Cooperation at the Interface of Human and Animal Health

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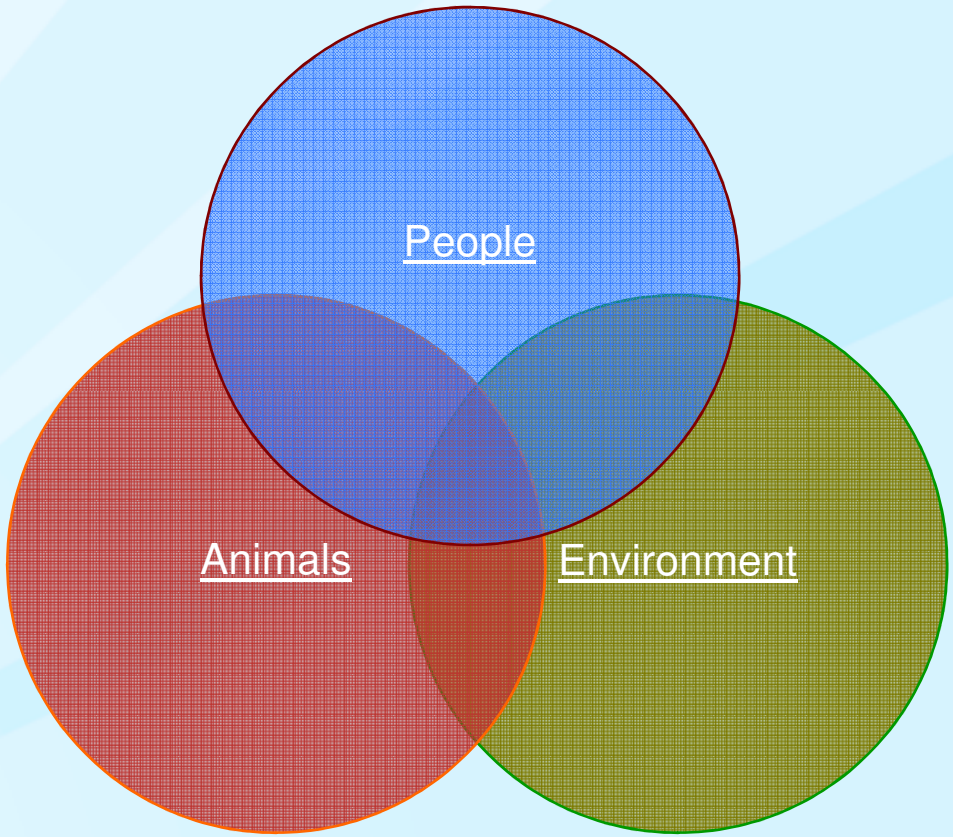
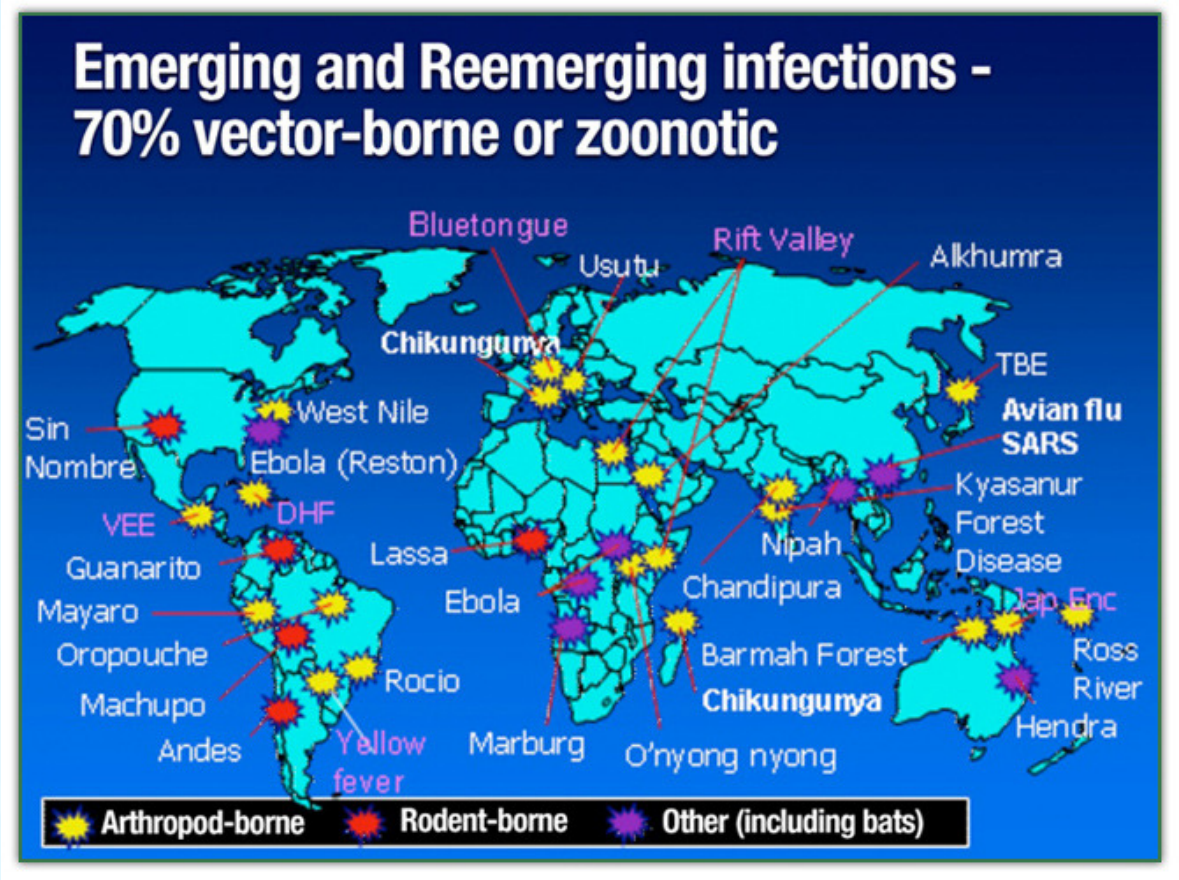
What is "One Health?"

