the research agendas described were very similar. The distinction between the needs of developed and less developed countries was reiterated and it was concluded that there is still a gap in funding more fundamental research into the problems of endemic areas. The distinction between pure and applied research was discussed and it was agreed that this is not always too clear.

A running theme was the need to develop new methods and vaccines as against using the available strategies of well controlled conventional vaccines. It was concluded that there have been no real breakthroughs in vaccines. The Indian expert illustrated the current norm by outlining a 5–15 year plan where conventional vaccines and diagnostics would be used to control and zonally eliminate FMD in India in an available, conventional operation.

The meeting discussed topics involving the improvement of more conventional methods and products for FMD control as well as 'novel' approaches. A major development shown by a commercial company was the penside use of rugged novel PCR systems with instant reporting of data. The possibilities and implications of instant testing and reporting were well discussed.

The temporal considerations for research were deemed important and the need for short, medium and long term planning was emphasized with particular reference to obtaining funds for well identified tasks. There is little doubt that a good deal of research is being maintained, mainly supported by developed countries through national resources. The coordination of such research both before it is made (the great importance of project planning and coordination of intent) and after it is implemented; was a major theme.

Specific gaps areas of research were identified in the areas of vaccines; immunology; communication and harmonization. Although there are good FMD management initiatives, these may be ending soon and the FAO/IAEA Joint division was targeted to take a lead to coordinate FMD research through their Coordinated Research Projects (CRP) approach. This was discussed and agreed and will be investigated with the Research Contract administration.

In many ways this first meeting illustrated the benefit of getting as many groups together involved in FMD research to cross fertilize ideas, exchange plans and modify approaches to save duplication and value add to other research lines. The meeting also gave the opportunity of developing countries to voice their needs and aspirations.

The following areas were identified by two groups set up during the meeting:

1. Increasing the duration of immunity following vaccination, shorter term aim

New adjuvants should be assessed for existing FMD preparations.

Intra-dermal injection using new technology injection 'guns' should be examined.

Methods to induce and mucosal immunity should be examined.

Tools to improve immunity testing should be developed and standardized.

2. Matching new FMD isolates with existing vaccines, shorter term aim

An agreed standardized procedure system for vaccine matching is needed.

3. Potency testing of vaccines, shorter term aim

An international accepted in vitro test system of vaccine efficacy is needed to avoid challenge protocols.

4. Disinfection, a shorter term major problem

No proper information exists on how to disinfect large premises. Existing rules and regulations as well as do literature search and come up with a proposal.

5. Vector vaccines, medium and long term problem

Regulatory problems were recognized as to which vectors would be acceptable for the public.

Products from this area of research are not proven as yet.

6. Fundamental immunology needs attention to understand host rather than virus, long term problem

Examine tropism and transmission in experimental and multiple field situations.

Better understand the genetics and phenotype mechanisms of virus adaptation in a combination of hosts.

Examine virus-host(s) interactions at the cellular level, including persistence and immune evasion.

Progress vaccine development in an informed way with distinct fitness for purpose guidelines clear at the start of any development.

7. Communication

The mechanisms of rapid updating on current research area results should be improved.

Data generation and risk analysis in aid of preparedness and rapid response should be highlighted and is fundamental.

8. Harmonization

Should be encouraged and applied tools better described and examined.

9. Antivirals

Research into chemical and biological antivirals should be highlighted as adjuncts to vaccination.

10. Multi-targeted screening

Progress here is good and should be encouraged for diagnosis, differentiation of agent and antibodies against agent.

11. Whole genome sequencing should be encouraged

Major overall recommendations

The meeting agreed that there is a fragmented research pattern in the world and that there is an intrinsic need to organize coordination meetings between groups, often comprising of the same limited panel of research workers.

The meeting fully endorsed the vital need for regular coordination meetings between the relevant parties and recommended that the FAO/IAEA Joint Division should organize, as soon as possible, a CRP to continue the coordination of FMD research for the progressive control of FMD as was done in the EU FMD/CSF coordinating action (which will functionally end at the end of 2007).

Regional Training Course on Integrated Control of Fascioliasis in Latin America (RLA5049)

Technical Officer: Gerrit Viljoen

The regional training course on Integrated Control of Fascioliasis in Latin America was held in Lima, Peru from 10 to 14 December 2007.

The objective was to discuss the regional needs, specific national needs and common problems to address in the area for sustainable control of veterinary fascioliasis; to establish the best approaches and tools for the diagnosis, control and prevention of Fascioliasis, including theoretical and practical training in the diagnostic serological and molecular diagnostic tools and procedures and to determine the epidemiological spread of the disease, by classical and new generation techniques, and to identify areas at risk.

Two experts from Spain lectured and six participants from Argentina, Bolivia, Cuba, Mexico, Panama and Uruguay plus 8 local participants attended this regional training course.

Consultants Meeting to define Joint Activities between the Animal Production and Health Section in Vienna and the Animal Production and Health Division in Rome.

Technical Officer: Paul Boettcher

As follow-up to the 'Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (NAFA or AGE) Week' in Rome (1–5 Oct 07) to increase joint collaboration and activities and FAO (AGAP Service) and IAEA (APH Subprogramme) interaction, a Consultants Meeting was scheduled and held from 15 to 18 January 2008 at the VIC, Vienna, to determine the joint FAO and IAEA plan of action in Animal Nutrition and Reproduction and Breeding.

Three areas of joint interest between APH and AGAP had been identified during AGE Week: 1) Reproduction and breeding of local animal genetic resources (AnGR), 2) Animal product traceability, and 3) Feed (and Food) safety. Two or three consultants were invited for each respective topic: 1) Mr. Graeme Martin, Australia and Mr. Johann Soelkner and Ms. Maria Wurzinger, Austria; 2) Mr. Didier Montet, France and Ms. Federica Camin, Italy; and 3) Mr. Gerhard Flachowsky, Germany and Ms. Eva Binder (Austria). Technical officers from APH and FAO also attended the meeting.

The first day of the meeting consisted of presentations by each of the invited consultants. Presentations were done in pairs, according to topic, followed by discussion of each topic. The second day of the meeting began with presentations outlining the goals, policies and activities of the AGA and AGE with respect to livestock production. These presentations were followed by a general discussion of major issues of importance in livestock production in developing countries and opportunities for AGA and AGE to work together to meet the demands of IAEA and FAO Member States (MS).

The meeting then broke into two parallel sessions. The general themes of each session were Joint AGA/AGE activities in animal reproduction and breeding and Joint AGA/AGE Activities in Animal Nutrition, Food Safety and Health. One of the main goals of the discussion was to propose possible topics for future Coordinated Research Projects (CRP) that would address the common interests of IAEA, FAO and their MS. The parallel sessions continued until the end of the third day, where upon the two groups reconvened to present an informal overview of each of their discussions.

The final day of the meeting consisted of more formal presentation of conclusions from each of the two groups. Mr. David Byron, Head of the Food and Environmental Section of NAFA and Mr. Andrew Cannavan, Head of the Agro-Chemicals Unit of NAAL were invited to attend the presentation, due to their shared interest in feed and food safety. The meeting was closed with a thank you address by Mr. Gerrit Viljoen, the head of APHS.

Conclusions

Animal identification and recording was noted as a topic of critical importance for livestock production in developing countries. Accurate identification is essential for efficient breeding programmes, traceability of

animal products, and monitoring and control of animal disease.

Analysis of stable isotopes has a number of potential applications in the fields of animal reproduction, nutrition and health, including traceability of animal products to their geographic region of origin. In the immediate term, work may be limited to research activities, however, as the cost of the technology is likely to be prohibitive for many developing MS.

Characterization of local populations of Animal Genetic Resources (AnGR), involving phenotypic information and genotypic markers, is an area where collaboration between AGA-and AGE is most valuable.

Because of the increasing demand for animal products around the world, limited grazing grounds, and competition with human food consumption and non-food uses of crops, agro-industrial by-products will play an increasing role in animal production. This may increase the risk of introduction of undesirable substances into the food chain.

Recommendations

The respective National Coordinator for FAO on AnGR should be informed when a CRP or TC project involving characterization of local AnGR is approved and should be kept informed of progress of the project.

The panel of microsatellite markers approved by the FAO and International Society of Animal Genetics (ISAG) are to be used in all characterization studies to ensure standardization and exchange of information among MS.

The AGE should be involved in further development of panels of molecular markers for genetic characterization of AnGR.

The AGE and AGA should strive to identify more uses of the Animal Production Unit's laboratory and participate in international technical networks to increase complementarity with FAO, which has no laboratories of its own.

A representative of the AnGR unit of AGE should participate in the upcoming Regional Training Course on the 'Follow-up of Cattle and Small Ruminants Bred via Artificial Insemination' to be held 2-6 June 2008 in Algeria. The purpose would be to inform participants about the benefits of animal identification and recording.

Titles and objectives of new reproduction and breeding TC projects to be re-stated in as necessary considering the achievability (measurable or demonstrable outcomes) and the specific needs of the MS.

Two new TC projects on animal production should be identified as pilots for full involvement of AGA-AGE collaboration and AGA should contribute to the project development. A representative from AGA should choose the two projects for the pilot study, based on AGA's current activities within the particular MS.

The environmental impacts (both positive and negative) of feeding agro-industrial by-products to livestock should be more precisely quantified for influencing factors on decision making with regard to their use.

Resistance to antibiotics due to their indiscriminate use and mycotoxins from naturally occurring fungi were identified as the most important health and safety risks associated with animal feeds.

The AGE should consider presenting a regional workshop or training course on transforming the local animal production industry for export to high-price markets, including aspects of policy, livestock management, environmental impact, and animal ethics and welfare. Possible targets of such a workshop may be Eastern Europe and Latin America.

The following topics should be considered as the basis for future CRP projects involving collaboration between AGE and AGA.

Long-term characterization of local and cross-bred dairy cattle — Objective: Comparison of life-time profitability of local and exotic genotypes within several geographical and economic environments — Nuclear component: 1) RIA and ELISA for determining concentrations of metabolites and hormones, 2) molecular analyses to evaluate genetic differences among animals, 3) Isotope labelling of metabolites to evaluate energy balance.

Overcoming socio-economic limitations to acceptance of identification and recording — Objective: To target female livestock keepers for the implementation of ID and record-keeping and better herd management and, subsequently, livelihoods. — Nuclear component: 1) RIA and ELISA for determining concentrations of metabolites and hormones, 2) molecular analyses to evaluate genetic differences among animals.

Evaluation of antibiotic resistance in microbes related to animal production — Objective: To develop and adapt systems for the identification of antibiotic compounds in feeds and products and for rapid screening of resistant strains of bacteria. — Nuclear component: 1) molecular analyses to identify resistant bacterial strains.

