Joint FAO/IAEA Centre
Nuclear Techniques in Food and Agriculture

VETERINARY LABORATORY NETWORKS

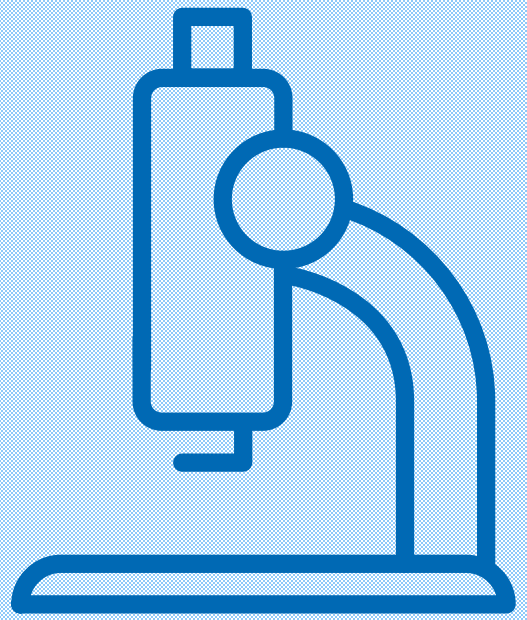
Animal Production and Health

Farai Muchadeyi, Section Head
Viskam Wijewardana, Lab Head

Emerging and re-emerging diseases

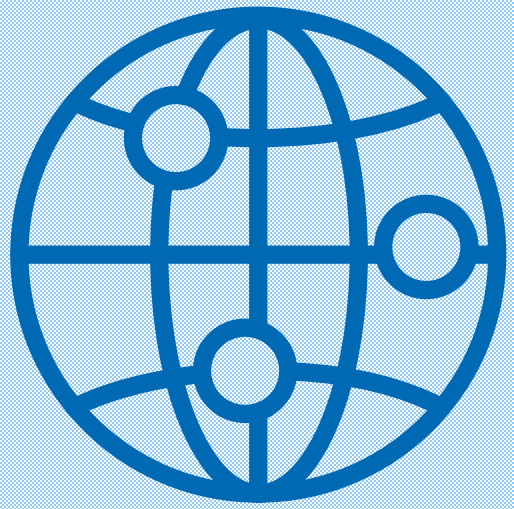
Globalization and interconnectedness

Zoonotic diseases

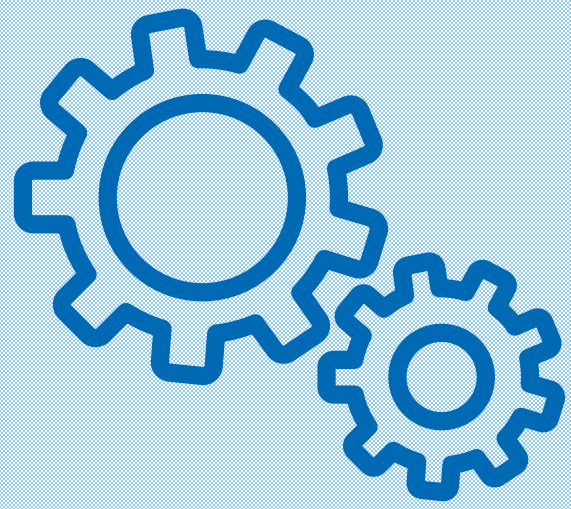


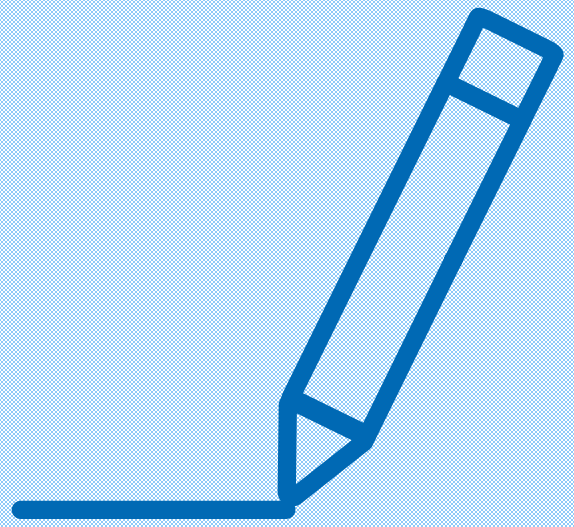
Varying capacities

Rapid spread of diseases



Public health risks





Economic losses

Challenges to control

The Role of Veterinary Networks

- ✓ Early detection and control of animal diseases
- ✓ Improved animal health and welfare
- ✓ Protection of public health
- ✓ Support for international trade
- ✓ Research and development

VETLAB Network

Zoonotic Disease Integrated Action (ZODIAC)

VETLAB Network

✓ Established in 2012

Aims:

1. Improve global veterinary diagnostics.
2. Support rapid outbreak response.
3. Foster international collaboration using nuclear techniques.

✓ 71 laboratories across 45 African and 19 Asian countries

Due to funding constraints, only 33 laboratories in 30 countries fully participate, while others receive emergency support and technical support based on requests.

Importance of Veterinary Laboratory Networking

Sharing of expertise, data, information and materials

Improving access to capacity building and R&D activities

Optimizing use of technical, financial and human resources

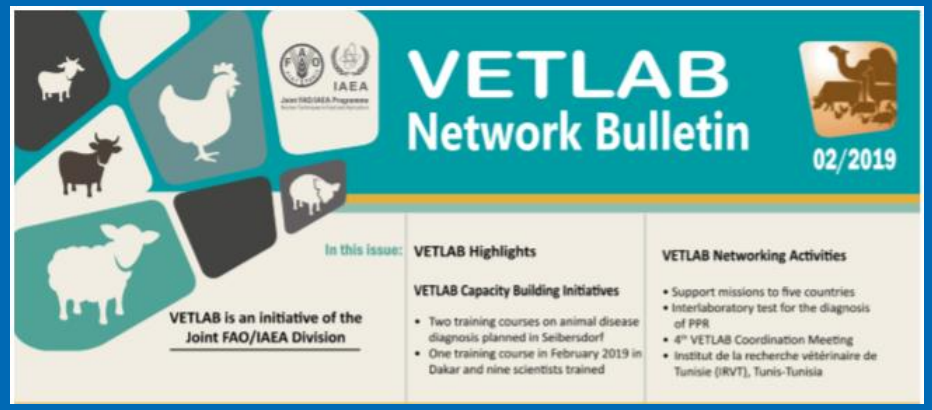
Synergizing efforts for the control of TADs and zoonoses

