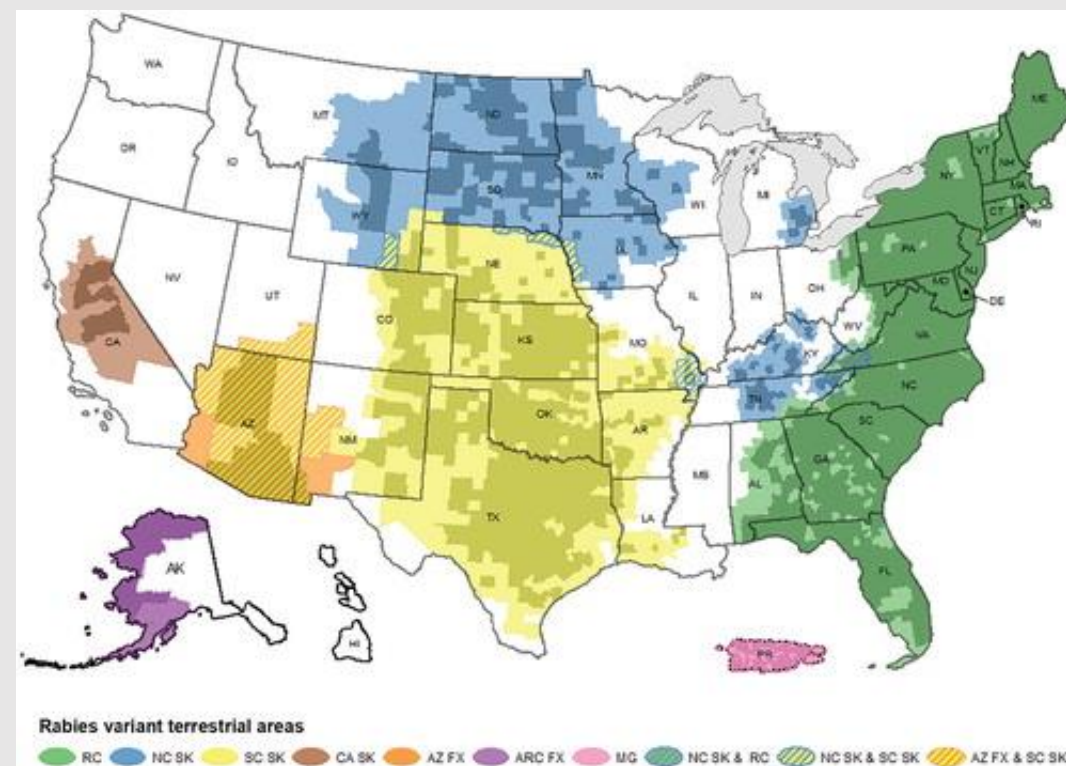
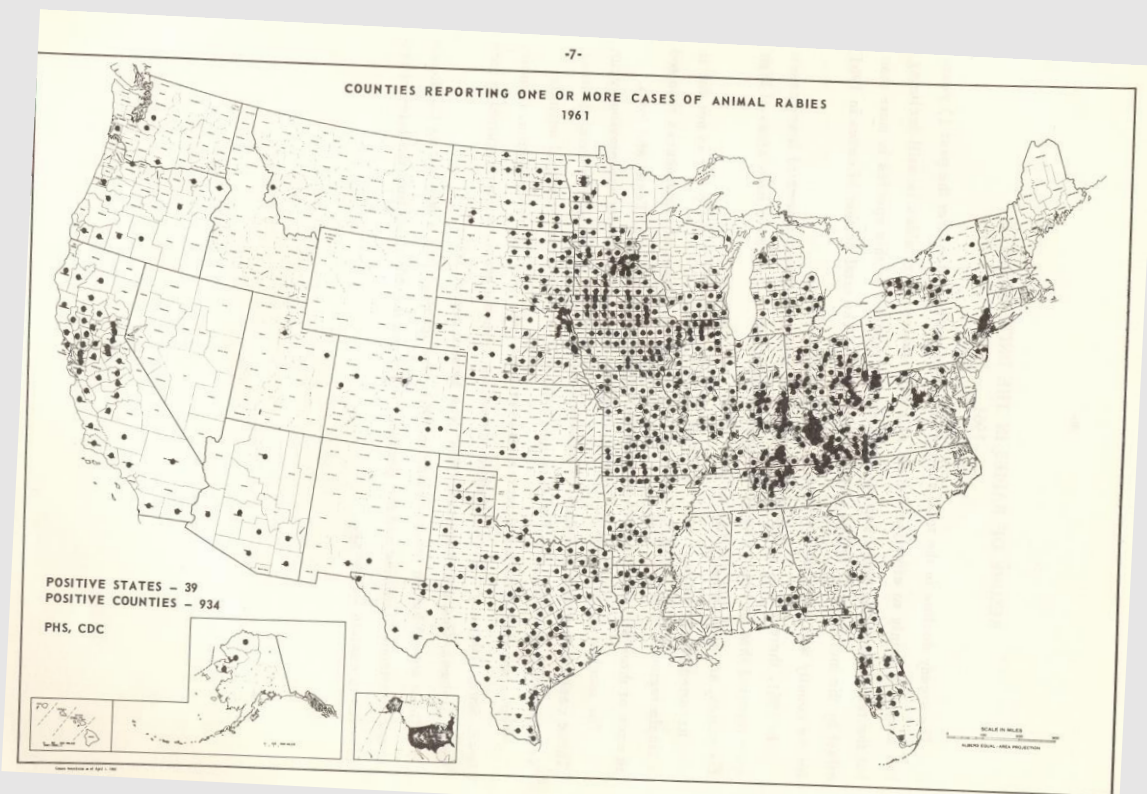