C*ontrol of mycotoxins in agro-industrial by products used in animal production* — Objectives: To quantify Aflatoxins and Zearalenone in feeds of agro-industrial by-products and to establish and evaluate easy extraction methods for these toxins. To develop and evaluate and apply field tests for the analysis of masked mycotoxins. — Nuclear component: 1) ELISA for the detection and evaluation of mycotoxins.

Control of contaminants in the bio-fuel by products used in animal production — Objective: To apply and evaluate analytical, chromatographic and ELISA based techniques for the quantification of (masked) mycotoxins, antibiotics and phyto-hormones in feeds of biofuel by-products and evaluate the effect of these substances on animal productivity. — Nuclear component: 1) ELISA for the detection and quantification of mycotoxins. 2) Nuclear based labelling of plant compounds for detection of toxins.

Analytical tools for tracing origin of feeds and animal products — Objective: Establish and compare technology, methods, and protocol for tracing by isotopes, genes or bio-molecules. — Nuclear component: 1)

Stable isotope analysis for determination of geographic origin 2) molecular labelling for determination of genetic and/or species origin.
Participants at the meeting were, Beshes, Badi; Food and Agriculture Organization (FAO); Division of Animal Production and Health (AGAH); Battaglia, Daniela; Food and Agriculture Organization (FAO) Division of Animal Production and Health (AGAH) Service of Animal Production, Binder, Eva; ERBER AG, Bruno, Annamaria; FAO, Secretariat, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme; Camin, Federica; Centro Sperimentale — Dipartimento Qualita, Agro Alimentare, Unita Enologia e Tracciabilita, Italy; Flachowksy, Gerhard; Institute of Animal Nutrition, Friedrich-Loeffler-Institute (FLI) Federal Agricultural Research Center (FAL) Germany; Martin, Graeme; School of Animal Biology, The University of Western Australia; Faculty of Natural &Agricultural Sciences, Australia; Montet, Didier; CIRAD, France; Soelkner, Johann; Universität für Bodenkultur (BOKU); Institut für Nutztierwissenschaften (NUWI); Department of Livestock Sciences, Austria and Wurzinger, Maria; Universität für Bodenkultur (BOKU); Institut für Nutztierwissenschaften (NUWI); Department of Livestock Sciences, Austria.

Research Coordination Meeting (RCM) on diagnosis and surveillance of Peste des Petits Ruminants (PPR)

Technical Officer: Hermann Unger
The first RCM on diagnosis and surveillance of PPR will be held in Vienna, Austria from 31 March to 4 April 2008.
This Coordinated Research Project (CRP) contributes to the Agency's project entitled 'Technologies for reducing risk from transboundary livestock diseases and those for veterinary public health' (E202). It focuses on the early and sensitive diagnosis and control of Peste des Petits Ruminants (PPR). This is a highly contagious, transboundary animal disease of wild and domestic small ruminants, caused by a morbillivirus similar to rinderpest virus and is on the list of economically important animal diseases to be reported to the World Organization for Animal Health (OIE: Office International des Epizooties- Paris). PPR is a transboundary animal disease which spreads though close contact and fostered by the movements of nomadic herdsmen and the livestock trade. Morbidity and mortality rates can be up to 90% which not only severely affects rural economies, but also reduces the genetic resources and endangers breeding policies. Clinically, PPR is characterized by high fever, depression and anorexia, followed by ocular and nasal discharge, pneumonia and severe diarrhoea. These symptoms can easily be misdiagnosed for pasteurellosis or rinderpest and diagnostic tests for RP were giving positive results due to the cross reactions.
The disease is endemic in parts of Africa, the Near and Middle East and South Asia and the incidence is gradually expanding and the Animal Production and Health Subprogramme (APHS) receives regular requests from Member States for support. In addition, PPR is one of the targets of the United Nation Food and Agriculture Organisation's (FAO) Emergency Preventive System (EMPRES) programme.
It is not easy to isolate and cultivate PPRV in cell culture and up to 2 to 4 weeks are needed for a positive result to be confirmed. In the late 1980's, specific reagents (monoclonal antibodies) and nuclear acid techniques (DNA probe hybridization and polymerase chain reaction, PCR) became available to facilitate more precise diagnosis. Currently, different ELISAs and PCR procedures are in use, however, these techniques are evolving quickly and need constant adaptation. A consultancy meeting organized in 2007 by the APH on 'The Early and rapid diagnosis of emerging and re-emerging transboundary animal diseases' concluded that 'amplification systems, in the form of real-time PCR (rt-PCR) as well as isothermal amplification (IA) approaches, have moved from research environments to routine diagnostic applications'. The APH Subprogramme was encouraged to foster the transfer of these new technologies to IAEA and FAO Member States. Their application of early and sensitive PPR diagnostic tools, in combination of protective and DIVA (differentiation between infected and vaccinated) vaccines to PPR would improve our management and control of the disease.
The RCM was opened by G. Viljoen and H. Unger (TO) from the APHS. The meeting was attended by eleven Research Contract Holders (RCHs), two Research Agreement Holders (RAHs), one consultant, one junior professional officer (JPO) and several observers from the Seibersdorf staff. The meeting commenced with two presentations by the TO on the activities of the Animal Production and Health Section and the objectives of the CRP and the RCM. It was followed by presentations from the RCHs on the work to be conducted in the CRP. Each presentation was thoroughly discussed, background raw data and calculations examined, future activities harmonized and focused in context with the objectives of the CRP. The RAHs and the consultants set the scene for the future work with their state-of-the-art presentations. The TO, RAHs and the JPO then assisted the individual RCHs in the development of their work plans. The TO and RAHs moderated and facilitated the discussion. All the presentations and work plans are available at the APHS. Each RCH and RAH was provided with the Animal Production and Health Section's Molecular Diagnostic PCR Handbook and a CD containing all presentations held. The main conclusions and technical recommendations from the meeting are as follows.
On Thursday 3rd of April, the group visited the Seibersdorf Laboratories. A RT-PCR for PPR, developed by APU, and a newly developed isothermal PCR by the

Veterinary University of Vienna were presented and the results discussed.
PPR is present and identified by all participants in their region of responsibility.
Serological tests will predominantly be used to determine the distribution and prevalence of PPR and vaccine trials through the detection of specific antibodies. This data will be used to establish/broaden the epidemiological knowledge of the disease in participating countries.
Evaluation will be made of the currently available vaccine and testing of the immunological response regarding the different strains in the participating countries.
Development and evaluation of a thermo-stable vaccine against PPR will continue.
The RAH, Dr Libeau, will evaluate three RT-PCR and one LAMP-PCR for analytical sensitivity and specificity by June 2008 and advise on the best setup to be used in the countries of the contract holders.
Individual work plans were made that defined the diagnostic methods to be used e.g. ELISA for serology and different molecular methods e.g. RT-PCR and LAMP-PCR.
The kits for all molecular methods will be assembled at the APU in Seibersdorf after evaluation in EMVT, Montpellier.
The RAH, Dr Merza, is developing a pen site test for the quick field diagnosis of PPR, and this will be transferred to the contract holders for evaluation. Reference sera are needed.
The RCHs will collect and send samples from infected sheep and goats to the EMVT and to Seibersdorf for genetic typing and as reference resources. This will also be done for positive camel sera.
Evaluation of a filter paper method for collection of samples will be compared against the RNA extraction method currently used in the laboratory for the diagnosis of PPR.
A computer platform to enhance communication and disseminate information should be established to include lists of new and available reagents to counterparts. Individual counterpart's intellectual property (IP) rights will be respected.

Recommendations:

- The activities of the PPR CRP should support national diagnostic, monitoring and control programmes and increase the national capability.
- FAO, OIE and other relevant organizations should be kept informed on the progress of the CRP.
- Enhanced networking between different laboratories is encouraged. This should include communication, exchange of data and other information, training and the transfer of technology.
- For PPR surveillance, the primary target should be goats, sheep and camels.
- The ELISA kits for antibody detection should be evaluated for their fitness for purpose.
- Molecular diagnostics should be introduced and used to facilitate early detection to contribute to a more timely containment and preventative response.
- Development of a more efficient and thermostable vaccine should be supported.
- A CRP open source databank and communication platform should be established and available.
- A serum and nucleic acid reference bank should be established at Seibersdorf.
- The publication of results emanating from this collaboration should be encouraged.

Research Coordination Meeting (RCM) on Control of Contagious Bovine Pleuropneumonia (CBPP)

Technical Officer: Hermann Unger

The second RCM on control of CBPP was held from 21 to 25 April 2008 in Bamako, Mali.
CBPP is again endemic in ~28 African countries after it was very much reduced during the Pan African Rinderpest Campaign through a combine vaccine of RP and CBPP.
Since the end of PARC CBPP began spreading again and due to local conflicts and cattle movements control exercises were met with little effect. This is most likely due to the inefficient protection conferred by the vaccine, the problem to identify vaccinated animals and the partly poor diagnostic sensitivity of the prescribed tests.
The CRP aims to improve the diagnostic capacities by validating the available methods, exploring new diagnostic pathways for instance for latent carriers; investigating the use of molecular markers to depict the epidemiology and the use of gene based diagnostics to allow a rapid diagnosis.
The RCM was opened by Dr. M. Niang, Head of the Diagnostic Department, Central Veterinary Laboratory of Mali (CVL), followed by Dr. M. Coulibaly, Director of the National Animal Production Industry. The TO gave a presentation on general developments in the control of CBPP. This was followed buy the presentation of Mr. J. Jores, ILRI/Kenya. Mr. F. Thiaucourt from the World Reference Centre on CBPP presented the results from a ring trial for CBFPP in 5 countries. Mr. J. Frey from Vetsuisse, Bern, presented his research results on the mode of action of the pathogenicity factor Glyceroltranferase, leading to necrosis and Mr. J. Busse from the University of Veterinary Medicine in Vienna (VUW) on molecular epidemiology of CBPP.
Counterparts presented the work carried out, results achieved and their new work plans. Individual discussions with the contract holders on the new work plans and their needs and inputs were held.
Technical problems were discussed and solutions presented for the linking of ELISA readers to computers (H. Unger) and the calibration of pipettes using a new dye (F. Thiaucourt) as well as software solutions

for data transfer. The principal of LAMP PCR was presented (H. Unger) and its application was discussed. As EMVT is working on a new real-time PCR based on sybr green, it was decided to test these two techniques in parallel to identify their sensitivity and specificity.
Friday morning was used to sum up the meeting and to agree on the conclusions and recommendations.

