The expectation of the development and operation of rabies network in Asia from the perspective of OIE/WHO/EU Reference Laboratory

Dr Florence Cliquet

Launching meeting of OIE twining project for rabies

17 - 18 October 2018, Taipei, TAIWAN
EURL IN THE FIELD OF ANIMAL HEALTH AND LIVE ANIMALS

Institut für Virologie des Tierarztlichen Hochschule Hanover
- Classical swine fever

Animal Health and Veterinary Laboratories Agency (AHVLA)
- Avian influenza, Newcastle disease, Crustacean disease

Pirbright Institute for animal health
- Bluetongue, Foot and mouse disease, Swine vesicular disease

Anses-Nancy
- Rabies serology, rabies

Laboratoire Ifremer
- Bivalve molluscs diseases

Anses-Alfort
- Brucellosis, Equine diseases other than AHS

Anses-Sofia
- Bee health

Laboratorio de sanidad y producción animal
- African horse disease

Centro de investigación en Sanidad Animal
- African swine fever

Visavet
- Bovine

DTU National Veterinary Institute
- Fish diseases

Interbull Center
- Zootechnics

Istituto Superiore di Sanità
- Parasitology

**RESPONSIBILITIES OF EURLS**

Concept of EURLS and National Reference laboratories (NRLs) are laid down in the regulation (EC) No 625/2017 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules (Article 94).

- **Coordinating** the methods employed in the Member States for diagnosing diseases and informing NRLs of advances in this field – coordinating or performing tests to check quality of reagents used for diagnosis;

- **Organising** regular proficiency tests and informing EC of the results and follow-up to proficiency tests;

- **Maintaining** reference strains, reference collections, up to date lists of reference substances and reagents - maintaining a QA system, biosafety and biosecurity;

- **Providing** NRLs with details and guidance on the methods of laboratory analysis, testing or diagnosis – providing reference materials and information on international research activities;

- **Assisting** actively in the diagnosis of disease outbreaks in Member States by carrying out confirmatory diagnosis, characterisation and epizootic studies;

- **Conducting** training courses for the benefit of staff from national reference laboratories and of experts from third countries and from other official laboratories.

- **Collaborating** with laboratories in third countries and with EFSA, EMA and ECDC – collaborate to develop new methods;
Rabies EURLs Networks

- EURL for rabies: Network of 64 laboratories
- EURL for rabies serology: Network of 86 laboratories*

NRLs from Member States and third countries

* In 2018
THE EUROPEAN UNION: FROM 6 TO 28 COUNTRIES!

NRLs from EU constitute a network!
### Rabies Serology Network

**Location of approved laboratories for rabies serology in September 2018**

- **Europe**
  - 33 labs from 28 EU countries
  - 8 labs from other countries (Russia, Serbia, Switzerland, Ukraine)

- **America**
  - 3 labs from USA
  - 1 lab from Mexico
  - 3 lab from Brazil
  - 1 lab from Chile

- **Africa**
  - 1 lab in Morocco
  - 1 lab in South Africa

- **Oceania**
  - 1 lab from Australia

- **Middle East**
  - 1 lab from Turkey
  - 1 lab from Israel
  - 1 lab from United Arab Emirates

- **Asia**
  - 1 lab from China
  - 2 labs from Japan
  - 4 labs from South Korea
  - 2 labs from Taiwan
RABIES DIAGNOSIS NETWORK

Location of evaluated laboratories for rabies diagnosis in May 2017

- Europe
  - 25 labs from 28 EU countries
  - 6 labs from other countries (Balkans, Moldavia, Norway)

- America
  - 1 lab from USA
  - 1 lab from Mexico
  - 1 lab from Colombia
  - 1 lab from Chile
  - 1 lab from Peru

- Middle East
  - 1 lab from Turkey
  - 1 lab from Israel

- Asia
  - 1 lab from Sri-Lanka
  - 1 lab from Philippines
  - 1 lab from Indonesia

- Africa
  - 2 labs in South Africa
  - 2 labs in Morocco
  - 1 lab in Nigeria
  - 1 lab from Egypt

- Oceania
  - 1 lab from Australia
RESPONSIBILITIES OF OIE REFERENCE LABORATORIES

✓ Coordinating or/and carrying out scientific and technical studies in collaboration with other laboratories, centres or organisation;

