Zoonoses Near and Far

Foreign Animal and Emerging Disease (FAED) Awareness Course

June 10, 2013

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Lecture Outline

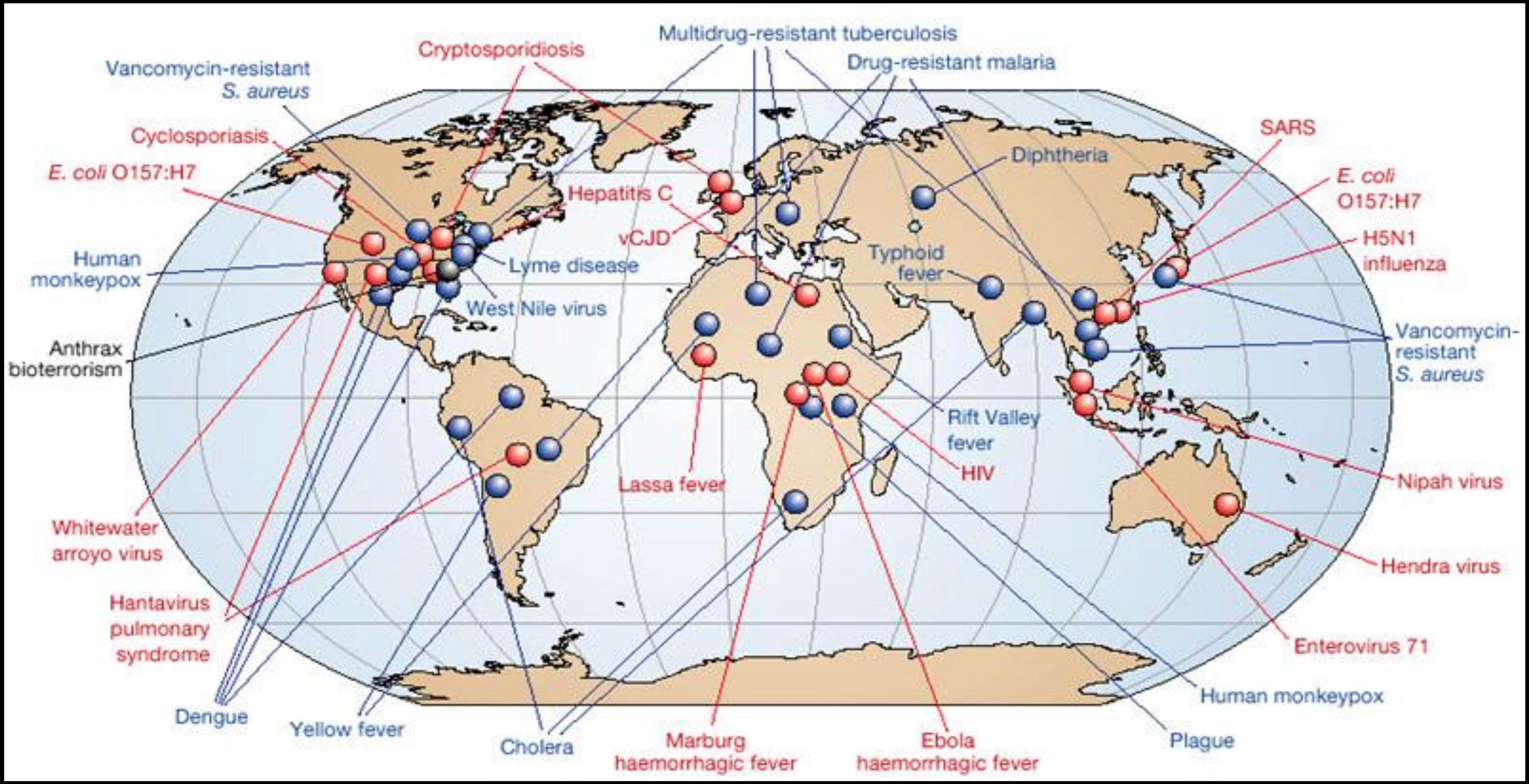
- Zoonotic disease concepts and factors of Emergence
- Zoonotic Disease Examples
- One Health Approach

Key Terms

- **Zoonoses** – infectious diseases transmissible from animals to humans and vice versa
- **Zooanthroponoses** - A zoonosis normally maintained by humans but that can be transmitted to other vertebrates (amebiasis to dogs)
- **Anthropozoonoses** - A zoonosis maintained in nature by animals and transmissible to humans; (rabies, brucellosis)
- **Saprozoonoses** – diseases that do not require a vertebrate reservoir because of their occurrence in water, in soil, on plants, or in food or fodder, whence they are transmitted to vertebrates (including man)

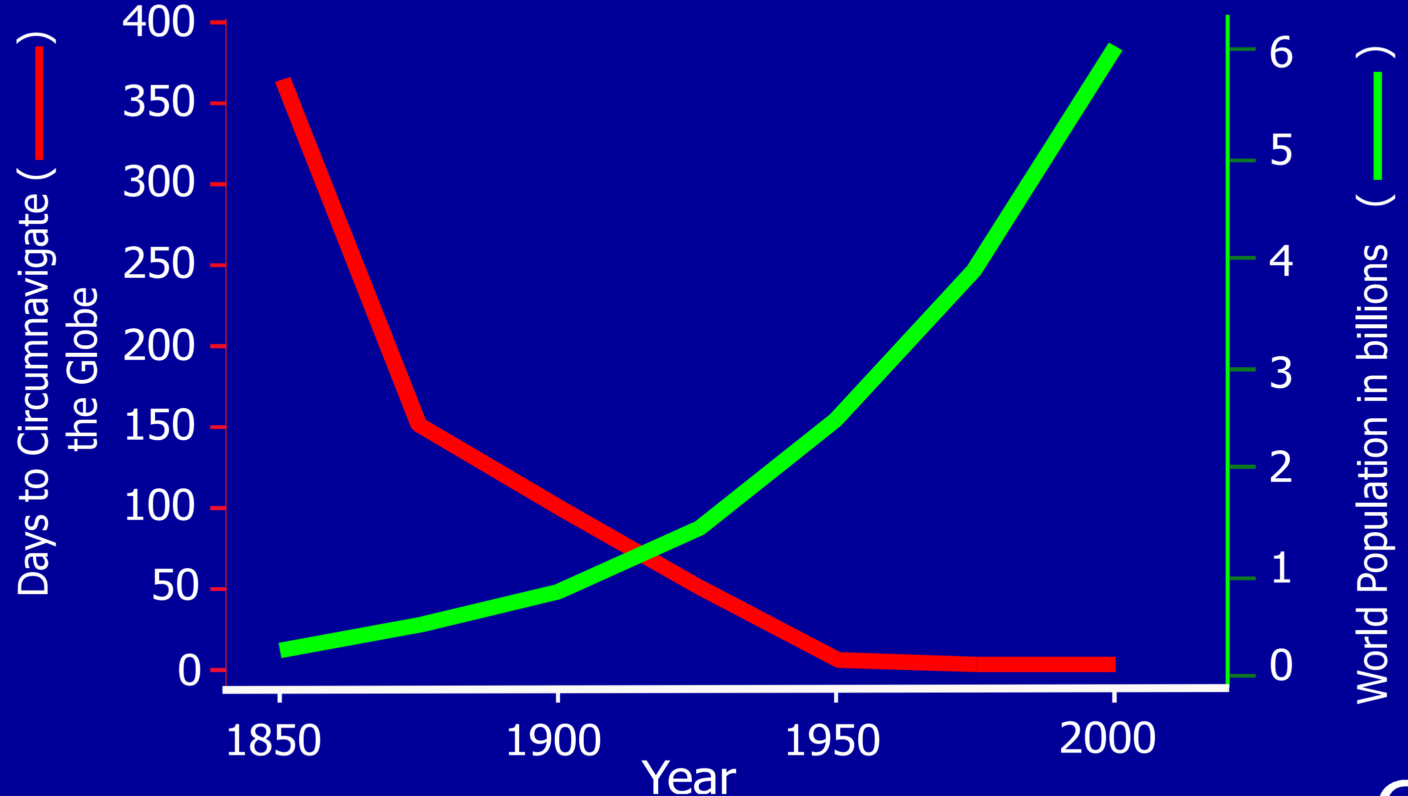
- Emerging infectious diseases   infectious diseases whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future. They include:
  - New infections resulting from changes or evolution of existing organisms
  - Known infections spreading to new geographic areas or populations
  - Previously unrecognized infections appearing in areas undergoing ecologic transformation
  - Old infections reemerging as a result of antimicrobial resistance in known agents or breakdowns in public health measures

From Emerging Infectious Diseases journal



Red represents newly emerging diseases; blue, re-emerging / resurging diseases; black, a 'deliberately emerging' disease from *Nature* **430**, 242-249(8 July 2004)

Speed of Global Travel in Relation to World Population Growth



From: Murphy and Nathanson. Semin. Virol. 5, 87, 1994

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

SARS OUTBREAK, 2003:
Rapid spread worldwide by movement of people

"Disease is only a plane flight away"

Factors Influencing Spread of Infectious Diseases

• Microbial adaptation and change	• Technology and industry
• Human susceptibility to infection	• Breakdown of public health measures
• Climate and weather	• Poverty and social inequality
• Changing ecosystems	• War and famine
• Human demographics and behavior	• Lack of political will
• Economic development and land use	• Intent to harm
• International travel and commerce	

List of NIAID Emerging & Re-emerging Diseases

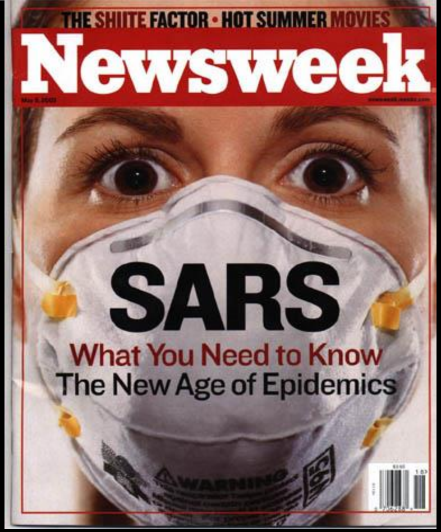
Group I—Pathogens Newly Recognized in the Past Two Decades

Acanthamebiasis
Australian bat lyssavirus
Babesia, atypical
Bartonella henselae
Ehrlichiosis
Encephalitozoon cuniculi
Encephalitozoon hellem
Enterocytozoon bieneusi
Helicobacter pylori
Henipah viruses
Hepatitis C
Hepatitis E
Human herpesvirus 8
Human herpesvirus 6
Lyme borreliosis
Parvovirus B19

Group II—Re-emerging Pathogens

Enterovirus 71
Clostridium difficile
Mumps virus
Streptococcus, Group A
Staphylococcus aureus

From www.niaid.nih.gov/topics/emerging/pages/list.aspx , Oct 2, 2011



SARS

Swine influenza

Monkeypox

Hendra virus

Nipah virus

Ebola virus

It has been estimated that 75% of emerging infectious diseases in humans are due to zoonotic pathogens and that zoonotic pathogens are twice as likely to be associated with emerging diseases than are non-zoonotic pathogens

Philos Trans R Soc Lond B Biol Sci. 2001 Jul 29;356(1411):983-9

comments on this story

Published online 14 July 2011 | Nature | doi:10.1038/news.2011.416

News

Respiratory virus jumps from monkeys to humans

Adenovirus remained infectious after crossing species barrier.

Zoe Cormier

Stories by subject

- Lab life
- Microbiology
- Health and medicine

Stories by keywords

- Viruses
- Monkeys
- Zoonotic
- Adenovirus

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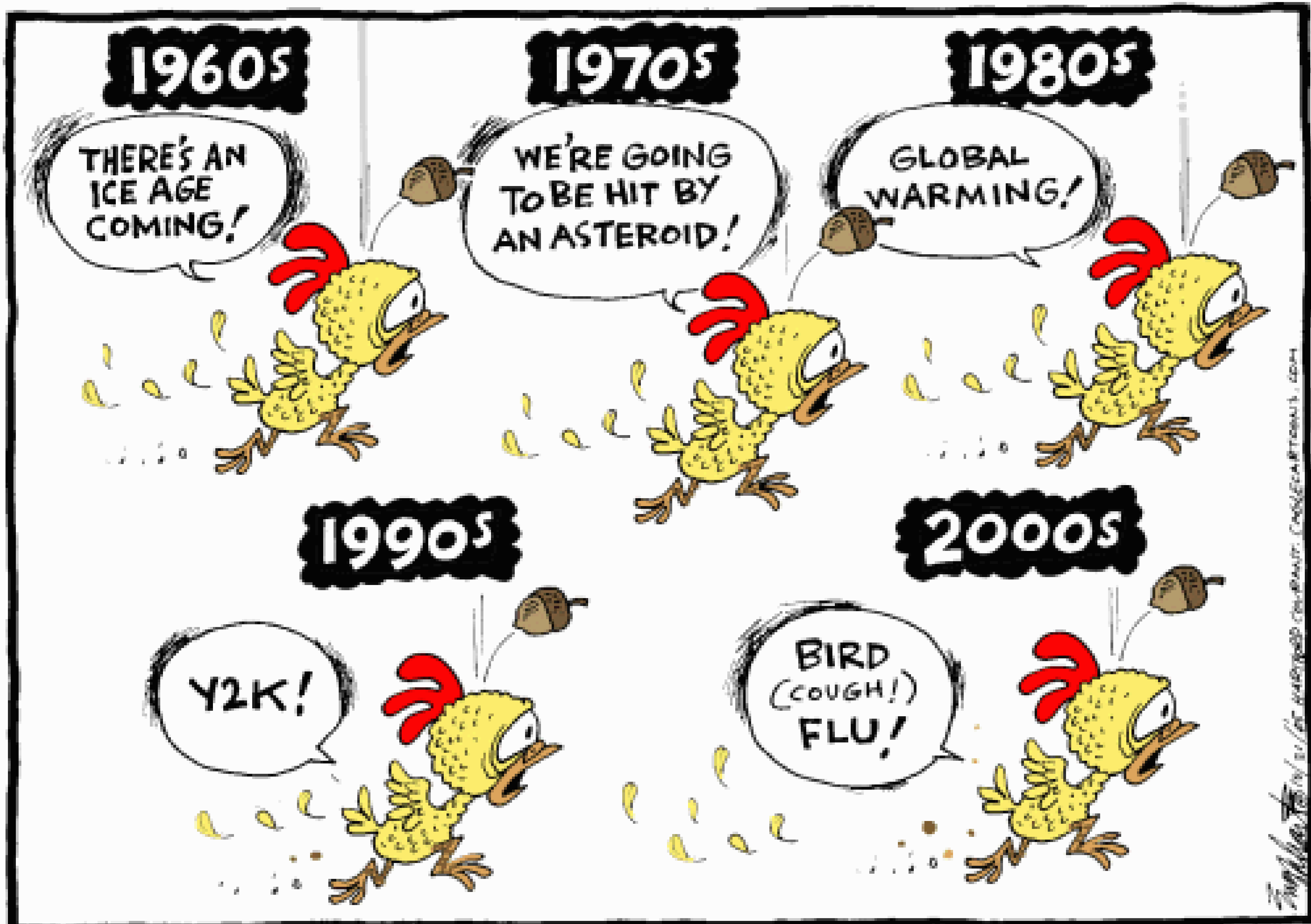
A class of virus has for the first time been shown to jump from animals to humans — and then to infect other humans.

A novel adenovirus, named TMAdV (titi monkey adenovirus), infected both a titi monkey colony and a human scientist and her family.

Photograph courtesy of Kathy West

The virus is described in *PLoS Pathogens* today[1]. The team that discovered it might also have found the first human to be infected: the primary carer for a colony of titi monkeys (*Callicebus cupreus*) that suffered an outbreak.