One Health seeks to promote, improve, and defend the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, and other scientific health professionals and by promoting strengths in leadership and management to achieve these goals.



http://www.onehealthinitiative.com/mission.php

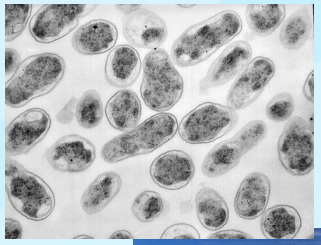
Human Infections are Increasingly Zoonotic or Vector-borne



http://www.onehealthinitiative.com/map.php

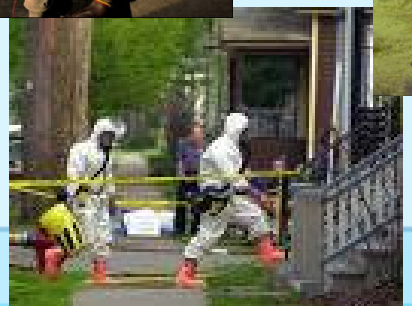
Factors in Emergence of Infectious Diseases

- Microbial adaptation and change
- Host susceptibility to infection
- Climate and weather
- Changing ecosystems
- Economic development and land use
- Human demographics and behavior
- Technology and industry



Factors in Emergence of Infectious Diseases (2)

- International travel and commerce
- Breakdown of public health measures
- Poverty and social inequality
- War and famine
- Lack of political will
- Intent to harm



The One Health Concept Is Not New

Rudolf Virchow (1821-1902)

"… between animal and human medicine there are no dividing lines— nor should there be."