# US Rabies Laboratory Networks

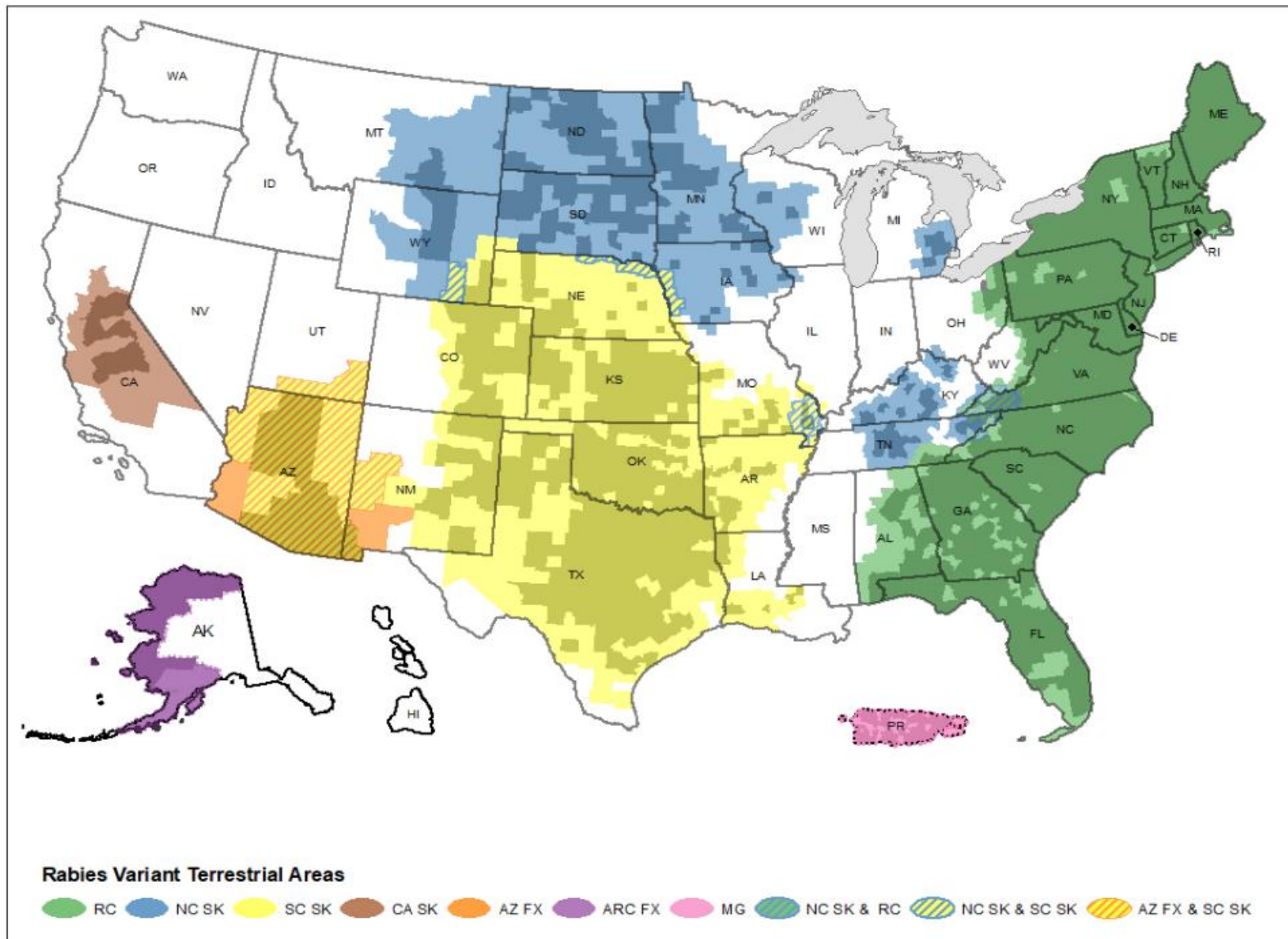
**Ryan Wallace**  
**DVM, MPH**

*U.S. Centers for Disease Control and Prevention  
 Poxvirus and Rabies Branch  
 Atlanta, GA*



# Rabies at CDC: We wear many caps





# Domestic Laboratory Networks

# Rabies in the US: Not Gone, but Oft Forgotten

## Rabies Reservoir Species



- At least **50,000** domestic animals are euthanized due to rabies exposures each year
- **~400** domestic animals develop rabies each year



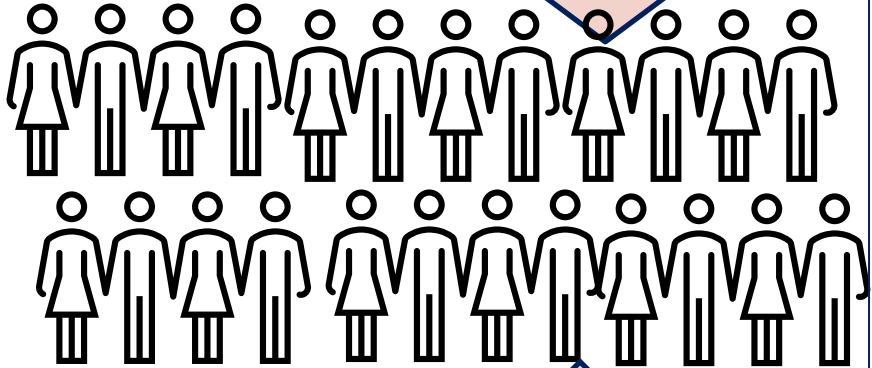
Rabies Spillover

# Rabies in the US: Not Gone, but Oft Forgotten

## Rabies Reservoir Species



60,000 exposures



**60,000** people get rabies post-exposure prophylaxis due to a rabies exposure, every year



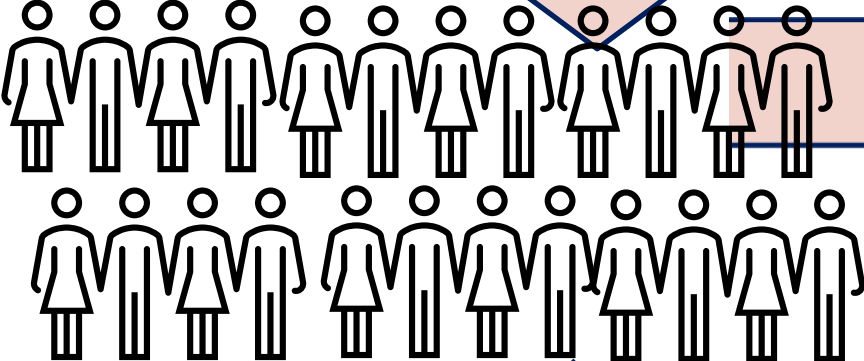
Rabies Spillover

# Rabies in the US: Not Gone, but Oft Forgotten

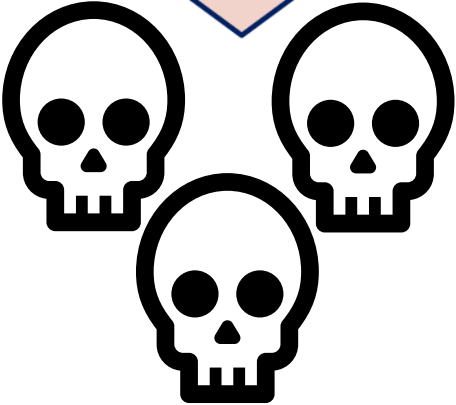
**Rabies Reservoir Species**



60,000 exposures

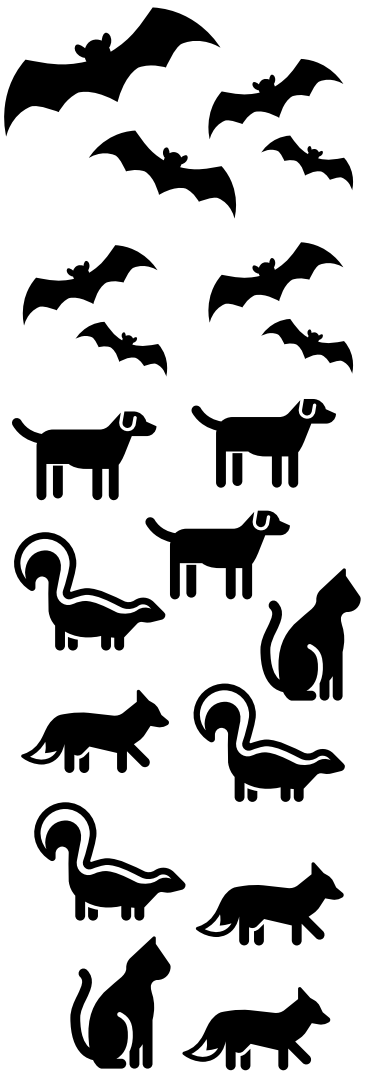


Rabies Spillover



**1 – 3 human rabies deaths each year**

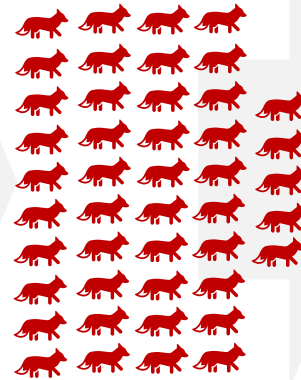
# Rabies Laboratory-Based Surveillance in the US