✓ Recommending and promoting diagnostic methods validated according to OIE standards;

✓ Providing diagnostic testing facilities and scientific and technical advice on disease control measures – providing trainings;

✓ Developing, standardising and validating new procedures for diagnosis and disease control – developing reference material;

✓ Storing and distributing biological reference products and any other reagents used in diagnosis and disease control;

✓ Organising proficiency tests with laboratories other than OIE ref labs to ensure equivalence of results – organising and participating in scientific meetings on behalf of OIE;

✓ Maintaining a network with other OIE ref labs – maintaining a QA system, biosafety and biosecurity.
WHO LABORATORIES FOR RABIES

- Pasteur Institute
  - PARIS, FRANCE
- Anses – Laboratory for rabies and wildlife
  - MALZEVILLE, FRANCE
- Friedrich Loeffler Institute
  - GREIFSWALD-INSEL RIEMS, GERMANY
- Centre for Traveller’s Health University of Zurich–ZURICH, SWITZERLAND
- Centre for Research on Rabies Pathogenesis and Prevention
  - BANGKOK, THAILAND
- National Centre For Disease Control
  - DELHI, INDIA
- National Institute of Mental Health and Neuroscience
  - BANGALORE, INDIA
- Animal and Plant Health Agency
  - WEYBRIDGE, UNITED KINGDOM
- Centre for Expertise for Rabies
  - CFIA/ACIA-NEPEAN, CANADA
- Centre for Neurovirology
  - PHILADELPHIA, UNITED STATES OF AMERICA
- Centre for Reference and Research on Rabies
  - PHILADELPHIA, UNITED STATES OF AMERICA
- Centers for Disease Control and Prevention
  - ATLANTA, UNITED STATES OF AMERICA
- Pasteur Institute
  - SAO PAULO, BRAZIL
- Pasteur Institute
  - TEHRAN, ISLAMIC REPUBLIC OF IRAN

Launching meeting of OIE twinning project for rabies 17 - 18 October 2018, Taipei (Taiwan)
**RESPONSIBILITIES OF ANSES - NANCY WHO COLLABORATING CENTRE**

- **Designing**, conducting and evaluating basic, operational and applied research projects for the control of zoonoses, more specifically on rabies and Echinococcosis;
- **Strengthening** networking among other WHO Collaborating Centres;
- **Providing** training – providing biological reference materials and laboratory services;
- **Assisting** countries to develop their surveillance against rabies and Echinococcosis - assisting with the preparation and dissemination of educational materials.

**On going programme :**
- Surveillance programs of Echinococcus granulosus sensu lato in North Africa.
- Surveillance programs of Echinococcus multilocularis in Eastern Europe.
- Collaboration on regional and international surveillance and control programs of vulpine and canine rabies.
- Collaboration with WHO collaborating Centres.
- Training activities.
OTHER RABIES INTERNATIONAL NETWORKS

• **GARC (PRP):**
  - To set up, coordinate and support networks at the global and regional levels, bringing stakeholders together to collaborate, acquire new tools, and share experiences.
  - Members of the Partners for Rabies Prevention (PRP), a group consisting of the major international rabies prevention stakeholders, including WHO, FAO, OIE, WHO rabies CCs, research scientists, the UBS Optimus Foundation, animal welfare NGOs and representatives from industry.

• **European Rabies Task Force:**
  - To monitor disease in EU countries to improve the cost-benefit ratio of eradication programmes co-funded by the EU.
  - Members are EU countries and Commission representatives.
  - To give tailored technical assistance to EU countries.

• **OMCL network (Official medicines Control Laboratories – EDQM):**
  - To support regulatory authorities in controlling the quality of medicinal products for human veterinary use available on the market.
  - Members are EU countries and non-European countries can participate as associate members of the work programme.
Reference material

Reference methods
PRODUCTION OF A OIE REFERENCE STANDARD SERUM OF DOG ORIGIN

At the beginning of 1990s:

- Expert groups to study on alternative measures of animal quarantine.
- Serology proven as a reliable indicator of effective vaccination (Aubert, 1992).
- Request of OIE to produce and characterize a reference serum of dog origin for rabies.
- Collaborative study to establish the titre of the OIE serum using RFFIT.

In 1994 – 1995:

- Development of the FAVN test to standardize serological tests to be used for assessing the ability of pets to travel with their owners.
- 4 workshops organised among the OIE, WHO and European networks.
- FAVN test has become referenced since 1996 (OIE) and 2005 (WHO).