The culprit is an adenovirus, one of a class of viruses that cause a range of illnesses in humans, including

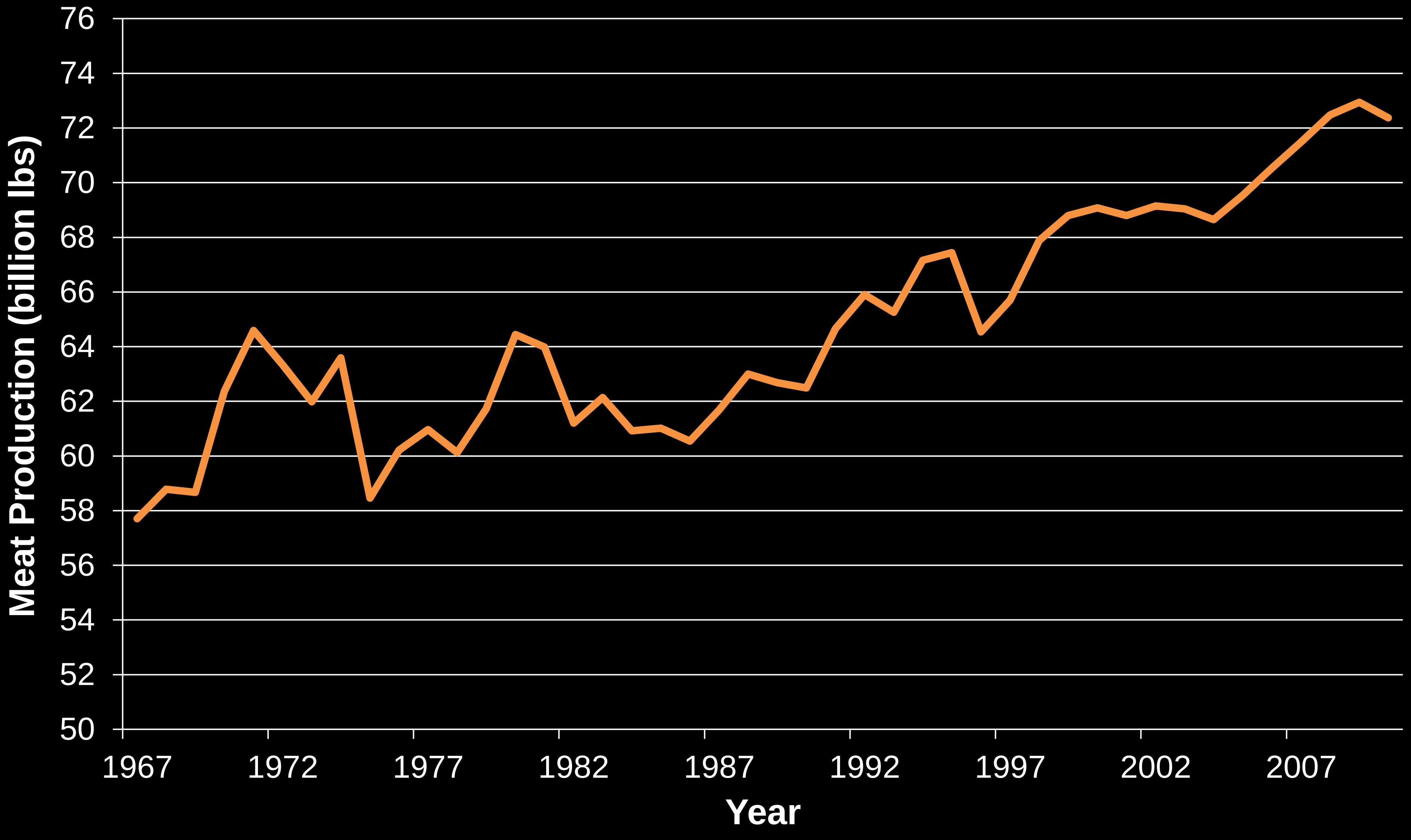

1960s
THERE'S AN ICE AGE COMING!
1970s
WE'RE GOING TO BE HIT BY AN ASTEROID!
1980s
GLOBAL WARMING!
1990s
Y2K!
2000s
BIRD (COUGH!) FLU!


I'M HAVING TROUBLE TAKING THE NEW GUY SERIOUSLY...
SWINE FLU
CAM
OTTAWA CITIZEN
caglecartoons.com


NEWLY ARRIVED TOURIST FROM....
MEXICO
AISLIN 09
MONTREAL THE GAZETTE

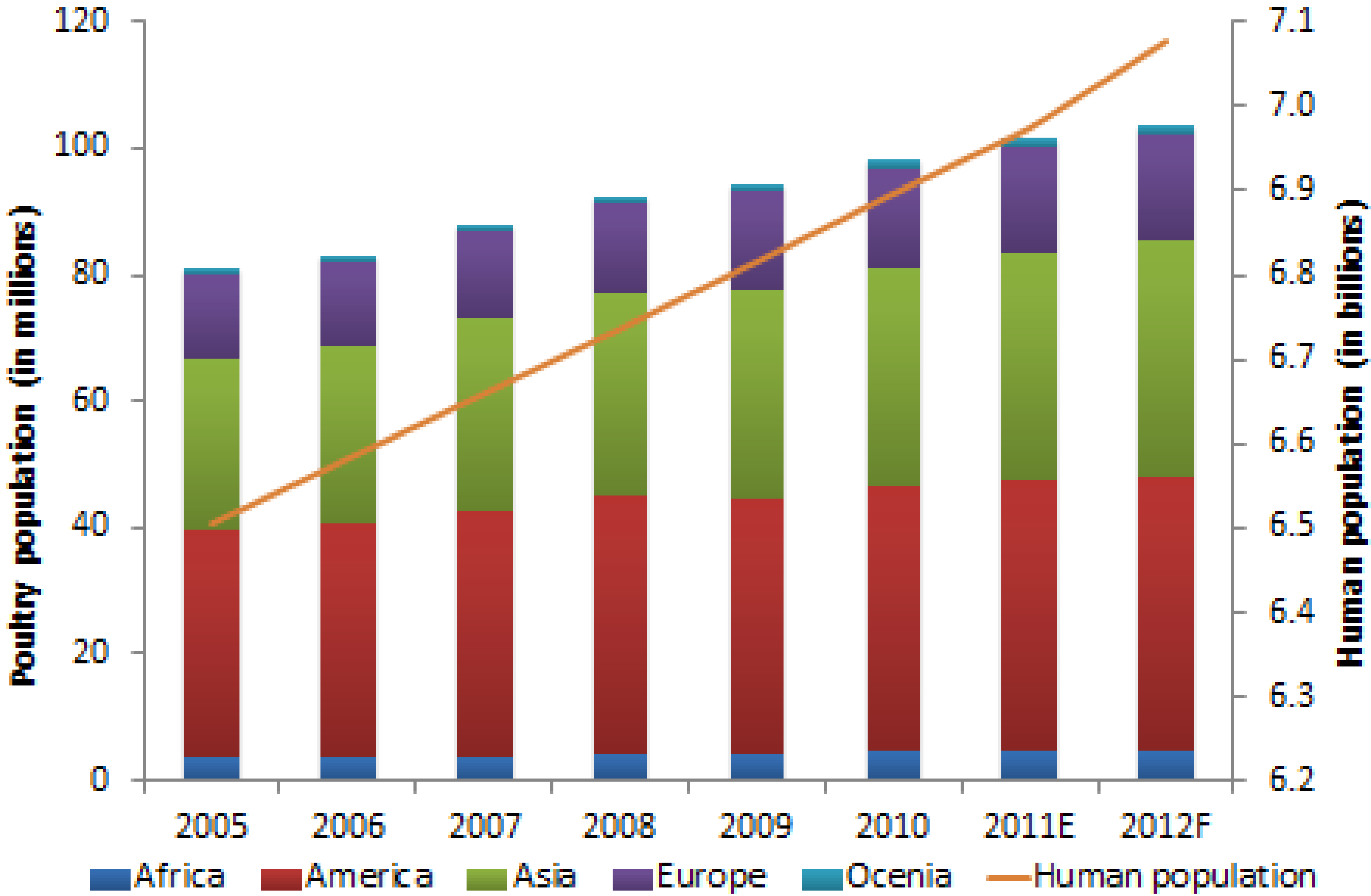
Meat Animal Production in the United States

(Cattle/Calves, Hogs/Pigs, Sheep/Lambs)



Source: USDA National Agricultural Statistics Service, Meat Animals Production, Disposition, and Income Annual Summary

Global poultry meat production by regions

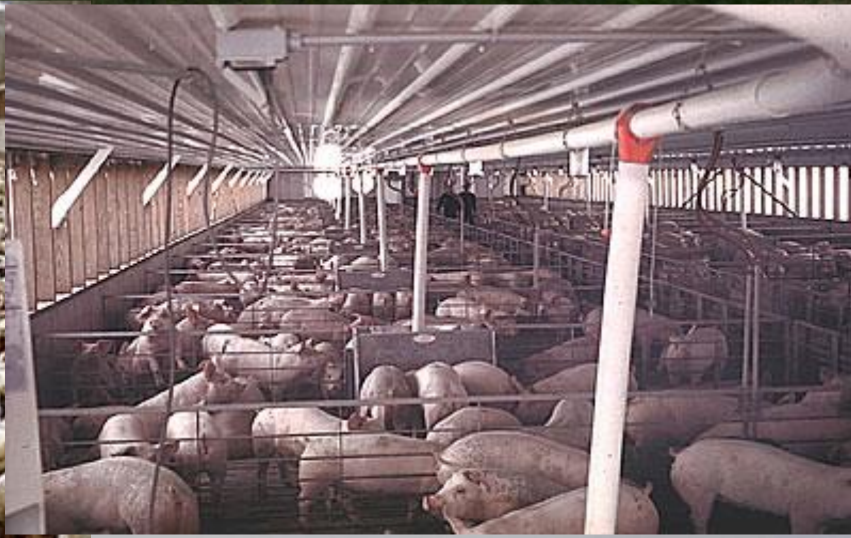


E=Estimated, F=Forecast

[Source: FAO][12]

Family Farm

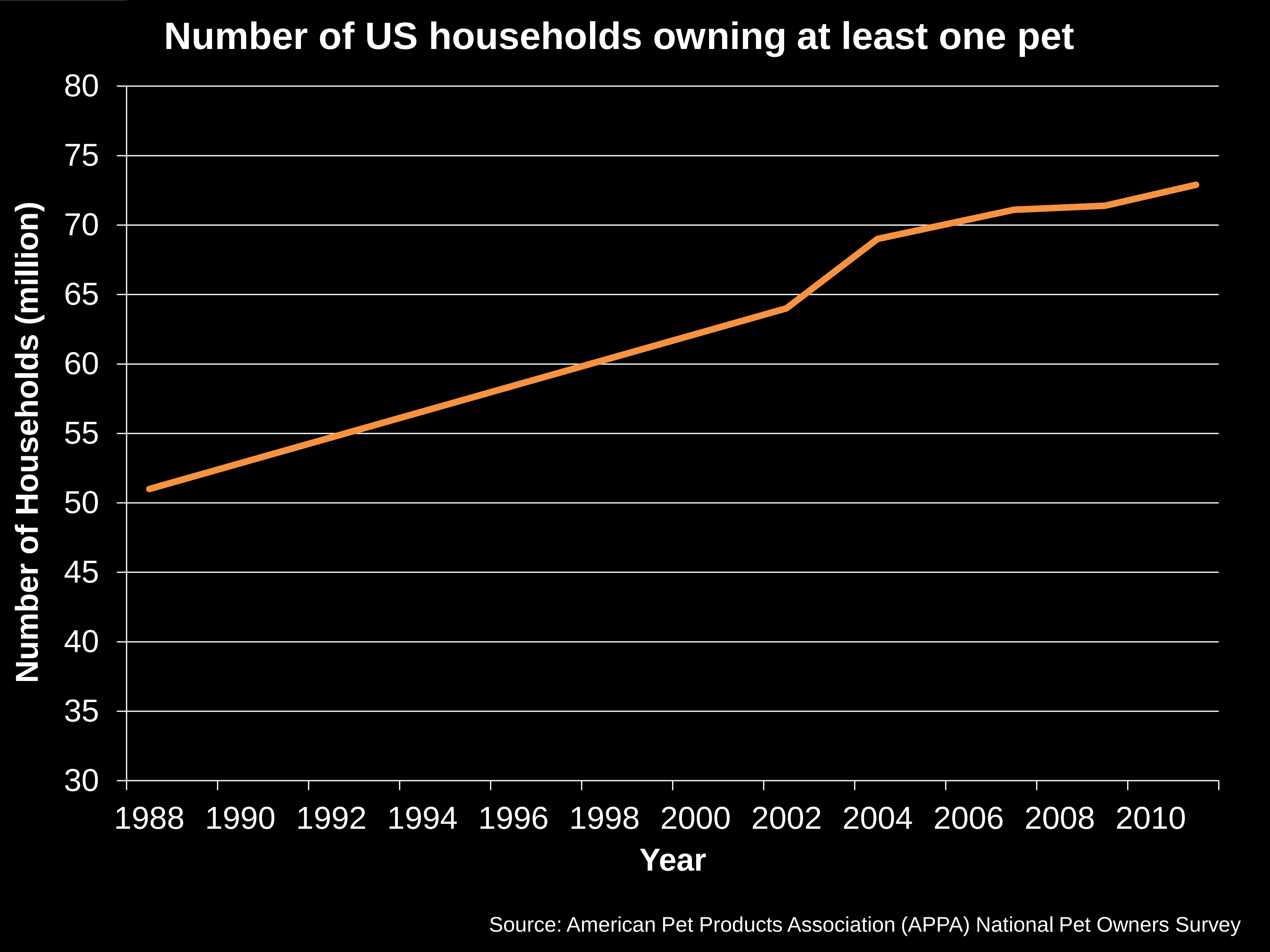
Industrial Farming



US Animal Worker Projections

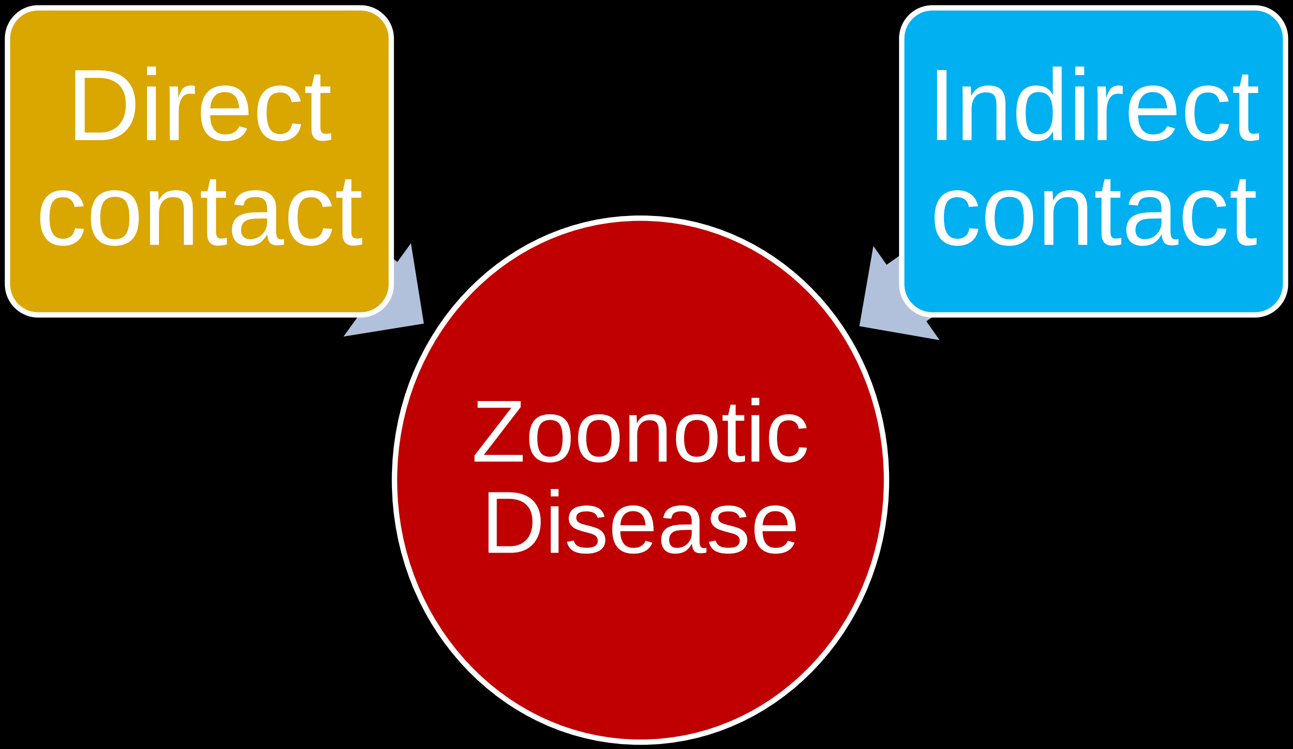
Occupational Title	SOC Code	2010	2020
Butchers and other meat, poultry, and fish processing workers	51-3020	397,100	413,900
Animal care and service workers	39-2000	220,400	265,900
Veterinary technologists and technicians	29-2056	75,000	108,100
Veterinary assistants and laboratory animal caretakers	31-9096	75,200	90240
Veterinarians	29-1131	59,700	79,400
Farmworkers, Farm, Ranch, and Aquacultural Animals	45-2093	31,880	31,880
Zoologists and wildlife biologists	19-1023	17,440	20928
Zoologists and wildlife biologists	19-1023	17,440	20928
Animal Control Workers	33-9011	15,500	17,300
	Total	**909,660**	**1,048.576**

Adapted from Bureau of Labor Statistics and O*NET OnLine March 10, 2012



Number of US households owning at least one pet
Number of Households (million)
80
75
70
65
60
55
50
45
40
35
30
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Year
Source: American Pet Products Association (APPA) National Pet Owners Survey

Zoonotic Pathogen Transmission



The Well-Traveled Salad

Foodborne Outbreaks in U.S.

