

Emerging Zoonosis – Blurring Interface of Human and Animal Diseases

Dr. Corrie Brown, DVM PhD

A Webber Training Teleclass

The Blurring Interface of Human and Animal Diseases



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Hosted by Paul Webber
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Rudolf Virchow



- 1821-1905
- Father of modern pathology
- First to use the term "zoonosis"



75% of all emerging diseases
are zoonotic



Underlying factors of disease emergence

- movement to a new population
- environmental disruption
- crossing species boundaries
- lifestyle (husbandry) changes

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Globalization/Future Shock

- Increasing human population
- Changing environment
- International trade/globalization

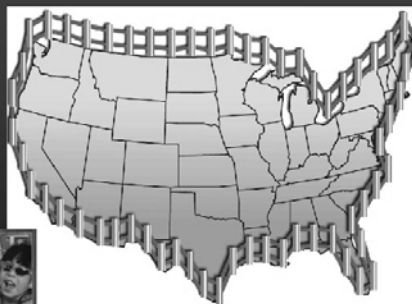
ALVIN TOFFLER



THOMAS L. FRIEDMAN

THE LEXUS AND THE OLIVE TREE

This Is Not An Option



THE ROYAL SOCIETY

Diseases of humans and their domestic mammals: pathogen characteristics, host range and the risk of emergence

S. Cleaveland¹, M. K. Laurenson and L. H. Taylor

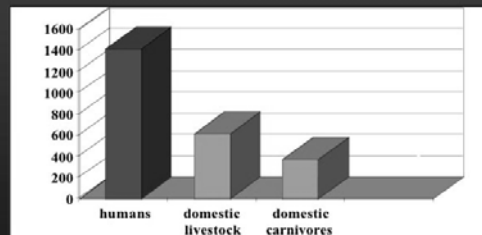
¹Centre for Tropical Veterinary Medicine, University of Edinburgh, Easter Bush, Roslin, Midlothian EH25 9RG, UK

Pathogens that can be transmitted between different host species are of fundamental interest and importance from public health, conservation and economic perspectives, yet systematic quantification of these pathogens is lacking. Here, pathogen characteristics, host range and risk factors determining disease emergence were analysed by constructing a database of disease-causing pathogens of humans and domestic mammals. The database consisted of 1415 pathogens causing disease in humans, 636 in livestock and 271 in domestic carnivores. Multihost pathogens were very prevalent among human pathogens (52%), and even more so among domestic mammalian pathogens (livestock 72.3%, carnivores 90.0%). Pathogens able to infect human, domestic and wildlife hosts contained a similar proportion of disease-causing pathogens for all three host groups. One hundred and ninety-six pathogens were associated with emerging diseases, 15 in humans, 29 in livestock and 12 in domestic carnivores. Across all these groups, helminths and fungi were relatively unlikely to emerge whereas viruses, particularly RNA viruses, were highly likely to emerge. The ability of a pathogen to infect multiple hosts, particularly hosts in other taxonomic orders or wildlife, were also risk factors for emergence in human and livestock pathogens. There is clearly a need to understand the dynamics of infectious diseases in complex multihost communities in order to mitigate disease threats to public health, livestock economies and wildlife.

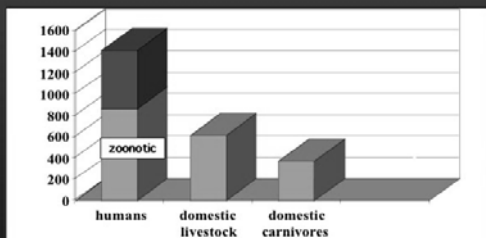
Keywords: pathogens; epidemiology; emerging diseases; zoonosis; wildlife; multihost pathogens