Capacity Building: Information, Knowledge and Experience Exchange

Third joint coordination meeting for Africa and Asia (August 2018)

Fourth joint coordination meeting for Africa and Asia (August 2019)

Sixth joint coordination meeting for Africa and Asia (August 2022)



Countries' contribution to the VETLAB Bulletin

Eighth joint coordination meeting for Africa and Asia (August 2024)

VETLAB Network: Building Capacity and Preparedness

Enhancing Diagnostic Capabilities

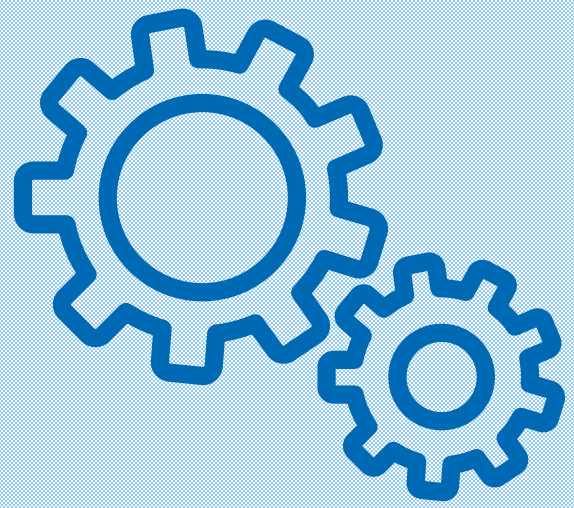
- ✓ 2014 to 2023: **16** **training courses**, training **342** **scientists** from **31** **countries** (Africa and Asia)
- ✓ 2014 to 2020: **19** **field missions** in **17** **countries** (Africa and Asia) to transfer technology and train **195** **scientists**
- ✓ Follow-up Actions: Provided reagents to implement newly learned techniques, followed up with discussions and troubleshooting
- ✓ Support: Supplied partners with equipment, consumables, and reagents

VETLAB Focus & Achievements

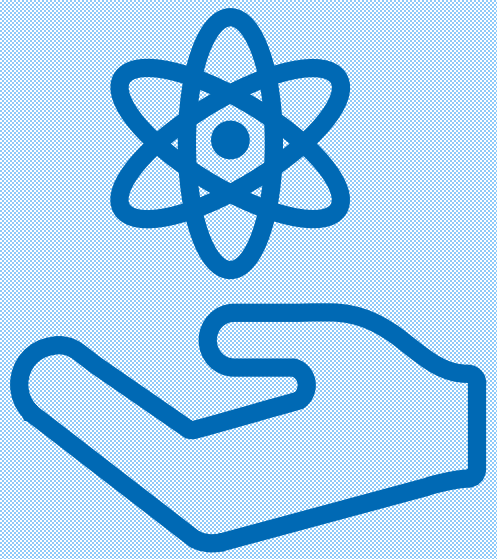
CAPACITY BUILDING

- ✓ Surveillance and diagnostic
- ✓ Assay development
- ✓ Vaccine production
- ✓ Characterization and epidemiology
- ✓ Standard Operating Procedures (SOPs)