Ref: Cliquet et al., 1998
NEW BATCH OF OIE STANDARD SERUM REFERENCE OF DOG ORIGIN

Results of the inter-laboratory titration (5 OIE participating laboratories)

- Technical and statistical data submitted to the OIE for assessment.
- In February 2014, the OIE Biological Standards Commission adopted this serum as an OIE-approved standard reagent for rabies serology.

Consensus titre established at 5.59 IU/mL

---

Ref: Wasniewski et al., Rev Sci Tech Off Int Epiz, 2017
Laboratory diagnosis is the key for surveillance of the disease and also to possibly initiate rational post-exposure rabies treatment decision: an appropriate and accurate diagnosis is consequently fundamental.

✓ Rabies methods (in compliance with OIE standards)

- **FAT** is based on the ability of a rabies FITC antibody conjugate to bind to rabies antigen and allow its visualisation using fluorescent microscopy technique.

- **RTCIT** is based on the propagation and isolation of the rabies virus in relevant cell cultures.

✓ Harmonisation of methods and elaboration of standardised procedures following identification of the critical points of the methods
MOLECULAR BIOLOGY TECHNIQUES: RT-PCR & qPCR

- Secondly commonly used confirmatory tests.
- Detects RNA even in degraded samples. RT-PCR useful for *intra vitam* diagnosis in humans (saliva samples or skin biopsies).
- Identifies the virus species (specific primers or typing).
- RT-qPCR quantifies DNA (less cross-contaminations).
- High sensitivity and specificity.
- High amount of analysis in a short time.
- Multiplicity of existing protocols, machines, primers...

- High technological laboratory requirement.
- Cross-contamination and false positive risks.
- Stringent quality assurance.

DIRECT RAPID IMMUNOHISTOCHEMICAL TEST

- dRIT developed at the CDC in the 2000’s.
- Detects viral antigens present in the CNS (RABV and all other lyssaviruses) with similar sensitivity and specificity to FAT.
- Similar to FAT except the use of streptavidin-biotin peroxidase staining with monoclonal or polyclonal antibodies either from OIE/WHO ref. labs. or self-produced; so fluorescence microscope not required.
- Already in routine use in North America for support of oral wildlife rabies vaccination programs.

• Requires basic laboratory equipment, reagents and training for application.
• Should improve decentralized lab-based surveillance in developing countries where the burden of rabies is important.

Ref: Coetzer et al., 2014; Dürr et al., 2008; Lembo et al., 2006; Madhusudana et al., 2012; Rupprecht et al., 2014; Saturday et al., 2009; Tao et al., 2008
CHAPTER 2.1.17 RABIES*

- Full revision, new chapter adopted in May 2018
- Update existing diagnosis tests:
  - FAT, dRIT, pan-lyssavirus PCR recommended as primary diagnostic tests
  - Conventional and real time PCR recommended for large number of samples
  - RTCIT, MIT (discouraged) or other molecular tests are recommended in case of inconclusive results
- Update vaccine’s section
  - Injectable
  - Oral use (wildlife and dog)

* Updated and published in 2018
Update on laboratory techniques (standard diagnostic tests and tests introduced since the WHO Laboratory techniques in rabies in 1996 and in 2018).

Role of oral vaccination of dogs during mass vaccination campaigns.

Template dossier for validation and verification that dog-mediated rabies has been eliminated.

Promoting the reporting of surveillance data through national, regional or international databases or platforms (i.e. DHIS).

Guidelines for palliative care of infected patients, safe techniques for human and animal immunization, strategies to reduce over-use of biologicals, potentials of new biologics.

* Updated and published in 2018
COLLABORATIVE STUDIES

- To evaluate a new method (in development or published) in comparison with a reference method
- To evaluate or to compare reagents or kits for rabies diagnosis, serology or molecular biology
- To evaluate or to compare equipment/machines

Examples:
- Evaluation of ELISAs for use in fox and raccoon dog samples to assess the efficacy of oral vaccination campaigns
- Comparison of FAT results among 12 NRLs from EU using various conjugates
- Comparison of conventional RT-PCR performances in 16 NRLs from EU
- Determination of the titre of a new reference vaccine