- German MD
- "Father" of pathology
- Coined term zoonosis
- Initiated the concept of meat inspection to prevent human illness

"Two Health" During the 20th Century

- Human and veterinary medicine increasingly specialized
- Separation between human and veterinary medicine (and human animal diseases)
- Zoonotic disease not emphasized in medical schools
- Veterinary training focus shifted from livestock medicine and comparative medicine research to companion animal medicine

Rebirth of One Health in the 21st Century

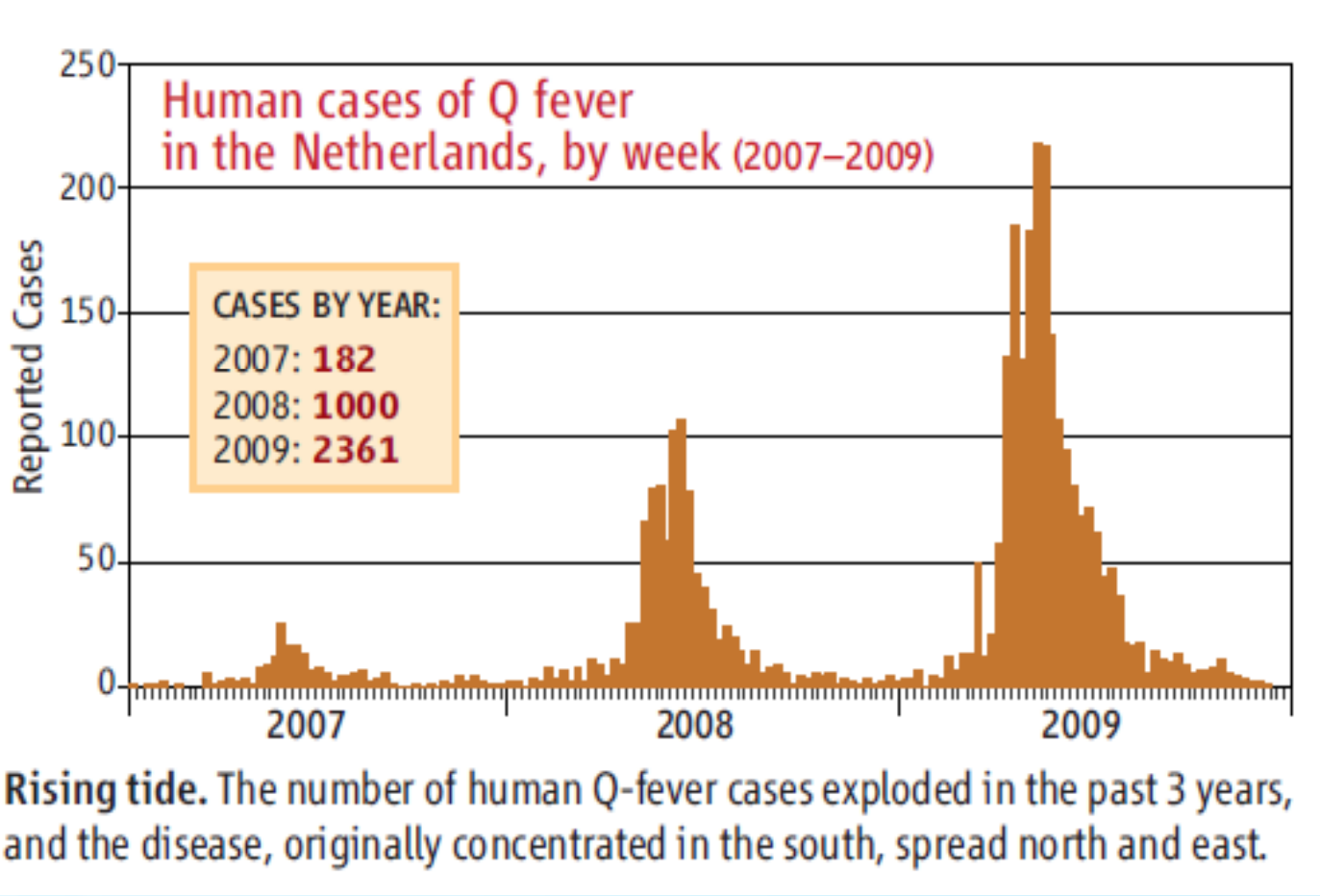
- **One World - One Health Symposium; New York, 2004**
  - Wildlife Conversation Society / Rockefeller University
  - 12 Manhattan Principles
- **One World – One Health: From ideas to Action; Winnipeg, 2009**
  - Public Health Agency of Canada
- **Operationalizing One Health; Atlanta, 2010**
  - 7 Workgroups: Training, Capacity Building, One Health Global Network, Proof of Concept, Information Clearing House, Business Plan, Needs Assessment