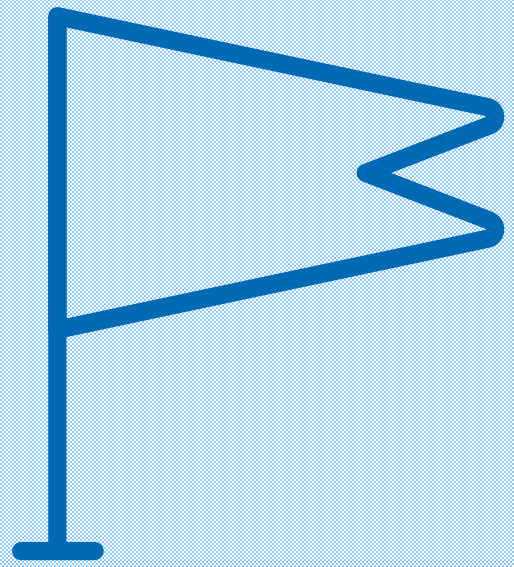
PPR, AMR, Monkeypox surveillance



Molecular characterization of PCV, ASF, PPR, Newcastle Disease



Syndromic testing, Multiplex assay, family-based approach



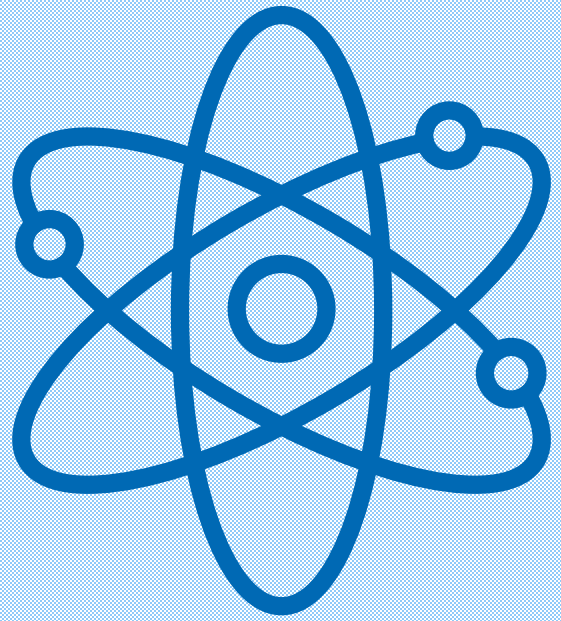
More than 500 SOPs available on iVetNet

VETLAB Focus & Achievements

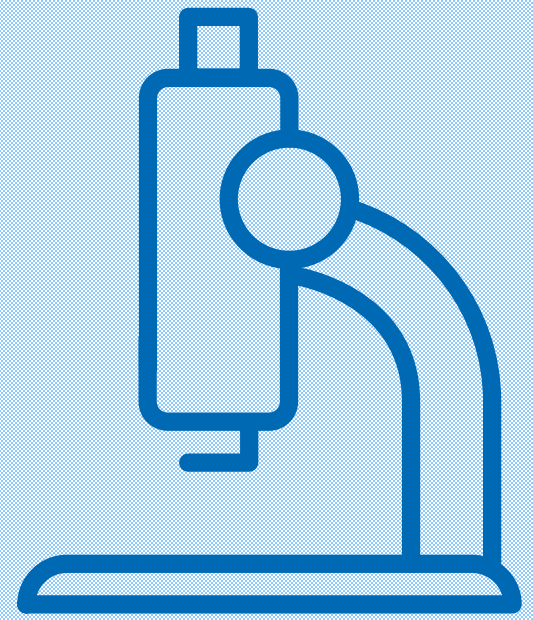
OUTBREAKS

- ✓ Provision of Standard Operation Procedures (SOPs) and protocols
- ✓ Equipment, reagents and controls
- ✓ Sequencing services
- ✓ Training Courses and Webinars

Lumpy Skin Disease outbreak in Libya (2023)



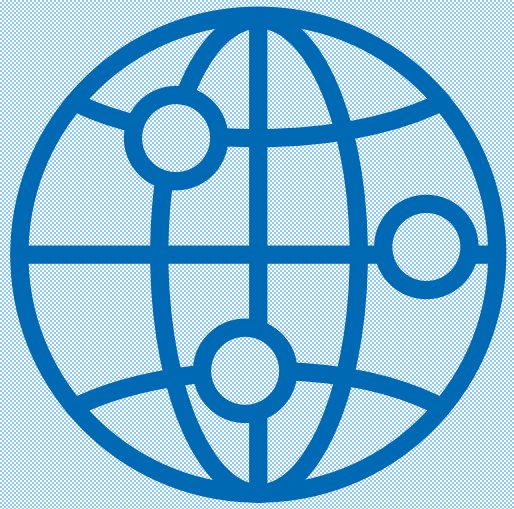
African Swine Fever in Burkina Faso and Nigeria (2019-2021), in Eastern Asia (2018-2019)



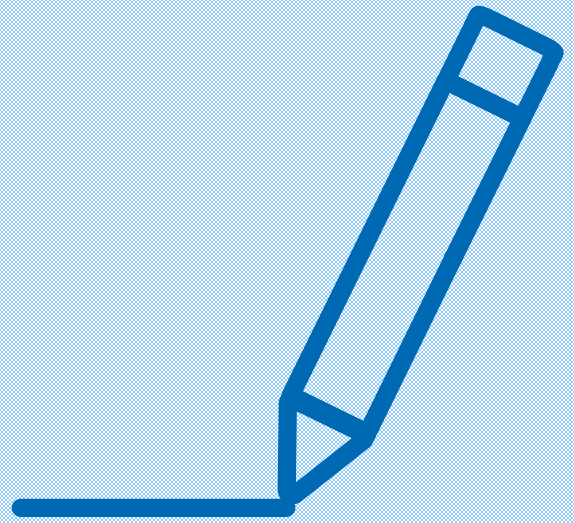
Avian Influenza (H5N1) (2020-2024)

RHDV2 in West Africa (2020)

Lumpy Skin Disease in Asia (2019-2020)



Foot-and-mouth disease in Morocco (2019)