Ref: Wasniewski et al., 2016; Robardet et al., 2013; Fischer et al., 2013; Cliquet et al., 2003
TRAININGS : VARIOUS FORMATS! (1/2)

- In France or in the laboratories
- Individual (on request or request from our lab) or several people (workshop)
- Laboratory methods:
  - Rabies serology (FAVN test and ELISA BioPro kit)
  - Rabies diagnosis (FAT and RTCIT)
  - Molecular biology (PCR, RT-PCR, real time RT-PCR)
  - Titration of oral vaccine baits
  - Potency of inactivated vaccines (NIH test)
  - Determination of biomarker (tetracycline) in oral vaccine baits
  - Others
- Field work (capture of bats, vaccination of dogs, dog counting)
- Rabies epidemiology (analysis of data)
TRAININGS : VARIOUS FORMATS! (2/2)

Organisation of workshops:

- Serology (4 workshops for the FAVN test in Nancy (1995 – 1999), one for ELISA (2004) and one in Taiwan (AHRI) in 2017
- Molecular biology (in Morocco in 2008 and 2015)
- Detection of biomarker in vaccine baits (in 2012)

A good way for creating networks and make them working!

Follow up of trainings:

- Satisfaction questionnaires
- Procurement of reagents, panels, calculation sheet models, SOPs, etc...
- Support for data and results analysis and interpretation
Proficiency tests
GENERAL PRINCIPLES

- Blind samples analysed in participating laboratories as if they are samples received for routine analysis
- All involved laboratories test the same samples with the same method (tests referenced by the OIE)

- In the context of rabies serological testing for pet movements, proficiency tests are regulated by the EC\(^1\) with the delivery of an annual approval ([https://ec.europa.eu/food/animals/pet-movement/approved-labs_en](https://ec.europa.eu/food/animals/pet-movement/approved-labs_en))

The overall objective is to assess the degree of confidence of results (positive and negative) produced by the laboratories

---

Tasks of the European Union Reference Laboratory in the frame of rabies surveillance and control in Europe and in third countries

Workshop on regional policies to control rabies in the Southern Mediterranean – Paris (France) – 15-16 October 2013 - 29

PROCESS OF AN INTER-LABORATORY COMPARISON

- Confidentiality (labs and samples are randomly coded)
- Collusion and falsification of results
PROFICIENCY TESTS ORGANIZED IN ANSES-NANCY

- Rabies diagnostic tests: FAT, RTCIT, PCR and real time PCR (OIE referenced tests) and dRIT from 2019

- Rabies serological test: FAVN test and original RFFIT (OIE referenced tests) : every year since 1999

- Tetracycline and age detections of orally vaccinated animals (foxes):
  - Biomarker incorporated into the oral vaccine-bait matrix used in Europe for wildlife
  - To analyse occurrence of tetracycline in teeth of wildlife to evaluate bait uptake
RABIES DIAGNOSTIC TESTS

TEST ITEMS COMPOSITION

- 8 to 10 different batches of homogenate of brain tissues

To mimic as much as possible the standard rabies diagnosis conditions: virus is produced in vivo and a single panel is sent for all the tested techniques

The panel composition changes from year to year:

- Negative sample (homogenate of red fox brain tissue from French territory)
- CVS 27 (fixed strain, in vivo production)
- RABV (field strain, in vivo production)
- EBLV-1; EBLV-2; DUVV; BBLV; etc... (in vivo production)
- + various samples to avoid collusion between laboratories (since 2016)

✓ Rule of the FAT, RTCIT, RT-PCR test:
At least one discordant result ⇒ the participant fails the test
✓ Since 2017: Additional “Rabies Diagnosis Conclusion” evaluation

- For each applied test, a technical questionnaire is filled by the participants.

(Evaluation of method variabilities and support in the interpretation of discordant results)
RABIES SEROLOGICAL TEST: COMPOSITION OF THE PANEL

Pool of vaccinated dogs/cats serums

S+ 1/w

1/x

1/y

1/z

Naive dogs/cats serums

S1
S2
S3
S9
S10
S11

Pool of vaccinated dogs/cats serums

S+

1/w

1/x

1/y

1/z

Naive dogs/cats serums

S1
S2
S3
S9
S10
S11

ONE SAMPLE IN 3 REPLICATES

ONE SAMPLE FOR AVOIDING THE COLLUSION

Launching meeting of OIE twinning project for rabies  17 - 18 October 2018, Taipei (Taiwan)
**Rabies serological test: Pass/Fail criteria (1/2)**

- **Specificity**: Ability to identify serum from naïve dog/cat. Each laboratory should determine such serum as being strictly < 0.5 IU/mL.