Scientific results

All counterparts presented their serological data acquired from 3 serological tests, the CFT, c-ELISA and LPPQ ELISA. The comparison of the test to post mortem results in ~800 animals in Zambia presents a unique database for the validation of the tests. The results should be published soon in an international research journal.
Serological results from an infection study in Kenya presented preliminary data on the performance of the 2 ELISA's. Further evaluation should give solid information on the precocity of the test.
Studies on the serological immune response to vaccination yielded conflicting results. The LPPQ assay gave in a vaccination trial with T1/44 in 9 cattle 1 responder from week 2 to 3 and one responder from week 4-9 and one dubious result in a 3rd animal. The c-ELISA had positive results for 3 animals from week 3 post vaccination for 4-6 weeks and intermittent positive results for up to 6 months for further 5 individuals, specifically after a boost in week 8 of the experiment.
Some counterparts have to provide further data and continue serological testing in order to get a final picture on the suitability of the serological tests. However, already the data produced during the CRP clearly show that the CFT is the test of choice for early infections by Mycoplasma mycoides mycoides small colony (mmsc) on herd level in areas which are free of disease. The other 2 tests are more suitable for the serological surveillance in cattle in endemic areas and prevalence studies.
Immunological studies applying Mycoplasmal antigen to lymphocytes gave a clear indication of the involvement of the cellular immunity in CBPP pathology. This lead to further studies on CBPP specific antigens and the immune cells involved.
For the rapid diagnosis of CBPP molecular techniques give the advantage of relative speed. From the practical point of view, classical PCR has a number of draw backs, therefore, quantitative techniques not requiring gel analysis should be employed. Real-time PCR's being published and work on a LAMP PCR is ongoing.
Data from molecular epidemiology applying RAPD and DGGE were presented by J. Busse (VUW). DGGE did not show any differences between strains while RAPD displayed few differences. VNTR allows a differentiation of strains confirming the McAullife publication, but discrepant results were found with some strains. These could be linked to strain identification or for particular strain history concerning the passage numbers on culture media.
A study in Cameroon identified 3 distinct genetic variations in 3 regions of Cameroon by MLSA.
New results on the research of virulence attributes of Mycoplasma mmsc were presented by J. Frey, Switzerland. Although the CBPP causing Mycoplasma is known as a severe pathogen, there is still very little knowledge on the patho-mechanism. In vitro investigations revealed a specific virulence mechanism novel in bacterial metabolism. After cell attachment of the Mycoplasma effectuates 2 components, a highly efficient Glycerol uptake mechanism converting it to glycerol 3-phosphate and a corresponding oxidase (GlpO) metabolizing the latter to 2-hydroxy acetophosphate with gain of ATP and the waste product hydrogen peroxide. This is directly transferred to the host cell leading to rapid necrosis as shown with embryonic calf nasal epithelial cells. While enzymes involved in this cyto-toxic event are common bacterial metabolic factors, the trans-membranal location of GlpO in this mycoplasma is exceptional including the H2O2 disposal. For this close contact special surface factors called adhesins are necessary. These still have to be identified, as they are expected to contribute to the host specificity of Mycoplasma mmsc as a bovine pathogen
As pipetting has a major influence on the performance of ELISA tests, the calibration of pipettes is vital. A calibration procedure by colour measurement in an ELISA reader and an Excel based software for the evaluation was presented by Mr. F. Thiaucourt, France.

Conclusions

Serology:
The CFT is a good diagnostic tool for CBPP outbreak diagnosis due to its early detection.
The c-ELISA is a good serological tool for prevalence studies as it detects as well a large number of chronic carriers.
The LPPQ based ELISA showed similar characteristics as the c-ELISA but being less sensitive in chronic carriers. Due to its ease of performance this test should be further developed. As this test is not commercially available anymore, a new test set up is encouraged; this entails new studies.
As sufficient data has already been generated for the c-ELISA there is no need to further evaluate this test.
Data of post vaccination sera gave some positive results. This should be followed up for clarification. Data from Kenya and Namibia are conflicting. Positive sera should be analyzed by immuno-blot in order to get clear results on which antigens of Mycoplasma mmsc are reactive.
Molecular genetics tools as Real-time PCR and isothermic PCR are highly performing diagnostic methods for the rapid diagnosis of animal pathogens. For CBPP these methods are under investigation. Particularly countries free of infection or on eradication programmes should employ such technologies for the sensitive and rapid diagnosis of CBPP. The culture and isolation of Mycoplasma mmsc should nevertheless be

encouraged, specifically in endemic countries, despite its long culture time. Such strains should be carefully stored and documented for molecular and epidemiological studies and to analyze antibiotic resistance and susceptibility.
A number of potential makers were recently identified for molecular epidemiology and the results applying MLSA are published. This is a useful tool for discriminating Mycoplasma mmsc strains but depends on the availability of new and recent strains for comparison.
Immunology:
Disease symptoms and protection by live vaccine immunisation indicate the involvement of the cellular immune system to both events. Stimulating bovine lymphocytes can lead to IFN secretion indicative for T cell involvement. As no experiment so far depicted an unequivocal result, further studies are necessary. The application of newly described antigens in a skin test model and as an experimental 'vaccine' to elicit measurable immune responses would help to decipher the supportive as well as the pathologic responses.
Recommendations
Serology:
No further validation work is necessary for the c-ELISA, but the performance data should be collected
The new LPPQ ELISA must be validated, applying samples with known history or abattoir samples.
Pathogen detection:
For the early and rapid diagnosis of Mycoplasma mmsc qPCR and LAMP should be evaluated for their useful application and their respective sample preparation.
Molecular epidemiology should only be done with strains of known history and if possible recent / fresh isolates. Therefore it would be most important to amend the existing strain banks.
Immunology:
Further studies involving immune cell-based assays and skin testing applying purified antigens should be initiated.
Experimentally Mycoplasma mmsc infected cattle should be tested for IFN gamma and TNF alpha in vitro stimulation assays employing PBMCs.
The full potential of responses of immunological T-cell memory for diagnostic purposes has to be evaluated in future experiments employing specific antigens/antigen preparations.
A harmonized approach for defining pulmonary lesions of Mycoplasma mmsc should be produced together with Namibia.

Conference on Predicting Disease Patterns According to Climatic Changes

Technical Officer: Hermann Unger
The conference on predicting disease patterns according to climatic changes took place in Trieste, Italy from 12 to14 May 2008.
Detection of infectious diseases at larger and larger regions is partially due to the improvement in diagnostic systems. Their spreading is also due to changes in transportation systems, in the habitat's extension (specially for vector borne diseases) and to changes in climatic conditions. Therefore one needs to take climate into account in modelling epidemics.
This Conference gave disease specialists and epidemiologists an insight into current research in climate modelling with the aim of improving the predictive power of epidemiological models by integrating climatic data and forecasts.
The influence of climatic conditions and the predictability of epidemics was discussed also on specific case studies, such as the ongoing Coordinated Research Projects by IAEA focusing on a Rift Valley fever and Avian Influenza.
Consequence of this meeting should be a better cooperation between climatologists and epidemiologists to improve the data base and exchange practices due to better understanding respective needs and limitations.
Invited speakers were:
Giulio De Leo - University of Parma, Italy
Leopold Haimberger - University of Vienna, Austria
Jeremy Pal - Loyola Marymount University, Los Angeles, USA
Dirk U. Pfeiffer - Royal Veterinary College, UK
Franz Rubel - University of Veterinary Medicine of Vienna, Austria
Thomas Selhorst - Federal Research Centre for Animal Health, Germany
Lorenzo Tomassini - Max Planck Institute for Meteorology, Germany
Wolfgang Wagner - Vienna University of Technology, Austria.
31 Participants from Algeria, Argentina, Austria, Belgium, Egypt, Ethiopia, Germany Hungary, India, Italy, Kenya, Malawi, Nepal, Netherlands, Nigeria, Pakistan, Sri Lanka, Sweden, and Uzbekistan, participated in the meeting.

Final Project Review Meeting of the RCA Regional Technical Cooperation project RAS/5/044 on 'Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment'

Technical Officers: Oswin Perera and Anthony Schlink
The meeting took place in Jakarta**,** Indonesia**,** from 5 to 9 May 2008
The objectives of the meeting were to: (a) review results obtained in each Member State (MS) in the two components of the project (animal nutrition and reproduction/breeding); (b) assess the achievements, outputs and potential outcomes; (c) make conclusions and recommendations; (d) list the activities that should be continued using national and other resources; and (e) prepare the scientific papers of Project Counterparts (PCs) for publication in an IAEA-TECDOC.
Of the 20 Project Counterparts (PCs) from 11 RCA Member States (MSs) continuing to participate in the

project, 14 PCs and 4 nominees of PCs from 10 MSs (Bangladesh, China, India, Indonesia, Myanmar, Mongolia, Pakistan, Philippines, Sri Lanka and Thailand) attended the meeting. One PC each from China and Thailand (reproduction/breeding) and both PCs from Vietnam (nutrition) did not attend. The meeting was supported by two IAEA experts (Dr. Karen Marshall of Australia and Prof. Singh Nanda of India) and the two Technical Officers (TOs). It was hosted by the National Nuclear Energy Agency of Indonesia (BATAN) and was held at the Hotel Bumi Karsa Bidakara in Jakarta, where all participants were also accommodated.

The opening session was addressed by Mr. Fauzi Luthan, Director of Ruminant Production, Directorate General of Livestock Services (DGLS), one of the TOs (O. Perera) as IAEA representative, and the Chief Guest Dr. Hudi Hastono, Director General of the National Nuclear Energy Agency (BATAN).

The meeting was planned to be held in the form of two parallel sessions for the nutrition and reproduction/breeding components of the project. However, since five PCs did not attend, it was decided to conduct the meeting as a combined session for both components. It was organized to include presentations, discussions, group work and a field visit. The technical sessions commenced with presentations by the TOs and IAEA experts and were followed by presentations from each PC. This was followed by a general discussion to summarize the main achievements of the project, draw conclusions and draft recommendations. Finally, the activities to be continued by each MS after the conclusion of the project, and the potential sources of support from local and other resources, were discussed and recorded.

The papers submitted by PCs will be edited and published as an IAEA-TECDOC.

A field visit was made to the Embryo Transfer Centre of the DGLS at Cipelang-Bogor, an integrated dairy farm and a medium-scale milk processing plant at Cisarua-Bogor.

The closing session of the meeting was addressed by one of the TOs (A. Schlink), the local organizer (PC for Indonesia), an expert (K. Marshall) and one of the participants (PC for Pakistan).

General conclusions and recommendations arising from the meeting are summarized below:

Conclusions:

The project dealt with several aspects that are important for improving livestock production and conserving the environment in the region.

The involvement of many RCA MSs in the project facilitated greater awareness and information exchange among the stakeholders.

Flexibility in the project objectives facilitated each participant to address the priorities in their countries, which was acceptable provided they were within the broad framework of the project.

The project resulted in capacity building for applying new technologies in several MSs.