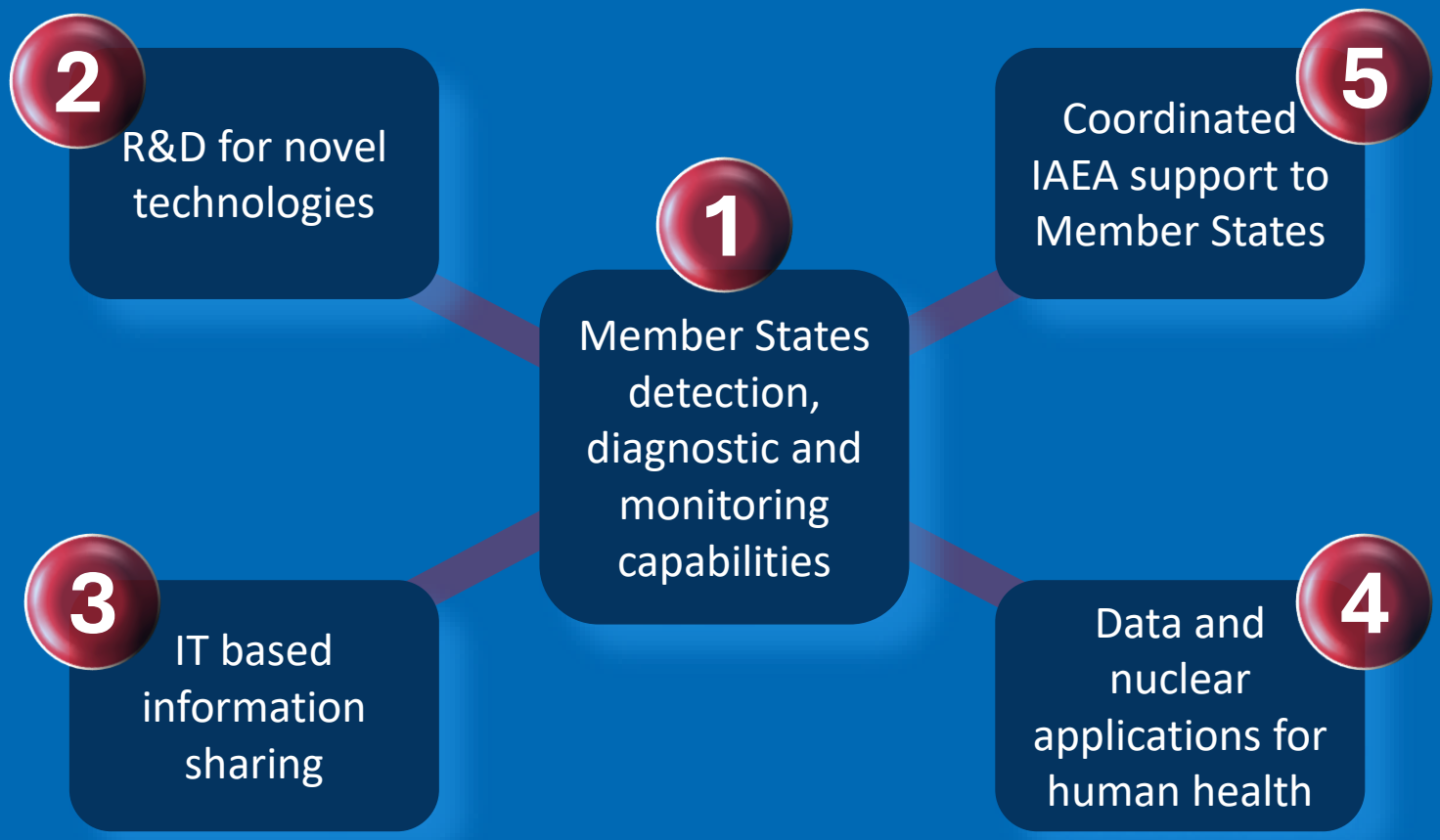


Avian Influenza (H5N6) in Mongolia (2020).
Avian Influenza (H5N8) in Namibia (2019)

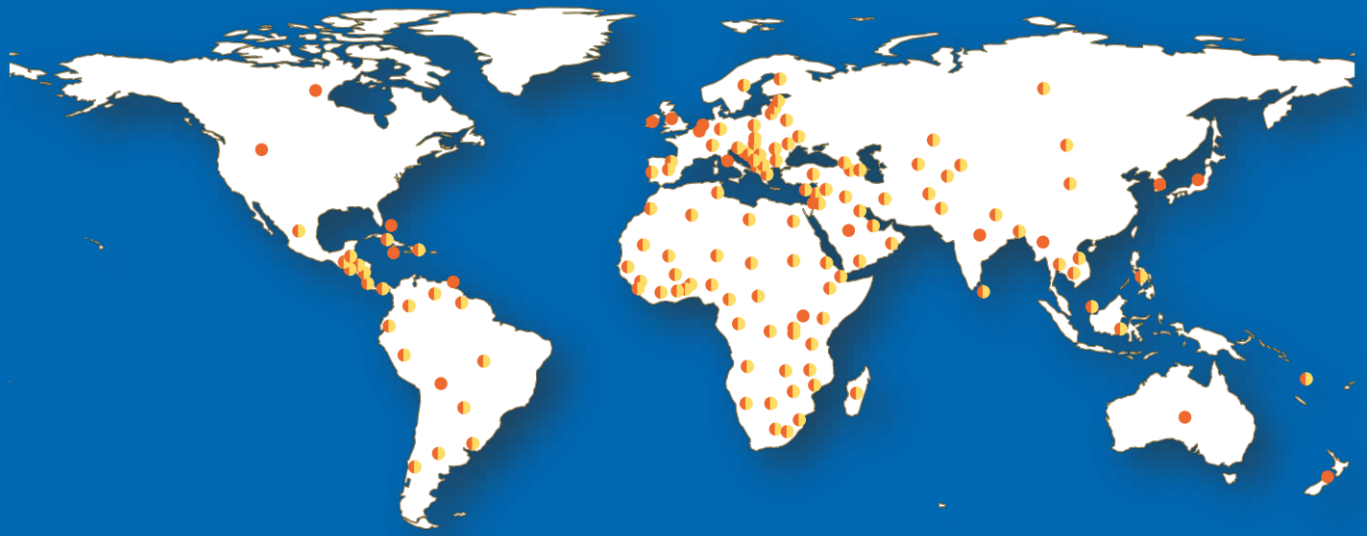
Equine influenza, African Horse Sickness and Strangles in West and Central Africa (2018-2019)

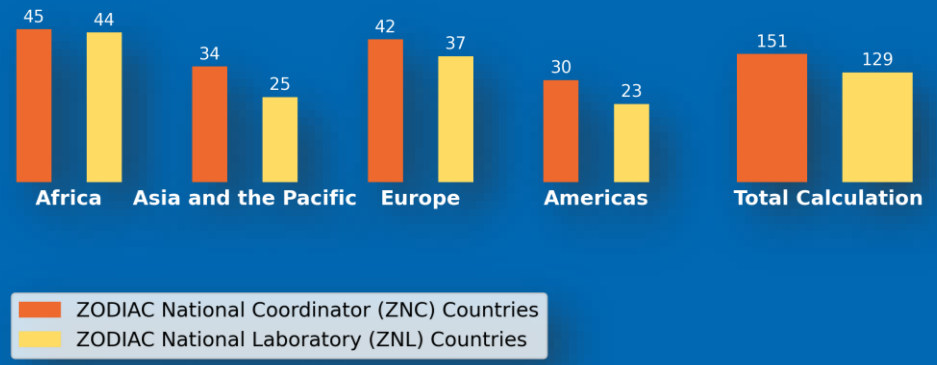
ZODIAC

An IAEA initiative to increase zoonotic diseases detection, diagnosis and monitoring capacities in Member States using nuclear and nuclear-derived techniques