Table 3. Top five pathogens causing domestically acquired foodborne illnesses resulting in hospitalization

Pathogen	Estimated annual number of hospitalizations	90% Credible Interval	%
Salmonella, nontyphoidal	19,336	8,545–37,490	35
Norovirus	14,663	8,097–23,323	26
Campylobacter spp.	8,463	4,300–15,227	15
Toxoplasma gondii	4,428	3,060–7,146	8
E. coli (STEC) O157	2,138	549–4,614	4
Subtotal			88

CDC 2011 estimates

uicc
global cancer control

IJC
International Journal of Cancer

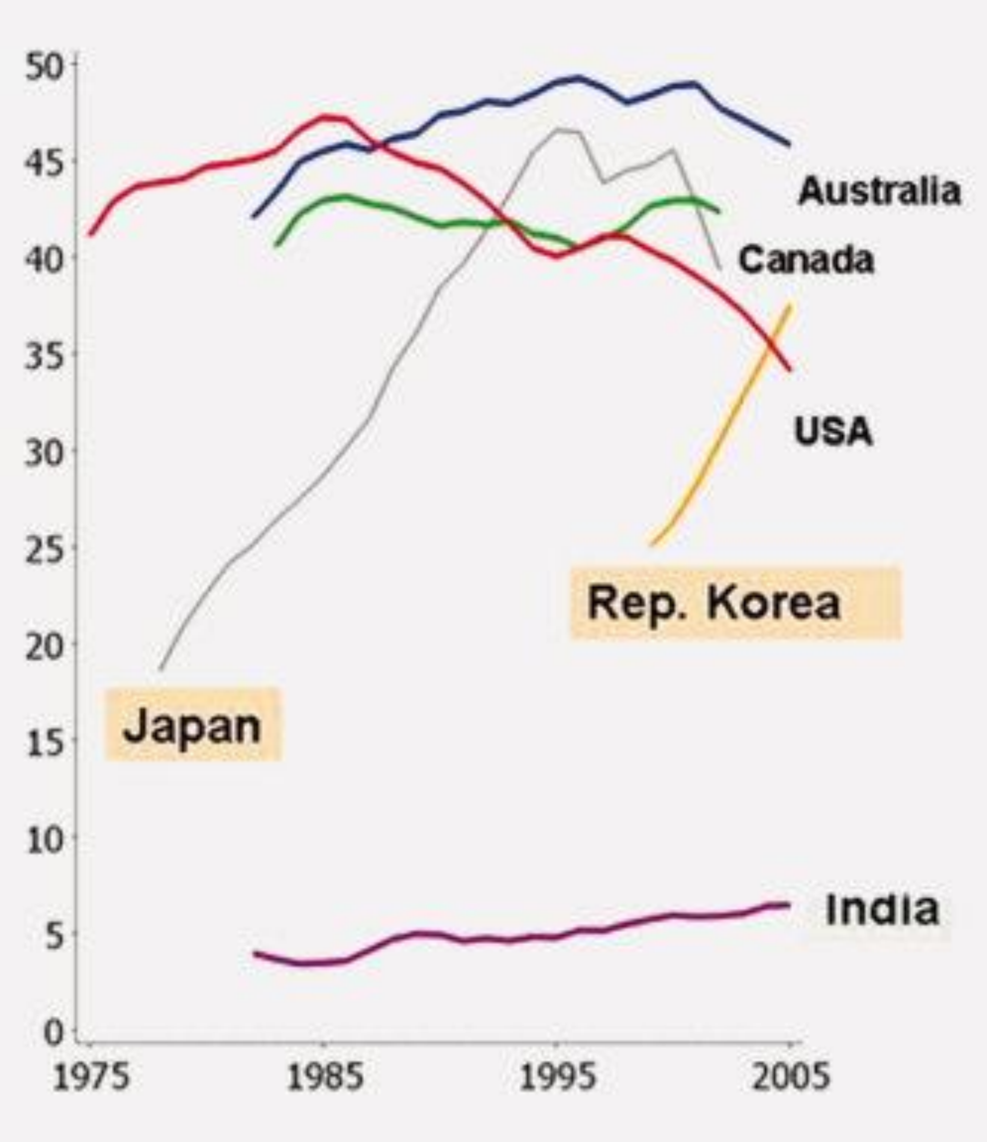
Red meat consumption and cancer: reasons to suspect involvement of bovine infectious factors in colorectal cancer

Harald zur Hausen

Deutsches Krebsforschungszentrum, Im Neuenheimer Feld 280, 69120 Heidelberg, Germany

An increased risk for colorectal cancer has been consistently reported for long-time consumption of cooked and processed red meat. This has frequently been attributed to chemical carcinogens arising during the cooking process of meat. Long-time fish or poultry consumption apparently does not increase the risk, although similar or higher concentrations of chemical carcinogens were recorded in their preparation for consumption. The geographic epidemiology of colorectal cancer seems to correspond to regions with a high rate of beef consumption. Countries with a virtual absence of beef in the diet (India) or where preferably lamb or goat meat is consumed (several Arabic countries) reveal low rates of colorectal cancer. In China, pork consumption has a long tradition, with an intermediate colorectal cancer rate. In Japan and Korea, large scale beef and pork imports started after World War II or after the Korean War. A steep rise in colorectal cancer incidence was noted after 1970 in Japan and 1990 in Korea. The consumption of undercooked beef (*e.g.*, shabu-shabu, Korean yukhoe and Japanese yukke) became very popular in both countries. The available data are compatible with the interpretation that a specific beef factor, suspected to be one or more thermoresistant potentially oncogenic bovine viruses (*e.g.*, polyoma-, papilloma- or possibly single-stranded DNA viruses) may contaminate beef preparations and lead to latent infections in the colorectal tract. Preceding, concomitant or subsequent exposure to chemical carcinogens arising during cooking procedures should result in increased risk for colorectal cancer synergistic with these infections.

Infectious Disease and Cancer?



International Journal of Cancer
pages n/a-n/a, 31 JAN 2012 DOI: 10.1002/ijc.27413
http://onlinelibrary.wiley.com/doi/10.1002/ijc.27413/full#fig2

Reverse Zoonoses (anthropozoonoses)

- 1990 – *Giardia duodenalis* & sheep
- 1999 – MRSA & horses
- 2004 – Human enteric parasites & pet macaques
- 2004 - Human waterborne parasites & zebra mussels
- 2007 - *Cryptosporidium parvum &* cattle
- 2008 - *Candida albicans* & nonmigratory wildlife
- 2009 - *Giardia duodenalis &* colobus monkeys
- 2010 - Pandemic H1N1 & pigs
- 2010 – Pandemic H1N1 & turkeys
- 2010 – Paramyxovirus & primates
- 2012 - *Escherichia coli* clone O25:H4-ST131 & dogs
- 2012- *Pseudomonas aeruginosa* & a cat

Examples of Zoonoses

- Influenza virus — Domestic — International
- Henipa viruses — International
- Lyme disease — Domestic

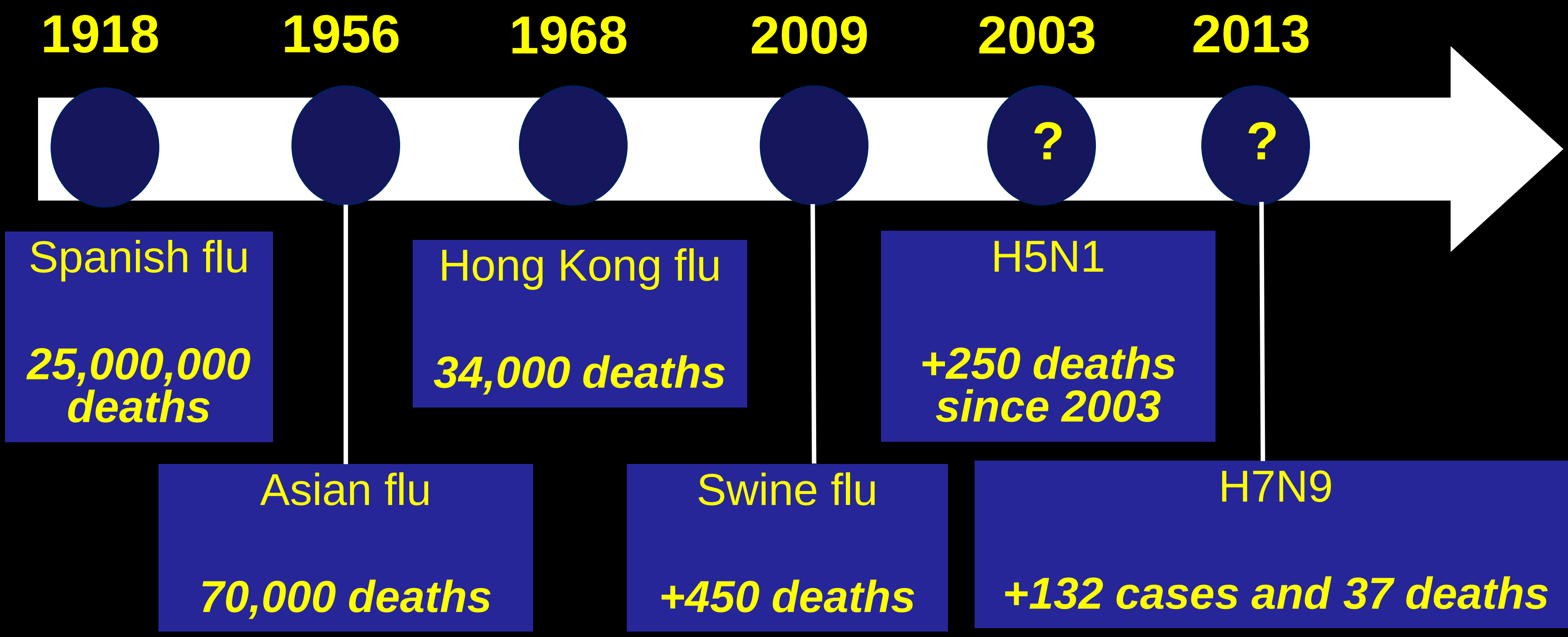
Examples of Zoonoses

- Influenza virus

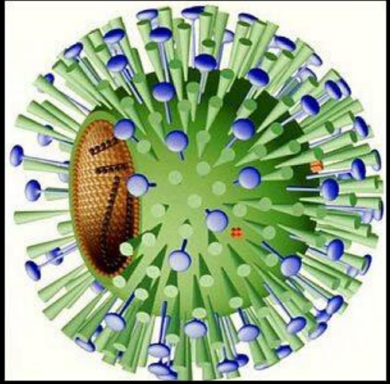
Domestic

International

Pandemic influenza timeline



Influenza Transmission



- **Influenza is <u>highly infectious</u> and easily transmitted.**
- **The virus spreads via**
  - ✓ **Direct contact with secretions**
  - ✓ **Large respiratory droplets (coughing, sneezing, talking, 6 feet radius)**
  - ✓ **Small respiratory droplets (aerosol transmission)***
  - ✓ **Indirect contact (fomites)**
- **<u>Incubation is from 1-4 days</u>**

*Aerosol transmission is subject of much current debate

http://pandemicflu.gov/plan/maskguidancehc.html#airborne

Influenza Transmission Among Humans

- Adults typically are infectious <u>from the day before symptoms</u> begin through approximately 5 days after illness onset.
- <u>Children can be infectious for >10 days</u>, and young children can shed virus for ≤6 days before their illness onset.
- <u>Severely immunocompromised persons can shed virus for weeks or months.</u>
- Virus can live on non-porous surfaces for 24-48 hrs

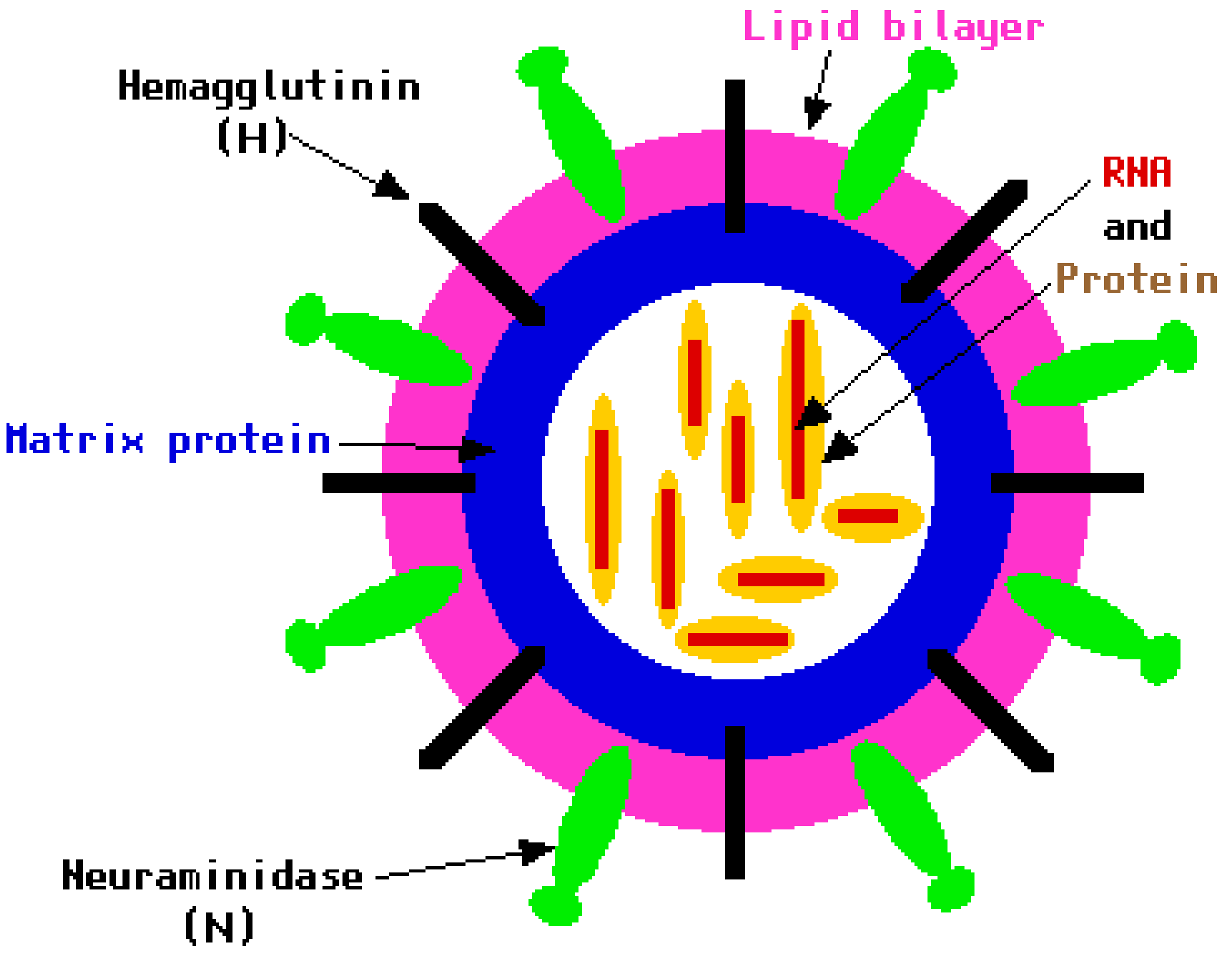
MMWR May 28, 2004 / 53(RR06);1-40 J Infect Dis 1982;146:47-51

Influenza Transmission Among Birds

- **Birds that survive avian influenza virus (AIV) infections excrete viruses for up to <u>10 days after infection</u>** **(www.who.int/mediacentre/factsheets/avian_influenza/en/)**
- **Rodents, insects (including flies) and wild birds (like sparrows) may act as vectors for AIV** **(www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/faq_ahai.html)**
- **AIV has been cultured from water for up to <u>100 days</u>** **(Avian Dis. 1990 Apr-Jun;34(2):412-8)**
- **AIV can survive in manure for up to <u>105 days</u>.** **(www.vetmed.ucdavis.edu/vetext/INF-PO_AI.html)**
- **AIV have been cultured from poultry houses for up to <u>100 days</u> after depopulation.** **www.nwhc.usgs.gov/pub_metadata/field_manual/chapter_22.pdf)**

How is zoonotic transmission associated?