http://www.oneworldonehealth.org/sept2004/owoh_sept04.html
http://www.phac-aspc.gc.ca/publicat/2009/er-rc/pdf/er-rc-eng.pdf

An Example of "Two Health" Paradigm Clash: Q fever in the Netherlands

- Infrequent bacterial zoonoses (Coxiella burnetti)
- Causes minor disease in animals (mostly sheep and goats) although can result in abortions and stillbirths
- Aborted goat placentas can distribute billions of microbes into the environment
- Human illness usually manifests as pneumonia
- Category 'B' bioterrorism agent

Q Fever in the Netherlands: Human Cases



Rising tide. The number of human Q-fever cases exploded in the past 3 years, and the disease, originally concentrated in the south, spread north and east.

SCIENCE; 327 Jan 2010

"Two Health"
Two Very Different Perspectives

- Human Health
- Vets didn't report soon enough
- Economic interests trumped human health
- Problem is increased high-intensity goat farming
- Massive culling is necessary

- Animal Health
- Most animals healthy
- Increase in cases due to better Dx tests and surveillance
- Problem due to strain variation
- Massive culling is unnecessary

Mass Culling of Pregnant Goats

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Current Outcomes

- All pregnant goats are being destroyed
- Potentially devastating impact on farmers
- 2011 vaccination campaign
- C. burnetii persists in the environment
- Role of cattle farms still undefined

How Could This Response Have Been Different if Approached from a One Health Perspective?

- Enhanced surveillance among animals for diseases that can impact human health
- Effective vaccination strategies
- Integrated surveillance communication channels that notify human PH of increased animals cases
- Improved laboratory diagnostics to identify new disease strain that may pose a human risk
- Recognize animal disease in a timeframe that prevents human disease