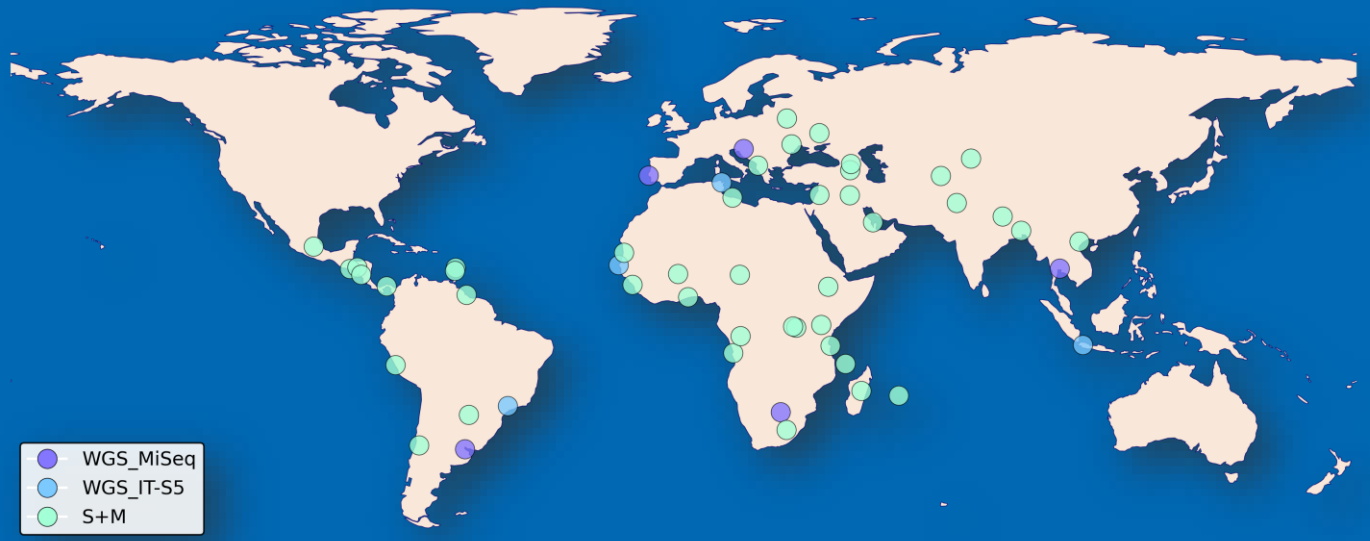
Zodiac National Laboratories – Capacity Building



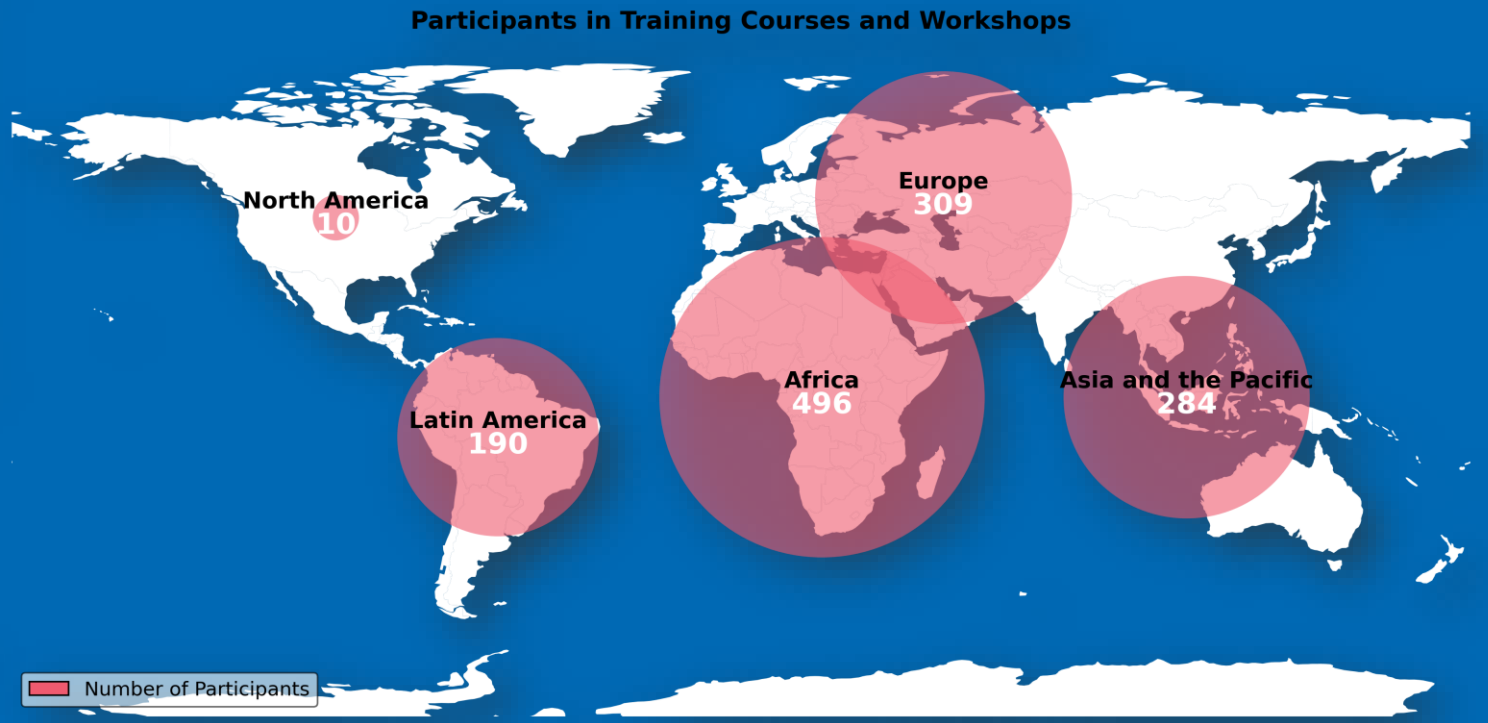


Sanger Sequencing Service

- ✓ More than 9600 samples submitted (6500 since ZODIAC)
- ✓ More than 70 different animal diseases
- ✓ More than 60 publications (10 ZODIAC related)
- ✓ Equivalent workflow for Whole Genome Sequencing is under development



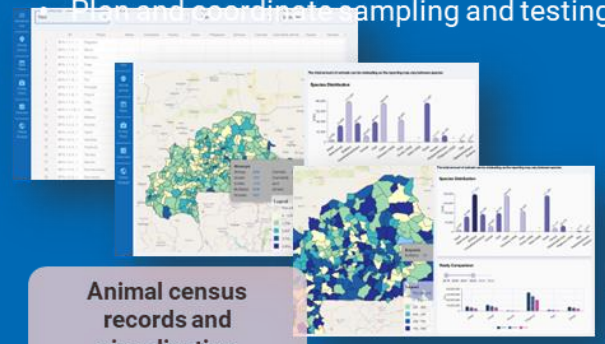
Capacity Building



Zodiac Information Platform

1 National Plans

- Develop and implement diseases monitoring program based on **animal census**.
- Plan and coordinate sampling and testing.