17 H types – types 1, 2, and 3 established in man

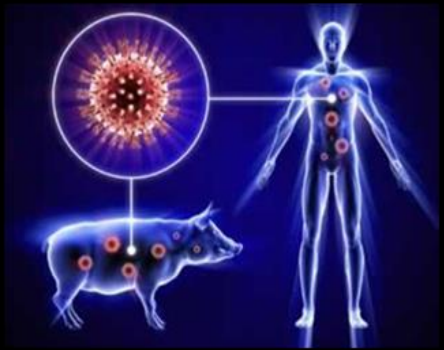


9 N types – types 1 & 2 found in man

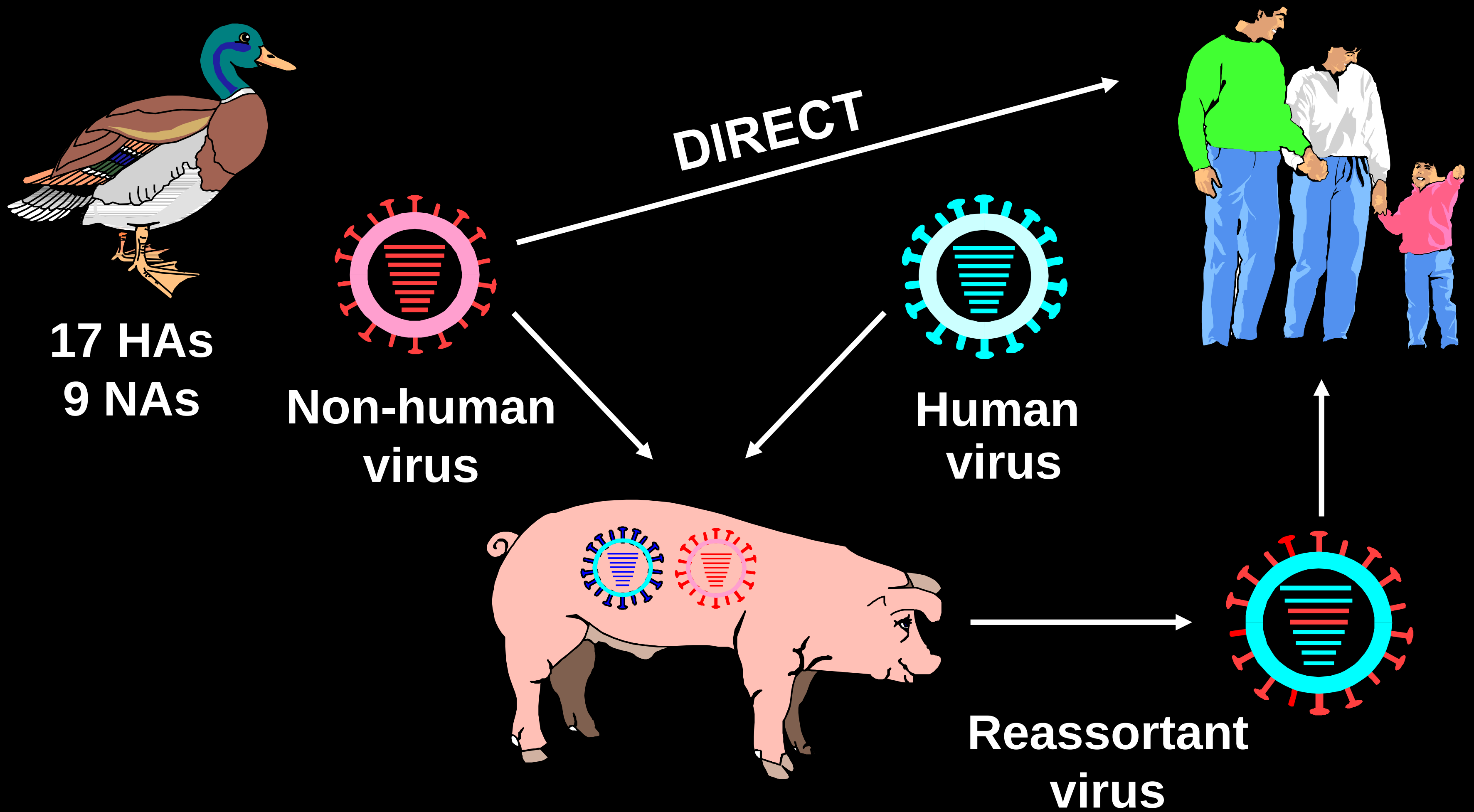
From www.ultranet.com/~jkimball/BiologyPages/ F/FluVirion.gif

Subtype Origin

Subtype	Waterfowl	Humans	Swine	Equines	Other mammals
H subtype					
H1	Yes	Yes	Yes	No	No
H2	Yes	Yes	No	No	No
H3	Yes	Yes	Yes	Yes	No
H4	Yes	No	No	No	Yes (seal)
[illegible]	Yes	Yes	No	No	No
H6	Yes	No	No	No	No
H7	Yes	Yes	No	Yes	Yes (seal)
H8	Yes	No	No	No	No
H9	Yes	Yes	No	No	No
H10	Yes	No	No	No	Yes (mink)
H11	Yes	No	No	No	No
H12	Yes	No	No		
H13	Yes	No	No	No	Yes (whale)
H14	Yes	No	No	No	No
H15	Yes	No	No	No	No
N subtype					
N1	Yes	Yes	Yes	No	No
N2	Yes	Yes	Yes	No	Yes (whale)
N3	Yes	No	No	No	No
[illegible]	Yes	No	No	No	Yes (mink)
N5	Yes	No	No	No	Yes (seal)
N6	Yes	No	No	No	No
N7	Yes	Yes	No	Yes	Yes (seal)
N8	Yes	No	No	Yes	No
N9	Yes	No	No	No	Yes (whale)



Mechanisms of Influenza Virus Antigenic "Shift"



Influenza A

- Key epidemiology features – Influenza epidemics are due to changes in the HA and NA glycoprotiens
- a major change (e.g. change in H type) is termed an antigenic shift (rare event, influenza A only); antigenic shift may lead to pandemics
- a minor change is termed an antigenic drift

Hong Kong H5N1

- **In May 1997, investigations revealed 18 (H5N1) human cases (6 deaths) by the end of 1997, all of them in Hong Kong. Exposure to birds the major risk factor**

- **This led to the culling of 1.2 million birds and cost the government 245 million in Hong Kong dollars in compensation.**

Recent Avian Influenza Outbreaks that have Infected Man

Years	Avian Influenza A	Place of Origin	Number of humans	Number of deaths
1997	H5N1	Hong Kong	18	6
1999	H9N2	Hong Kong	2	-
2002	H7N2	Virginia	2	-
2003	H5N1	Hong Kong	2	1
2003	H7N7	The Netherlands Belgium	89	1
2003	H9N2	Hong Kong	1	-
2003	H7N2	New York	1	-
2004	H7N3	Canada	1	-
2004	H10N7	Egypt	2	-
2004+	H5N1	Numerous	Many	>50%
2013	H7N9	China	132+	37

Data derived from various CDC and WHO reports

H7N9: New Pandemic Threat?

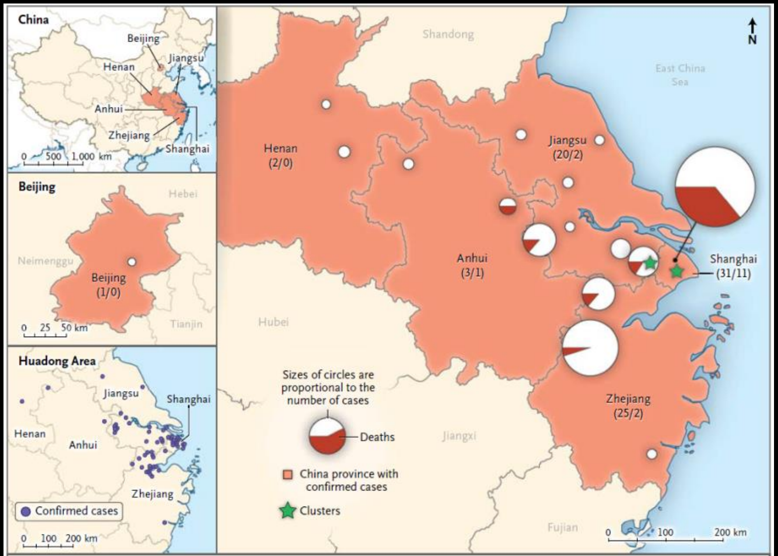


Figure 2. Geographic Distribution of 82 Confirmed and 2 Suspected Cases of H7N9 Virus Infection in China, as of April 17, 2013.
The numbers in parentheses below the names of the provinces are the number of cases/number of deaths.

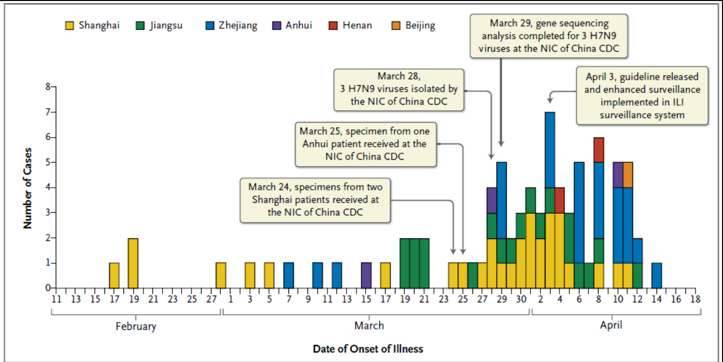
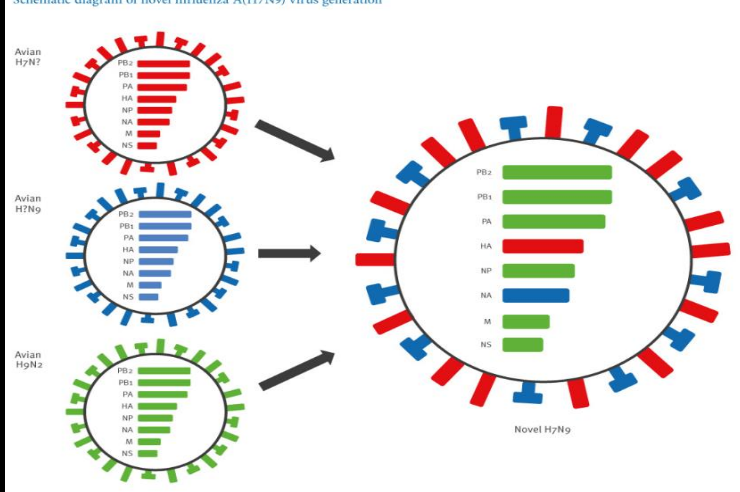


Figure 1. Date of Onset of Illness in First 82 Patients with Confirmed H7N9 Virus Infection, According to Province in China.
CDC denotes Chinese Center for Disease Control and Prevention, ILI influenza-like illness, and NIC National Influenza Center.

FIGURE 3
Schematic diagram of novel influenza A(H7N9) virus generation



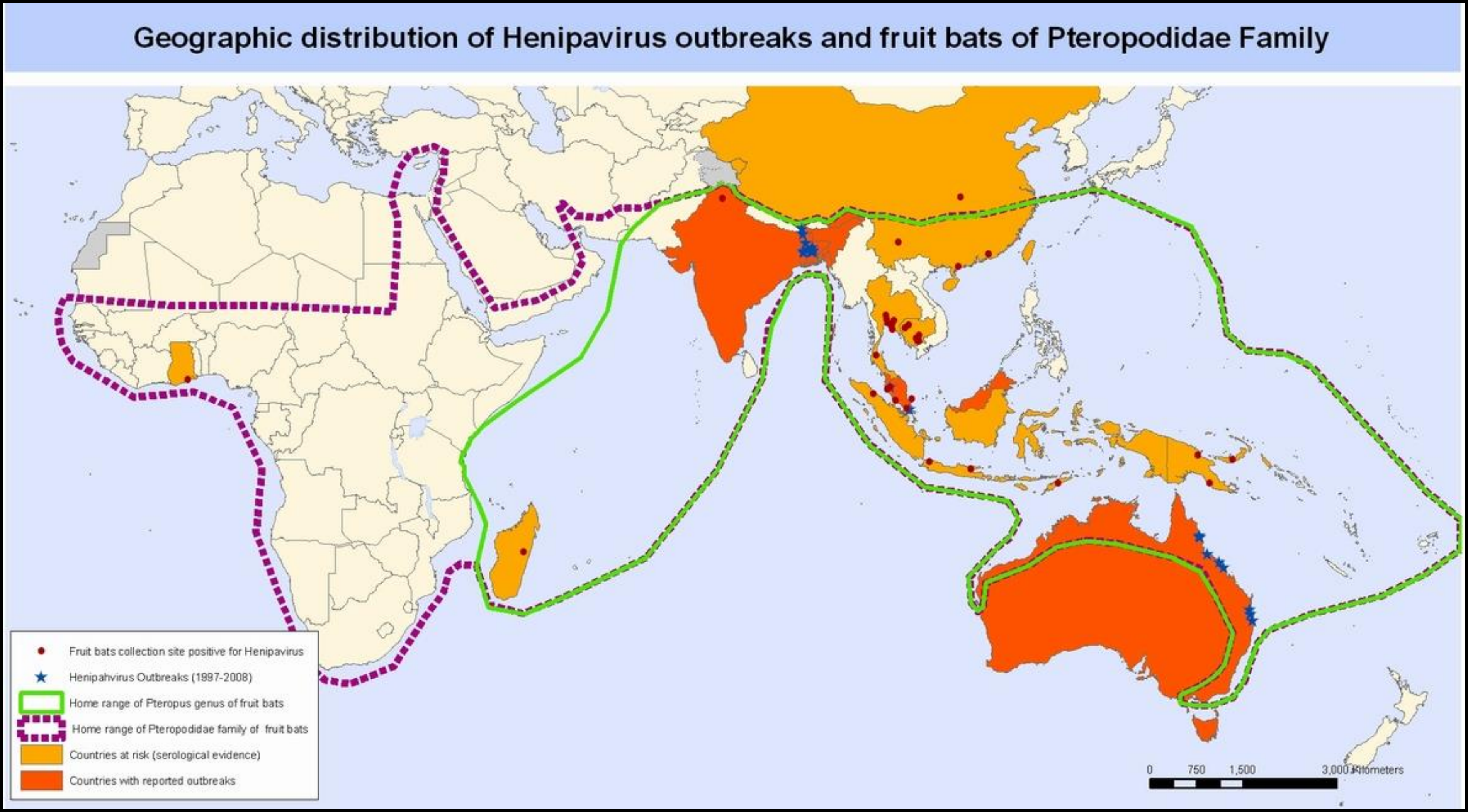
HA: haemagglutinin; NA: neuraminidase.

eurosurveillance.org

Examples of Zoonoses

- Influenza virus — Domestic | International
- Henipa viruses — International

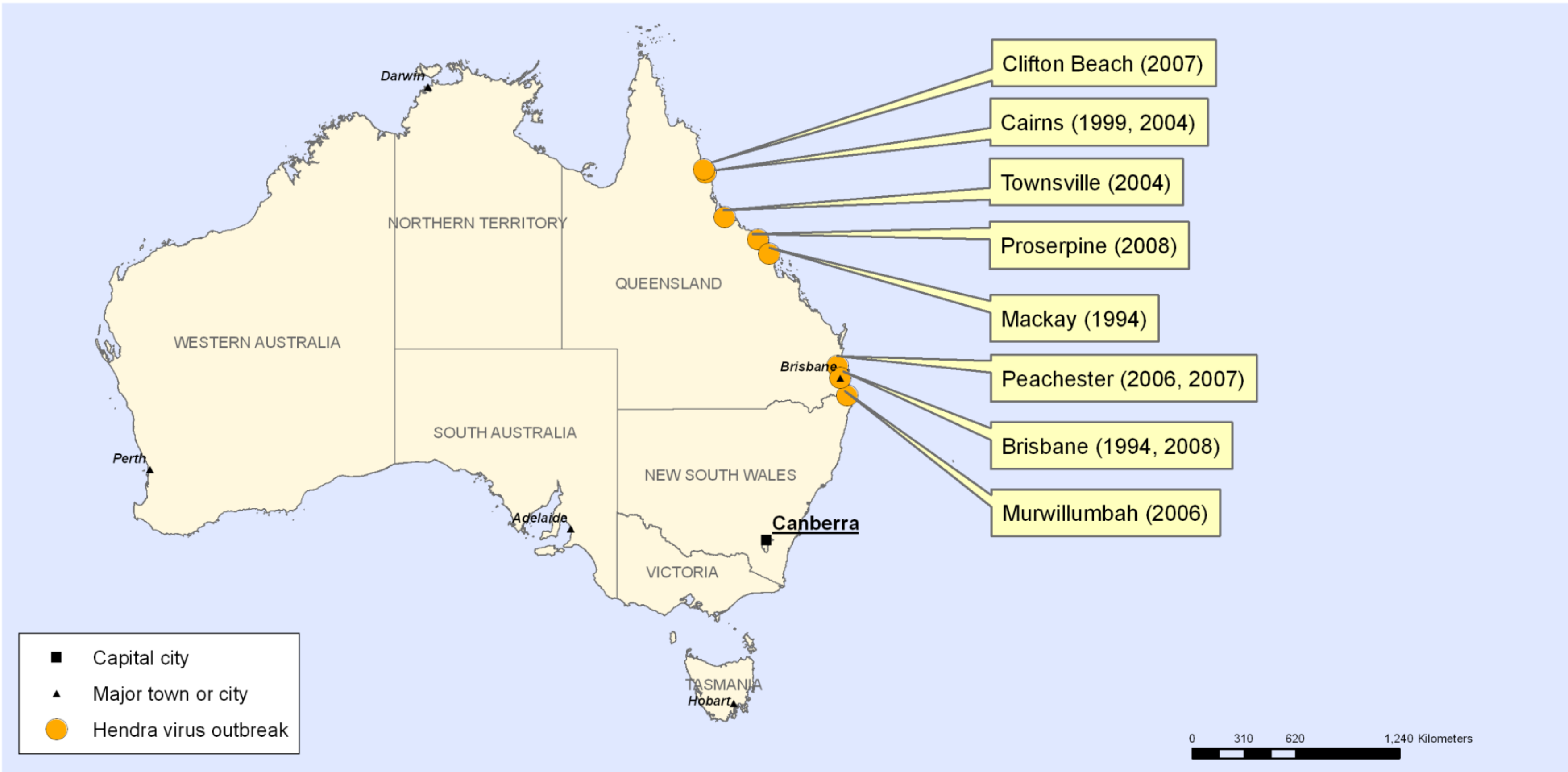
Henipa viruses distribution



Source: www.who.int

Hendra virus timeline

Geographic distribution of Hendra virus outbreaks in Australia from 1994 to July 2008



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

Prevention or control?

