World Organisation for Animal Health

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WOAH Collaborative Centre Reports Activities 2024

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CENTRE INFORMATION

***Title of WOAH Collaborating Centre**	ELISA and Molecular Techniques in Animal Disease Diagnosis
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***Name Director of Institute (Responsible Official):**	Dongxin Feng, Director, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria
***Name (including Title and Position) of Head of the Collaborating Centre (WOAH Contact Point):**	Viskam Wijewardana, Laboratory Head Animal Production and Health Laboratory
***Name of the writer:**	Viskam Wijewardana

TOR 1 AND 2: SERVICES PROVIDED

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by WOAH

Category	Title of activity	Scope
		The purpose of the event is to enhance

Training, capacity building (true)	Training Course for Veterinary Diagnostic Laboratory Network Partners on the Detection and Characterization of Pathogens Causing Major Transboundary Animal Diseases and Zoonoses	the capacity of partners in the Veterinary Diagnostic Laboratory Network (VETLAB Network) to utilize nuclear-derived and molecular assays to accurately detect and characterize pathogens associated with major transboundary and zoonotic animal diseases. The event will also focus on vaccine quality assessment and serological assays for disease control.
Diagnosis, biotechnology and laboratory (true)	Molecular epidemiology and genome sequencing study - samples	A total of 322 new samples for molecular characterization and gene sequencing have been received from laboratories in resource-limited settings. These samples represent a diverse range of pathogens, including Lumpy Skin Disease Virus and other poxviruses, African Swine Fever Virus and other porcine viruses, Rabies Virus, Rift Valley Fever Virus, Peste des Petits Ruminants Virus, various avian viruses (such as HPAI Virus, NDV, and IBV), fish pathogens, and samples for various metagenomic analyses.
Vaccines (true)	Irradiated vaccines development	Inactivation doses through irradiation for vaccines against Betanodavirus were determined. This is an effort to develop an inactivated vaccine against Nodavirus infection in Seabass.
Training, capacity building (true)	Training Course for Veterinary Diagnostic Laboratory Network Partners on Next Generation Sequencing and Nanopore Sequencing Applications for the Detection and Characterization of Pathogens	The purpose of the event is to enhance the capacity of partners in the Veterinary Diagnostic Laboratory Network (VETLAB Network) to apply new sequencing technologies and relevant bioinformatics tools for the direct detection, characterization, and molecular surveillance of major pathogens causing transboundary animal diseases and zoonoses.
Training, capacity building (true)	Open Event for Veterinary Diagnostic Laboratory Network Partners on the Diagnosis of Peste des Petits Ruminants and Respiratory Diseases of Small Ruminants	The purpose of the event is to strengthen the capacities of the Veterinary Diagnostic Laboratory Network (VETLAB Network) and the Peaceful Uses Initiative Peste des Petits Ruminants (PPR) project partner laboratories in implementing diagnostic tests related to different phases of the PPR Global Eradication Programme.
		To provide an update on the PPR global

Training, capacity building (true)	Workshop on laboratory methods for peste des petits ruminants (PPR) diagnosis (Jordan)	eradication programme (PPR GEP), give an overview on molecular epidemiology and diagnosis of PPR, and to strengthen or build up the laboratory capacity in various countries or regions for the detection of PPR by providing hands-on laboratory training on various diagnostics methods and sequencing
Training, capacity building (true)	Workshop on laboratory methods for peste des petits ruminants (PPR) diagnosis (Georgia)	To provide an overview of the PPR Global Eradication Programme (GEP) Secretariat activities, give an overview on the diagnosis of PPR in small ruminants, introduce differential diagnosis between PPR and similar small ruminants' diseases (CCPP, Orf, BTV, FMD, Pasturella and Capripox), provide a detailed explanation and hands-on experience on the use of antibody detection, antigen detection, and Nucleic amplification (PCR) tests.
Training, capacity building (true)	Regional Training Course on PPR (Peste des Petits Ruminants): Control Strategies, Epidemiology and Detection using Serology and Molecular Diagnostics	The training aims to equip participants with theoretical and practical skills to support the global strategy to eradicate Peste des Petits Ruminants (PPR), focusing on control strategies, including epidemiological tools and molecular and serological techniques
Training, capacity building (true)	National Training on Early Detection and Characterization of Animal Diseases in Post Flooding Environment, with Emphasis on Water Borne And Vector Borne Diseases for Ukraine	To improve the diagnostic capacities in veterinary medicine and biomedical laboratories dedicated to diagnosing especially dangerous and zoonotic animal diseases using serological and molecular (basic and advanced) testing.
Training, capacity building (true)	Training course on the molecular and serological diagnosis of Peste des Petits Ruminants (PPR) FAO (ECTAD Indonesia)	To assist Indonesia in Early Warning and Rapid Detection of PPR Disease
Training, capacity building (true)	Regional Training Course on Next Generation Sequencing (NGS) using Illumina Platform	To provide theoretical and practical training on the principle and applications of the New Generation Sequencing (NGS) technologies, using the Illumina platform
Training, capacity building (true)	Virtual LSDV workshop (FAO Tunisia)	To provide an overview LSD diagnosis, investigation of LSD outbreaks, post-vaccination adverse effects, and the importance of quality control of LSDV