Animal census records and visualization

Assign & Coordinate

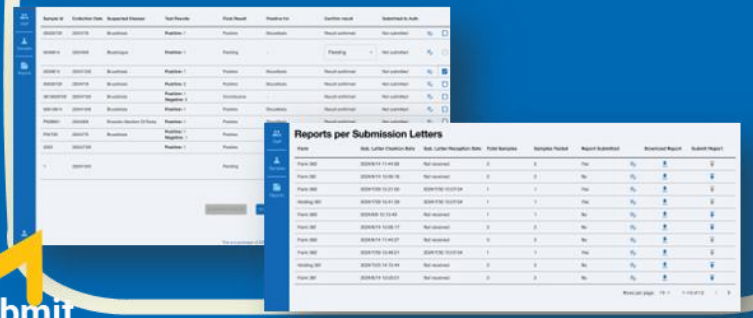
2 Field Veterinary Officer

- **Collect** samples including **farm metadata, animal metadata**, and **epidemiological data**.
- **Update** animal census.
- **Generate** submission letters

Submit

3 Laboratory Officer

- **Test** samples.
- **Generate** Reports with final status.



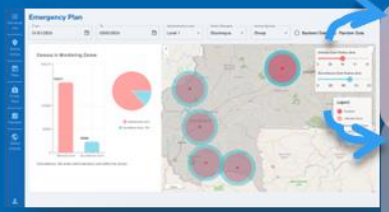
Submit

4 Real-Time Visualization

Monitoring Implementation plan

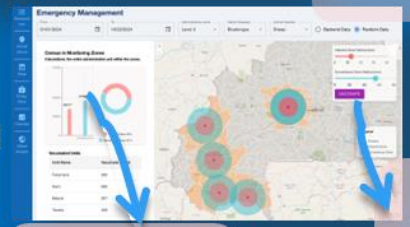
ANIMAL CENSUS
Samples PLANNED
Samples COLLECTED
Samples TESTED

Emergency Outbreak Management



Adjust Coverage of Infected zones

Adjust Coverage of Surveillance Zones

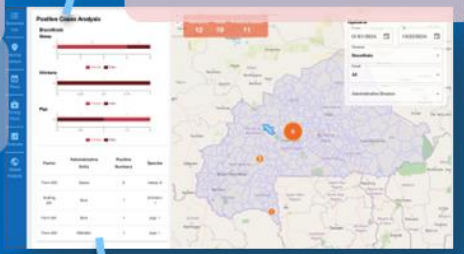


Automatic Analysis of CENSUS under the defined zones

Automatic Calculation And Targeting Animal Census to Vaccinate

Epidemiological Overview

Epidemiological Analysis (Connected to Laboratory)



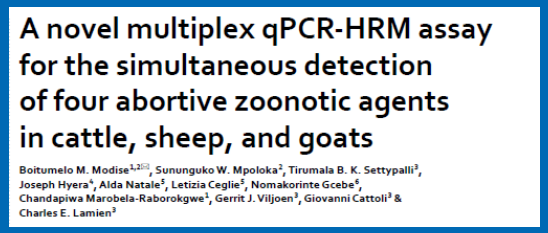
Geographical Distribution

Animal Production and Health Laboratory (APHL)

- ✓ Equipped with an array of nuclear and derived technology platforms
- ✓ Experts in the application of technologies in Animal Production & Health
- ✓ Critical mass of skills to disseminate these technologies and build capacity in MS

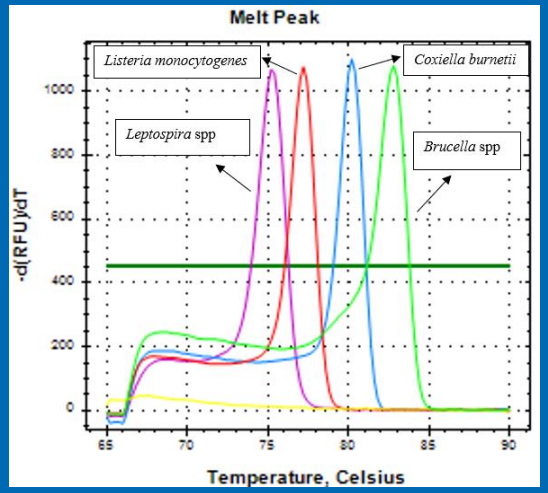
Disease detection and surveillance

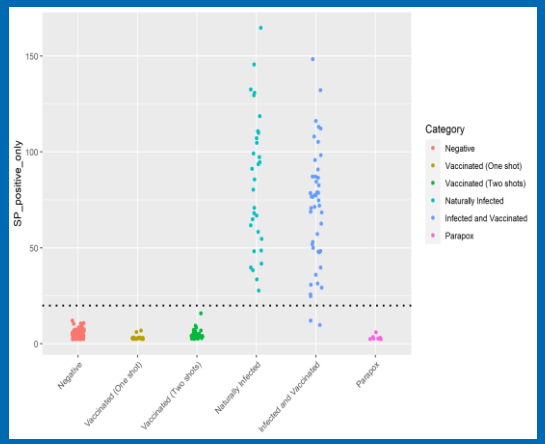
- ✓ Multiplex real-time PCR assays for syndromic surveillance and differential diagnosis of TADs and zoonoses
  - Zoonotic abortifacient agents of ruminants
- ✓ Innovative serological testing
  - Surveillance and post-vaccination monitoring for capripox
  - Species-independent serology (SARS-CoV2, Lyssaviruses, Lassa fever virus, and PPRV) for disease surveillance
- ✓ Family-based approach for detection/surveillance of zoonotic pathogens
- ✓ Generation of high-quality sequences to support molecular epidemiology