Crossing species boundaries

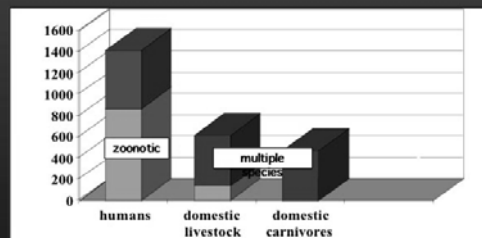
Numbers of Known Pathogens



Numbers of Known Pathogens



Numbers of Known Pathogens

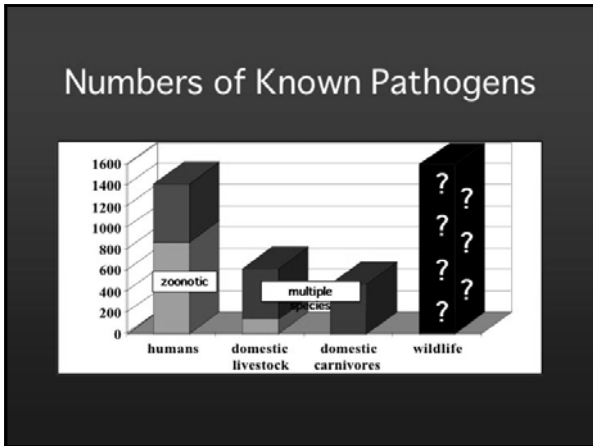


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OUTBREAK

Ebola, a continuing saga

NEWS

Massive Great Ape Die-Off in Africa—Ebola Suspected

Ebola blamed in tragic decline of great apes

Emergency meeting aimed at staving off extinction from disease, poaching, habitat destruction

By Karl Mose
PHOTO: AP/WIDEWORLD
Published: 9:27 a.m. ET Dec. 30, 2012

Bovine Spongiform Encephalopathy

“mad cow disease”

- First noted in cattle in U.K. 1987
- Source was “infected” meat and bone meal
- Caused by a prion agent

TSE Pathogenesis

➤ all are caused by “prions”
proteinaceous infectious particle

HOW PRIONS MAY WORK

Brain cell

Normal protein

Prion converts normal protein into new prion

BSE _ A Zoonosis?

➤ March 20, 1996
cluster of unusual CJD cases

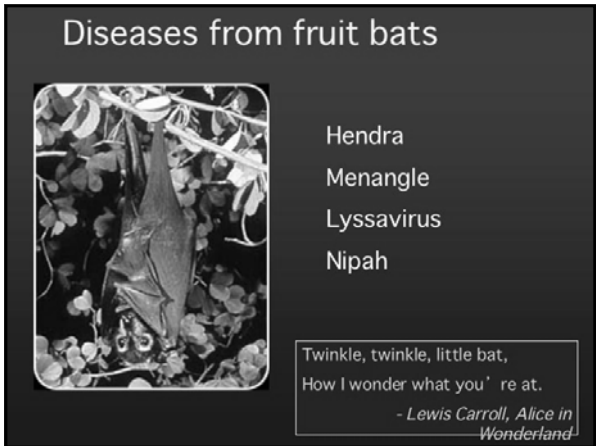
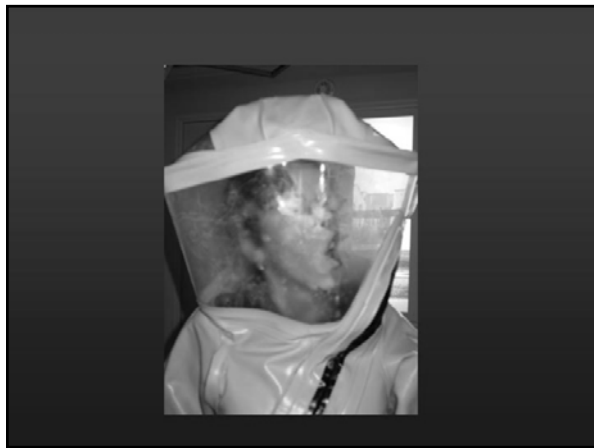
Spongiform Encephalopathy Advisory Committee