A number of planned activities were conducted but all objectives could not be achieved due to the short life span of the project, inadequate financial support from the IAEA and participating institutes, and lack of continuity in technical support.

The project was adversely affected by changes in PCs in many MSs as well as high turnover in IAEA TOs. The communication between PCs and RCA-coordinators were poor in some MSs.

It would have been beneficial to have conducted a mid-term review meeting, as agreed at the planning meeting in China.

Recommendations to IAEA

Future projects of this nature should have a longer duration and more inputs, considering the nature of livestock generation intervals and livestock-environment interactions.

The participants strongly recommend the initiation of CRPs on the following topics, which are considered to be of high priority for the region:

Studies on methane emission and manure management in further detail. This should include methods for increasing productivity per animal.

Establishment of genetic improvement systems via characterization of breeding objectives, genotypes and production systems. This should include use of isotopic techniques to determine reproductive efficiency of cows, milk intake of suckled calves and feed conversion ratios, etc.

The Agency should take note of the concerns of MSs regarding the lack of continuity of technical support due to high turnover of Technical Officers assigned to projects.

Recommendations to Member States

The PCs should clearly communicate the outcomes of this project that have practical application for improving livestock production and mitigating environmental pollution to the relevant national authorities and actively promote their adoption in national livestock development programmes.

Governments should consider implementing the recommendations arising from this project.

Adequate local support should be provided for continuation of the activities initiated under this project.

Participating institutes should ensure the continued and long-term involvement of nominated PCs.

National Training Course on Diagnosis of Brucellosis-Field, Laboratory and Epidemiological Analysis (TAD5003)

Technical Officer: John Crowther

The Training Course was scheduled to take place from 12 to 23 May 2008 in Dushanbe, Tajikistan.

Four trainees from Tajikistan were receiving training on diagnosis of brucellosis by conventional serological methods as well as molecular methods (PCR) by Dr. Ivanco Naletoski and his staff; University St 'Ciryl and Methodius' Skopje, to be able to train others and assist in the subject training course.

The objective of this training course is to educate all personnel involved in brucellosis control in sampling and identification of animals; storage and sending of samples; laboratory analysis of samples using serological and molecular techniques and epidemiological analysis. 25 trainees were trained.

Regional (AFRA) Training Course on Data Collection, Organization, Analysis and Associated Software RAF5054

Technical Officer: A. Schlink & O. Perera

This training course was held from 26 to 30 May 2008 in Gaborone, Botswana. The purpose of the course was to provide training on the design of experiments on livestock production and the collection, organization and statistical analysis of the resulting data, and the interpretation and presentation of results.

National Training Course on Diagnosis of Brucellosis SUD5031

Technical Officer: Hermann Unger

The Training Course took place from

1 to 11 June 2008 in Khartoum, Sudan.

This national training course provided basic training in the diagnosis of Brucella. A full report can be found in the next issue of the Newsletter.

Ongoing Activities

Education to Improve the Quality of Research in Developing Countries

Technical Officer: John Crowther

The site which holds the education package under development can be visited under URL: researcher-training.org.

Coordinated Research Projects

Integrated Approach for Improving Small-scale Market Oriented Dairy Systems (D3.10.23)

Technical Officer: Mario Garcia Podesta

The activities of this CRP have been completed. The final RCM was held in Edinburgh, UK, from 4 to 8 December 2006. The papers containing results from Participatory Rural Appraisals and Economic Opportunity Surveys performed in the initial phase of the CRP were published as a Special Issue of the scientific journal Tropical Animal Production and Health. Hard copies of this issue are available on request. The final reports containing results from the second phase of the CRP are now being prepared for publishing as an IAEA-TECDOC.

Development and Use of Rumen Molecular Techniques for Predicting and Enhancing Productivity (D3.10.24)

Technical Officer: Antony Schlink

The project is progressing as planned toward its objectives. The activities being undertaken at the moment are the identification of plants and plant materials that reduce the production of methane when fermented in vitro. In addition, six of the eight RCH have developed and are applying an in vivo system of measuring methane production to test and verify the results obtained in vitro. Several plant compounds have been identified that merit additional research and have progressed to in vivo experiments to validate the in vitro results. A resent publication from CRP (D.N. Kamra, A.K. Patra, P.N. Chatterjee, Ravindra Kumar, Neeta Agarwal and L.C. Chaudhary in Australian Journal of Experimental Agriculture, 2008, 48, 175–178) found that the inhibi-

tion of methanogenesis was accompanied with a depression in vitro feed degradability with the extracts of S. mukorossi, T. chebula, S. aromaticum and P. guajava, but not with the extracts of M. indica, A. sativum and F. vulgare.

Gene-based Technologies in Livestock Breeding: Phase 1: Characterization of Small Ruminant Genetic Resources in Asia (D3.10.25)

Technical Officer: Massoud Malek

The genotyping for all 18 microsatellites of the sheep has been completed, at the Joint ILRI/CAAS animal molecular genetics laboratory in Beijing. The counterpart from Bangladesh (Mr. Omar Faruque) is organizing the data from each of the countries into the same format and then will distribute the joint datasets to each counterpart on a CD. The genotyping of 37 breeds of goats for 15 microsattelite markers has been completed. The IAEA Collaborating Centre on Animal Genomics and Bioinformatics, located in Brazil, is currently a contract holder of this CRP by performing the sequencing of mitochondrial DNA of a subset of individuals from Asian sheep and goat breeds, aiming to reveal differences among them in the D-loop region of the mtDNA. The São Paulo State University (UNESP) group, lead by Mr. Fernando Garcia, has developed kits for DNA amplification, which were distributed to the nine counterparts. DNA sequencing work is on the way in his lab and final results are expected by the fourth quarter 2008, when data will be compared and analysed in order to provide new information about genetic diversity among sheep and goat breeds, facilitating decision making initiatives on those livestock breeds conservation. Phenotypic and farming system information has been collected for each breed, and will be inserted into the Domestic Animal Diversity Information System (DAD-IS) of the FAO. Protocols for genotyping of SNP in various candidate genes that may influence traits of economic importance in small ruminants are in progress at IAEA Animal Production Unit in Seibersdorf. The genotyping and data analysis needed for basic genetic characterization is expected to continue through the end of 2008.

Veterinary Surveillance of Rift Valley Fever (D3.20.23)

Technical Officer: Gerrit Viljoen

The main objectives are the evaluation, validation and implementation of RT-PCR and PCR sequencing procedures for early and sensitive detection of the RVF virus and its use in molecular epidemiology using isotopic techniques to improve diagnostic sensitivity (via isotope incorporation into PCR amplicons) and to confirm diagnostic specificity (via hybridization of amplicons with isotope labeled probes). In laboratories equipped with real-time PCR capabilities, the manual PCR procedures are being adapted to include their use as part of the Standard Operating Procedures (SOPs). Manual isotope based slab PCR-sequencing procedures are implemented (In laboratories equipped with automated sequencing equipment, these procedures will be adapted for use). The specific objectives are:

- Evaluation, validation and use of iELISA formats to detect virus-specific antibodies.
- Evaluation of recombinant antigens for use in indirect and competition ELISA's.
- Harmonization of Standard Operating Procedures (SOPs) and introduction of quality assurance procedures for RVF-ELISA.
- Evaluation, validation and implementation of classical RT-PCR and real-time PCR, and PCR sequencing procedures for early and sensitive detection of the RVF virus and its use in molecular epidemiology
- Setting up of a serological and molecular epidemiological database (based on antibody prevalence and virus isolate genetic variation).

This CRP is under the Agency Project 'Molecular technologies for improving productivity in smallholder livestock'. The aim of the CRP is to develop, evaluate, validate and harmonize nuclear and nuclear related serological and molecular diagnostic technologies to improve Member State capacities to effectively control transboundary animal diseases. Rift Valley fever (RVF) is one of the several important diseases of livestock that are targeted under this project. RVF epidemics occur at irregular intervals in Africa when heavy rains facilitate the breeding of the mosquito vectors. The latest outbreaks were in Kenya (2006/7), Tanzania (2006/7), Sudan (2007/8) and South Africa (2008), leading in some cases to great losses in animals and humans.

Progress towards achieving the objectives of the CRP is satisfactory and all the RCH are within the timeframe of their work plans. In short: The IgG and IgM ELISA platforms (using irradiated virus antigens and control sera) were evaluated, validated and implemented in RCHs laboratories (and other laboratories); The serological procedures were harmonized and are available as SOPs; the RCHs were trained in molecular technologies and quality assurance management; the recombinant RVF antigen was evaluated and is under validation as substitute antigen for the ELISA platforms and epidemiological and surveillance (including sampling frame) strategies were developed and are implemented by all RCHs. The future objectives to be achieved (2009) are: evaluation, validation and implementation of the molecular diagnostic platforms and procedures and their presentation to OIE, FAO and WHO; the validation of the recombinant ELISA platform; the finalization of the DNA and sera reference material; continued maintenance of the established epidemiological databank.

Rift Valley fever (RVF) inflicts great economic losses due to reduced productivity in livestock, widespread abortions in pregnant animals and mortality in young animals. In addition, RVF is zoonotic and may cause

debilitating encephalitis, blindness and deaths in humans. The virus was first isolated in 1930 in sheep in the Rift Valley of Kenya and is endemic to sub-Saharan Africa with sporadic outbreaks in the Arabian Peninsula. RFV outbreaks have severe consequences to trade in the region.

RVF epidemics occur at irregular intervals in Africa when heavy rains facilitate the breeding of the mosquito vectors. The latest major outbreaks were in Kenya (2006/7), Tanzania (2006/7), (2007/8) and South Africa (2008), leading in some cases to great losses in animals and humans. With rising or fluctuating global temperatures, RVFV can spread to new ecosystems. In September 2000, RVF was first reported outside Africa in Saudi Arabia and Yemen, disrupting all livestock trade from the horn of Africa to the Arabian Peninsula. In Yemen, the 2000 RVF outbreak affected more than 2,000 humans, killing nearly 300 people, while 20,000 abortions occurred in livestock. This expansion in the epidemic area to the Arabian Peninsula raises the possibility of RVF spread to other parts of Asia and Europe, especially since RVFV can be spread by a wide range of mosquito vectors. Although transmission is mainly by mosquitoes, it can also occur via contact with infected animals (in the case of veterinarians or abattoir workers), infected blood or tissue samples (laboratory workers) and patients (family, physicians or nursing aides).