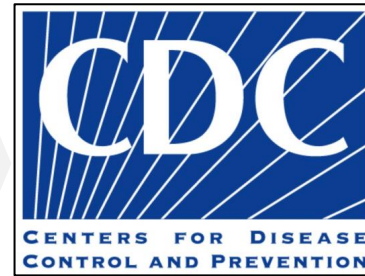
134 laboratories test ~95,000 animals for rabies each year as part of the U.S. Passive Public Health Surveillance System

USDA biologists test ~7,000 animals for rabies each year as part of the USDA National Rabies Management Program

~4,500 samples are positive each year



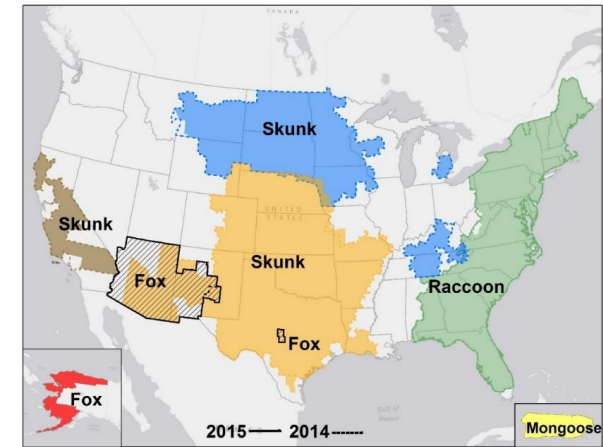
~200 samples are positive each year



Agencies share data for comprehensive national datafile maintained by CDC



Data informs CDC public health and animal vaccination guidance

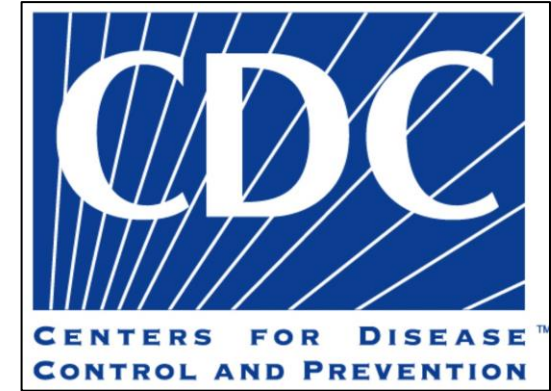


Data informs USDA oral rabies vaccination program



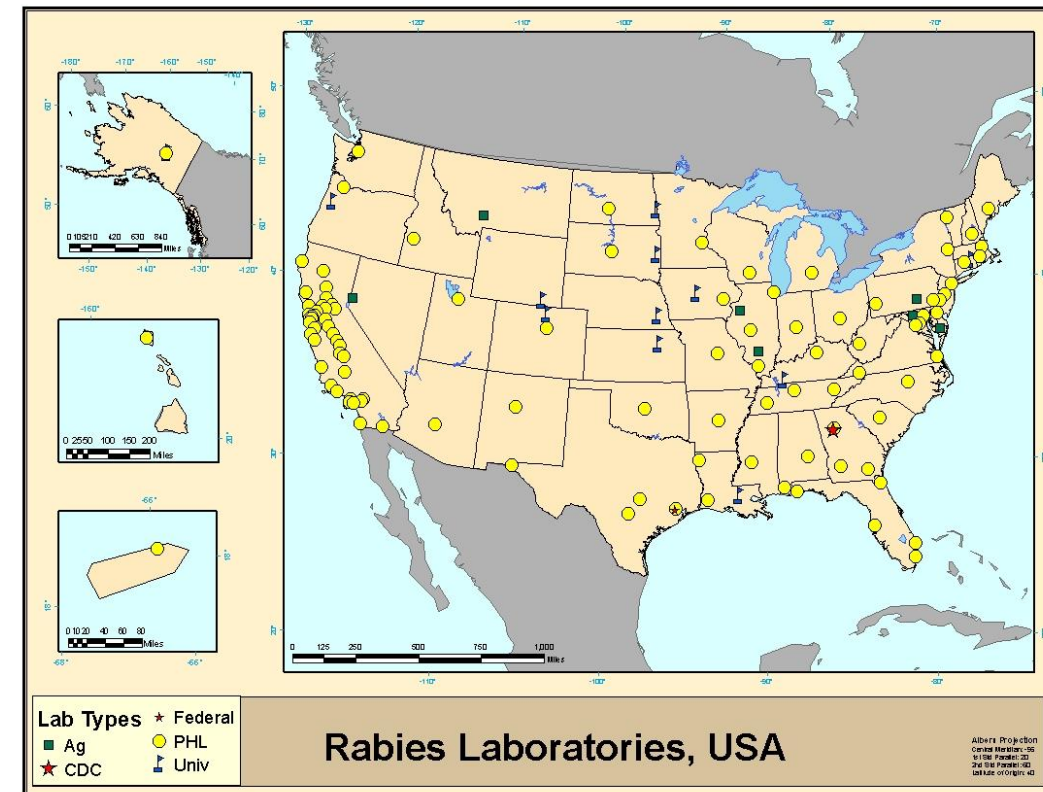
# National Rabies Reference Laboratory

- Operated by 3 Teams / ~30 staff
  - Immunodiagnostics & Proteomics
  - Genomic Diagnostics
  - Quality and Compliance



## ANNUAL ANIMAL SAMPLE TESTING (2021)

	TESTED
CLIA Animal Samples	78
CLIA Human Samples	55
State Health Departments	543
Agriculture Departments	120
Wildlife Serological Testing	2,982
<b>Totals</b>	<b>3,778</b>





# Role of National Rabies Reference Laboratory

- Testing to inform human treatment decisions
- Determine enzootic areas and regional patterns of animal rabies
- Detect changes in reservoir areas
- Provide trainings and training materials
- Develop and evaluate new test methods
- Advise on proficiency panels

**Public Veterinary Medicine: Public Health**

## Rabies surveillance in the United States during 2014

**Benjamin P. Monroe MPH**  
**Parneela Yager BS**  
**Jesse Blanton MPH**  
**Meseret G. Birhane MPH**  
**Ashutosh Wadhwa PhD, MVSc**  
**Lillian Orciari MS**  
**Brett Petersen MD, MPH**  
**Ryan Wallace MPH, DVM**

During 2014, 50 states and Puerto Rico reported 6,033 rabid animals and 1 human case of rabies to the CDC, representing a 2.83% increase from the 5,865 rabid animals and 3 human cases of rabies reported in 2013. Of the 6,034 cases of rabies, 5,588 (92.61%) involved wildlife. Relative contributions by the major animal groups were as follows: 1,822 (30.20%) raccoons, 1,756 (29.10%) bats, 1,588 (26.32%) skunks, 311 (5.15%) foxes, 272 (4.51%) cats, 78 (1.29%) cattle, and 59 (0.98%) dogs. Compared with 2013, there was a substantial increase in the number of samples submitted for rabies testing. The 1 human case of rabies involved a 52-year-old male in Missouri. Infection was determined to be a result of a rabies virus variant associated with *Peromyscus subflavus*; however, no specific exposure event was identified.

From the Poxvirus and Rabies Branch, Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Disease, CDC, 1600 Clifton Rd NE, Atlanta, GA 30333.  
Address correspondence to Mr. Monroe (bhd2@cdc.gov).