- **Intra-laboratory consistency**: Comparison of the values given by a laboratory with the values that this laboratory should have found (using the scale of dilutions).

  The degree of consistency is measured using the linear regression:
  
  - Value of the coefficient of determination $R^2$,
  - Value of the y-intercept $a$,
  - Value of the slope $b$.

  These values are defined by the historical data and the current campaign.

---

![Graph showing linear regression formula $y = ax + b$ with $R^2$ value and example data points.](image)
Three areas are defined:

- **Success**: Values of $R^2$, $a$ and $b$ are in the **expected area**
- **Close examination**: Values of $R^2$, $a$ and $b$ are in the **warning area**
- **Failure**: Values of $R^2$, $a$ and $b$ are in the **action area**
Tetracycline and Age Determinations

- Jaws collected from red foxes sampled in the field in an infected country following oral vaccination and in France for negative samples.

- Jaw divided in two parts:
  - One to determine the status of the sample in Anses (2 readers).
  - The other one to be sent to participating laboratory.

**Panel Test Composition:** 6 half red fox jaws

- 1 adult weak positive jaw,
- 3 adult positive jaws,
- 1 juvenile negative jaw,
- 1 adult negative jaw.

- Panel sent in dry ice to avoid tetracycline signal deterioration under UN3373 conditions.

- Testing:
  - Determination of tetracycline (results as positive or negative).
  - Determination of animal age (juvenile/adult) on the same samples.
FAT RESULTS TREND

Very few false negatives on undiluted RABV and bat samples!
RTCIT RESULTS TREND

Very few false negatives on bat samples!
RT-PCR RESULTS TREND

Very few false negative results!

False positives

Few false positives
CONCLUSIONS ON THE TREND FOR RABIES DIAGNOSIS

- The 2017 session presented the best performances ever observed on positive samples.
- Questions raised within the network:
  - With the use of more and more sensitive tests (real time PCR), how to effectively discriminate true positive samples from contaminated material?
  - In view of new OIE reference tests, which test to consider as a confirmatory test?
  - Need to harmonize rabies diagnosis decision tree.

Batch contamination of the negative sample in 2017.
RESULTS AND CONCLUSIONS ON THE TREND FOR BIOMARKER AND AGE DETERMINATIONS

- Significant lower rates of discordant results in 2017 for age and tetracycline determinations compared to 2012 and 2010, respectively.
- High level of performances of the laboratories and improvement, particularly for age determination.
OVERVIEW OF SEROLOGICAL RESULTS (SUCCESS/FAILURE) 1999 - 2018

- From 1999 to 2017, the average failure is 4.10%, no trend.
- Proficiency testing is part of the quality assurance of laboratories (ISO/CEI 17025).
- This system of laboratory approval for those which are involved in titrations of serum samples from pets for international movements is globally satisfactory.

Since 2017, proficiency tests conducted according to ISO/CEI 17043:2010 and ISO 13528:205
Meetings - Consultations
WHO:
- Expert consultations and regular phone meetings

OIE:
- Working groups
- Terrestrial Code: regular update (chapter 8.14) (in progress)
EU RABIES TASK FORCE AND GARC

- EU rabies task force
  - Regular meetings in different infected countries (Romania in 2017, Hungary in 2015)
  - Facts and findings report with practical recommendations

- GARC
  - Annual meetings of the PRP (Banna, Italy 2008 – 2012; Wolfsberg, Switzerland 2013 – 2018)
  - Support for MEEREB (MERACON), ARACON and PARACON meetings
EURL WORKSHOPS

- Organised every year for EURL for rabies with Member States and certain European and non European from third countries
- Organised every 3 years for EURL for rabies serology with all international laboratories approved for rabies serology
Sharing and disseminating epidemiological data
**EPIDEMIOLOGICAL DATA**

- Rabies diagnosis based on laboratory investigations of dead animals (suspect).
- Diagnostic data = Surveillance data (rabies incidence) = Epidemiological data if analysed.
- Essential component for short and long term analysis of rabies situation, for deciding the strategy of control, evaluation of control measures and for understanding spatiotemporal dynamics of virus spread.
- These epidemiological data are used by the decision makers.

- Sharing the data
  - From the local, regional to national level,
  - To the network of neighbouring countries, if existing,
  - To national and international databases (WHO, OIE, DHIS2, RBE, etc...)

---

Rabies is a transboundary disease, exchanging data is transparency for the same objective: elimination of rabies!
PARACON, ARACON and MERACON aims to …

- **Unify** countries and rabies control networks of the world’s dog rabies endemic regions and promote co-operation in a One Health approach towards rabies control and elimination.

- **Create sustainable platforms** to showcase countries’ successes towards achieving rabies control and elimination as well as any lessons learnt and challenges faced.

- **Promote the implementation of tools** for rabies control such as the Rabies Blueprint/SARE, National Workplans, Educational initiatives such as GEP and the Rabies Epidemiological Bulletins.

In Europe: Rabies Bulletin Europe

---

1: Slide partly from Louis Nel, GARC
Rabies EU RL Networks

- Website (network presentation, news, calendar of activities, reports, events, reagents, catalogue, etc...)
- Bimestrial Newsletter (news, calendar, rabies alerts, list of new publications, etc...)
- Annual report of laboratory analysis for rabies surveillance and control in EU countries
ORAL RABIES VACCINATION EVALUATION RESULTS IN EUROPE

Rabies serology: Multiple tests, Comparability of results?

Biomarker determination: Unique standardized procedure
Discussion
STRATEGIC PLAN « ZERO BY 2030 » IN A ONE HEALTH APPROACH

Objective 1: To efficiently prevent and respond through effective use of vaccines, medicines, tools and technologies.

Objective 2: To generate, innovate and measure impact through policies, guidance and governance; reliable data to enable effective decision-making.

Objective 3: To sustain commitment and resources to drive progress. By providing a coherent foundation for rabies control, confidence in the feasibility of global elimination, and engages countries, research institutions and development partners in the fight to end rabies.

Our common objective: to end human deaths from dog-mediated rabies by 2030.


Launching meeting of OIE twinning project for rabies 17 - 18 October 2018, Taipei (Taiwan)

Networks of Organizers *supported by both OIE and WHO*

- Increase of participation availabilities
- Reduction transport costs
- Need to build a network of PT organisers with comparable PT process
PROFICIENCY TESTS ORGANISATION IN EAST-ASIA

- Experienced in Asian Networking (Workshop, APEC, etc.)
- Successful participation in rabies proficiency tests
- Central geographical position
- Building and staff with high capacities
SOME AREAS OF COLLABORATIONS

- Rabies control and surveillance (irrespective of the rabies status of the country):
  - Exchanging data
  - Creating shared databases
  - Organising regular meetings
  - Possibly confirming certain positive cases by another laboratory of the network

- Proficiency tests:
  - Production of reference materials - Exchanging of reagents, materials

- Trainings/workshops
  - Exchanging or receiving staff of laboratories

- Communication, result valorisation:
  - Creating tools (website, newsletter)

- Research activities in collaboration

The OIE Twining project AHRI – Anses could be an opportunity to improve and strengthen Asian laboratories collaboration
AS A PRE-CONCLUSION

- We do not know:
  - How countries from Asia are organized on the local, regional and national levels
  - How the relations between different countries/regions from Asia are established
  - Existing networks, even not recognized, involved in rabies surveillance and control activities

- We only know that..... being part of network(s), more or less large, more or less recognized is a win-win deal (mutually beneficial)

- We humbly hope this talk will provide you with some items you could develop, adapt or use
In 2017: six cases (2 cases in Hungary, 2 cases in Poland and 2 cases in Romania)
CONCLUSION

- Reasonable hope to achieve rabies elimination in Europe in the next years
  - Political engagement from EU countries, with associated co-funding from EC
  - Efficient EU network
- With the One Health approach and 2030 as a common objective of OIE, WHO, GARC and FAO for “No human case worldwide by 2030”
  - All efforts to be gathered for this objective from all ad hoc sectors on the local, regional and national levels – OIE/WHO/GARC networks
  - Building of networks at the “local” level
- The OIE Twining is a first stage of the steps to build an Asian network aiming at rabies elimination

*If you want to go fast, go alone, if you want to go far, go together*  
(African proverb)
Thank you for your attention

LYSSAVIRUS TEAM - ANSES-NANCY