Inactivated and attenuated RVF-vaccines are available for veterinary use although both have limitations (they cause abortions), but none are available commercially for humans. It is therefore critical to confine and control the spread of the virus and to limit its spread to non-infected animals and to humans, and prevent spread to non-endemic areas. This can be achieved by the rapid, early and definitive detection of RVFV and consequently controlling animal movement, instituting quarantine measures and/or implementing suitable vaccination strategies. Hence, considerable efforts have been made recently to validate and implement techniques for the rapid and early diagnosis and characterization of RVFV. Enzyme linked immunosorbent assays (ELISA) have the potential to detect RVF specific antibodies in RVFV –infected animals, although their use has been limited due to the lack of standardized procedures, validation data and the unavailability of safe antigens. It is, however, not able to differentiate between vaccinated and field-infected animals; therefore the laborious monitoring of sentinel animals in herds in endemic areas is still required.

In addition, it is of paramount importance to identify the presence of virus as early as possible, even within the window period prior to the development of RVFV antibodies, to allow for the timely implementation of action. Thus the nuclear and nuclear related molecular detection of RVFV was developed and evaluated with a limited panel of field samples. This approach is not only highly specific but can detect presence of RVFV nucleic acid in infected animals during the window period prior to sero-conversion. Only a few of the participating countries were able to implement this technique during this stage and it is expected that all counterparts will participate in the validation phase.

The validation of the serological IgM and IgG platforms (using irradiated or recombinant antigens and irradiated control sera) together with the early stage molecular diagnostic techniques greatly contributed, in the countries experiencing RVF outbreaks (e.g. Kenya and Sudan), to the early and rapid diagnosis of RVF and allowed for the timely response and effective control. The molecular diagnostic technologies and the molecular characterization (i.e. sequencing) of all RVFV isolates will form the last part of this CRP (as basis of the DNA database), using either isotope or fluorescent labeling of sequences, to obtain a genetic databank for the rapid bioinformatical analysis and classification of all isolates. This will allow for molecular epidemiological studies to determine the origin and spread of the virus, the origin of outbreaks as well as in helping to differentiate vaccine virus from wild-type field strains.

Overall Assessment of Progress towards Achieving Objective:

- Progress towards achieving the objectives is satisfactory. Serological assays (several ELISA platforms) were validated and implemented in all RCHs' laboratories:
- The IgG and IgM ELISA platforms were evaluated, validated and implemented in RCHs laboratories (and other laboratories).
- Serological procedures were harmonized and are available as SOPs.
- RCHs were trained in molecular technologies and quality assurance management. Guidelines and a manual are available.
- The recombinant RVF antigen was evaluated and are under validation as substitute antigen for the ELISA platforms.
- Epidemiological and surveillance (including sampling frame) strategies were developed and are implemented by all RCHs.
- The training of RCH's were facilitated through other funds to help achieve the objectives of the CRP.

Adjustment to Proposed Workplan until next RCM:

Progress towards achieving the objectives is satisfactory and limited adjustment will be needed. It is however proposed that the CRP be extended for one year (to 2010) if all objectives and targets are not met by the 5 year end date of 2009. The training of RCH's will be facilitated through other funds to help achieve the objectives of the CRP.

Other changes:

Sudan has approached the Agency to joint the CRP.

The request is under evaluation.

The introduction of an irradiated RVF vaccine as human and animal vaccine. There is no human vaccine available, and the animal vaccine that is being used

cause abortions in pregnant animals. Two of the RCHs are currently evaluating the efficiency of irradiated RVF as save and potent immunogens (i.e. providing a more complete MHC class I and II protection) for animals and possible humans (outside of the CRP scope).

The Control of Contagious Bovine Pleuro Pneumonia in Sub-Saharan Africa (D3.20.24)

Technical Officer: Hermann Unger

The second Research Coordination Meeting took place from 21 to 25 April 2008 in Mali. Please read the report under 'Past Events'.

The Early and Rapid Diagnosis of Transboundary Animal Diseases such as Avian Influenza (D3.20.25)

Technical Officer: John Crowther

Most contract renewals have been sent and will be considered for funding. The participants have all maintained a high level of work in their countries. A new commercial system will be exploited soon into 2008 to accelerate progress in the instant testing of avian influenza as well as set up the model for all livestock diseases. The next Research Coordination Meeting will be held in November 2008.

The Early and Sensitive Diagnosis and Control of Peste des Petits Ruminants (PPR) (D3.20.26)

Technical Officer: Adama Diallo/Hermann Unger

The first Research Coordination meeting took place from 31 March to 4 April 2008 in Vienna, Austria. The meeting report is under 'Past Events' in this Newsletter.

African Swine Fever Technical Contract 11294 (D3.00.00)

Technical Officer: John Crowther

Indirect ELISA kits are still available from the Institut Sénégalais de Recherches Agricoles ISRA, Laboratoire National de l'Elevage et de Recherches Vétérinaires (LNERV), for the detection of antibodies against ASF. Each kit includes plates, tips and reagents for testing 2800 samples and costs US$ 2000. Applications for kits should be sent to the Senegal laboratory directly (Dr. Joseph Sarr; Josarr@refer.sn).

General information applicable to all Coordinated Research Projects

Submission of Proposals

Research Contract proposal forms can be obtained from the IAEA, the National Atomic Energy Commissions, UNDP offices or by contacting the Technical Officer. The form can also be downloaded from the URL http://www-crp.iaea.org/html/forms.html

Such proposals need to be countersigned by the Head of the Institutions and sent directly to the IAEA. They do not need to be routed through other official channels unless local regulations require otherwise.

Complementary FAO/IAEA Support

IAEA has a programme of support through national Technical Cooperation (TC) Projects. Such support is available to IAEA Member States and can include additional support such as equipment, specialized training through IAEA training fellowships and the provision of technical assistance through visits by IAEA experts for periods of up to one month. Full details of the TC Programme and information on how to prepare a project proposal are available at the URL http://www-tc.iaea.org/tcweb/default.asp

For further information contact Roswitha Schellander (r.schellander@iaea.org)

Activities of the Animal Production Unit (APU) at the FAO/IAEA Agriculture and Biotechnology Laboratory

Diagnosis of Capripox Virus Infections and the Epidemiology of the Diseases

An important prerequisite for the successful control of infectious diseases is a comprehensive understanding of the factors that determine their epidemiology. This requires a thorough knowledge of their biology in the host and invariably depends on the availability of sensitive diagnostic techniques that enable identification and differentiation of the organisms. In the case of sheep pox virus (SPPV) and goat pox virus (GTPV) infections, the cause of serious economic losses to small ruminants in Asia, the Middle East and parts of Africa, this is not yet possible. Clinically, the diseases appear similar, and serological diagnostic techniques are not sufficiently specific to discriminate between them. In seeking to overcome these problems, studies on the genome of capripox viruses at APU have resulted in the development of molecular methods that will provide the means for both differential diagnosis and characterization of different virus isolates. Initially, a classical PCR, based on a deletion in the chemokine gene of SPPV appeared to allow discrimination between SPPV and GTPV, but screening of a number of isolates from infected goats revealed similarities with SPPV. Further work, involving cloning of the chemokine gene and analysis of the sequence data from different capripox virus isolates enabled creation of a phylogenetic tree that showed that while SPPV and GTPV clustered separately, the deletion seen in SPPV was not a special event, since some GTPV isolates exhibited a similar characteristic. Since classical PCR could not be used with confidence to differentiate the viruses, a real-time PCR was developed using fluorescence resonance energy transfer probes (FRET). This real-time PCR was able to distinguish isolates of SPPV from GTPV and had a high analytical sensitivity. The test will be validated further using more isolates from the field as well as samples from experimentally-infected animals in collaboration with our partners in Mali.

Sequencing the Capripox Virus Genome

In endemic areas, the control of SPPV and GTPV is attempted by vaccination using live, attenuated virus. However, vaccine failures and adverse effects have been reported, indicating the need to develop safer and more effective capripox vaccines. Studies with other poxviruses have enabled the identification of genes responsible for pathogenicity. Rational deletion of pathogenic genes, as for example has been achieved in the case of vaccinia, has led to the attenuation of virus infectivity and virulence thereby enabling the production of safer vaccines. In order to understand the molecular basis of capripox virus pathogenicity, and also the host species-specificity, it was decided to sequence the genomes of different capripox virus strains. Later, these viruses will be tested in animals in Africa to determine their virulence in vivo. Using the data obtained from these studies, as well as the information already available in the literature, it may be possible to develop better vaccines. Sequence data was obtained from a GTPV isolate from Turkey and compared with that of another isolate available in the gene bank; it showed that the two viruses shared some 99% similarity in nucleotides over the length of their genomes. It is planned to sequence another nine isolates in the near future, and this information, together with data from the experimental studies, should lead to the identification of the genes involved in pox virus pathogenicity and host specificity.

Improving the Stability and Robustness of the FMD ELISA

We have already reported on the successful development of a c-ELISA, based on the non-structural protein (NSP) of Foot and Mouth Disease Virus (FMDV) and a mouse monoclonal antibody (1E6-11), that could be used to differentiate between infected animals, animals that had been vaccinated and uninfected animals. This test was based on a recombinant protein (3ABC NSP) that is a protease, and can initiate self processing that could lead to alterations in the functional stability of the test. In order to enhance the stability and robustness of the test, further modification of the recombinant protein was undertaken to inactivate this protease site. Two DNAs of the 3ABC gene (3ABC site_pro_mut and 3ABC_mut_optG) were synthesized with several mutations inserted, in order to inactivate the protease site and the four protein cleavage sites. The codons of this second gene were optimized for synthesis in insect cells, so that protein production was enhanced. A third gene (3ABC_WT_Ge), representing the ‘wild type’ virus was also synthesized. After electrophoresis of the expressed proteins and immunoprecipitation using 35S-labelled methionine it was shown clearly, that whilst proteins produced from the 3ABC site_pro_mut gene, or from ‘wild type’ genes showed evidence of extensive proteolytic degradation, recombinant proteins expressed from 3ABC_mut_optG, that included five

mutations was not degraded. The recombinant protein was purified using paramagnetic precharged nickel particles (Promega), eluting the proteins with 1M imidazole. This product appeared to have only minor contaminants and will be used in ELISA validation trials to be carried out on serum samples from cattle, pigs, buffalo and sheep.

Training in the APU

Fellowship

Ms Argamjav Bayanzul, a parasitologist in the School of Veterinary Medicine and Biotechnology at the Mongolian State University of Agriculture, Ulaanbaatar, Mongolia, joined APU in March 2008 for a three-month fellowship in the diagnosis of transboundary diseases using rapid and sensitive molecular diagnostic techniques. She is supported by Technical Cooperation Project MON5013, 'Diagnosis and Surveillance of Transboundary Diseases and Production of Diagnostic Reagents'. Ms Bayanzul has received training in the use of the classical PCR, including extraction of DNA, target selection for PCR, primer design using appropriate software programs and the use of PCR for the differentiation of morbilliviruses. She has also used real-time PCR for the diagnosis of Peste des Petits Ruminants and Capripox. The next stage in her fellowship will involve the use of enzyme linked immunosorbent assays (ELISA) for the diagnosis of a number of infectious diseases.