The present report provides a detailed update on rabies epidemiology and events in the United States during 2014 as well as a brief summary of rabies events in 2015. Updates are also provided for Canada and Mexico.

Rabies is caused by neurotrophic viruses of the genus *Lyssavirus*. It is almost always fatal once clinical signs develop, but is preventable if appropriate post-exposure prophylaxis is administered in a timely manner. The primary route of transmission is through the bite of an infected mammal, but rabies may also be transmitted when fresh saliva from an infected animal comes into contact with a wound or mucous membranes. For human patients who have never been vaccinated against rabies, post-exposure prophylaxis consists of immediate cleansing of any bite wounds with soap and water, infiltration of the wounds with human rabies immune globulin, and administration of 4 doses of rabies vaccine over the next 14 days.<sup>1,2</sup>

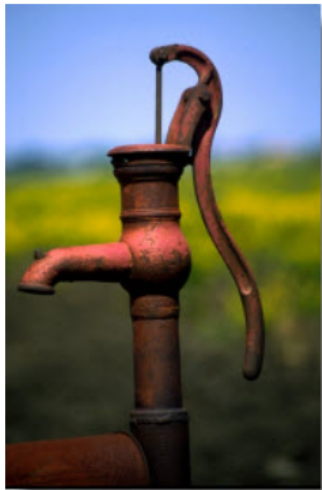
Since 1980, wildlife has accounted for > 90% of all rabid animals reported in the United States. The 5 species considered primary reservoirs include raccoons, bats, skunks, foxes, and mongooses (in Puerto Rico). Although cross-species transmission of rabies does occur (eg, infection of domestic dogs with the raccoon rabies variant), rabies virus variants are primarily transmitted within a single species that is the reservoir of that variant. Rabies virus variants associated with the major mesocarnivore species (ie, raccoons, skunks, foxes, and mongooses) are distributed in distinct geographic regions (Figure 1), whereas rabies virus variants associated with bat species are broadly distributed across the geographic ranges associated with specific bat species. Natural and anthropogenic factors (eg, drought

**Figure 1**—Distribution of major rabies virus variants among mesocarnivores in the United States and Puerto Rico for 2008 through 2014. Black diagonal lines represent fox rabies variants (Arizona gray fox and Texas gray fox). Solid borders represent 5-year rabies virus variant aggregates for 2009 through 2014; dashed borders represent the previous 5-year aggregates for 2008 through 2013.

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# Who gives CDC the authority to operate national rabies reference laboratory?

## ABOUT CSTE



CSTE works to advance public health policy and epidemiologic capacity. We also provide information, education, and developmental support of practicing epidemiologists in a wide range of areas as well as expertise for program and surveillance efforts.

CSTE is an organization of member states and territories representing public health epidemiologists. CSTE works to establish more effective relationships among state and other health agencies. It also provides technical advice and assistance to partner organizations and to federal public health agencies such as the Centers for Disease Control and Prevention (CDC). CSTE members have surveillance and epidemiology expertise in a broad range of areas including occupational health, infectious diseases, environmental health, chronic diseases, injury, maternal and child health, and more. CSTE supports effective public health surveillance and sound epidemiologic practice through training, capacity development, and peer consultation.



### **09-ID-12**

**Committee:** Infectious

**Title:** Public Health Reporting and National Notification for Animal Rabies

#### **I. Statement of the Problem**

CSTE position statement 07-EC-02 recognized the need to develop an official list of nationally notifiable conditions and a standardized reporting definition for each condition on the official list. The position statement also specified that each definition had to comply with American Health Information Community recommended standards to support “automated case reporting from electronic health records or other clinical care information systems.” In July 2008, CSTE identified sixty-eight conditions warranting inclusion on the official list, each of which now requires a standardized reporting definition.

#### **II. Background and Justification**

*Background<sup>1</sup>*

# Who gives CDC the authority to operate national rabies reference laboratory?



## VI. Criteria for case ascertainment

### A. Narrative: A description of suggested criteria for case ascertainment of a specific condition.

#### A1. Clinical Criteria for Reporting

N/A

#### A2. Laboratory Criteria for Reporting\*

Report all results, positive, negative or unsatisfactory/inconclusive

- Any rabies virus direct fluorescent antibody test; OR
- Any rabies virus direct rapid immunohistochemical test (dRIT); OR
- Any rabies virus test by immunohistochemistry (IHC) on formalin-fixed tissue; OR
- Any pan-lyssavirus probe-based real time reverse transcription-polymerase chain reaction (RT-PCR) test.

Report positive results only

- Detection of lyssavirus nucleic acid by genomic sequencing; OR
- Isolation of rabies virus (in cell culture or in a laboratory animal).

*\*While central nervous system (CNS) tissue is most commonly tested and is the preferred tissue type for ruling out a rabies virus or non-rabies lyssavirus infection, identification of rabies virus or a non-rabies lyssavirus in any tissue or body fluid provides evidence of infection.*

# National Rabies Surveillance System – data collection

- Participatory vs Regulatory (legal)

County/Local



State



CDC



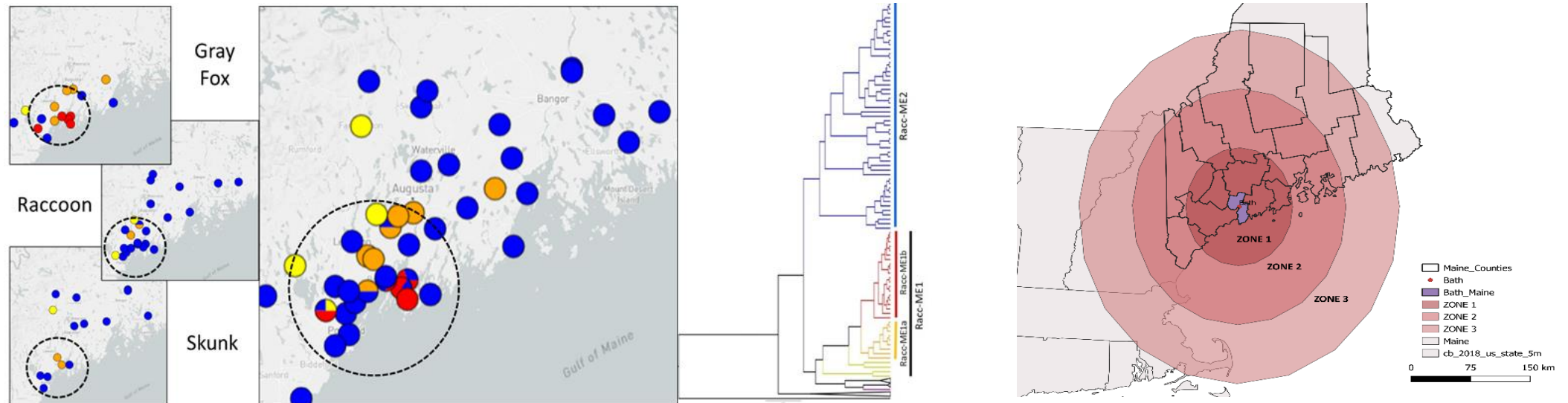
>4,000 laws referring to rabies control



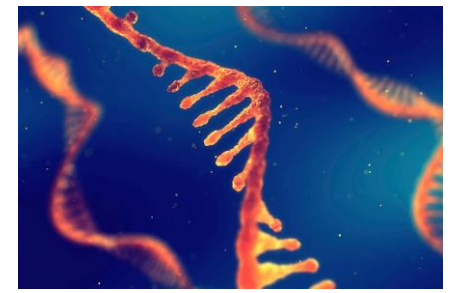
# NRRL Examples: Phylo-Epidemiologic Investigations

From 2019 to 2021, midcoastal Maine had an aberrant increase in rabid gray foxes focused in 2 counties.