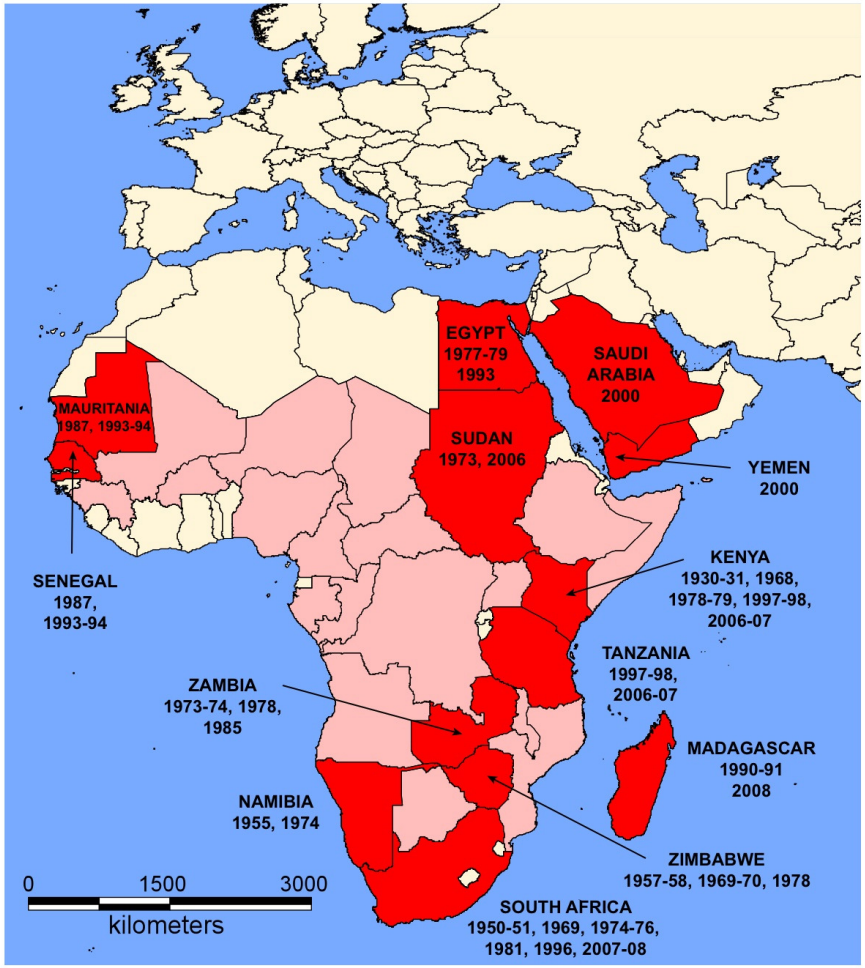
One Health in Action: Rift Valley Fever

- Impact:
  - Massive Human and Veterinary morbidity/mortality
- Risk groups:
  - Farmers, veterinarians, animal health workers, general public
- Incentive for Intervention:
  - Massive economic damages during epizootics

Rift Valley fever: lethal in many animal species

Geographic Distribution of Rift Valley Fever

- First Case Reports:
  - 1910 – 1920
- Virus first isolated:
  - Kenya, 1931
- Widespread outbreak in South Africa, 2010



Rift Valley Fever – Enzootic Cycle

Heavy rainfall - Flooding

Emergence of floodwater mosquitoes, including transovarially infected *Aedes* sp.