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	<u>vCJD</u>	<u>CJD</u>
age	young	old
disease course	prolonged	rapid
clinical disease	behavioral changes	dementia
PrP plaques	frequent	infrequent



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West Nile virus, USA, 1999

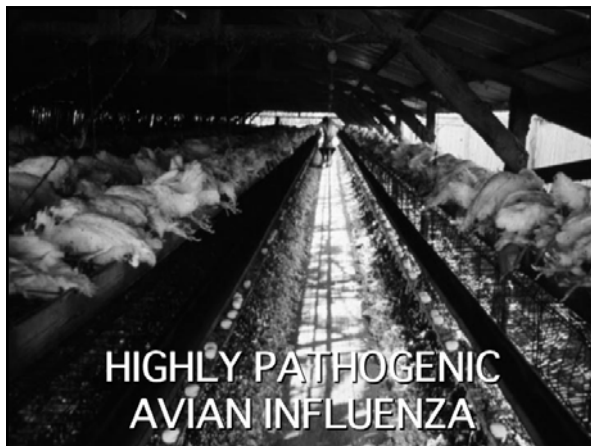
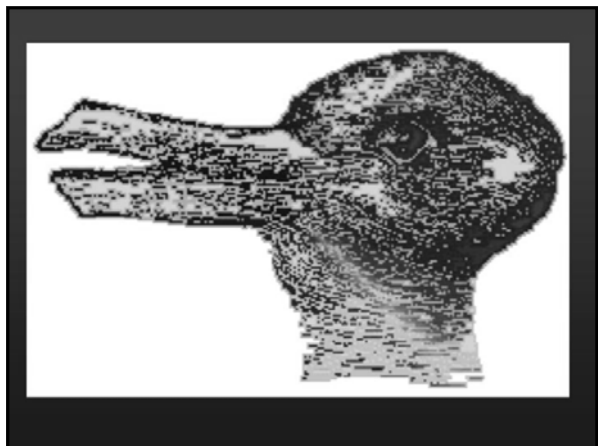
WCS

Rift Valley fever

Outbreaks in humans always preceded by outbreaks in animals

Outbreak in Arabian peninsula, 2000
2,000 human infections, 14-26% mortality rate

transmitted by 25 species of



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Host Range


- Many birds, especially aquatic






100 million chickens killed

Avian Influenza in Asia as of 5 March 2004




* 1 human case
 Thailand - 10
 Viet Nam - 22

■ H5N1
 ■ H5N2
 ■ H7

Data source: OIE/FAO/WHO, National authorities

Disclaimer: The presentation of material on the maps contained herein does 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 areas or its authorities or its frontiers or boundaries.




World Health Organization

Confirmed Human Cases of Avian Influenza A(H5N1)

24 March 2004

Country/Territory	Total cases	Deaths
Thailand	12	8
Viet Nam	22	15
Total	34	23

Notes
Total number of cases includes number of deaths.
WHO reports only laboratory-confirmed cases.



World Health Organization

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Publications **Avian influenza: H5N1 detected in pigs in China**

Research tools

WHO sites **20 August 2004**

CSR Home
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A researcher from China's Harbin Veterinary Research Institute has today presented initial evidence that pigs from farms in parts of China have been infected with the H5N1 strain of avian influenza. The findings, set out in a table and without further supporting data, were presented today at an international symposium on SARS and avian influenza held in Beijing.

WHO has requested confirmation and further details about this study.

Pigs are known to be susceptible to infection with avian influenza viruses. However, natural infection of pigs with the H5N1 strain has not been previously reported.

In order to assess the implications for human health, it is important to know whether the reported infections in pigs are rare events, possibly caused by contact between pigs and wild birds, and avian birds, which are the natural reservoir of all influenza A viruses, can carry the H5N1 strain without developing symptoms, and are known to excrete large quantities of the virus in their faeces.