One clade (**RED**) suggests an emerging host shift in the local gray fox population



# One Health Partnership to Validate a New Sampling Framework

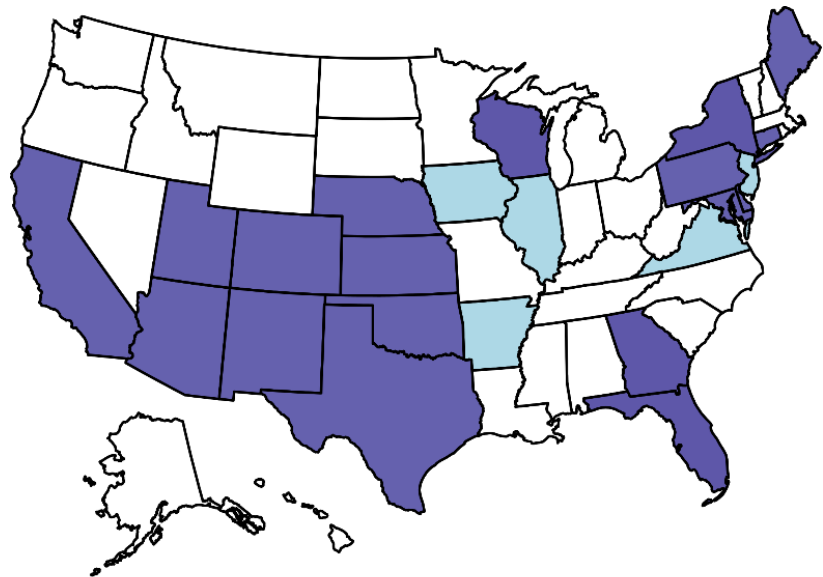
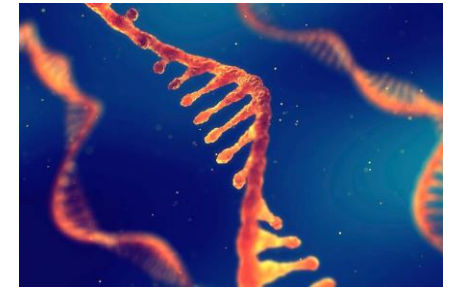


- Ministry of Agriculture conducts **Roadkill Surveillance** to inform rabies prevalence in areas with low human populations
- **PROBLEM:** Many samples hit-by-car are unsuitable for routine rabies diagnostic tests
- **SOULTION?** A new CDC PCR test is more sensitive, possibly enabling Ministry of Agriculture to collect poor-condition samples and still test

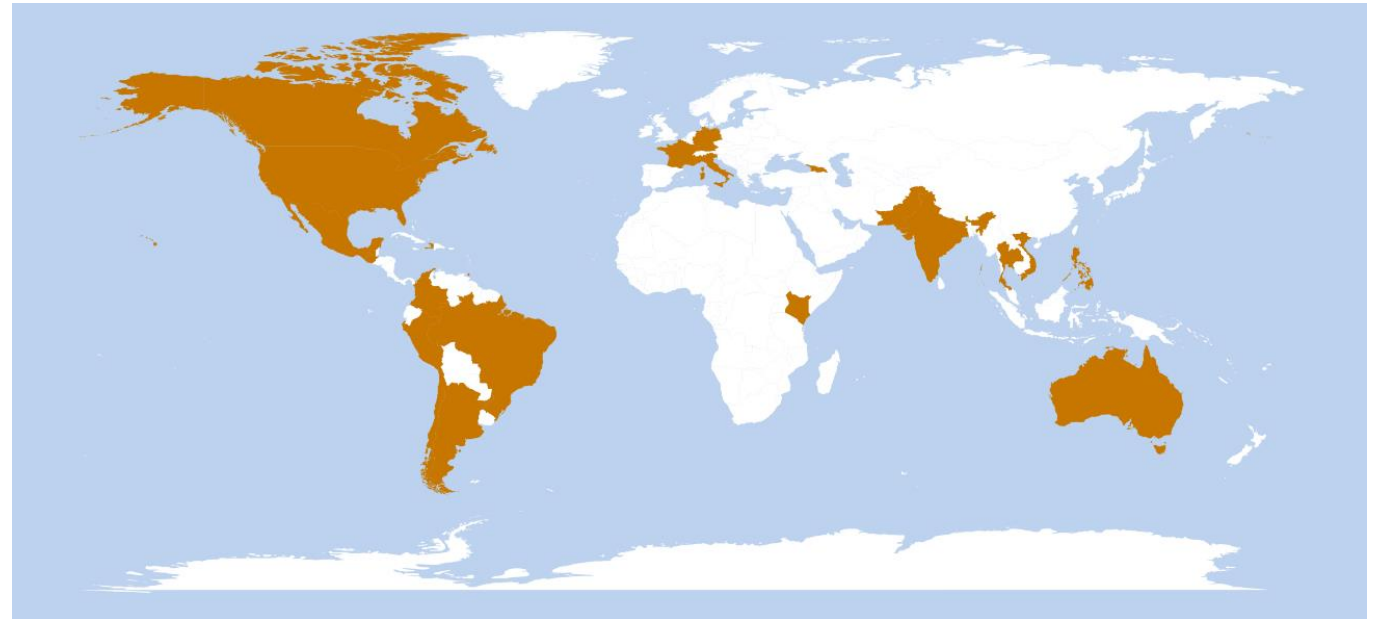
	Tested	Positive	Percent Positive
Total	243	6	2.5%
Raccoon	178	5	2.8%
Skunk	44	1	2.27%
Fox	17	0	0%



# Developing new diagnostic methods: Real Time RT PCR for Rabies Virus



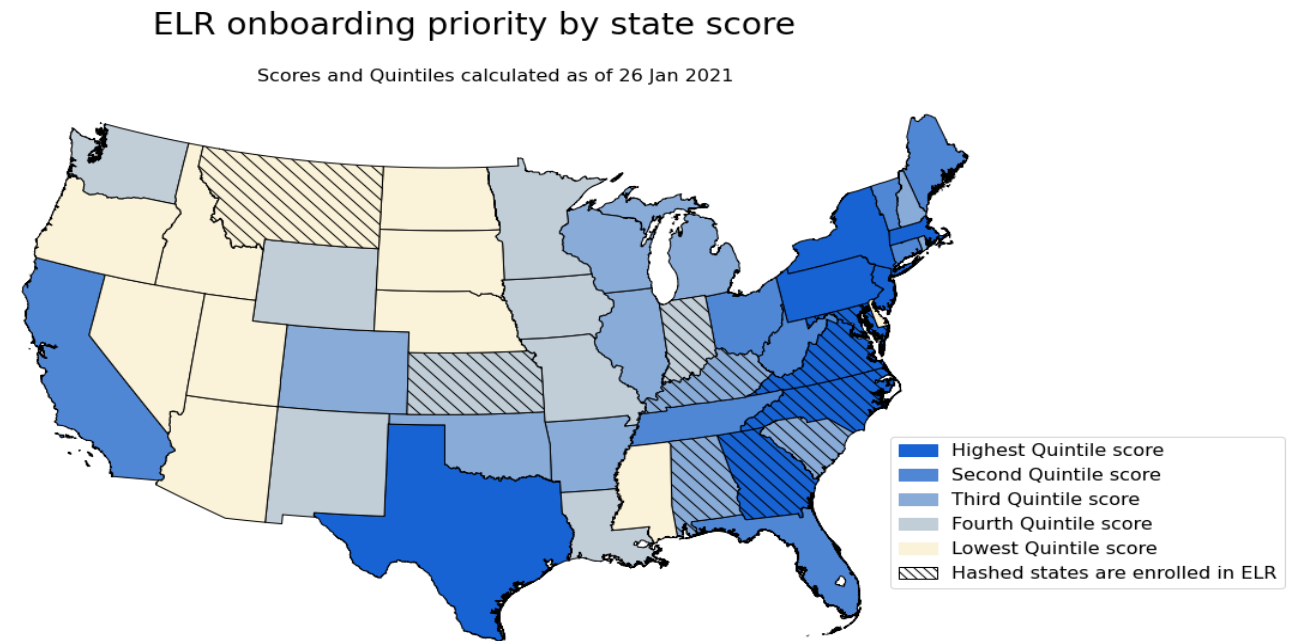
- CDC provided protocols and information
- CDC provided protocols and reagents