Mr Nino Dante Arias Cruz, assistant researcher in the field of molecular biology and genetics at the Veterinary Faculty of the Universidad Peruana Cayetano Heredia (UPCH) in Peru, joined the APU in January 2008 for a five-month fellowship. His work at the Seibersdorf Laboratories is related to the Technical Cooperation Project PER5029 'Genomics of the Alpaca: Identification of Expressed Genes and Genetic Markers Associated with Productivity and Embryonic Mortality'. The main focus of his work is in the area of alpaca genomics, namely to use the PCR to identify DNA markers for the Y chromosome of alpaca. This has involved training in the acquisition and use of archived information on public databases and pathways

to select candidate genes for his study. He has also assisted APU in the implementation of the new technology of Single Nucleotide Polymorphisms (SNP) analysis for sheep by developing Restriction Fragment Length Polymorphisms (RFLPs). He will present some of the results of his work in Seibersdorf at the 16th

International Congress on Animal Reproduction (ICAR) 2008, in July in Budapest, Hungary. His paper, entitled 'DNA Markers for Sex Identification in South American Camelids' will be presented at the satellite meeting 'Camelid Reproduction'

Technical Cooperation Projects

TC Project	Description	TO
ANG/5/007	Improvement and Veterinary Assistance to Local Small Stock Breeds **Objective:** The sustainable improvement of small-scale livestock production systems.	Viljoen
BEN/5/002	Diagnosis and Control of Animal Diseases **Objective**: Assistance for the control and diagnosis of major diseases affecting livestock.	Crowther Viljoen
BEN/5/003	Veterinary Drug Residue Monitoring Programme **Objective:** To develop a capacity for veterinary drug residue monitoring in livestock products.	Cannavan Byron Viljoen
BKF/5/002	Development of a Veterinary Medicine to Combat the Fowl Pox Virus **Objective**: To make available to traditional poultry farmers, rural population medicines against fowl pox virus based on extracts of galls from Guiera Senegalensis, thus reducing the poultry mortality rate in traditional poultry farming systems.	Luckins Schaten
BKF/5/006	Establishment of Feeding Tables for Feedstuffs that are Locally Available to Stockholders in Burkina Faso **Objective:** To improve the reproductive performance of local livestock bred through food supplementation strategies, develop feeding table for locally available food resources, characterize genetic types of cattle used for milk production, improve the effectiveness of artificial insemination on local cattle breeds, and train a qualified team on animal production (nutrition, feeding, reproduction and genetics).	Garcia Podesta Schlink
CAF/5/002	Assistance for Epidemiological Surveillance of Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Central Veterinarian Laboratory (LACAVET) to monitor and control major animal diseases.	Unger
CMR/5/015	Use of Nuclear Techniques for Improving Ruminant Productivity & Disease Control **Objective**: Develop capability for improved breeding by disease control and artificial insemination.	Garcia Podesta Unger
ELS/5/010	Improving Nutrition Practices and Reproductive Efficiency in Cattle **Objective:** To increase milk production and profitability of dairy farms through development and use of appropriate feeding strategies using locally available feed resources and enhancing reproductive efficiency.	Schlink Garcia Podesta
ERI/5/003	Monitoring and Control of Transboundary Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Central Veterinary Laboratory to monitor and control trans-boundary diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Viljoen Unger
ERI/5/005	Zoonotic (diseases that can be transmitted from animals to humans) Disease Control and Analysis of Veterinary Residues in Foods **Objective**: The objective of the project is to determine: 1. The epidemiological prevalence of brucellosis and tuberculosis in the major dairy producing areas; 2. Baseline data on veterinary drug residues in milk and meat products.	Cannavan Unger
ETH/5/012	Integrating Sterile Insect Techniques for Tsetse Eradication **Objective**: To eradicate the tsetse fly from the southern Rift Valley, thereby creating an environment conducive to livestock development and improved agricultural production.	Feldmann Parker Viljoen
ETH/5/014	Monitoring and Control of Major Animal Diseases **Objective**: To strengthen the diagnostic capacity of the National Veterinary Institute to monitor and control trans-boundary diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Viljoen

TC Project	Description	TO
GAB/5/002	Diagnosis and Control of Animal Diseases **Objective**: To aid identification and control of livestock diseases.	Crowther
HON/5/002	Improvement in the Nutritional and Sanitary Conditions of Cattle to Enhance their Productivity through Nuclear Methods **Objective**: To enhance the national capabilities for developing feeding strategies, improving the reproductive status of cattle and diagnosis of diseases in livestock herds through isotopic techniques.	Schlink Garcia Podesta Viljoen
HON/5/004	Improving the Nutrition and Health Conditions of Livestock in Honduras in Order to Increase Productivity and Reproductivity, Phase II **Objective**: To strengthen and improve livestock production in Honduras.	Schlink Garcia Podesta Viljoen
INS/5/034	Development of Environmentally Sound Livestock and Agricultural Production **Objective**: To improve livestock productivity without adversely affecting the environment through improved feed supplementation strategies, managing nutrient waste on farms and reducing methane emissions.	Schlink
INT/5/148	Establishing Quality Systems in Veterinary Testing Laboratories **Objective**: To establish quality systems in 15 selected laboratories in Africa (5), Asia and the Pacific (5), and Latin America (5), and to train at least 15 specialists from these laboratories using the materials already available on this subject.	Viljoen Crowther
IRA/5/012	Preparation of ELISA Kits for Diagnosis of Foot and Mouth Disease **Objective**: To establish the ability to prepare standardized assays for use in foot and mouth disease (FMD) control.	Crowther
IVC/5/028	Surveillance and control of African Swine Fever **Objective**: To diagnose, control and monitor the prevalence of African Swine Fever (ASF) from the pig population in Côte d'Ivoire using nuclear techniques and related techniques.	Luckins Schaten
MAU/5/002	Improving the National Capacity in Diagnostics for Animal Diseases (Infection and Parasitic Diseases) **Objective**: To strengthen the diagnostic capacity of the Centre National D'Elevage et de Recherches Veterinaires (CNERV) to monitor and control trans-boundary animal diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Luckins Schaten
MLI/5/019	Improving Pneumopathies Diagnosis in Ruminants Using PCR **Objective**: To improve knowledge about the epidemiology of the dominant respiratory pathologies affecting small ruminants in Mali's agro-pastoral areas through improving the diagnosis of pneumopathies in small ruminants to support the national control and eradication programme.	Viljoen
MON/5/012	Monitoring of Residues in Livestock Products and Surveillance of Animal Diseases **Objective**: To develop a capacity for veterinary drug residue and contaminant monitoring in livestock products and to expand serosurveillance capabilities to achieve rinderpest and foot and mouth disease (FMD) free status in the country or specific zones.	Cannavan Crowther
MON/5/013	Diagnosis and Surveillance of Transboundary Animal Diseases and Production of Diagnostic Reagents **Objective**: To obtain international recognition of freedom from several transboundary animal diseases, to develop a capacity for the local production, standardization and validation of diagnostic reagents and diagnostic kits, and to establish a quality system for diagnosis of transboundary animal diseases using the local produced diagnostic kits.	Crowther Viljoen

TC Project	Description	TO
MON/5/016	Improving Productivity of Cattle, Camels and Yaks Through Better Nutrition and Reproductive Management **Objective**: To increase milk, meat and wool production of yaks, cattle and camels by improving the quality and quantity of feed with high nutritional value and tolerance to low temperature and improving the genetic potential using artificial insemination coupled with radio immunoassay for progesterone.	Schlink Garcia Podesta
MOR/5/030	Improving Sheep and Goat Production in Morocco through Genomic and Reproductive Physiology Characterization with the Help of Radio-immunoassay and Molecular Techniques (Not yet funded) **Objective**: Increase sheep and goats for consumption and producers' revenue while preserving natural resources.	Garcia Podesta Malek
MYA/0/006	Human Resource Development and Nuclear Technology Support **Objective**: To upgrade and strengthen the skills and capabilities of human resources within the broad range of the applications of nuclear science and technology.	Crowther
MYA/5/013	Integrated Approach for Enhancing Cattle Productivity **Objective**: To improve smallholder dairy cattle production in Yangon and Mandalay regions.	Garcia Podesta Schlink
MYA/5/015	Strengthening the National Capacity for the Production of Veterinary Vaccines **Objective**: To enhance the national capacity for quality vaccine production to support efforts to control infectious diseases in livestock production, particularly FMD.	Crowther Cannavan
NAM/5/007	Control of Animal diseases in Northern Namibia **Objective**: To create a sustainable veterinary diagnostic service that will contribute to the control of the major diseases affecting livestock in the northern parts of the country.	Viljoen
NER/5/011	Upgrading Laboratory Services for Diagnosis of Animal Diseases **Objective**: To support the Government effort in controlling main livestock transboundary diseases, mainly contagious bovine pleuropneumonia (CBPP), peste des petits ruminants (PPR) and foot and mouth disease (FMD). To help improve the national animal disease diagnosis capabilities at the Laboratoire Central d'Elevage (LABOCEL) in the use of modern techniques to obtain specific and rapid results with focus to CBPP, PPR and FMD.	Luckins Unger
NER/5/013	An Integrated Approach for Improvement of Livestock Productivity **Objective**: To increase the productivity of livestock through implementation of an integrated programme dealing with nutrition and reproduction.	Schlink Garcia Podesta Luckins
PER/5/027	Use of Nuclear Techniques to Improve Alpacas Productive and Reproductive Methods **Objective**: To improve reproduction performance of alpacas using nuclear and related techniques to recover and conserve the individual species.	Garcia Podesta
PER/5/029	Genomics of the Alpaca: Identification of Expressed Genes and Genetic Markers Associated with Productivity and Embryonic Mortality **Objective**: To identify and characterize the factors associated with embryonic mortality in alpacas.	Garcia Podesta Malek
RAF/5/054	Improvement of Livestock Productivity through an Integrated Application of Technologies (AFRA III-4) **Objective:** To develop and facilitate the application of appropriate selection criteria for genetically improved stock; to institute integrated management, nutrition, healthcare and follow-up practices for genetically improved stock; and to use modern reproductive techniques to improve productivity and reproductive efficiency of livestock in the region.	Garcia Podesta Schlink