A comparison of the H5N1 strain isolated in pigs with strains recently circulating in poultry populations in parts of Asia is needed to determine whether the virus is being passed directly from poultry to pigs. Evidence of direct transmission of H5N1 from poultry to large numbers of pigs would be of particular concern, as this would increase opportunities for a new influenza virus with pandemic potential to emerge.

Pigs have been implicated in the emergence of new influenza viruses responsible for two of the previous century's influenza pandemics. Pigs have receptors in their respiratory tract that make them susceptible to infection with both human and avian influenza viruses. If a pig is simultaneously infected with both a human and an avian influenza virus, it can serve as a "mixing vessel", facilitating the exchange of genetic material between the two viruses in a process known as "reassortment". The resulting new virus, which will not be recognized by the human immune system, will have pandemic potential if it retains sufficient human genes to allow efficient human-to-human transmission, and if it causes severe disease in humans.

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World Health Organization

Avian influenza

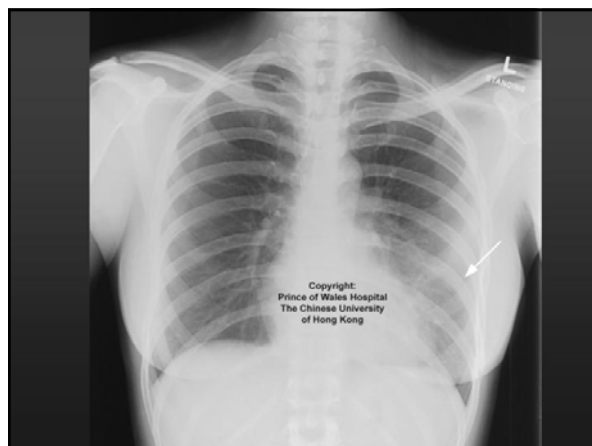
Confirmed Human Cases of Avian Influenza A(H5N1)

Country/Territory	Total cases	Deaths
Thailand	17	16
Vietnam	1	1
Total	18	17



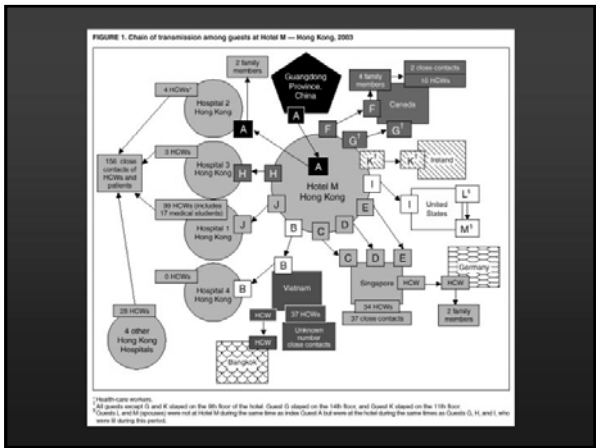
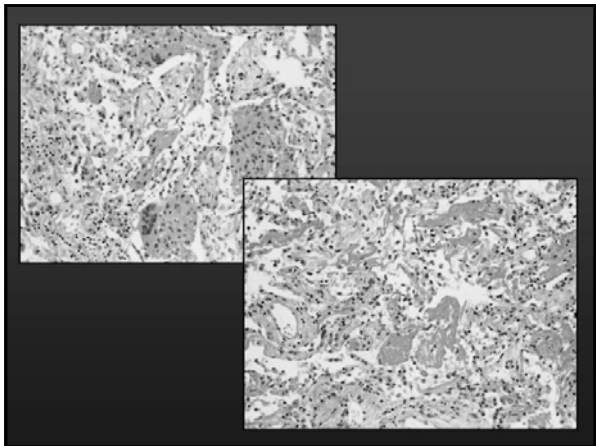
This Is Not An Option