NEWS

BIOSECURITY

Hendra vaccine success announced

Successful trials of a horse vaccine against the Hendra virus were announced by Deborah Middleton at May's AVA Annual Conference in Adelaide.

The vaccine

The Hendra virus attaches to host cells via the attachment glycoprotein G. The experimental horse vaccine generates

Australian Veterinary Journal Volume 89, No 7, July 2011

Nipah virus

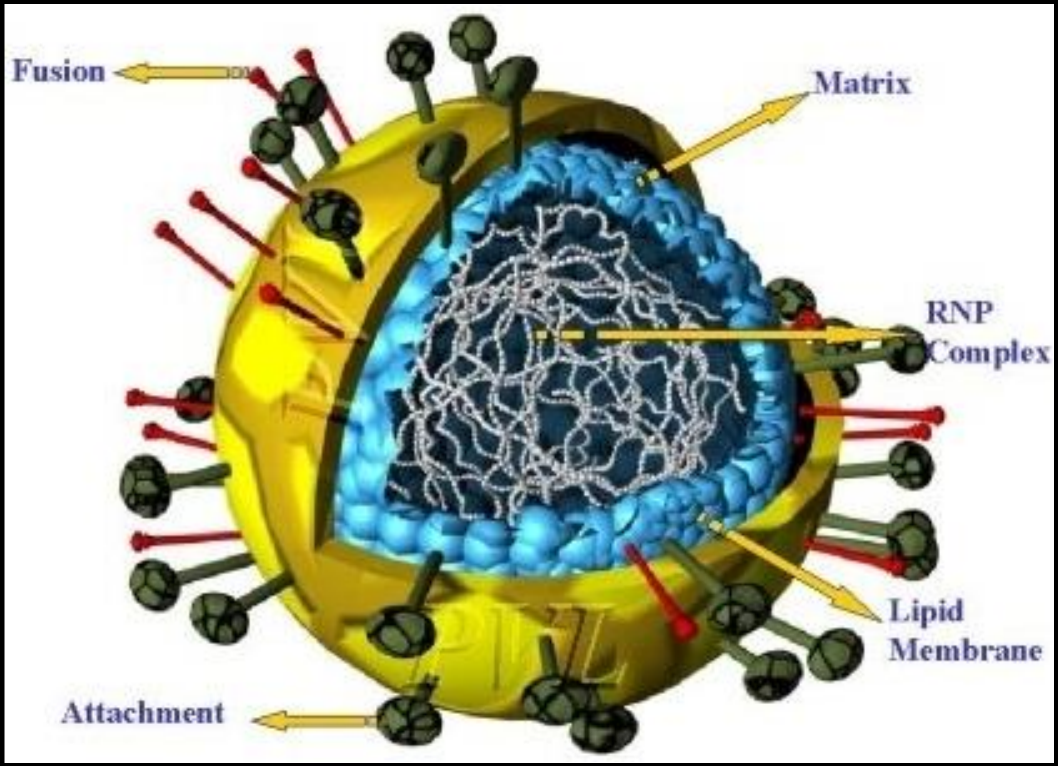


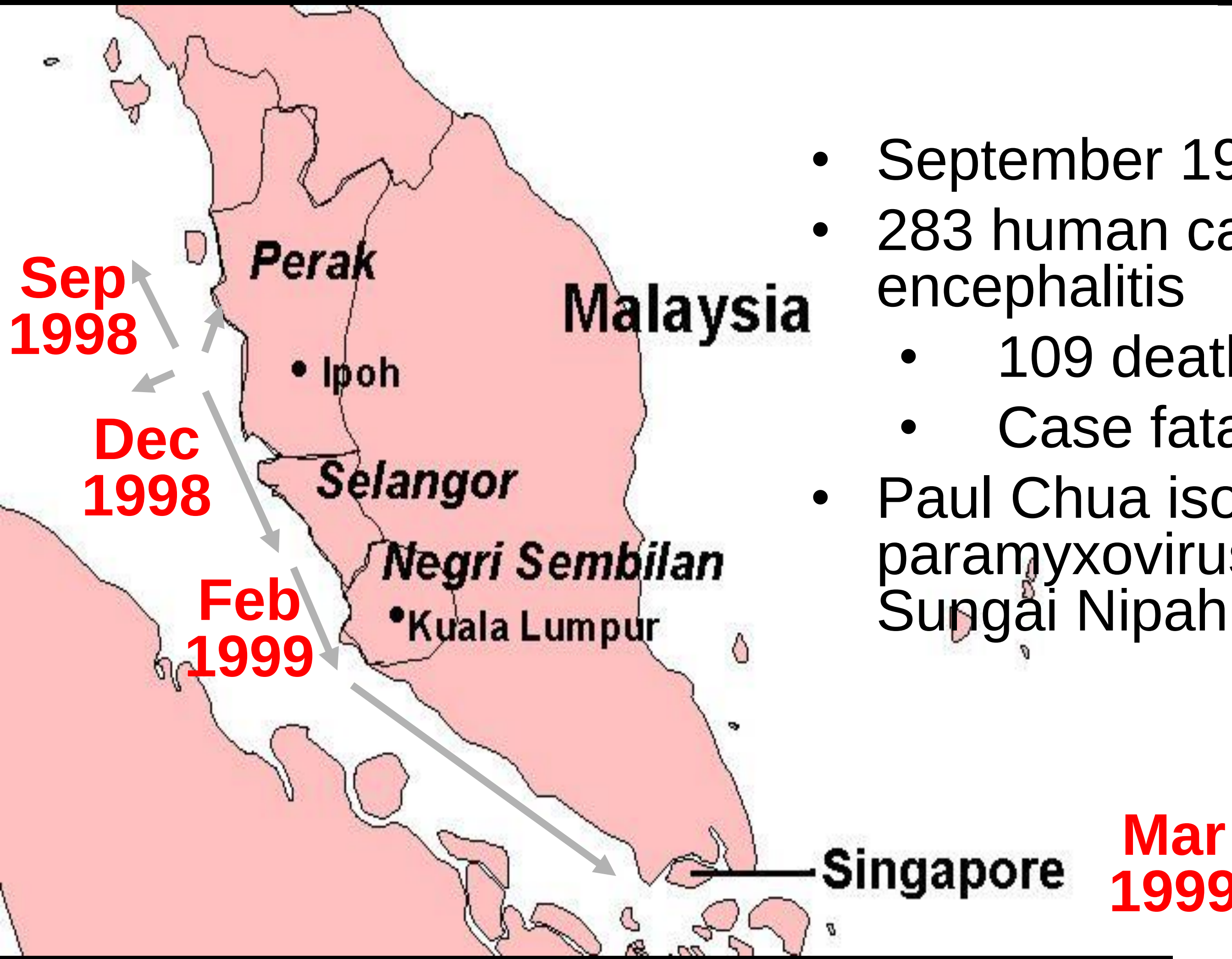
Image source: doctorexclusive.com

- Member of Paramyxoviridae
  - Enveloped spherical virus
  - Single strand negative sense RNA
  - Related to Hendra and Measles virus

Image source: C.S. Goldsmith and P.E. Rollin (CDC), and K.B. Chua (Malaysia).

Nipah Virus in Malaysia

Malaysia Nipah Outbreak



- September 1998 – May 1999
- 283 human cases of acute encephalitis
    - 109 deaths
    - Case fatality rate 39%
- Paul Chua isolated a novel paramyxovirus from a patient in Sungai Nipah village

Nipah Clinical Features

Symptoms:

Moderate
- high fever
- headache
- myalgia
- vomiting
- drowsiness
- dizziness

Severe
- encephalitis including
  - disorientation
  - hallucinations
  - seizures/convulsions
  - coma

Respiratory symptoms:
- 14% non-productive cough
- 6% of chest radiographs mild focal abnormalities

Goh KJ. *N Engl J Med* **2000; 342:**1229–35.

CDC

How did people contract Nipah Virus in Malaysia?

- The outbreak was concentrated among pig farmers
  - 92% of cases reported contact with pigs

- Compared to controls, persons with Nipah encephalitis were
  - 5.6 times more likely to have close contact with pigs.
  - 3.7 times more likely to have contact with sick pigs

CDC

How did Nipah transmit between pigs?

- Pig respiratory secretions contained Nipah virus
- 2.4 million pigs in peninsular Malaysia
- Active pig trade
  - Distributed infected but asymptomatic pigs throughout the country
- As the PRES epidemic spread
  - "fire sale" of sick pigs markedly increased mixing of sick and well pigs

http://www.xanga.com/c_lar_a

From where did the pigs get Nipah?
Nipah wild animal studies

- Numerous wild animals trapped and tested
- 8 different species of fruit bats sampled
  - 4 of the 8 species had antibodies against Nipah virus
- Nipah virus isolated
  - Urine from *Pteropus hypomelanus* in Malaysia
  - Urine from *Pteropus lylei*
    - In Cambodia
    - In Thailand

Photo source: Ivan Kuzmin

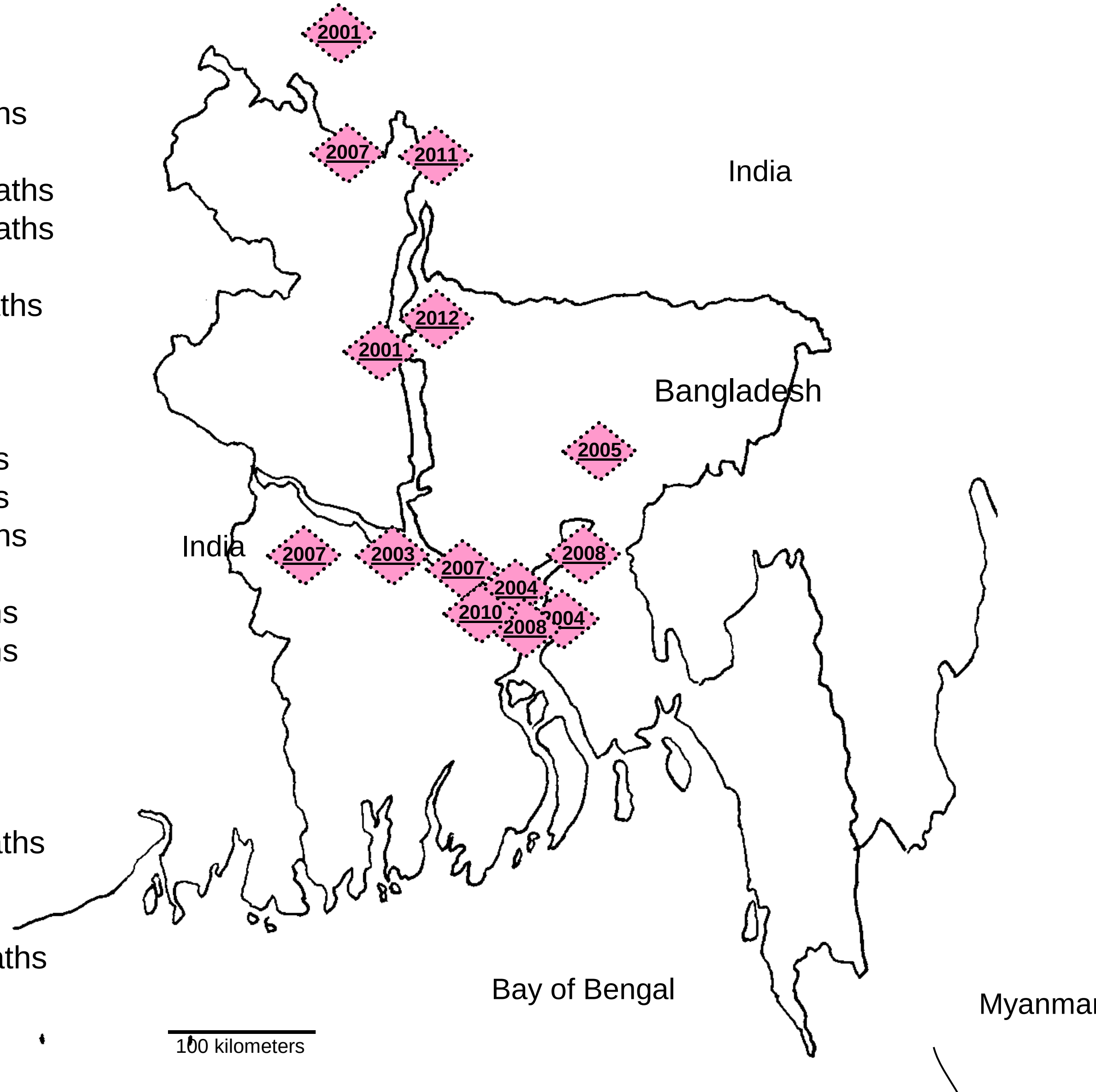
Malaysia Outbreak Control

- Outbreak ceased following the culling of over 900,000 pigs
  - Fruit trees no longer permitted above pig pens
  - Pork industry decimated
- No subsequent cases of Nipah recognized in Malaysia from people or animals

Photo: www.fao.org

Nipah virus in Bangladesh

2001
Siliguri 66 cases 49 deaths
Meherpur 13 cases 9 deaths
2002
No cases
2003
Naogaon 12 cases 8 deaths
2004
Rajbari 31 cases 23 deaths
Faridpur 36 cases 27 deaths
2005
Tangail 12 cases 11 deaths
2006
No cases
2007
Thakurgaon 7 cases 3 deaths
Kushtia 8 cases 5 deaths
Nadia 5 cases 5 deaths
2008
Manikgonj 4 cases 4 deaths
Rajbari 6 cases 5 deaths
2009
Rangpur , Gaibandha, Rajbari, Niphamari 4 cases 1death
2010
Faridpur, Rajbairi, Gopalgonj ,Kurigram 17 cases 15 deaths
2011
Lalmonirhat, Dinajpur, Comilla, Nilpahmari, Faridpur, Rajbari 28 cases 28 deaths
2012
Joypurhat, Rajshahi 13 cases 10 deaths
Total **266 cases 204 deaths**



Pteropus giganteus in Bangladesh

	2004	2006	2007
Bats Tested	92	81	218
Nipah IgG+	48	15	107
% positive	52%	19%	49%

How does Nipah virus transmit from wildlife to humans in Bangladesh?