TC Project	Description	TO
RAF/5/055	Support to African Union's Regional Programmes for Control and Eradication of Major Epizootics **Objective**: To support within the framework of a strategic partnership with the African Union, the global effort of control and eradication of major trans-boundary animal diseases affecting livestock in the region led by the Inter-African Bureau for Animal Resources (AU/IBAR). This programme will aim at helping African countries to improve and produce livestock to ensure their role and participation in international markets that will lead to poverty alleviation and increased livelihoods. The specific objectives of the project are (i) to provide support to selected national veterinary laboratories to implement a quality assured disease control programme; (ii) to transfer appropriate and state-of-the-art technology to support diagnostic, surveillance and epidemiological activities relating to the control of major livestock diseases; and (iii) to support the establishment of a regional centre in Africa (Pan African Veterinary Vaccine Centre [PANVAC]) that would be responsible for (a) the production, assembly and distribution of diagnostic kits; (b) evaluating and monitoring the development of quality assured animal vaccines and (c) advising on the use of vaccines and vaccine strategies.	Viljoen Lelenta
RAS/5/044	Integrated Approach for Improving Livestock Production Utilizing Indigenous Resources and Conserving the Environment (RCA) **Objective**: To improve livestock productivity through better nutritional and reproduction strategies while conserving the environment. The specific objectives are to improve animal productivity and decrease discharges of selected greenhouse gases, (methane and carbon dioxide) and selected nutrients (nitrogen and phosphorus) into the environment; and to identify and adopt better breeding strategies that will improve animal productivity through the use of better selection criteria for offspring from cross-breeding programmes, optimum utilization of appropriate indigenous cows, benchmarking for growth and reproduction, and improving procedures for management, nutrition and healthcare programmes in dairy farms.	Garcia Podesta Schlink
RLA/5/049	Integrated Control of Fascioliasis in Latin America (in support of National Programmes	Viljoen Schaten
SIL/5/006	Improving the Productivity of N'dama Cattle **Objective**: To establish a national capability for the application of nuclear techniques to (i) assess the nutritional quality of locally available feed resources, and to develop optimal feeding strategies, (ii) evaluate the reproductive performance under different management and nutritional conditions, and improve artificial insemination (AI) services, and (iii) diagnose and determine epidemiological status of important diseases.	Garcia Podesta
SIL/5/010	Improving the Productivity of Ndama Cattle In Sierra Leone **Objective**: To strengthen the diagnostic capacity to monitor and control animal diseases affecting cattle, (ii) to apply feeding strategies and supplementation packages, and (iii) to produce hydrids with greater potential for increased growth rate and milk yields.	Garcia Podesta Schlink Viljoen
SRL/5/041	Maximizing Productivity on Goat Farms through Cost-Cutting and DNA-Based Technology in Selection for Breeding **Objective**: To improve the productivity of goats of small-holder farmers in Sri Lanka, by introducing new strategies such as supplementary feeding, improved management practices and disease control and by transferring genetic technologies to assist in proper selection of superior breeding animals.	Garcia Podesta Schlink Viljoen Malek
SUD/5/028	Epidemiology and Control of Snail-borne Diseases in Irrigated Areas **Objective**: The overall objectives of the project are to increase animal production, and maintain healthy and productive herds in irrigated areas by controlling snail-borne diseases.	Unger

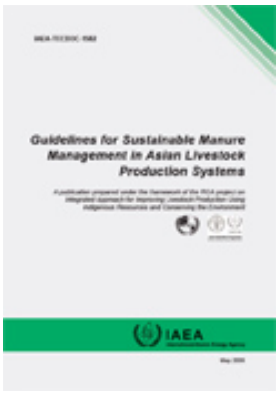
TC Project	Description	TO
SUD/5/029	The Characterization and Quality Assured Production of an Attenuated Theileria Annulata vaccine **Objective**: To protect cattle against tropical theileriosis through vaccination in order to improve animal health and reduce reliance on acaricidal/pesticide tick control. More specifically, to establish quality-assured procedures and protocols for T. annulata cell culture vaccine production.	Unger
SUD/5/031	Setting up a National Network for the Control of Livestock Diseases that affect Exports **Objective**: To establish capacity to diagnose Brucellosis in ruminants to improve food safety and secure animal exports.	Unger
TAD/5/003	Diagnosis and Control of Brucellosis in Cattle, Sheep and Goats **Objective**: To improve diagnosis of brucellosis in cattle, sheep and goats in order to prevent the spread of the disease among animals and the human population in Tajikistan.	Crowther
UGA/5/028	Improving the Capacity for Diagnostic of Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Diagnostics and Epidemiology Laboratory of the Ministry of Agriculture, Animal Industry and fisheries to monitor and control transboundary animal diseases of importance (e.g. CBPP, FMD, AI, Rabies, Brucellosis and RVF) to Uganda.	Viljoen Unger
URT/5/025	Support for the Delivery of Artificial Insemination services **Objective**: The sustainable intensification of milk and meat through the provision of efficient and reliable AI services.	Garcia Podesta
YEM/5/006	Quality Management for Upgrading Animal Disease Control **Objective**: To improve the management of diagnostic testing for livestock diseases in Yemen, leading to increased assurance of results in aiding control programmes.	Crowther/Viljoen
ZAI/5/015	Upgrading Laboratory Services for Diagnosis of Animal Diseases **Objective**: Control and eradication of livestock transboundary diseases or other epizootics through the laboratory investigations using nuclear and related technologies.	Unger
ZAM/5/025	Development of Feeding Strategies for Smallholder Dairy Animals in Njolwe and Palabana Dairy Tenant Schemes **Objective**: To improve household food security and income generation among small scale farmers through increased production and marketing of livestock by developing sustainable feeding and breeding strategies based on increased use of locally available resources.	Garcia Podesta Schlink
ZIM/5/010	Improvement of Veterinary Diagnostic Laboratory Services **Objective**: To enhance the capability of the Department of Veterinary Services (DVS) through the Central Veterinary Laboratory (CVL) in order to develop/adapt DNA-based diagnostic techniques for difficult to diagnose infections using conventional techniques; and to establish DNA/RNA-based molecular typing methods as epidemiological tools to study disease dissemination routes and sources of infection, and to characterize and differentiate between vaccine and field strains of diseases such as anthrax, rabies, and foot and mouth disease.	Unger

Publications

Recently published

Guidelines for Sustainable Manure Management in Asian Livestock Production Systems

IAEA-TECDOC Series No. 1582



This publication was produced under an IAEA Technical Cooperation Project and includes information about: trends in livestock production and animal manure management in Asia, a systems approach to sustainable manure management, production and composition of manure, manure management during housing and storage, processing and handling of manure to reduce pollution and improve nutrient utilization, and the field application and utilization of manures. It also reports the main conclusions and recommendations from the experts' meeting. This publication is aimed at all levels of administrative and technical personnel involved in the management of manure in livestock systems and environmental sustainability in Asia, including ministries of agriculture, livestock and environment, directorates of livestock and veterinary services, local authorities responsible for livestock development services, faculties of agriculture and animal, plant and soil sciences, and institutes involved in environmental sustainability. It is also a useful resource for teachers and students in faculties of veterinary and animal sciences, and soil and plant sciences. IAEA-TECDOC-1582, 2008, ISBN 978-92-0-111607-9, English

IAEA-TECDOCS are available electronically on:
http://www-pub.iaea.org/MTCD/publications/publications.asp
Orders for hardcopies and requests for information may be addressed directly to:
Sales and Promotion Unit,
International Atomic Energy Agency,
Wagramerstrasse 5,
P.O. Box 100,A-1400 Vienna,, Austria,
Telephone: +43 1 2600 22529 (or 22530);
Facsimile: +43 1 2600 29302;
E-mail: sales.publications@iaea.org
http://www-pub.iaea.org/MTCD/publications/publications.asp

In Preparation

Managing Prenatal Development to Enhance Livestock Productivity

The need for a book dealing with managing prenatal development to improve livestock productivity was identified during a Consultants meeting on Research Needs for Improvement of Livestock Productivity in Developing Countries Through Manipulation of Nutrition in utero, held in October 2005.

There is a growing demand worldwide for livestock products and the role of developing countries in meeting this demand will increase. Within this, the current production systems will come under increasing pressure because of the access to feed resources and other environmental challenges. The reproductive female will be under the most pressure in the future because she will be expected to reproduce consistently, and at the very least, annually. The female will also face nutritional and other environmental challenges in meeting the developmental needs of the embryo and foetus throughout gestation and in the preweaning period. Therefore, the foetus is exposed to various challenges that are mostly, but not exclusively, of a nutritional nature. The question is whether these challenges impact on foetal development and subsequent health, growth, reproductive and lactational characteristics of the offspring.

The objectives of this book are to provide a quantitative assessment of the role of, and current state of understanding of the mechanistic basis to, environmental plasticity in producing healthy and productive livestock. The book will contain review papers covering all the key livestock species as well as chapters covering relevant information on non-livestock species.

In vitro screening of plant resources for extranutritional attributes in ruminants: nuclear and related methodologies

Responsible Technical Officer: Anthony Schlink

This document is the outcome of a meeting between the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and Writtle College titled 'Alternative feed resources: a key to livestock intensification in developing countries' held 14/15 September 2006. The meeting planned to produce a manual on in vitro methodologies used to screen flora for bioactive compounds. The manual will compile the processes used by experts invited to the meeting from the areas of nutrition, screening native plants for bioactive compounds for animal health and production, rumen molecular biology, gut parasitism, and feeding behaviour to develop a

research and technical programme for future plant screening techniques to improve livestock production for Member States.

This will assist developing countries in the trend towards intensification of livestock production and this intensification has both opportunities and risks. The potential opportunities are the flow-on benefits to the local economy and producers and the potential risks are the flow-on costs to the environment, livestock health and welfare and human health, through increased chemical and nutrient pollution, disease transmission and centralization of feed resources. The intensification of livestock production can lead to higher levels of greenhouse gas emissions and a localization or concentration of nutrient wastes and pollution of waterways, increased chemical and drug use to overcome the increased risk of disease transmission and can also put pressure on the local feed and reproduction management systems. There is also global pressure from consumers to have sustainable production systems, ones where high quality and safe products are produced efficiently with minimal impact on the environment and human health, thus there is need to ensure that developing countries do not miss this new developments in livestock production. They will be under similar pressures to those developed countries are under to limiting the input of, and finding 'natural' alternatives to, chemicals, exploring alternative sources of feed, reducing methane transmissions and addressing animal health and welfare issues; in other words increasing productivity from local resources in a clean, green and ethical way. This manual will provide the methodologies for Member States to screen their flora for alterative feed additives to improve livestock productive and reduce environment impact. The techniques outline in the manual will also allow the Member States, their scientist and local communities to formally capture and value traditional knowledge and the genetic diversity of their flora.