Global Distribution of CDC's RT RT PCR Assay as of 2022

# The Future -- Rabies Electronic Laboratory Reporting (r-ELR)

- Data dashboards
- Alerts!
- New data streams to collect public health investigation data
- New onboarding methods (more states, faster)
- Developing prioritization process

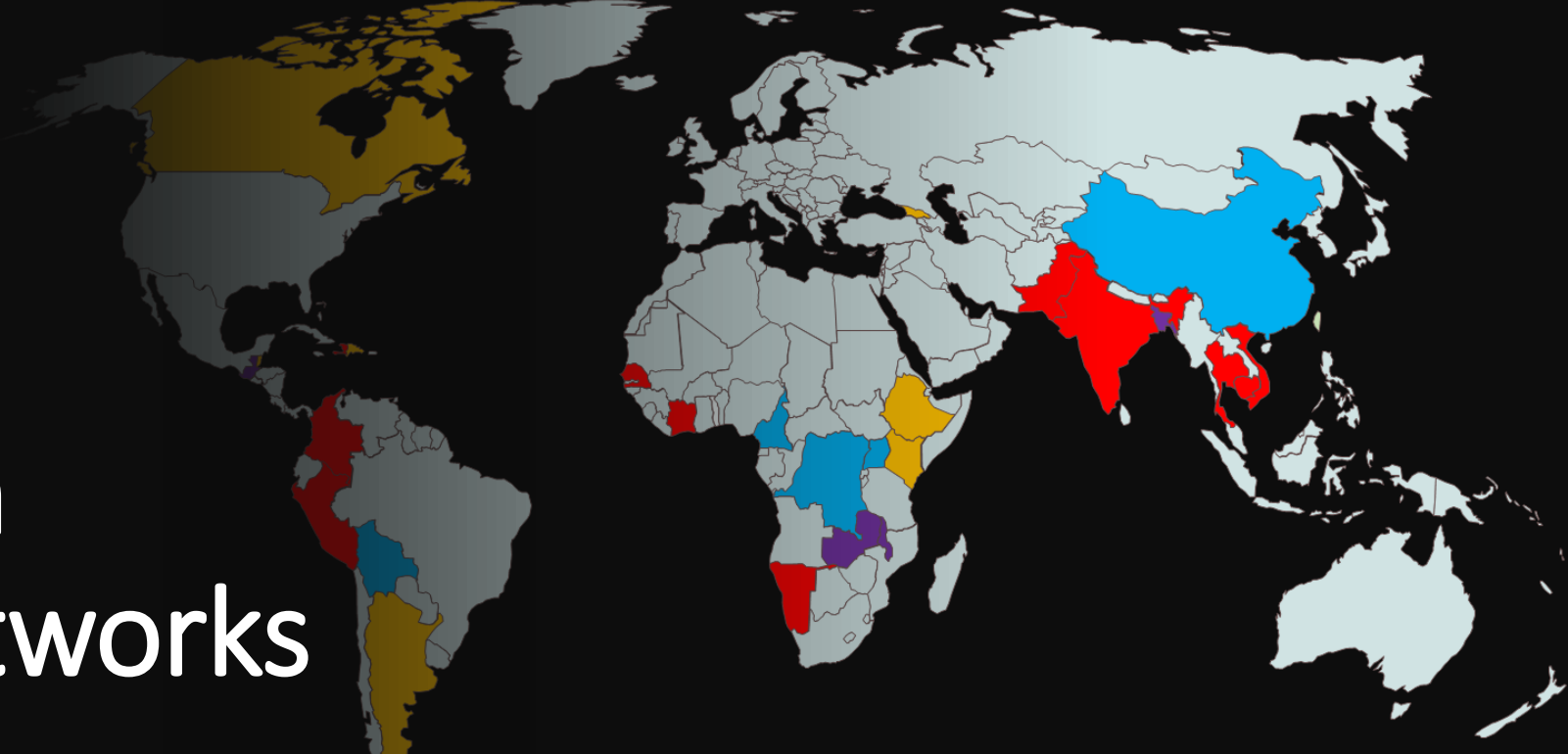




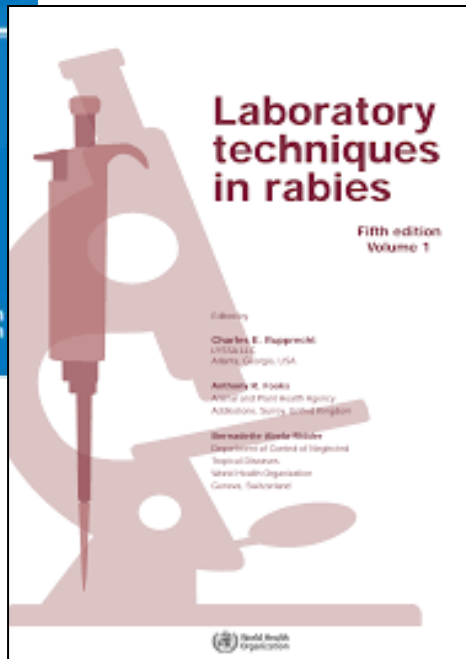
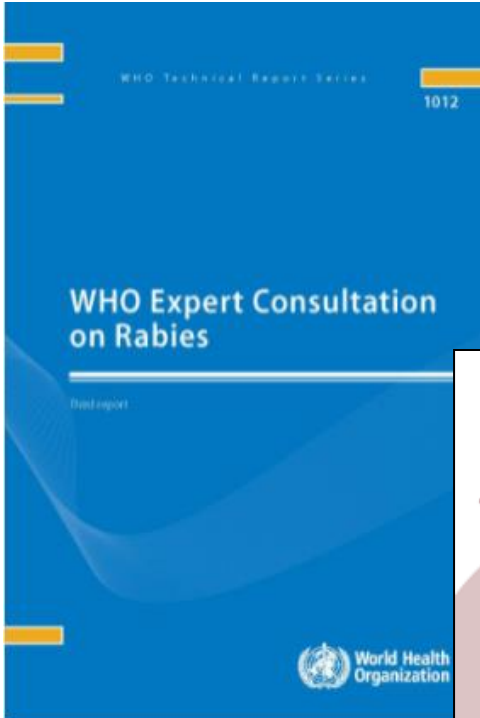
# International Participation in Laboratory Networks