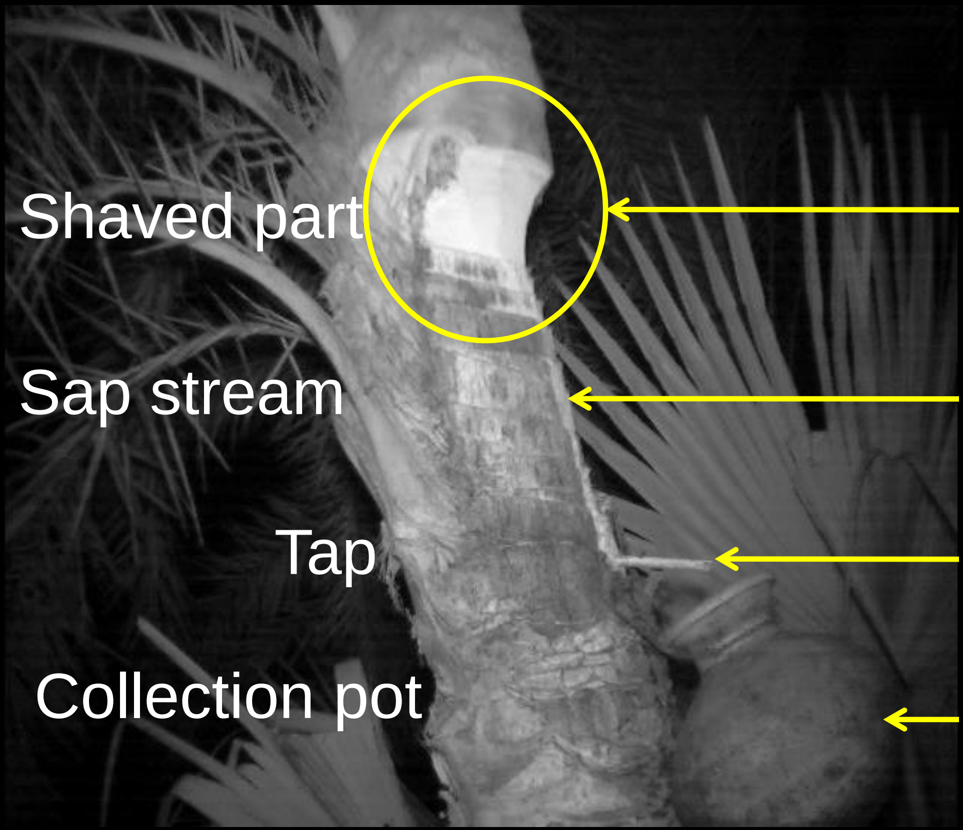
Pathways for transmission

- Zoonotic
- Human-to-human

Outbreak investigations

Risk factor	No. and % of cases with this risk factor	No. and % of controls with this risk factor	Odds Ratio	95% confidence limit	p-value
Physical contact with sick animal	5 (42)	5 (14)	4.4	0.9,20.4	0.09
Physical contact with sick chicken	3(25)	3(8)	3.7	0.5,24	0.16
Killed a sick animal	1(8)	2(6)	1.6	0.05,22	1.00
Ate any sick animal	1(8)	2(6)	1.6	0.05,22	1.00
Seen fruit bats during daytime	3(25)	5(14)	2.1	0.34,11	0.39
Seen fruit bats during nighttime	8(67)	13(36)	3.5	0.9,15.4	0.06
Drank raw date palm sap	**7(58)**	**6(17)**	**7.0**	**1.6,31**	**0.01**

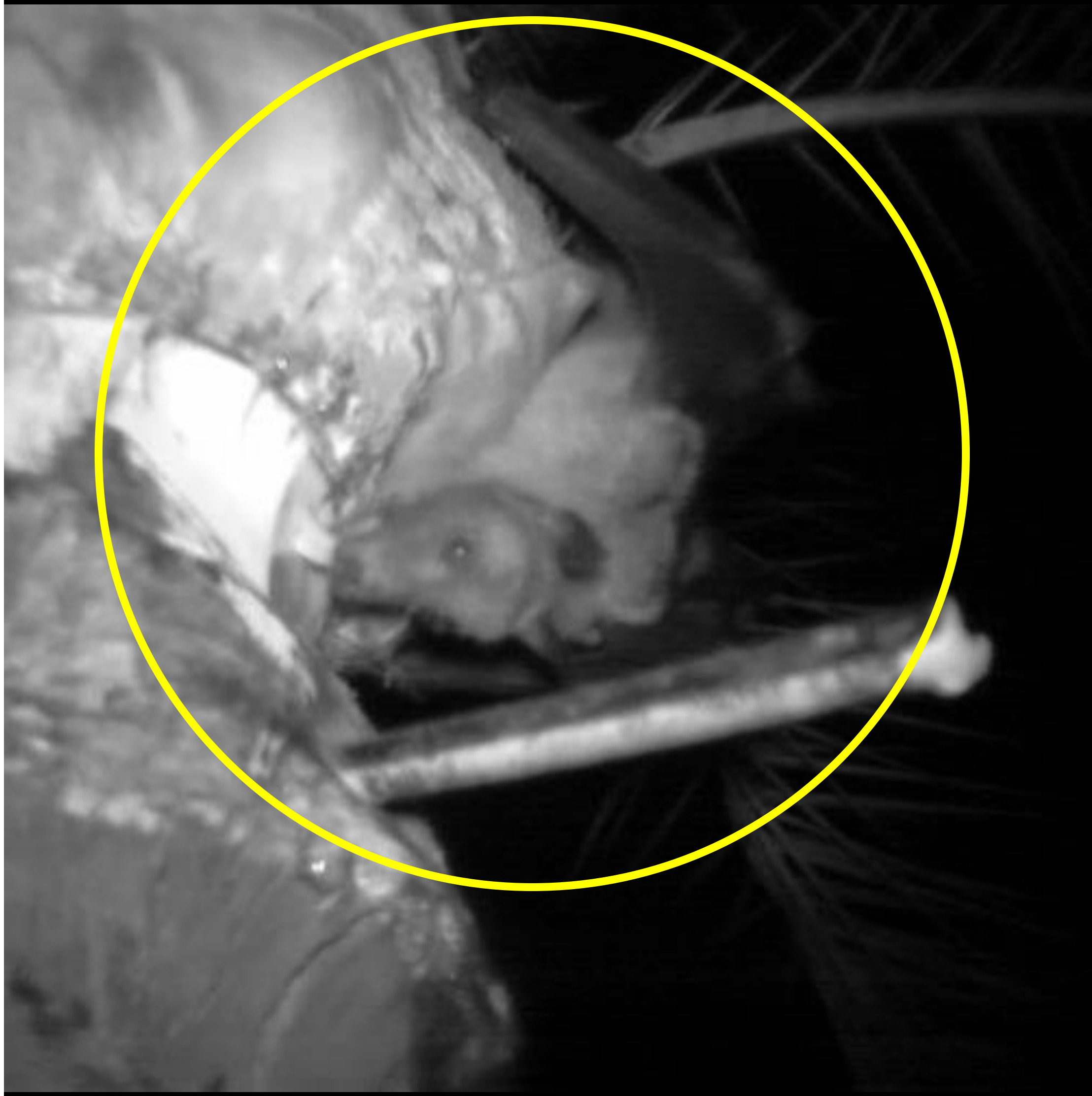
Date Palm Sap Collection



- Late November through March/April
  - Sap harvesters cut a tap is cut into the tree
    - In the evening they place a clay pot under the tap
    - Each morning the pot is removed
  - Most sap is made into molasses
  - Some sold fresh early in the morning
    - A local delicacy

Manikgonj Outbreak 2008

- 7 trees where implicated date palm sap was collected
- 7 nights of observation
- Mean 15 bat visits per night
- Bats licked the sap mean 8.4 times per night
- 49% of bats were *Pteropus sp.*

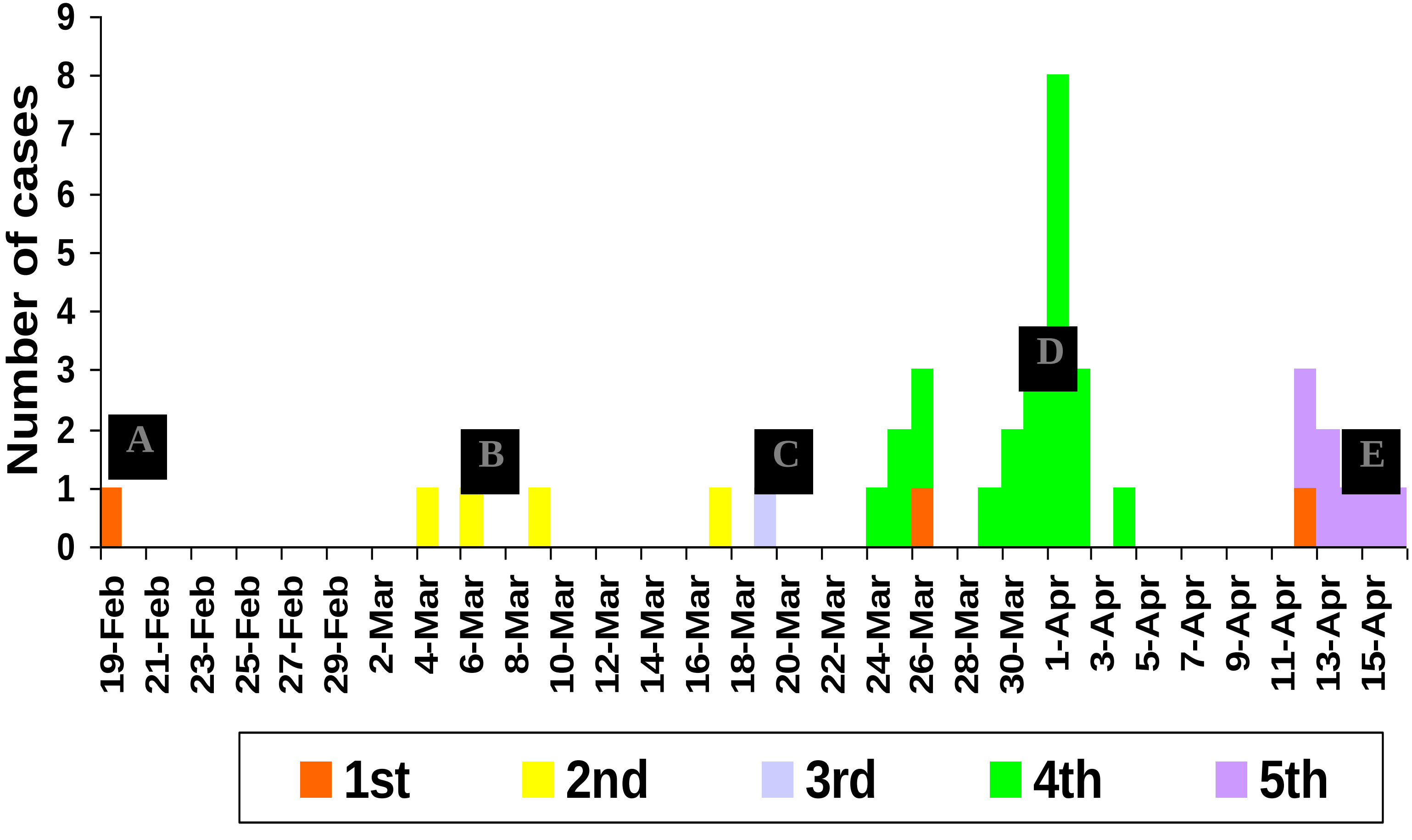


Date palm sap transmission of NIV

Epidemiological Evidence

Year	Location	Cases Exposed (%)	Controls Exposed (%)	Odds Ratio	95% Confidence Limit
2005	Tangail	58	17	**7.0**	1.6, 31
2008	Manikgonj	100	25	**18**	2.2, inf
2010	Faridpur	69	30	**5.2**	1.2, 26
2011	Lalmonirhat	68	11	**17**	4.0 , 70

Dates of illness onset from Faridpur outbreak coded by transmission generation (N=36)



Gurley E, *Emerg Infect Dis*, 2007 Jul;13(7):1031-7.

What contact was associated with Nipah transmission?

Faridpur Cohort Study

- Touching a Nipah patient who later died (RR 15.0, 95% CI 4.0, 65)
- Touching an unconscious patient (RR 4.5, 95% CI 1.7, 12)
- Touching a patient with respiratory symptoms (RR 5.0, 95% CI 2.0, 14)
- Washing hands after contact with Patient F (RR 0.20, 95% CI 0.03, 0.90)

Gurley E, *Emerg Infect Dis*, 2007 Jul;13(7):1031-7.

Jute

Bat Visits

	Bamboo	Dhoincha	Jute	Poly ethylene	Control
Bat visits on and around tree	176	45	125	112	4630
% landed on the tree	20	18	43	11	78
Number contacting date palm sap	0	0	11	0	3556
% contacting sap	0	0	9	0	76

Community acceptance and uptake of the intervention?

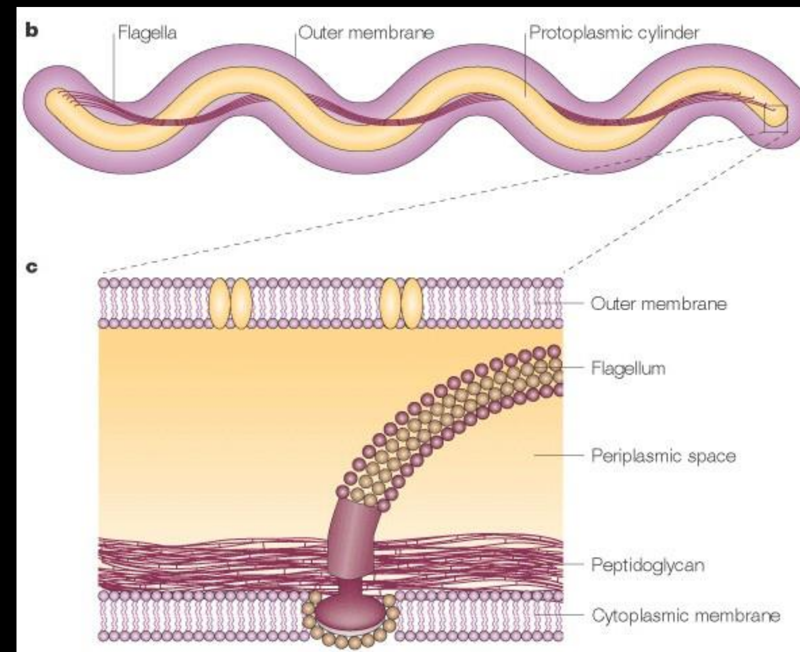
Khan SU, *PLoS One*, 2012 7(8):e42689

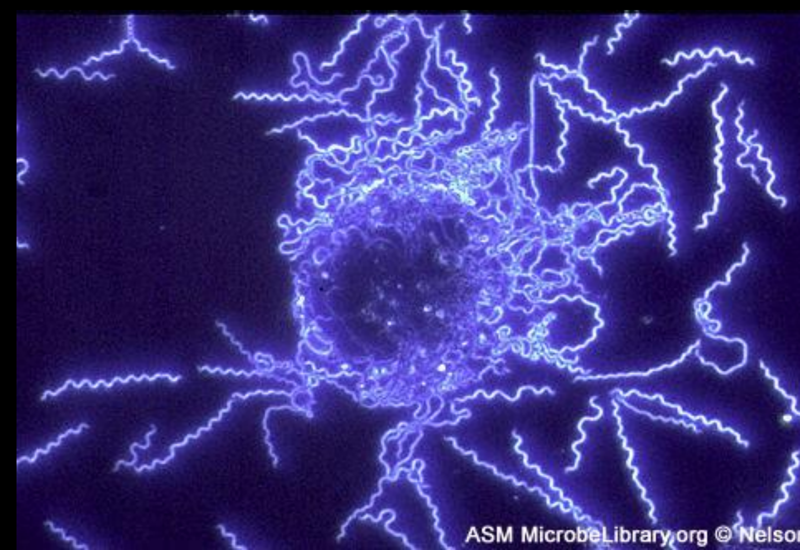
Examples of Zoonoses

- Influenza virus — Domestic — International
- Nipah virus — International
- Lyme disease — Domestic

Lyme Disease

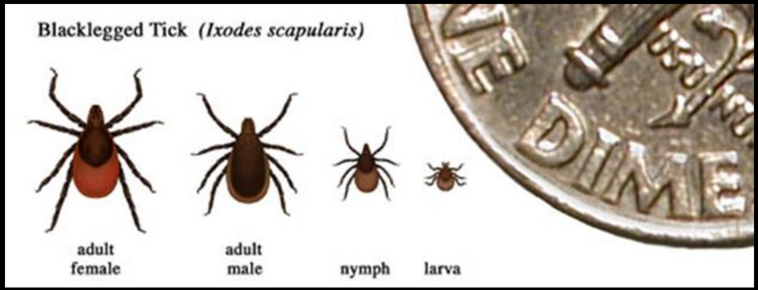
- The most common tick-borne infection in both North America and Europe
- First cases in 1975
  - Lyme and Old Lyme, CT
  - 50 cases pediatric arthritis
  - EIS investigation
- *Borrelia burgdorferi*
  - *Gram (-) spirochete*
  - *Discovered 1982*





Background

- *Ixodes spp.*
  - *I. scapularis* (Eastern, North-Central US)
  - *I. pacificus* (Pacific Coast)
- Common Names
  - Black-legged tick
  - Deer tick
- Ecology
  - Floor of decidious forests
  - Brush
  - High humidity
- Life-Cylce
  - Complex
  - Egg→Larva→Nymph→Adult