Infected mosquitoes feed on livestock

High viremia develops in susceptible animals

Aerosol/ percutaneous exposure

Infection of secondary vectors

Epidemic in human population

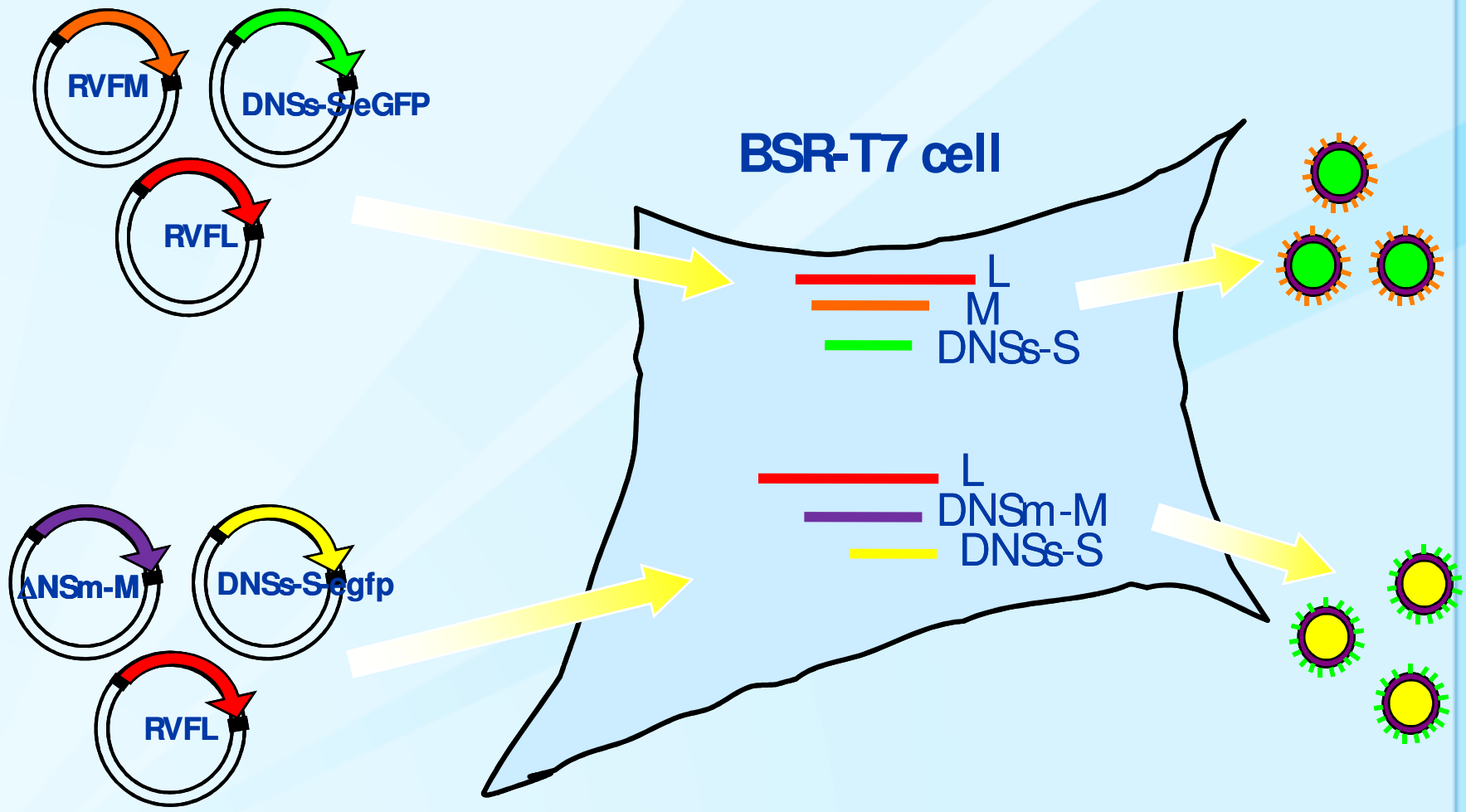
RVF: Human Health Impact

Location	Infections	Fatalities
Egypt 1977-78	~200,000	600
Saudi Arabia, Yemen 2000	1,973	245
Kenya 2006-07	660	153
South Africa 2010	164	15

RVF: Animal Health Impact

Location	Consequences
Egypt 1977-78	$115M (USD)
Saudi Arabia, Yemen 2000	??$ Collapse of trade from E. Africa
Kenya 2006-07	??$ Loss of ~10% of herd
South Africa 2010	??$ Widespread outbreak

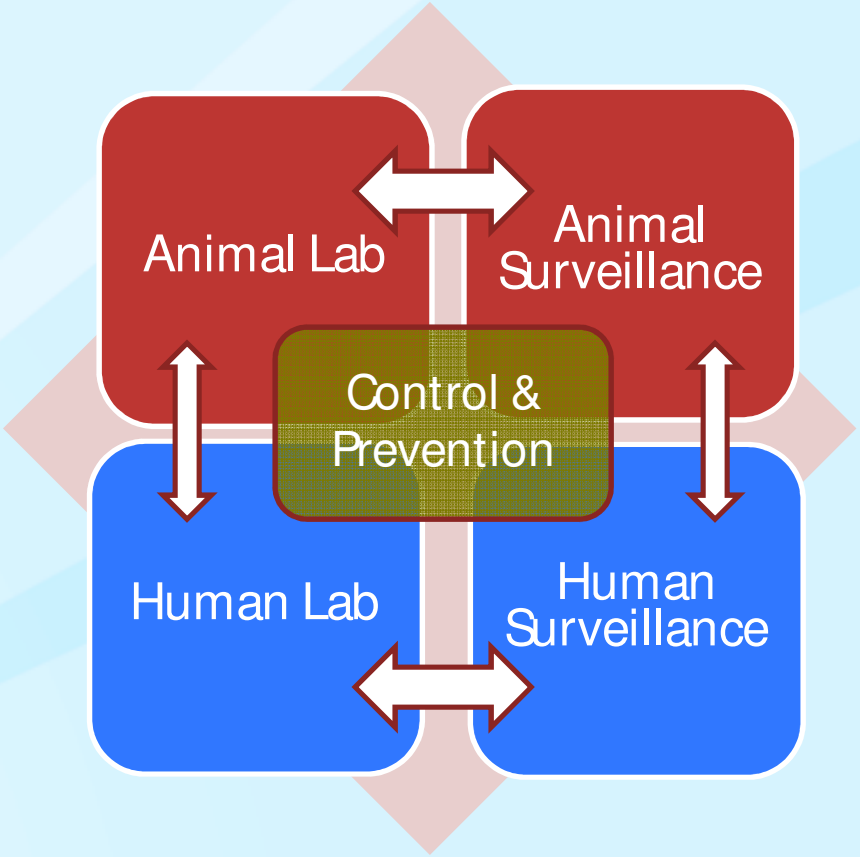
Rational Design of RVF Live-attenuated Vaccine