“Exotic disease is an oxymoron.”
Joshua Lederberg, 1997



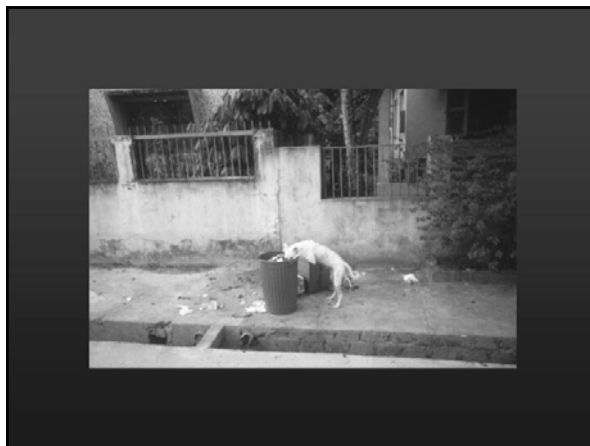
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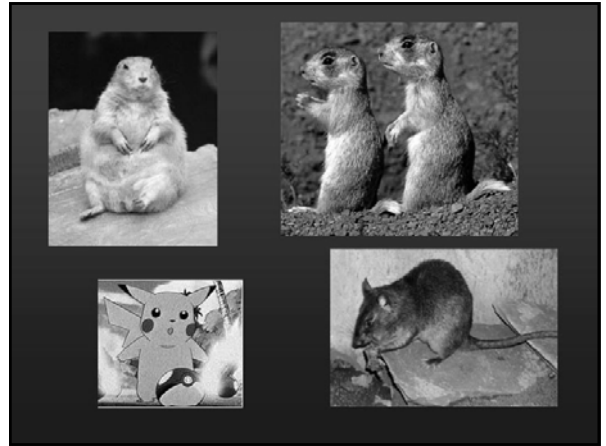
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Tularemia outbreak identified in pet prairie dogs

In late July, investigators at the national Centers for Disease Control and Prevention, working with the Texas Department of Health, identified an outbreak of tularemia, a zoonotic disease, in captive, wild prairie dogs at a commercial facility that distributes many of them for sale as pets. The facility is located in Denton County, Texas.

"Prairie dogs are kept as pets. It's actually more common than you might think," said Julie Rawlings, deputy state epidemiologist for the Texas Department of Health.

Officials recommended that people who had handled a sick or dead prairie dog contact a health care provider. Officials had not reported any human cases of the disease associated with the dogs.

Human cases of tularemia year in the United States, individuals living in the central and western states.

Officials notified states and countries that received shipments of the potentially infected animals. These included Arkansas, Florida, Illinois, Michigan, Mississippi, Nevada, Ohio, Texas, Washington, West Virginia, Belgium, the Czech Republic, Japan, the Netherlands, and Thailand.

The Division of Quarantine, CDC, Atlanta, has coordinated international notifications with the World Health Organization and with the European Disease Surveillance Network, said David Dennis, MD, a medical epidemiologist at the CDC.

Until the company halted shipments Aug. 1, approximately 250 of an estimated 2,000 prairie dogs that had passed through the Texas facility had died of the bacterial disease. Officials determined that the sick animals were part of a single shipment of prairie dogs caught in South Dakota starting May 18 and shipped to the Texas distributor June 16. All prairie dogs that were shipped by the Texas facility after June 16 or by the South Dakota trader after May 18 were recalled. According to Dr. Dennis, Texas, West Virginia, and the Czech Republic reported unusually high numbers of sick or dead prairie dogs.

Tularemia, an infectious disease caused by the bumpy bacterium *Francisella tularensis*, is found in animals, especially rodents, rabbits, and hares. The bacterium is transmitted via direct or indirect methods, including tick and flea bites, contact with infected animal carcasses, consumption of contaminated food or water, or inhalation of infected aerosols. Symptoms include high fever, chills, head and muscle aches, a feeling of weakness, chest discomfort, and a dry cough. The disease, which can be treated with antibiotics, cannot be spread person to person.