		vaccines
Training, capacity building (true)	LSDV workshop (FAO Indonesia)	To provide an overview LSD diagnosis, investigation of LSD outbreaks, post-vaccination adverse effects, the importance of quality control of LSDV vaccines and post-vaccination monitoring
Training, capacity building (true)	Distribution of laboratory PCR controls, PCR and ELISA reagents, and Standard Operating Procedures (SOPs) for emerging zoonoses	To support the early detection and surveillance of abortifacient bacteria in ruminants, avian influenza virus, mpox virus, and other zoonotic pathogens in veterinary laboratories across endemic and newly affected countries in Asia and Africa
Training, capacity building (true)	Distribution of laboratory PCR controls, PCR and ELISA reagents, and Standard Operating Procedures (SOPs) for major transboundary animal diseases	To support the early detection and surveillance of PPRV (Peste des Petits Ruminants Virus), small ruminant respiratory pathogens, capripoxviruses and other ruminant poxviruses, avian pathogens, African swine fever virus, and other pathogens in veterinary laboratories across endemic and newly affected countries in Asia and Africa
Diagnosis, biotechnology and laboratory (true)	Molecular epidemiology and genome sequencing study sequence analysis	A total of 206 sequences for LSDV (Lumpy Skin Disease Virus), ASFV (African Swine Fever Virus), SARS-CoV-2, Avian Influenza Virus, Mccp (Mycoplasma capricolum subsp. capripneumoniae), PPRV (Peste des Petits Ruminants Virus), and BPSV (Bovine Papular Stomatitis Virus) were analyzed and made publicly available in the genetic database GenBank
Diagnosis, biotechnology and laboratory (true)	Development of multiplex Luminex	To develop and evaluate the performance of a duplex Luminex assay for Capripox and RVF
		Key Points Multiplex PCR Assays: Develop and assess multiplex PCR assays targeting multiple zoonotic pathogens. Nanopore Sequencing Integration: Combine these assays with nanopore sequencing to enhance detection and analysis. Surveillance Focus: Utilize the combined technology for both syndromic surveillance (monitoring disease

Diagnosis, biotechnology and laboratory (true)	Design and evaluate multiplex PCR assays for selected zoonotic pathogens, integrating nanopore sequencing for syndromic and species-based animal surveillance.	symptoms) and species-based surveillance (tracking specific animal hosts). Previously developed assays were fine-tuned in Collaboration with the Pasteur Institute of Cambodia to replace conventional primers in the viral family-based assay with indexed primers, Two new assays using indexed primers were developed: one targeting orthopoxviruses, including vaccinia virus, cowpox virus, and camelpox virus, with plans to extend evaluation to include the mpox virus, and another targeting filoviruses.
Diagnosis, biotechnology and laboratory (true)	Development of a pan-Lyssaviruses LIPS serological assay	A species-independent serological assay to detect Lyssavirus Nucleoprotein antibodies. In 2024, the PAN_Lyssav LIPS assay has been tested and validated across all four lyssavirus phylogroups. With the optimization of the PAN_Lyssa LIPS assay now complete, the remaining step is to test additional clinical serum samples.
Diagnosis, biotechnology and laboratory (true)	Development of a Phylogroup-Specific LIPS Serological Assay for West Caucasian Bat Lyssavirus	A Species-Independent Serological Assay to Detect glycoprotein Antibodies Specific to West Caucasian Bat Lyssavirus: this work is still ongoing
Diagnosis, biotechnology and laboratory (true)	Whole genome sequence for pathogens characterization	Two workflows have been optimized for sequencing large DNA viruses and bacteria directly from clinical samples, utilizing HiFi sequencing on the PacBio platform. Data analysis pipelines for both the Ion S5 and PacBio systems have been further automated to include: - Host Removal: Filtering out host-derived sequences to focus on pathogen data. - De Novo Assembly: Employing three different assemblers and comparing their outputs to select the most accurate assembly. - Reference-Guided Assembly: Followed by the extraction of specific genomic regions for viral subpopulation analysis. - Metagenomic Classification: Identifying and classifying sequences from mixed microbial communities. - Extraction of Classified Reads: Using classified reads to enhance the quality of