The following major areas will be included in the document:

Challenges in extrapolating in vitro to in vivo evaluation of plant resources

In vitro screening of feed resources for efficiency of microbial protein synthesis

Assessing antiprotozoal agents

Screening plants and plant products for methane inhibitors

Screening plants for the antimicrobial control of acidosis in ruminant livestock

In vitro methods for the primary screening of plant products for direct activity against ruminant gastrointestinal nematodes

This publication will be of interest to Member States wishing to improve livestock production, improved utilization of local flora, reduction in the use of chemicals in livestock production, and reduced environment impact to meet national and international requirements for trade in food and food products. The recipients will include current, and future TCP and CRP counterparts, laboratory managers and staff, fellows and training course participants ay regional and inter-regional courses, enthobotanists, enthoveterinarians, and tertiary training institutions in livestock production and plant secondary compounds

Veterinary Diagnostic Real-time PCR Handbook

Responsible Technical Officer: Gerrit Viljoen

The uses of nucleic acid-directed methods have increased significantly in the past five years and have made important contributions to disease control country programmes for improving national and international trade. These developments include the more routine use of PCR and real-time PCR as diagnostic tools in veterinary diagnostic laboratories. However, there are many problems associated with the transfer and particularly, the application of this technology. These include lack of consideration of: the establishment of quality-assured procedures, the required set-up of the laboratory and the proper training of staff. This can lead to a situation where results are not assured.

This book will give a comprehensive account of the practical aspects of real-time PCR and strong consideration will be given to ensure its optimal use in a diagnostic laboratory environment. This includes the basic principles, setting-up of a Real-Time PCR laboratory; Good Laboratory Practice and Standard Operating Procedures; Diagnostic Implementation, Execution and Interpretation and Problem Solving. Examples of Standard Operating Procedures as used in individual specialist laboratories and an outline of training materials necessary for real-time PCR technology transfer will be presented. The difficulties, advantages and disadvantages in PCR and real-time PCR applications will be explained and placed in context with other test systems.

Emphasis will be placed on the use of real-time PCR for detection of pathogens, with a particular focus on diagnosticians and scientists from the developing world. It is hoped that this book will enable readers from various disciplines and levels of expertise to better judge the merits of real-time PCR and to increase their skills and knowledge in order to assist in a more logical, efficient and assured use of this technology.

The following major areas will be included in the document:

Traditional PCR

Real-Time PCR- The Basic Principles

Diagnostic Real-Time PCR Applications (e.g., TaqMan, Molecular beacons, Primer-Probe Energy Transfer methods, others)

Novel PCR techniques aimed for diagnostic use

Laboratory automation, molecular diagnostics

Real-time PCR analysis and interpretation/statistical analysis

Real-time PCR laboratory set-up and quality assurance management of the diagnostic laboratory and the diagnostic test (Including Quality assurance and validation of molecular assays).

This publication will be of interest to Member States wishing to improve disease control country programmes for improving national and international trade. The recipients will include current, past and future TCP and CRP counterparts, laboratory managers and staff, fellows and training course participants at regional, inter-regional courses, and tertiary training institutions in livestock production.

Economic Impact of Targeted Interventions to Improve Productivity of Peri-Urban Small-holder Dairy Farms

Technical Officer: Oswin Perera

This document was produced under an IAEA Coordinated Research Project entitled 'Integrated Approach for Improving Small Scale Market Oriented Dairy Systems', with technical support of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. It details the results obtained by project counterparts from interventions to improve animal productivity by overcoming the most important contraints identified during Participatory Rural Appraisals made and Economic Opportunity Surveys performed in direct interaction with stakeholders. The publication presents both the results of case studies in which the interventions were applied and methods for evaluating their economic impact. The publication is intended for livestock specialists involved in the management of dairy production services for cattle farmers in Asia, including those in Ministries of Agriculture/Livestock, Departments of Livestock and Veterinary Services, AI centres, public and private veterinarians and consultants.

Guidelines for selection and breeding of cattle and buffalo in Asia'

Technical Officer: Mario Garcia Podesta

This publication contains the outcome of a Consultants Meeting conducted under the framework of a regional IAEA/RCA project on 'Integrated approach for improving livestock production using indigenous resources and conserving the environment' (RAS/5/044). The need for such a document was identified during the first planning meeting of the project. The topics covered are all relevant to the IAEA programme, including artificial insemintion (AI) nuclear techniques on livestock reproduction and breeding and to the activities being undertaken by project counterparts with support from national and regional projects in Asia.

The topics covered include: information about trends in livestock production and cattle breeding management in Asia; the important traits for dairy and beef cattle, their selection criteria, and breeding objectives; proposed systems for operating a cattle breeding and genetic improvement programme in Asia; and an overview of current and future technologies for improvement of cattle breeding.

Instant Testing and Reporting Systems

A paper is to be submitted on Instant Testing and Reporting Systems to the OIE. The Joint Division is actively supporting the system which comprises highly mobile rugged and operator fool proof devices to perform diagnostics with defined diagnostic specificities ad sensitivities which can instantly send results back from the field to a central control point. In this way real-time diagnosis can be made. The devices use variants of the PCR and instant extraction and analysis of samples, thereby avoiding the problems of sample storage and transport- often the most damaging feature to molecular tests. The system is at the heart of the CRP D3. 20.25 involving the rapid diagnosis of Avian Influenza. The devices will be validated in reference laboratories and then in the field. Such systems offer the way forward to improving early warning of disease spread and should revolutionize diagnosis in developed and developing countries.

CD-ROMs

A CD-ROM is available dealing with training material for the diagnosis of rinderpest and for the preparation for the OIE pathway. It was produced under an IAEA Technical Cooperation project RAF/0/013 ICT based training to strengthen LDC capacity. Contact John Crowther at j.crowther@iaea.org for further information.

A new batch of CDs with a training package to help artificial insemination (AI) technicians to improve the performance of AI and field services provided to farmers was produced for users with a slow internet connection and is now available through the APHS. It is also accessible from the AP&H Section website:
http://www-naweb.iaea.org/nafa/aph/index.html

Information on New FAO titles:

To be regularly informed on FAO new titles, subscribe to FAO-Bookinfo, the free electronic newsletter from the FAO Sales and Marketing Group. Please send an email to mailserv@mailserv.fao.org leave the subject blank and then put in the first line of the message the following: Subscribe FAO-Bookinfo-L.

Websites

- The AP&H Section website is being updated on a regular basis. Please feel free to look at it and make comments.
- http://www-naweb.iaea.org/nafa/aph/index.html
- A training package to help artificial insemination (AI) technicians to improve the performance of AI and field services provided to farmers is now accessible from the AP&H Section website (http://www-naweb.iaea.org/nafa/aph/public/d3_pbl_1_10.html). It was produced under an IAEA Technical Cooperation Project RAF/0/013 — ICT – Based Training to Strengthen LDC Capacity with the collaboration of the Animal Production & Health Section of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. This package is also available as a CD ROM for users who have no access to internet connection.

FORM A
IAEA-CN-174

INTERNATIONAL SYMPOSIUM ON
SUSTAINABLE IMPROVEMENT OF ANIMAL PRODUCTION AND HEALTH

8-11 June 2009
VIENNA, AUSTRIA

To be sent to the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee, or the National Atomic Energy Authority) for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria (telefax no. +43 1 26007). E-mail: APHS-Conference2009@iaea.org by 15 November 2008

PARTICIPATION FORM

FAMILY NAME:	GIVEN NAME(S):	Mr./Ms.
INSTITUTION:	FULL ADDRESS:	
	TELEPHONE No.: TELEFAX No.: E-MAIL ADDRESS:	
NATIONALITY:	DESIGNATING GOVERNMENT OR ORGANIZATION:	
MAILING ADDRESS (IF DIFFERENT FROM THE ADDRESS INDICATED ABOVE):		

DO YOU INTEND TO PRESENT A CONTRIBUTED PAPER?	YES ☐	NO ☐
DO YOU INTEND TO PRESENT A POSTER?	YES ☐	NO ☐
TITLE OF PAPER/POSTER:		

FORM B
IAEA-CN-174

INTERNATIONAL SYMPOSIUM ON
SUSTAINABLE IMPROVEMENT OF ANIMAL PRODUCTION AND HEALTH

8-11 June 2009
VIENNA, AUSTRIA

To be sent to the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee, or the National Atomic Energy Authority) for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria (telefax no. +43 1 26007). E-mail: APHS-Conference2009@iaea.org by 15 November 2008

FORM FOR SUBMISSION OF A PAPER/POSTER

TITLE OF THE PAPER/ POSTER:		
AUTHOR(S) INITIAL(S) AND FAMILY NAME(S)	SCIENTIFIC ESTABLISHMENT(S) IN WHICH THE WORK WAS CARRIED OUT	TOWN/ COUNTRY
1.		
2.		
3.		
4.		

AUTHOR WHO WILL PRESENT THE PAPER	Mailing address:
Mr./Ms.	
Initial(s):	
Family name:	For urgent communications please indicate: Telephone No.: Telefax No.: E-Mail address:

I hereby agree to assign to the International Atomic Energy Agency

☐ the copyright or

☐ the non-exclusive, royalty-free licence (this option is only for those authors whose parent institution does not allow them to transfer the copyright for work carried out in that institution)

to publish the above-mentioned paper, and certify that no other rights have been granted that could conflict with the right hereby given to the Agency.

Date: (Signature of main author)

FORM C
IAEA-CN-174

INTERNATIONAL SYMPOSIUM ON
SUSTAINABLE IMPROVEMENT OF ANIMAL PRODUCTION AND HEALTH

8-11 June 2009
VIENNA, AUSTRIA

To be sent to the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee, or the National Atomic Energy Authority) for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria (telefax no. +43 1 26007). E-mail: APHS-Conference2009@iaea.org by 15 November 2008

GRANT APPLICATION FORM

(To be completed only by participants from developing countries on whose behalf a grant is requested)

FAMILY NAME: GIVEN NAME(S) MR./MS.:

DATE OF BIRTH: NATIONALITY: DESIGNATING COUNTRY:

E-MAIL: FAX: TELEPHONE:

MAILING ADDRESS:

1. EDUCATION (POST-SECONDARY)

NAME AND PLACE OF INSTITUTION	FIELD OF STUDY	DIPLOMA OR DEGREE	YEARS ATTENDED	
			FROM	TO

2. RECENT EMPLOYMENT RECORD (STARTING WITH YOUR PRESENT POST)

NAME AND PLACE OF EMPLOYER/ORGANIZATION	TITLE OF YOUR POSITION	TYPE OF WORK	YEARS EMPLOYED	
			FROM	TO

3. DESCRIPTION OF WORK (PERFORMED OVER THE LAST THREE YEARS)

4. INSTITUTE'S/MEMBER STATE'S PROGRAMME IN FIELD OF MEETING

....

Date Signature of applicant

....

Date Name and title (printed) and signature of responsible Government official

IAEA International Atomic Energy Agency

Animal Production and Health Newsletter

No. 48 July 2008

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

International Atomic Energy Agency
Wagramer Strasse 5, P.O. Box 100,
A-1400 Vienna, Austria

Printed by the IAEA in Austria,
July 2008

08-22222222