Bird, et al (CDC);

Implementing One Health Nationally: A Coordination Challenge

Implementing an effective One Health approach to disease control and prevention requires multi-dimensional coordination at the regional/global level



Implementing One Health Globally: A Multi-dimensional Challenge

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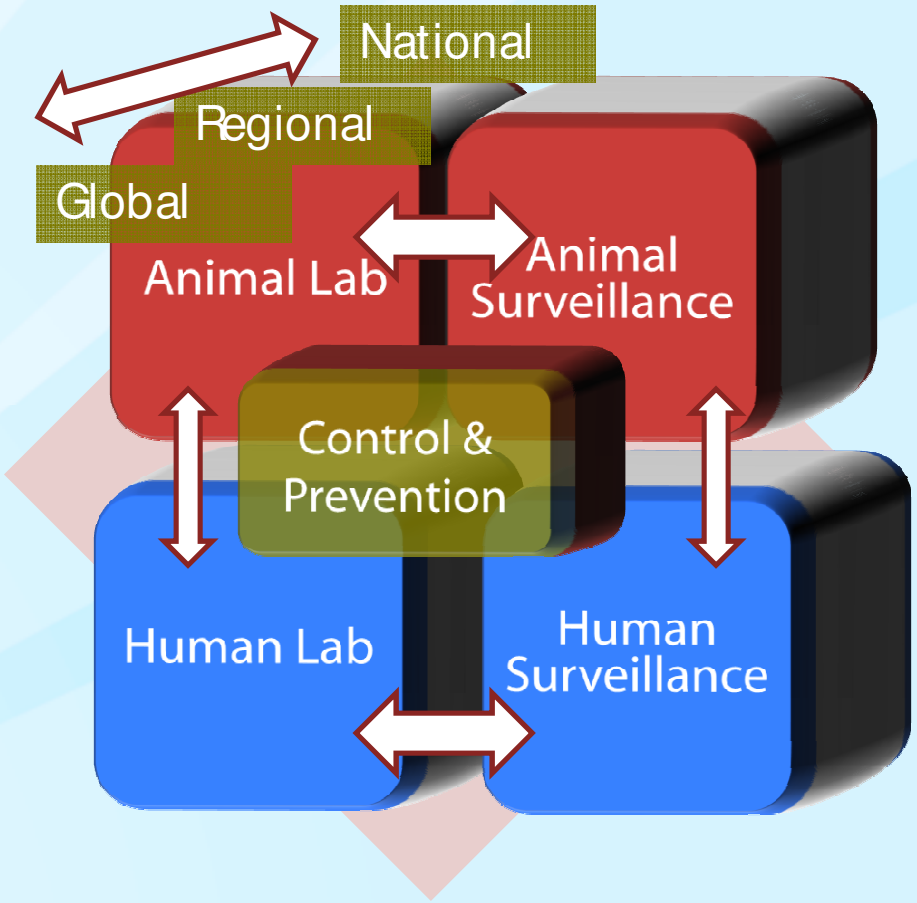

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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