		de novo assemblies.
Diagnosis, biotechnology and laboratory (true)	Identification of pathogens by metagenomics	Two data analysis pipelines were established for the metagenomic identification of pathogens, including zoonotic pathogens, using reads produced by MinION nanopore and PacBio sequencers. Both pipelines utilize a metagenomics classifier followed by visualization with Kronaplots.
Diagnosis, biotechnology and laboratory (true)	Transfer of family-based assays transferred to Vietnam, Mongolia, Thailand, and Indonesia	The viral family/ genus-based assay for Coronavirus, Flavivirus, Lyssavirus, Orthomyxovirus, Paramyxovirus was adapted with indexed primers and transferred to Vietnam, Mongolia, Thailand, and Indonesia
Diagnosis, biotechnology and laboratory (true)	Sanger Sequencing Service for transboundary animal and zoonotic diseases	A standardized multi-step procedure for sequencing services through an external service provider; consists of instructions for sample preparation, evaluation and shipment, sequence assembly and sequence alignment, and development and interpretation of phylogenetic trees of pathogens. In 2024, 1318 samples were submitted from 8 Member State veterinary laboratories using this service. The contribution of the sequencing service has been acknowledged in 6 scientific publications in peer-reviewed journals published by member states.
Vaccines (true)	Irradiated vaccines development	Established optimal irradiation doses for inactivating PRRSV: Building on previous research, determination of the optimal dose of gamma irradiation for deactivating PRRSV while preserving its immunogenic properties was continued.

TOR 3: HARMONISATION OF STANDARDS

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the main fucus area for which you were designated

Proposal title	Scope/Content	Applicable Area
Organization of inter-laboratory comparison	43 laboratories in Africa, Asia, and Europe participated to the ring trial for PPR virus and	Laboratory Expertise

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for PPRV	antibody detection	

3. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

No

4. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
WOAH CC Diagnostic Test Validation Science in the Asia-Pacific Region CSIRO Australian Animal Health Laboratory (AAHL)	Australia	Asia y el Pacífico	Diagnostic tests validation
Viral Genomics and Bioinformatics University of Glasgow Centre for Virus Research (CVR), Glasgow	United Kingdom	Europa	Bioinformatics and genome analysis

TOR 4 AND 5: NETWORKING AND COLLABORATION

5. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
WOAH RL for Brucellosis, Servicio Nacional de Sanidad y Calidad Agroalimentaria (SENASA)	Argentina	Americas	Brucella reference material
WOAH CC for Quality Control of Veterinary Vaccines, PANVAC	Ethiopia	Africa	Trainings and workshops, scientific collaboration Vaccine quality analysis using NGS and seed sequencing using PacBio hifi sequecing

WOAH RL for PPR, CIRAD Region: Europe	France	Europe	PPRV research and technology transfer
WOAH RL for Contagious bovine pleuropneumonia, BNVL	Botswana	Africa	Rapid laboratory diagnoses, quality control
WOAH RL for Avian influenza and Newcastle disease, IZSVe	Italy	Europe	Avian influenza and Newcastle disease detection and typing