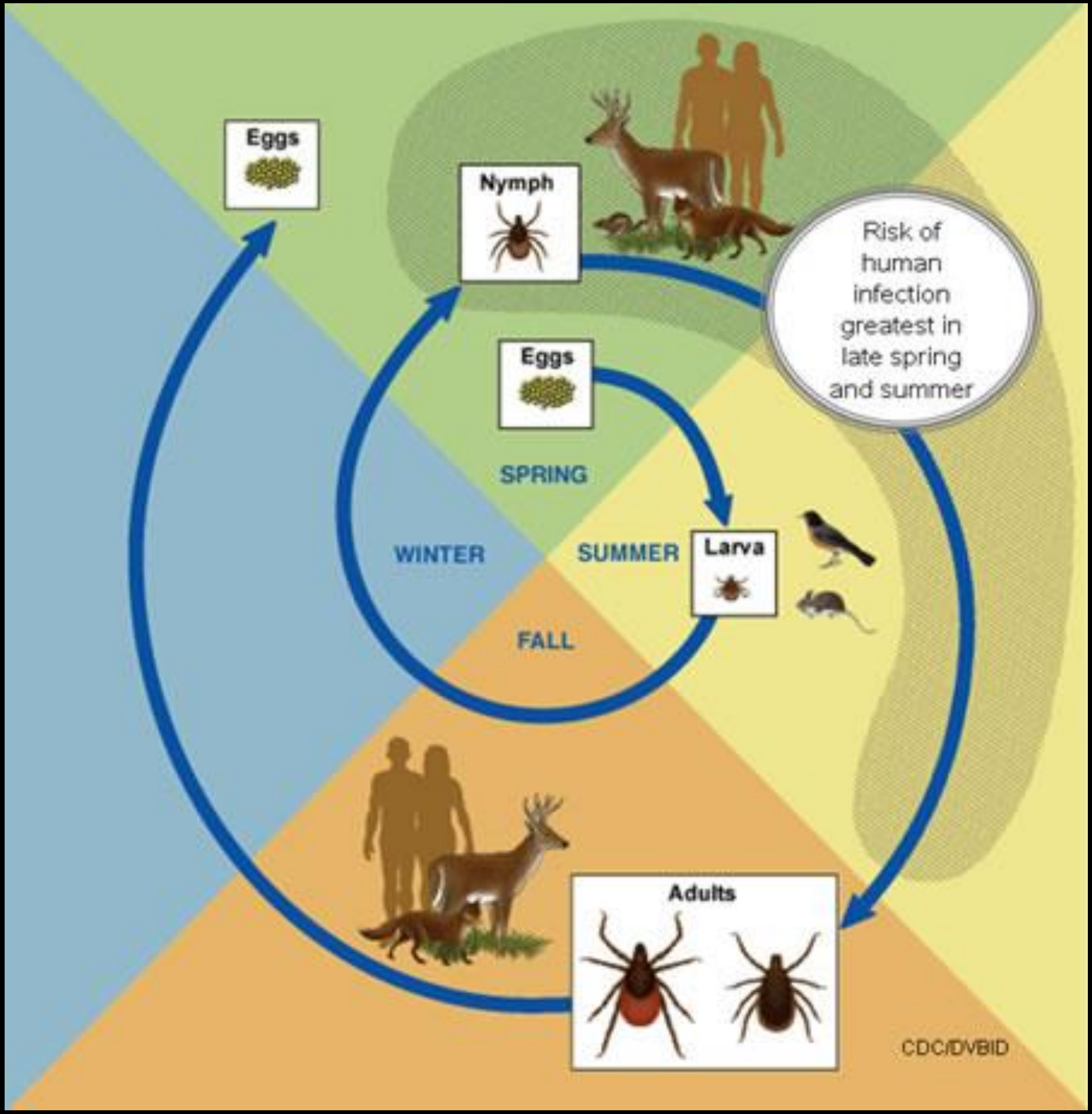


Signs and Symptoms

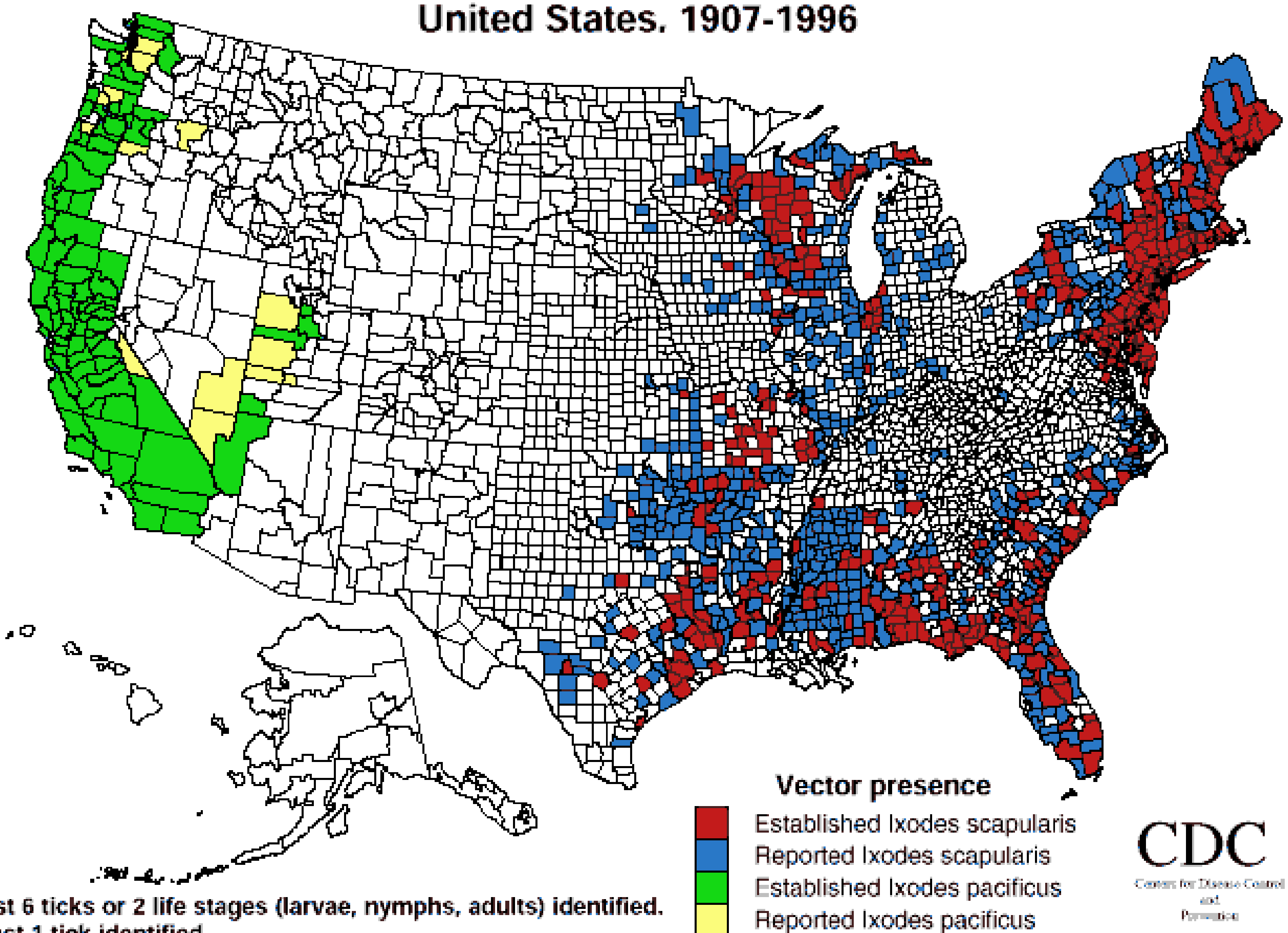
3 Stages

- **Early Localized Stage (3-30 days P.I.)**
  - Rash called erythema migrans (EM)
    - Distinct Bull's Eye appearance
  - Fatigue, chills, fever, headache, muscle and joint aches, and swollen lymph nodes
- **Early Disseminated Stage (days-weeks P.I.)**
  - Facial or Bell's palsy
  - Severe headaches/neck stiffness
  - Joint pain/swelling
  - Heart irregularities
- **Late disseminated stage (months-years P.I.)**
  - Chronic arthritis (60%)
  - Neurological abnormalities (5%)

Vector Life-cycle



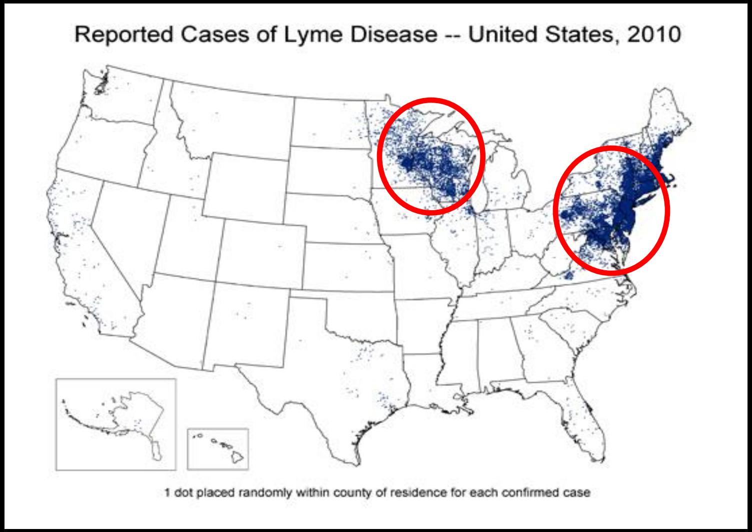
Established* and reported** distribution of the Lyme disease vectors Ixodes scapularis (I. dammini) and Ixodes pacificus, by county, United States. 1907-1996

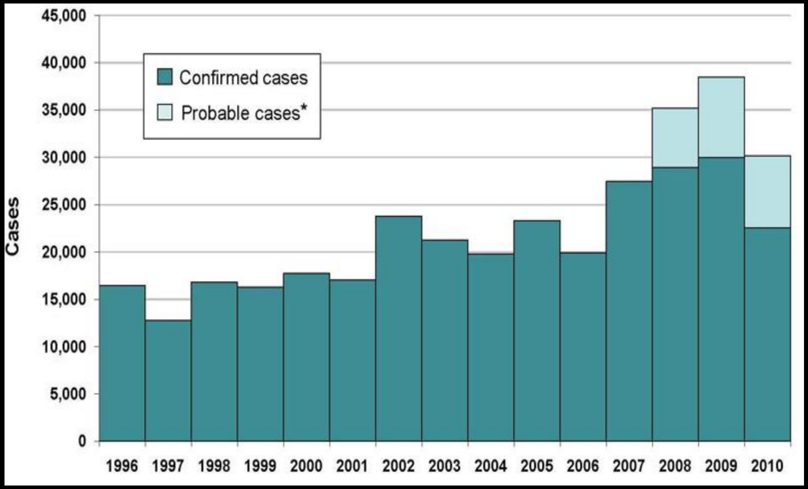


*at least 6 ticks or 2 life stages (larvae, nymphs, adults) identified.
**at least 1 tick identified.

Epidemiology

- Cases are geographically clustered
  - North Central US
  - North Eastern US





- Incidence
  - Aprox. 22,000 new cases 2010
  - Steady increase
  - Most infections occur during summer months

Interventions

- <u>Prevention</u>
  - Protective clothing
  - Repellants (DEET, Pyrethrin)
  - Environmental management
    - Controlled burns
    - Landscaping
- <u>Acaricides</u>
  - Broad-application
  - Reservoir targeted
- <u>Vaccines</u>
  - “LYMErix“ (2002) pulled
- <u>Therapy</u>
  - doxycyline, amoxicillin, or cefuroxime axetil for 2-3 weeks

Protective Clothing

Environmental Management

Contraversies

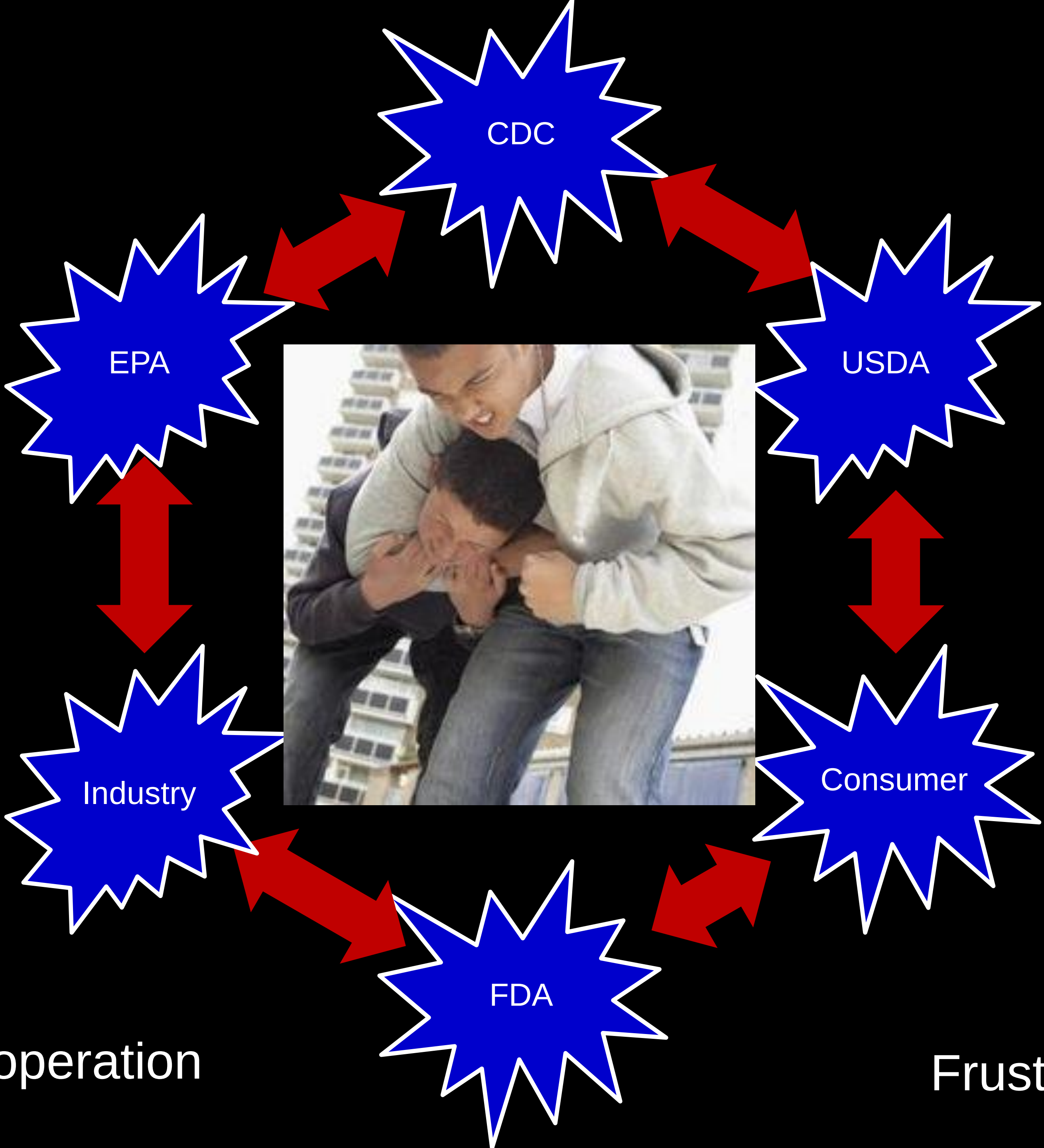
- Some groups argue that the prevalence is much greater than reported
- Conspiracy theorists suggest Lyme disease is clandestinely connected with biological warfare
- Clinical diagnostic criteria and laboratory testing methods are a focus of criticism

http://www.underourskin.com/emvideo/modal/3021/853/510/field_video/youtube/z5u73ME4sVU

Understanding and controlling zoonotic diseases can be vastly complicated.