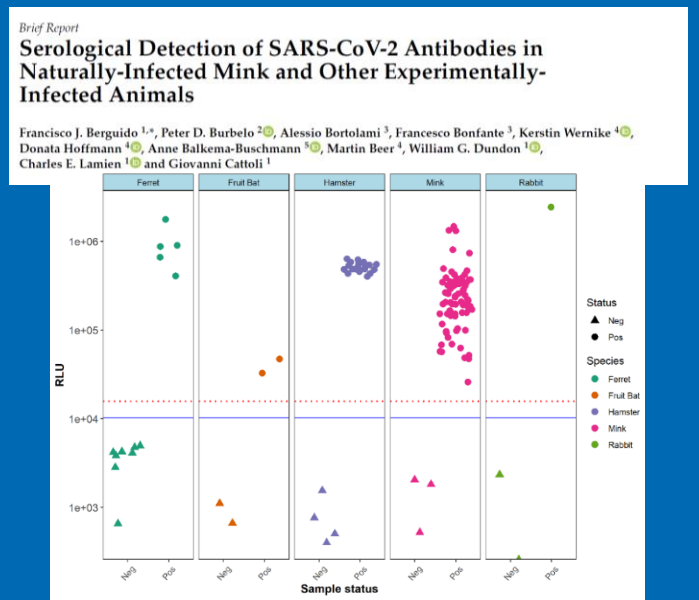


A novel multiplex qPCR-HRM assay for the simultaneous detection of four abortive zoonotic agents in cattle, sheep, and goats

Boitumelo M. Modise[1,2✉], Sununguko W. Mpoloka[2], Tirumala B. K. Settypalli[3], Joseph Hyera[3], Alda Natale[5], Letizia Ceglie[5], Nomakorinte Gcebe[6], Chandapiwa Marobela-Raborokgwe[4], Gerrit J. Viljoen[3], Giovanni Cattoli[3] & Charles E. Lamien[3]







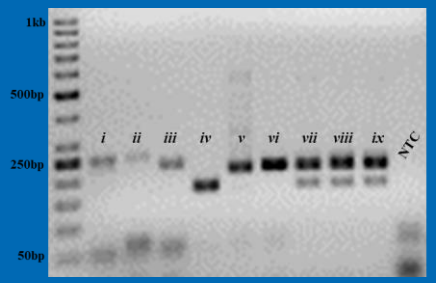
Brief Report

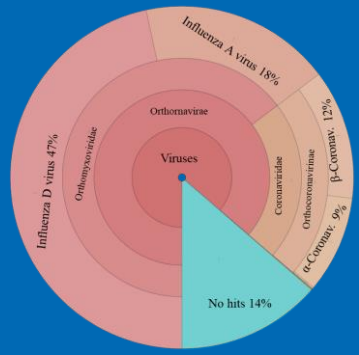
Serological Detection of SARS-CoV-2 Antibodies in Naturally-Infected Mink and Other Experimentally-Infected Animals

Francisco J. Berguido [1,*], Peter D. Burbelo [2], Alessio Bortolami [3], Francesco Bonfante [3], Kerstin Wernike [4], Donata Hoffmann [4], Anne Balkema-Buschmann [5], Martin Beer [4], William G. Dundon [1], Charles E. Lamien [1] and Giovanni Cattoli [1]

Syndromic surveillance

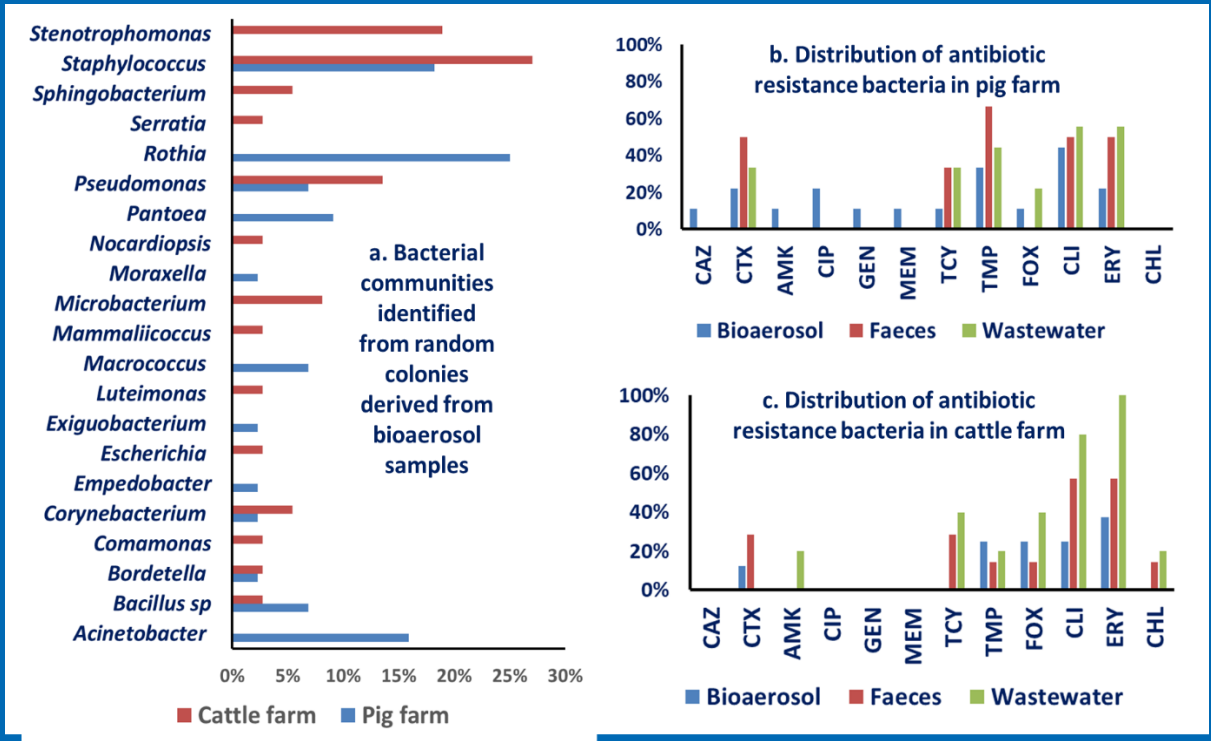
❖ Respiratory viruses (alpha/Beta coronaviruses and Inf A/D orthomyxoviruses)