TOR 6: EXPERT CONSULTANTS

6. Did your Collaborating Centre place expert consultants at the disposal of WOAH?

Yes

Name of expert	Kind of consultancy	Subject
William D. Dundon	online	Peste des petits ruminants in Wildlife 20-21 March 2024
Charles E. Lamien	online	4th meeting of the GF-TADs for Africa Standing Group of Experts (SGE) for African swine fever (ASF) :15 - 17 October 2024

TOR 7: SCIENTIFIC AND TECHNICAL TRAINING

7. Did your Collaborating Centre provide advice/services to requests from Members in your main focus area?

Yes

Provide access to genome sequencing technology by facilitating access to- and support for- sequencing service providers as well as by sequencing samples upon request of member states.
Provide technical assistance and troubleshooting for ELISA and molecular techniques to national veterinary diagnostic laboratories.
Coordinate and support activities of a global network of national diagnostic veterinary laboratories.
Facilitate access to reference material, maintenance and calibration of laboratory equipment, and external quality assurance for laboratories operating in limited resourced settings.

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8. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by WOAH, to personnel from WOAH Members?

Yes

a) Technical visit : 1

b) Seminars : 160

c) Hands-on training courses: 91

d) Internships (>1 month) : 6

Type of technical training provided (a, b, c or d)	Content	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
A	Arab Atomic Energy Agency Workshop on the Development of Irradiated Vaccines, organized in collaboration with the Tunisian National Centre for Nuclear Sciences and Technology (CNSTN)	Tunisia and Arabic countries	23
B	Hybrid Workshop on Mpox, 22 August 2024	Global	100
B	Highly Pathogenic Avian Influenza - UPDATE WEBINAR | 9 May 2024	Global	60
D	Next-generation sequencing, Nanopore sequencing, and bioinformatics	Mauritania	1
D	Irradiated vaccines and CRISPR-based technologies to enhance veterinary vaccine production for transboundary and zoonotic diseases.	China	1
D	Data management and processing, integrating multi-tier spatial and temporal data into interactive tools, and designing a user-friendly platform for GIS-based data visualization and analysis	China	1
D	Next generation sequencing (Ion S5 Platform), third generation sequencing (Nanopore and PacBio),	Brazil	2

	bioinformatics and phylogenetic		
D	AMR diagnostics	Sierra Leone	1
C	Provided training on Detection and Characterization of Pathogens Causing Major Transboundary Animal Diseases and Zoonoses	Africa and Asia	31
C	Provided training on the Diagnosis of Peste des Petits Ruminants and Respiratory Diseases of Small Ruminants	Africa	13
C	Provided training on Next Generation Sequencing and Nanopore Sequencing Applications for the Detection and Characterization of Pathogens	Africa and Asia	19
C	Provided training on Pan-viral family/genus-based assays combined with nanopore sequencing for the detection, monitoring, and surveillance of transboundary animal and zoonotic diseases	Vietnam	9
C	Provided training on Pan-viral family/genus-based assays combined with nanopore sequencing for the detection, monitoring, and surveillance of transboundary animal and zoonotic diseases)	Mongolia	8
C	Provided training on Next Generation Sequencing (Illumina platform)	Ethiopia	5
C	Provided training on training on the diagnosis of transboundary and zoonotic animal diseases	Eswatini	6

TOR 8: SCIENTIFIC MEETINGS

9. Did your Collaborating Centre organise or participate in the organisation of scientific meetings related to your main focus area on behalf of WOAH?

No

TOR 9: DATA AND INFORMATION DISSEMINATION

10. Publication and dissemination of any information within the remit of the mandate given by WOAH that may be useful to Members of WOAH

a) Articles published in peer-reviewed journals:

17

1. MONJANE, I.; DJEDJE, H.; TAMELE, E.; NHABOMBA, V.; TIVANE, A. R.; MASSICAME, Z. E.; ARONE, D. M.; PASTORI, A.; BORTOLAMI, A.; MONNE, I.; WOMA, T.; LAMIEN, C. & DUNDON, W. G. (2024). H7N6 highly pathogenic avian influenza in Mozambique. Emerging Microbes & Infections. DOI: 10.1080/22221751.2024.2321993