The Problem

- No one discipline is trained to engage such complex one health problems
- No one agency or organization can control such problems



Poor cooperation

Frustration

Home page
About One Health
Mission Statement
Advisory Board (Hon.)
One Health News
AVMA Task Force Report
One Health Newsletter
Publications
ProMED Outbreak Reports
Supporters
Supporter Endorsements
Upcoming Events
Follow Us on Twitter
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Reciprocal Links

About the One Health Initiative

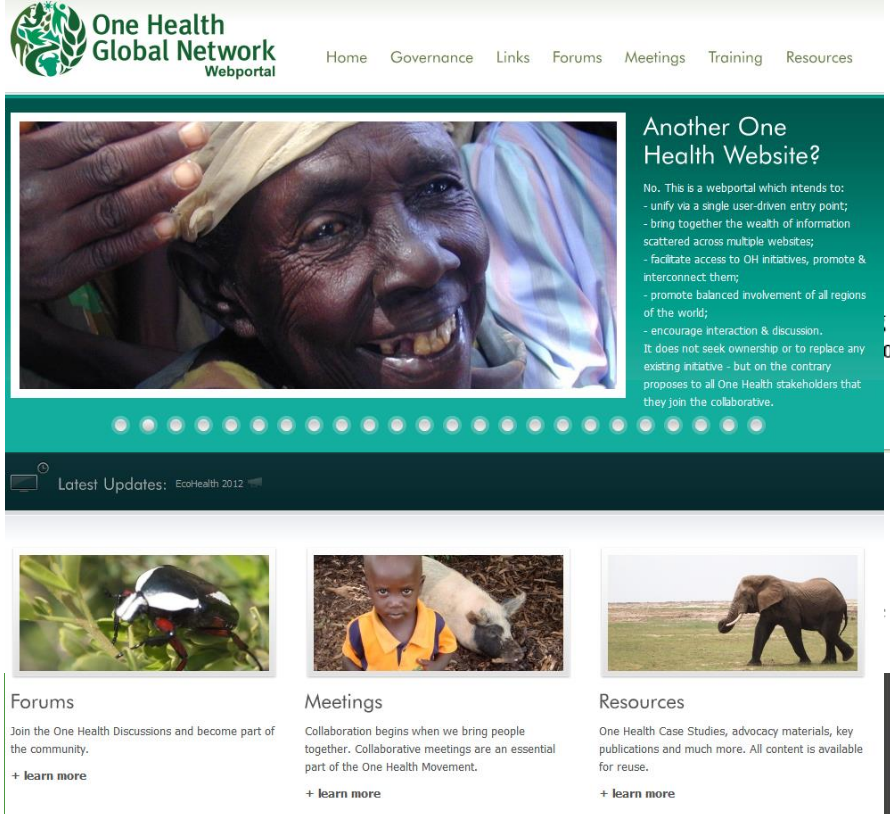
The One Health concept is a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment. The synergism achieved will advance health care for the 21st century and beyond by accelerating biomedical research discoveries, enhancing public health efficacy, expeditiously expanding the scientific knowledge base, and improving medical education and clinical care. When properly implemented, it will help protect and save untold millions of lives in our present and future generations.

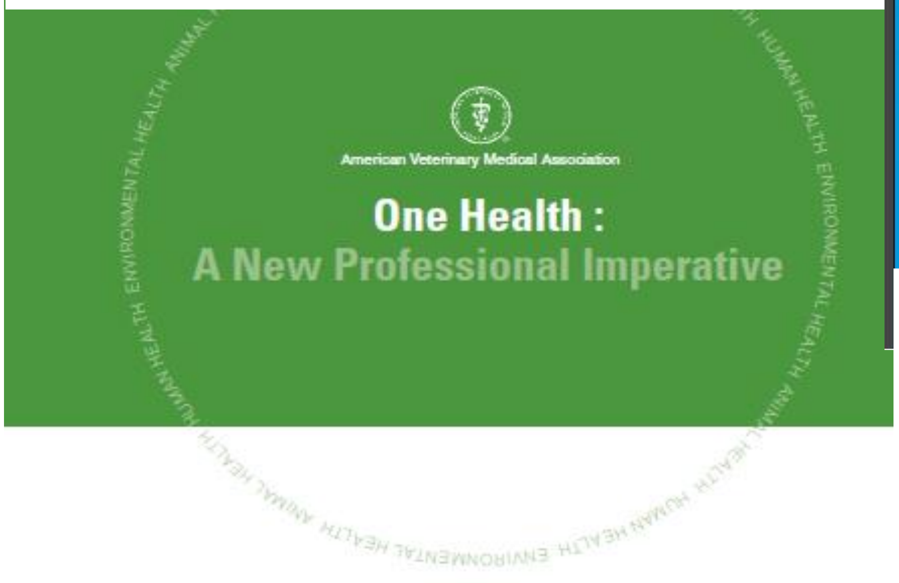
"May there never develop in me the notion that my education is complete but give me the strength and leisure and zeal continually to enlarge my knowledge."
- Maimonides -

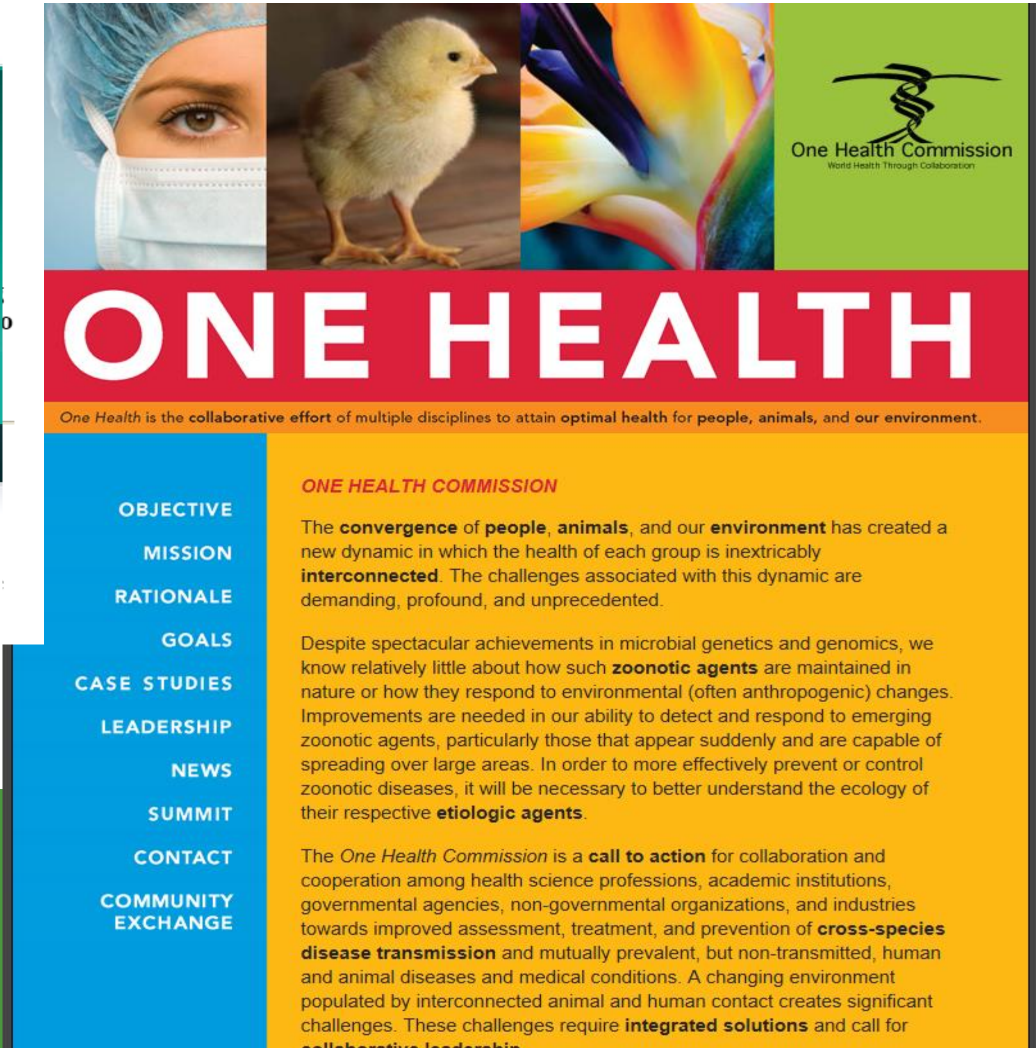
One World-One Medicine-One Health

Addressing the connections between health and the environment—Accelerated biomedical research discoveries—Enhanced public health efficacy—Expanded scientific knowledge base—Improved medical education and clinical care

-- ADVANCING HEALTH CARE for the 21st century --
Humans & Animals
Collaborative-Synergistic-Enlightening


One Health Global Network
Webportal
Home
Governance
Links
Forums
Meetings
Training
Resources
Another One Health Website?
No. This is a webportal which intends to:
- unify via a single user-driven entry point;
- bring together the wealth of information scattered across multiple websites;
- facilitate access to OH initiatives, promote & interconnect them;
- promote balanced involvement of all regions of the world;
- encourage interaction & discussion.
It does not seek ownership or to replace any existing initiative - but on the contrary proposes to all One Health stakeholders that they join the collaborative.
Latest Updates: EcoHealth 2012
Forums
Join the One Health Discussions and become part of the community.
+ learn more
Meetings
Collaboration begins when we bring people together. Collaborative meetings are an essential part of the One Health Movement.
+ learn more
Resources
One Health Case Studies, advocacy materials, key publications and much more. All content is available for reuse.
+ learn more


American Veterinary Medical Association
One Health :
A New Professional Imperative
ENVIRONMENTAL HEALTH ANIMAL HEALTH HUMAN HEALTH ENVIRONMENTAL HEALTH ANIMAL HEALTH HUMAN HEALTH ENVIRONMENTAL HEALTH


One Health Commission
World Health Through Collaboration
ONE HEALTH
One Health is the collaborative effort of multiple disciplines to attain optimal health for people, animals, and our environment.
OBJECTIVE
MISSION
RATIONALE
GOALS
CASE STUDIES
LEADERSHIP
NEWS
SUMMIT
CONTACT
COMMUNITY EXCHANGE
ONE HEALTH COMMISSION
The convergence of people, animals, and our environment has created a new dynamic in which the health of each group is inextricably interconnected. The challenges associated with this dynamic are demanding, profound, and unprecedented.
Despite spectacular achievements in microbial genetics and genomics, we know relatively little about how such zoonotic agents are maintained in nature or how they respond to environmental (often anthropogenic) changes. Improvements are needed in our ability to detect and respond to emerging zoonotic agents, particularly those that appear suddenly and are capable of spreading over large areas. In order to more effectively prevent or control zoonotic diseases, it will be necessary to better understand the ecology of their respective etiologic agents.
The One Health Commission is a call to action for collaboration and cooperation among health science professions, academic institutions, governmental agencies, non-governmental organizations, and industries towards improved assessment, treatment, and prevention of cross-species disease transmission and mutually prevalent, but non-transmitted, human and animal diseases and medical conditions. A changing environment populated by interconnected animal and human contact creates significant challenges. These challenges require integrated solutions and call for


One Health Newsletter
A quarterly newsletter highlighting the interconnectedness of animal and human health
Summer 2008
Volume 1, Issue 3
In This Issue
Articles:
Efficacious "One Health" Implementation........page 1
This newsletter was created to lend support to the One Health Initiative and is dedicated to enhancing the integration of animal, human, and environmental health for the benefit of all.
Efficacious "One Health" implementation
Bruce Kaplan, DVM

Which human, animal, and environmental risk factors predict disease?

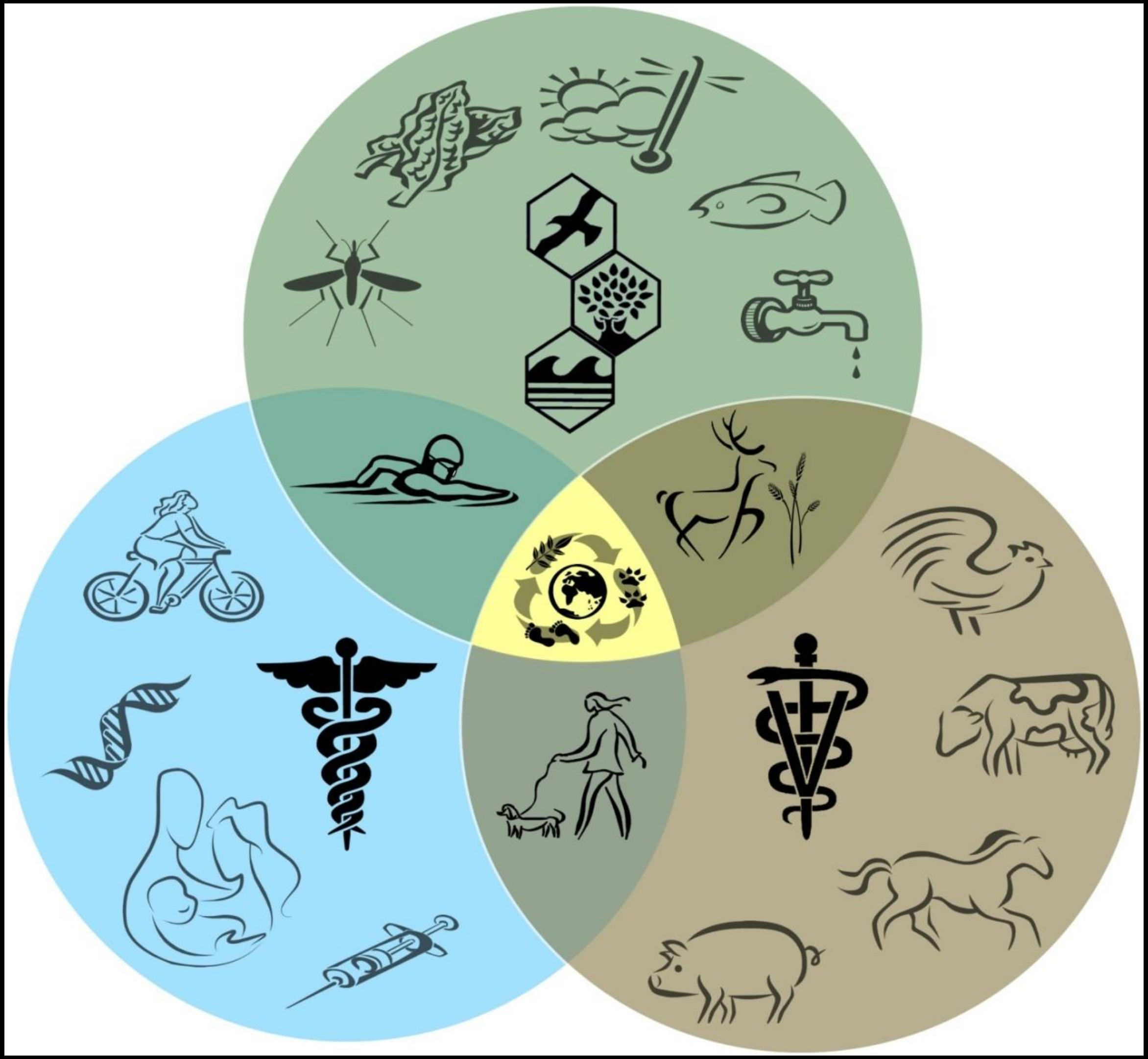


Table 1. Organizations that have endorsed the *One Health* Initiative as of July 2011

American Association of Veterinary Laboratory Diagnosticians	Immuno Valley Consortium in The Netherlands
American Association of Wildlife Veterinarians	Indian Veterinary Public Health Association
American College of Veterinary Microbiologists	Institute for Preventive Veterinary Medicine and Food Safety Lazio and Tuscany Regions [Italy]
American College of Veterinary Pathologists	Institute of Tropical Medicine, Department of Animal Health, Antwerp, Belgium
American College of Veterinary Preventive Medicine	International Zoonosis Research Institute - Islamabad, Pakistan
American Medical Association	Italian Society of Preventive Medicine
American Nurses Association	National Association of State Public Health Veterinarians
American Physiological Society	National Environmental Health Association (NEHA)
American Phytopathological Society	National Park Service (USA)
American Society for Microbiology	New Zealand Centre for Conservation Medicine
American Society of Tropical Medicine and Hygiene	Nigerian Biomedical and Life Scientists
American Veterinary Medical Association	Nigerian Veterinary Medical Association
Association of Academic Health Centers	Praecipio International
Association of American Medical Colleges	SAPUVET III Project
Association of American Veterinary Medical Colleges	Society for Tropical Veterinary Medicine
Association of Schools of Public Health	State Environmental Health Directors
Conservation through Public Health	United States Animal Health Association (USAHA)
Corporation Red SPVet, Bogota-Columbia	Veterinarians without Borders/ Vétérinaires sans Frontières - Canada
Council of State and Territorial Epidemiologists	World Association of Veterinary Laboratory Diagnosticians Zoonotic and Emerging Diseases, Edinburgh, UK
Croatian Society for Infectious Diseases	
Delta Society	
Department of Molecular and Comparative Pathobiology, Johns Hopkins University School of Medicine	
Exuberant Animal	
Federation of Veterinarians of Europe (FVE)	
Global Alliance for Rabies Control	

from http://www.onehealthinitiative.com/supporters.php

One Health Training Elements (Tools)

- Environmental health
- Modern laboratory techniques
- Epidemiology
- Biostatistics
- Food safety
- Animal science
- Meat science
- Soil and water engineering
- Modern animal production
- Human and animal ecological studies
- Agriculture engineering
- Climate change
- Geographical information systems
- Zoonotic infections
- Toxicology

Our One Health Vision

- To train professionals to conduct "one health" investigative and experimental research
- Certificate, Master's, & PhD programs
- To attract outstanding US and international researchers to such a training program

http://egh.phhp.ufl.edu

UNIVERSITY of FLORIDA

Emerging Pathogens Institute

Global Pathogens Laboratory
http://gpl.phhp.ufl.edu

Thank You