Antimicrobial resistance

Antimicrobial resistance in animal production environments: preliminary analysis of bioaerosol, faeces, and wastewater

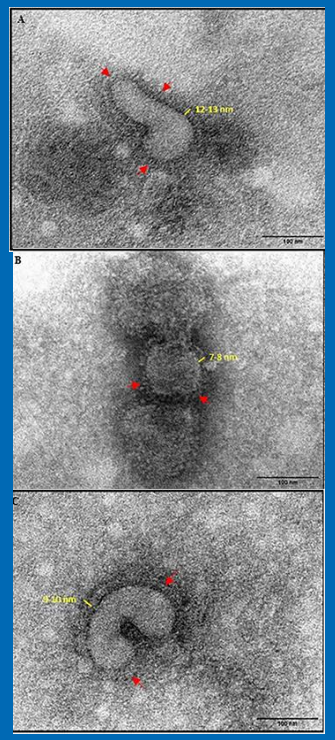


Genus of randomly selected bacterial colonies present in bioaerosol samples collected from pig and cattle farm; Distribution of antibiotic resistance bacteria in bioaerosols, faeces, and wastewater in (b) pig farm and (c) cattle farm

Building research capacity to improve farm environment sampling techniques for detection and characterization of AMR

Impactor bioaerosol samplers for detection and characterization of AMR in animal farms

Irradiated vaccine development

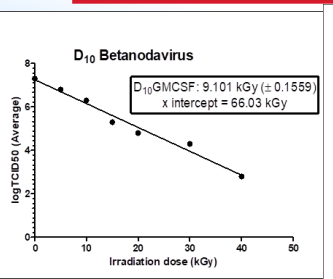


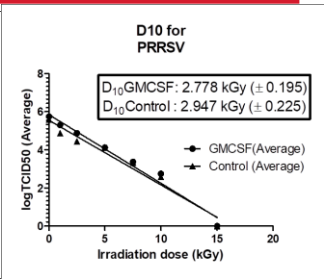
- ✓ Irradiated vaccines are created using ionizing radiation to inactivate pathogens
- ✓ Structural integrity and antigenic properties is preserved
- ✓ Short frame of time economical to manufacture
- ✓ In contrast to traditional inactivated vaccines, yields a broader protection
- ✓ Over 25 pathogens targeted, inactivation doses for important vaccine candidates determined
- ✓ Better formulations and optimum conditions for irradiation, antigenicity following irradiation assayed –invitro
- ✓ One collaborative agreement – partner filed two patent applications
- ✓ 30 peer-reviewed publications, one E-book IF 9

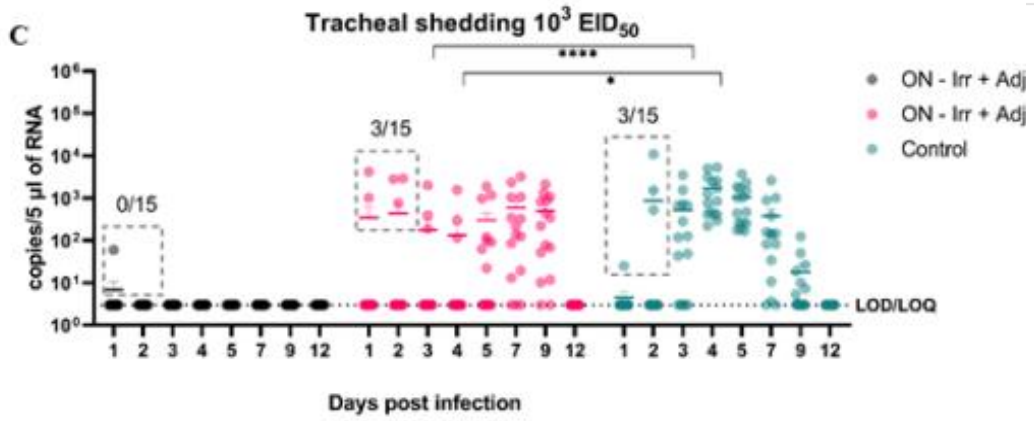
15 Articles

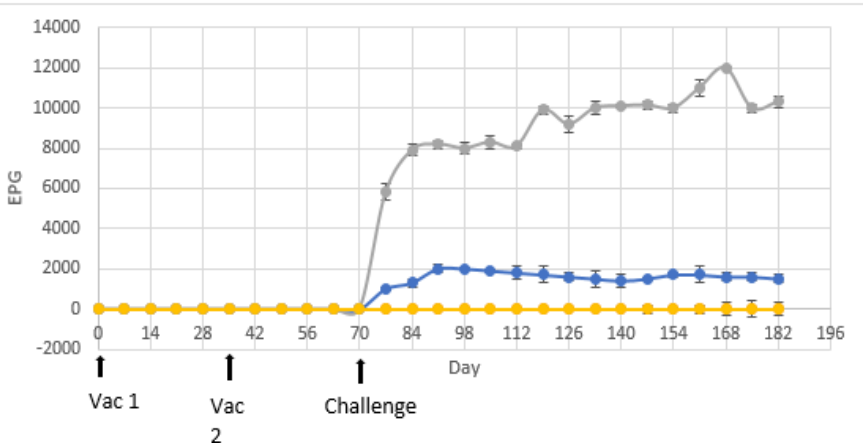
frontiers

Irradiation Technologies for Vaccine Development









IAEA

THANK YOU

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Nuclear Techniques in Food and Agriculture

Animal Production and Health Section

27 February 2025