2. SENDOW, I.; MEKI, I.K; DHARMAYANTI, N.L.P.I; HOERUDIN, H.; RATNAWATI, A.; SETTYPALLI, T.B.K.; AHMED, H.O; NURADJI, H.; SAEPULLOH, M.; ADJI, R.S.; FAIRUSYA, N.; SARI, F.; ANINDITA, K.; CATTOLI, G. & LAMIEN, C.E. (2024). Molecular characterization of recombinant LSDV isolates from 2022 outbreak in Indonesia through phylogenetic networks and whole-genome SNP-based analysis. BMC Genomics. https://doi.org/10.1186/s12864-024-10169-6

3. BEYIT, A.; YAHYA, B.; HAKI, M.; ELGHASSEM, A.; SIDINA, M.; BENIOG, M.; BABA, D.; BENANE, H.; EL WAVI, S.; SIDI, A.; BABA GUEYA, M.; AHMED, H.; SETTYPALLI, T.; LAMIEN, C. & DUNDON, W. (2024). Molecular characterization of peste des petits ruminants virus and Mycoplasma capricolum subsp. capripneumoniae in small ruminants in northern Mauritania, 2023. Veterinary Research Communications. DOI: 10.1007/s11259-024-10527-5

4. BERGUIDO, F.; KANGETHE, R.; SHELL, W.; WIJEWARDANA, V.; GRABHERR, R.; CATTOLI, G. & LAMIEN, C. (2024). Different Neutralising Antibody responses of Heterologous Sera on Sheeppox and Lumpy Skin Disease Viruses. Viruses. https://doi.org/10.3390/v16071127

5. MAKONGA, F.; CHANG'A, J.; MEKI, I.; MAYENGA C.; SETTYPALLI, T.; BITANYI, S.; MAGIDANGA, B.; PETER, E.; CHENGULA, A.; CATTOLI, G. & LAMIEN, C. (2024). Detection and molecular characterization of lumpy skin disease and bovine papular stomatitis viruses in lumpy skin disease-suspected outbreaks in Tanzania. Virol J. https://doi.org/10.1186/s12985-024-02558-w

6. MAKALO, M.; SETTYPALLI, T.; MEKI, I.; BAKHOUM, M.; AHMED, H.; PHALATSI, M.L RAMATLA, T.; ONYICHE, T.; NIONZIMA-BOHLOA, L.; METLIN, A.; DHINGRA, M.; CATTOLI, G.; LAMIEN, C. & MOLIFI THEKISOE, O. (2024). Genetic Characterization of Lumpy Skin Disease Viruses Circulating in Lesotho Cattle. Viruses. DOI: 10.3390/v16050762

7. AUER, A.; CATTOLI, G.; PADUNGTOD, P.; LAMIEN, C.; OH, Y.; JAYME, S. & ROZSTALNYY, A. (2024). Challenges in the Application of African Swine Fever Vaccines in Asia. Animals. https://doi.org/10.3390/ani14172473

8. TAKEMURA, T.; ANKHANBAATAR, U.; SETTYPALLI, T.B.K.; PUREVTSEREN, D.; SHURA, G.; DAMDINJAV, B.; AHMED H.O.; DUNDON, W,G,; CATTOLI, G. & LAMIEN, C.E. (2024). SARS-CoV-2 Infection in Beaver Farm, Mongolia, 2021. Emerging Infect Dis. DOI: 10.3201/eid3002.231318

9. BERGUIDO FJ, SETTYPALLI TBK, MBUYI CGT, BAKHOM MT, VAN VUREN PJ, PAWĘSKA JT, CATTOLI G, GRABHERR R, LAMIEN CE (2024). Development of a luminex-based assay for the detection of anti-capripoxvirus and rift valley fever virus antibodies in domestic ruminants. Virol J. 21(1):335. doi: 10.1186/s12985-024-02602-9

10. MODISE-TLOTLENG, B. M., MPOLOKA, S. W., SETTYPALLI, T. B. K., HYERA, J., KGOTLELE, T., KUMILE, K., SECHELE, M. E., RABOLOKO, O. O., MAROBELA-RABOROKGWE, C., VILJOEN, G. J., CATTOLI, G., & LAMIEN, C. E. (2024). Molecular Testing of Zoonotic Bacteria in Cattle, Sheep, and Goat Abortion Cases in Botswana. Microorganisms, 12(12), 2644. https://doi.org/10.3390/microorganisms12122644