JAMA, Vol 291, No. 7, October 1, 2002

Wildlife ranching

- South Africa _ 13,000 game ranches, 4,000 are integrated domestic/wild animals
- Deer farming _ 4.8M worldwide
 - _ New Zealand _ \$200M per year
 - _ China _ 0.5M animals for velvet
 - _ Throughout Europe
- Costa Rica _ 10,000 iguanas per year
- Brazil _ 100 metric tonnes of capybara, peccaries, turtles, for consumption



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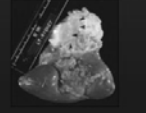
Diseases from pets

- 136M dogs and cats in U.S.
- 62M households with pets
- Increasing importance of human-animal bond



Emerging diseases from pets

- Cat scratch disease
- *Capnocytophaga canimorsus*
- Salmonellosis
- Alveolar hydatid disease
- *Baylisascaris procyonis*



- Cat scratch disease
- *Capnocytophaga canimorsus*



Emerging diseases from pets

- Salmonellosis

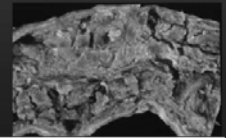
Reptile owner donates blood, passes on lethal *Salmonella* infection

A study in the New England Journal of Medicine (Oct.3,2002) reports that a snake is the source of a *Salmonella* organism that contaminated a platelet transfusion and infected two platelet recipients, killing one of them. The AVMA and Association of Reptilian and Amphibian Veterinarians have long been proponents of educating the public about *Salmonella* risks and reptile ownership, and the study is further evidence that this is key.

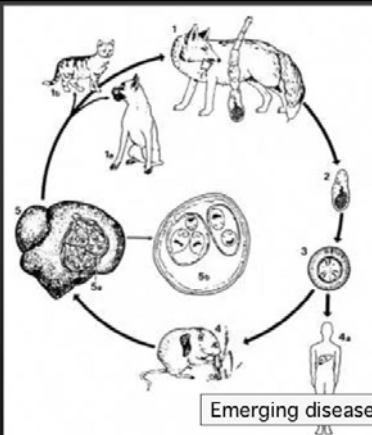
Doctors traced the infection to the platelet donation and discovered that both transfusions came from the same individual. Upon further investigation, they found that the donor, although appearing healthy at the time of splenectomy, had asymptomatic salmonellosis.

cases of *Salmonella* infections that occur annually in the United States. Dr. Wilbur Amund, ARAV executive director, thinks the top figure is closer to eight percent. "There are many more cases of salmonellosis due to contamination of poultry and egg products than there are to cases coming from reptiles," he said.

"To me, the message (of this study) is to reemphasize the need for the (reptile) pet-owning public to maintain high sanitation standards," Dr. Amund said. "I think that the veterinarian has a role to remind clients (that), whether it is a green iguana, or a box turtle, or a box coon, that any or all of them may be a carrier of the organism, and as such they need to



Emerging diseases from pets



Emerging diseases from pets

Alveolar hydatid disease

- *Echinococcus multilocularis* _ range increasing




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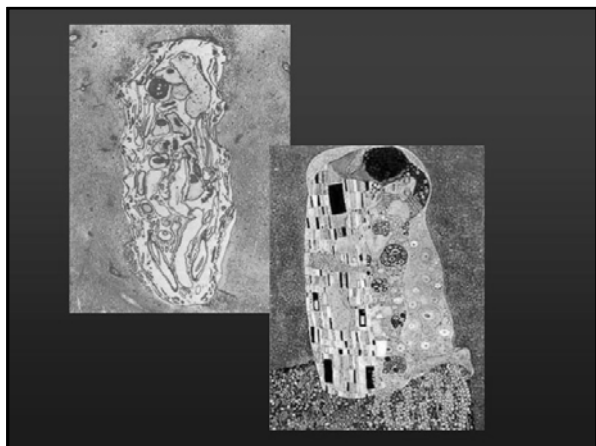


Baylisascaris procyonis



- 60-80% of all raccoons carry
- VERY persistent in the environment

Emerging diseases from pets



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