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- **SURVEILLANCE**
- **DIAGNOSTICS**
- **DOG VACCINATION**
- **DISEASE BURDEN ESTIMATION**



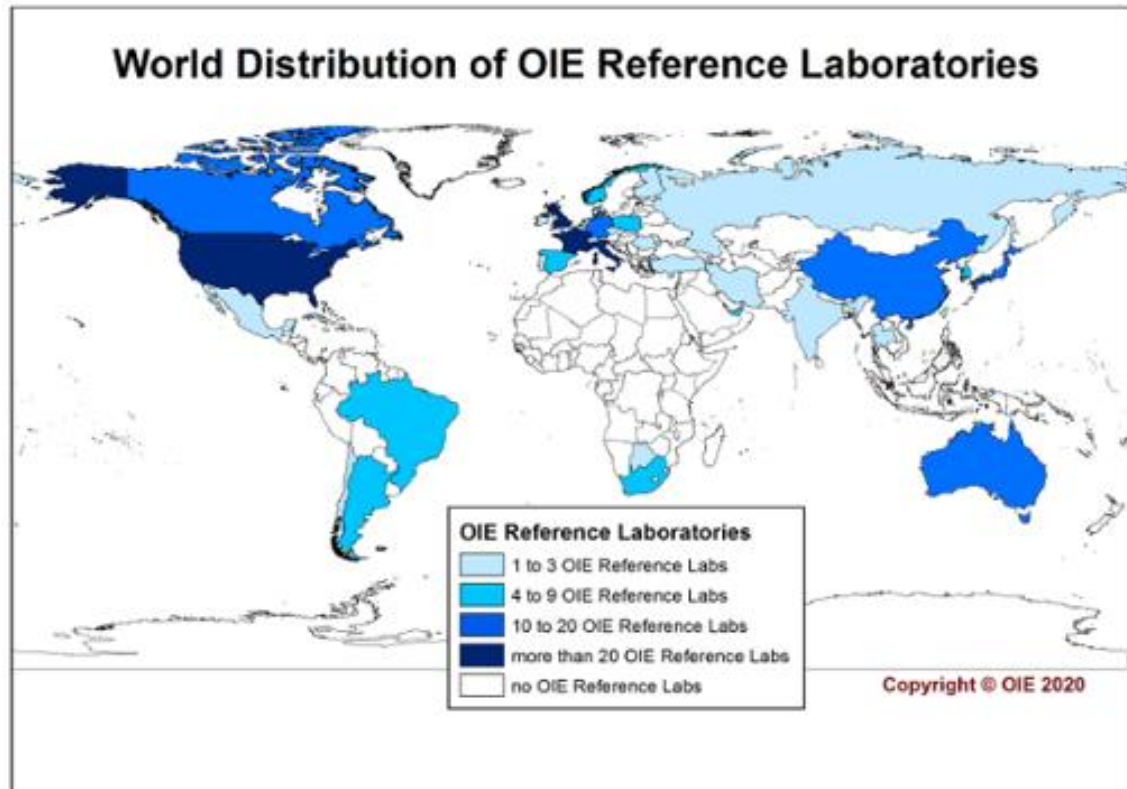
# WHO Collaborating Center



- The **WHO Technical Report Series (TRS)** makes available the findings of various international groups of experts that provide WHO with the latest scientific and technical advice on a broad range of medical and public health subjects.

# WOAH Ref Labs

Central core of the WOAH scientific excellence



# WOAH RABLAB

## Rational

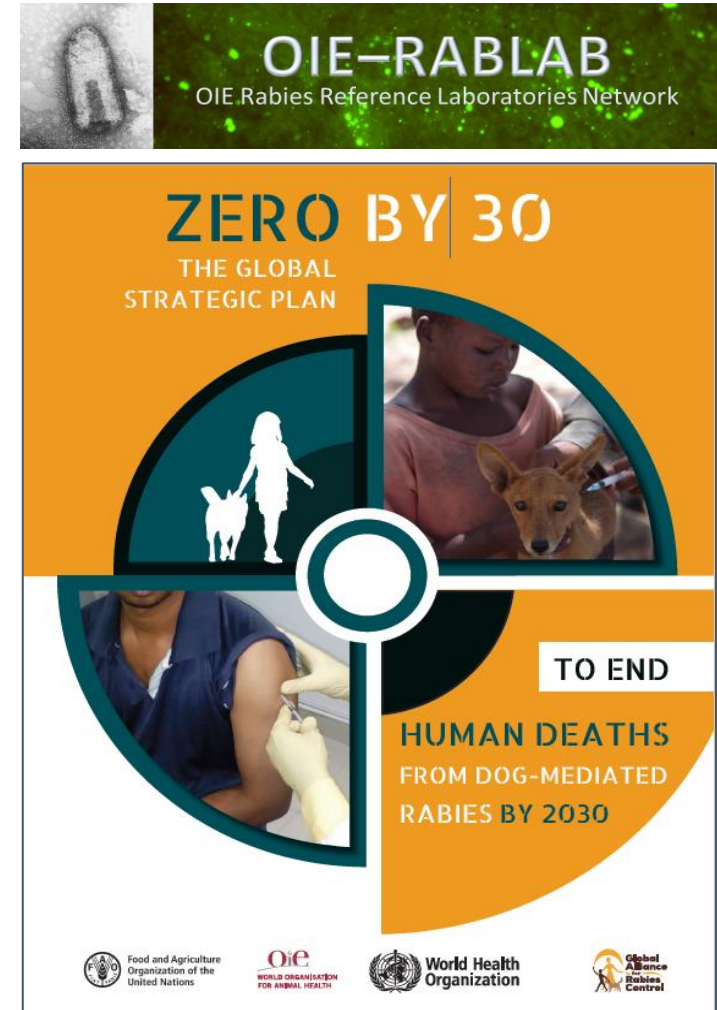
- **Role of diagnostic laboratories has expanded beyond testing**
- **Increasing number of other key responsibilities**
  - training and outreach,
  - communications
  - laboratory-based surveillance
  - laboratory data management
- **Filling diagnostic gaps and improving capacity of national labs in support of global rabies elimination efforts is pivotal**



# WOAH RABLAB

## Goals/Vision

- to develop closer relations among OIE-RLs for Rabies,
- to build strong partnerships for cooperation to support OIE and the tripartite in their global fight against rabies,
- to expand access to high-quality diagnostic services to continuously enhance regional and national diagnostic capacities,
- to contribute to worldwide improvement of laboratory-based rabies surveillance and information exchange



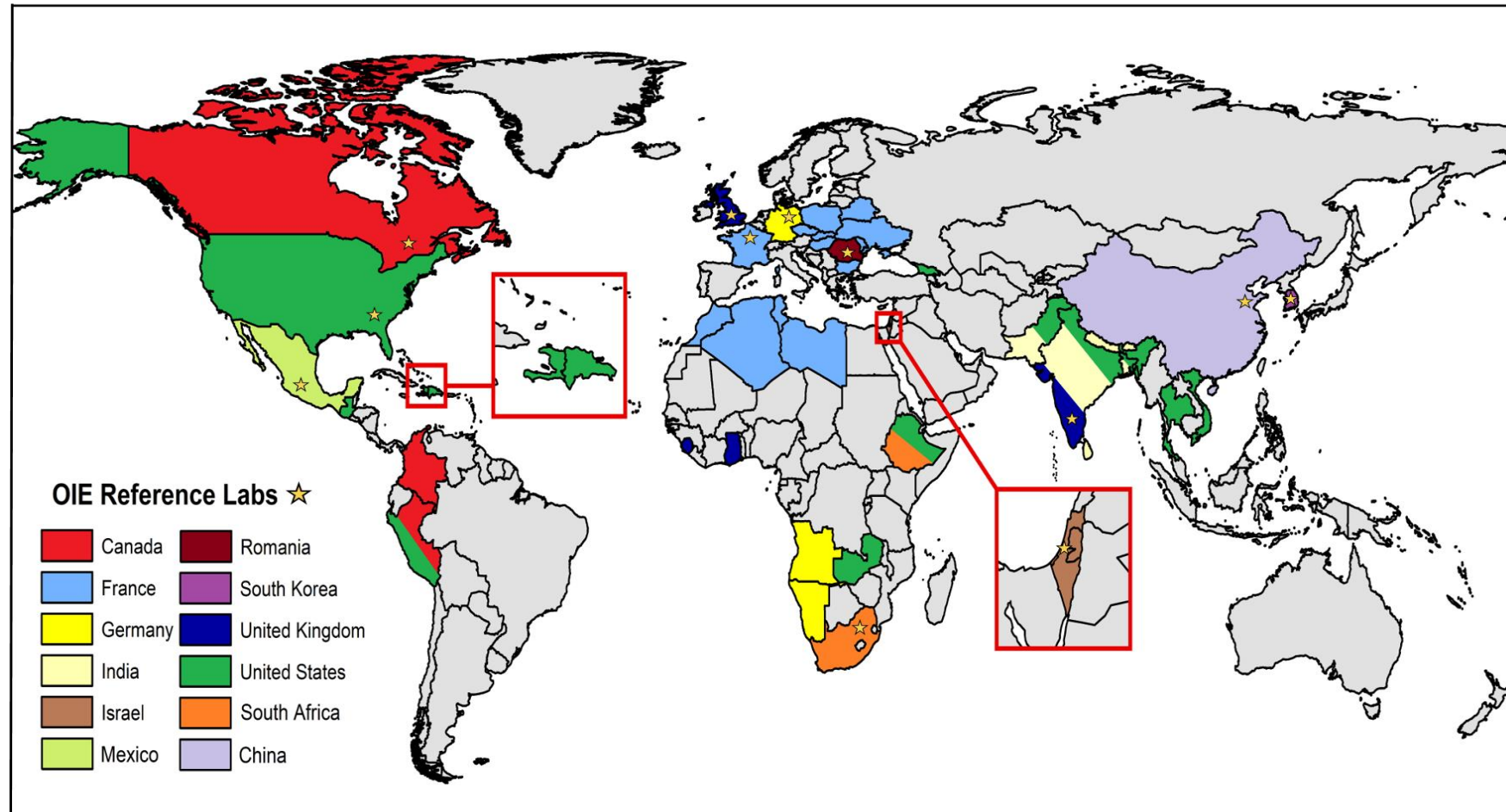
# WOAH RABLAB

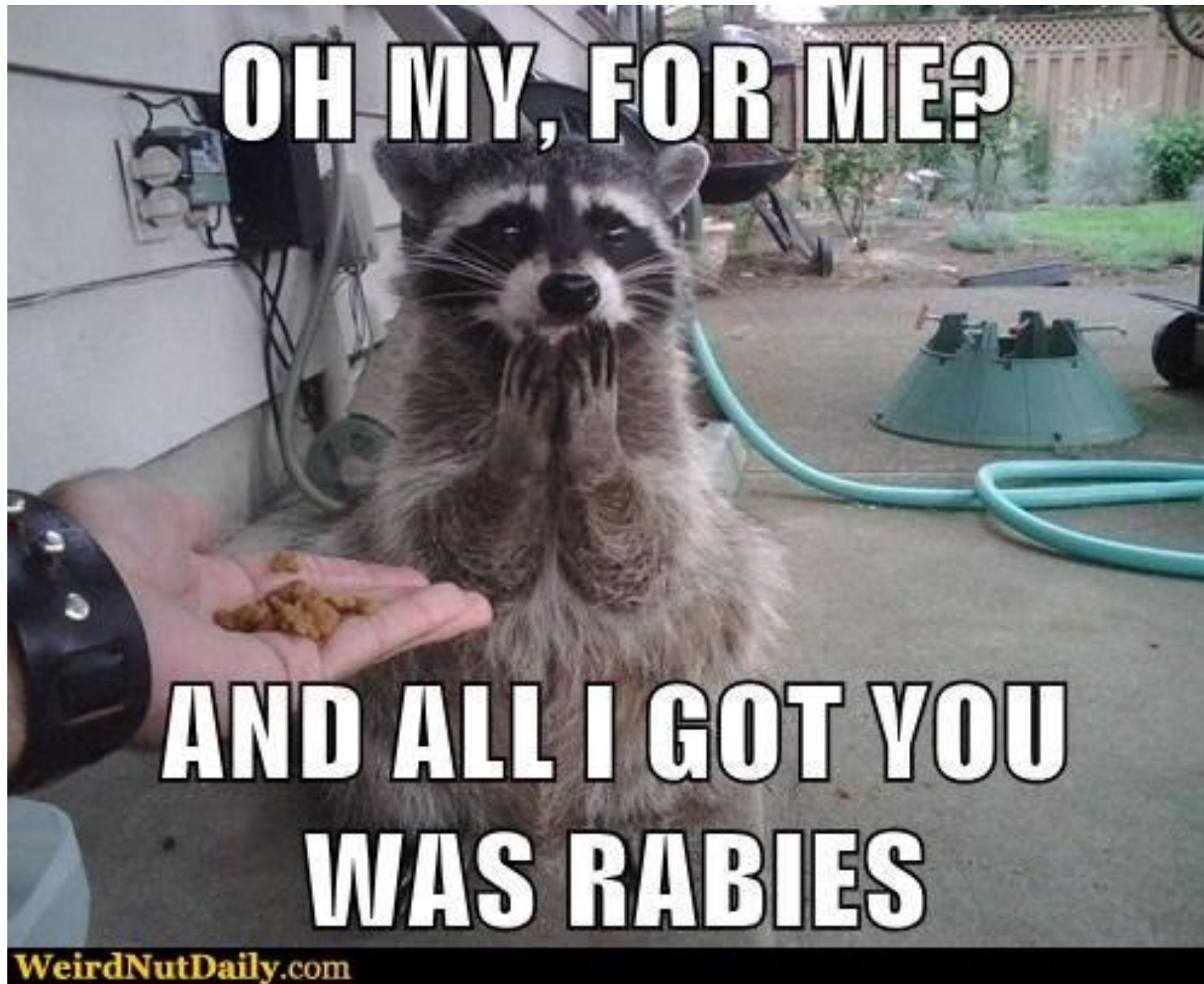
## Mode of operation

- Regular (quarterly) teleconferences for the purpose of coordinating RABLAB activities
- Annual physical meetings
- Active participation in all agreed Network activities
- Sharing of information on
  - updates and advancements in rabies control with a focus on progress towards the 2030 goal
  - rabies diagnosis, planned training opportunities, their own rabies research and scientific publications
  - share information on scientific rabies meetings
  - changes in the epidemiology of rabies



# Where RABLAB works





Thank you!