11. MOLINI, U.; COETZEE, LM.; CHRISTIANS, V.; HEMBERGER, M.Y.; CHIWOME, B.; AMUKWAYA, M.; KHAISEB, S.; CATTOLI, G.; DUNDON, W.G. & FRANZO, G. (2024). High detection frequency and genetic diversity of porcine circovirus 3 (PCV-3) in Namibian backyard farms and warthogs. Acta Tropica. https://doi.org/10.1016/j.actatropica.2023.107085

12. MOLINI, U.; COETZEE, LM.; HEMBERGER, MY.; CHIWOME, B.; KHAISEB, S.; DUNDON, WG. & FRANZO, G. (2024). First detection and molecular characterization of porcine reproductive and respiratory syndrome virus in Namibia, Africa. Frontiers in Veterinary Science.

https://doi.org/10.3389/fvets.2023.1323974
13. FRANZO, G.; MOLINI, U.; DUNDON, W.G. (2024). Six underreported viral diseases of domesticated and wild swine in Africa: Implications and perspectives. Veterinary Microbiology. https://doi.org/10.1016/j.vetmic.2024.110120
14. ASHANI S. PALKUMBURA, P. G.; MAHAKAPUGE, T. A. N.; KAVINDRA WIJESUNDERA, R. R. M. K.; WIJEWARDANA, V.; KANGETHE, R.T. & JAYANTHE RAJAPAKSE, R. P. V. (2024). Mucosal Immunity of Major Gastrointestinal Nematode Infections in Small Ruminants Can Be Harnessed to Develop New Prevention Strategies. Special Issue Modern Strategies for Diagnosis and Treatment of Parasitic Diseases. DOI: 10.3390/ijms25031409
15. AHMED, S.; NEMR, W.; EL-SHERSHABY, A.; FOUAD, E.; EL-FATAH MAHMOUD, M.; LIAQAT, F.; WIJEWARDANA, V. & UNGER, H. (2024). Gamma Irradiated Pasteurella multocida Vaccine induces strong humoral immunity and protects rabbits from disease. Vet Res Commun. https://doi.org/10.1007/s11259-024-10388-y
16. LIU, Y.; WANG, L.; CHEN, X.; MA, X.; YIN, C.; YANG, C.; LIU, B. & DU, J. (2024). Expression of goat poxvirus P32 protein and monoclonal antibody preparation. Frontiers. DOI: 10.3389/fcimb.2024.1427588
17. SGHAIER, H.; BOUHAOUALA-ZAHAR, B.; CHERIF, N.; KANGETHE, R.; AOUEILEYINE, M.; BECKER, D.; BENKAHLA, A.; KRAIEM, M.; SOUILEM, O.; BODJO, S.; MOTAMEDI-SEDEH, F.; ULBERT, S.; JAMES, E.; PRAVEEN, C.; WIJEWARDANA, V. & ELMAGHRABY, T. (2024). AAEA-CNSTN workshop summary: "Development of irradiated vaccines", 16–20/09/2024, Republic of Tunisia.

b) International conferences:
2
1. ANNA S. FOMSGAARD, IRENE MEKI, CHARLES E. LAMIEN, HEIDI AUERSWALD, LIMMEY KHUN, JANIN NOUHIN, BRIAN N. MERRITT, PETER THIELEN, ERIK A. KARLSSON (2024). Closer to origin. A single assay for on-site genomic surveillance of high-risk zoonotic viruses. Poster, 8th World One Health Congress, 20-23 September 2024, Cape Town, South Africa
2. IRENE KASINDI MEKI, FRANCISCO J. BERGUIDO, BARBARA ZECCHIN, STEFANIA LEOPARDI, CHARLES E. LAMIEN, PAOLA DE BENEDICTIS, GIOVANNI CATTOLI (2024) A Species-Independent Luciferase Immunoprecipitation System (LIPS) for Serological Surveillance of Lyssaviruses. Poster, 8th World One Health Congress, 20-23 September 2024, Cape Town, South Africa

c) National conferences:

d) Other (Provide website address or link to appropriate information):

11. What have you done in the past year to advance your area of focus, e.g. updated technology?
Progress in advanced and long reads genome sequencing technology and related bioinformatic applications..
Progress in irradiation technology for pathogens inactivation and vaccines development.

12. Additional comments regarding your report: