Emerging Infections

"New, reemerging or drug-resistant infections whose incidence in humans has increased within the past two decades or whose incidence threatens to increase in the near future."

Emerging Infections: Microbial Threats to Health in the United States. Institute of Medicine, 1992.
Epidemics of Emerging Diseases, 1996–2003

Emerging Infectious Diseases:
Major resources are lost

- **USA, Periodically:**
  - *E. coli O157*
  - Meat recall/destruction

- **USA, 2001:**
  - Anthrax
  - US$ 250 million?

- **Peru, 1991:**
  - Cholera
  - US$ 770 million

- **U.K., 1990-98:**
  - BSE
  - US$ 9 billion

- **India, 1994:**
  - Plague
  - US$ 2 billion

- **Tanzania, 1998:**
  - Cholera
  - US$ 36 million

- **Malaysia, 1999:**
  - Nipah Virus
  - Swine slaughtering
  - US$ 540 million

- **China, 2003:**
  - SARS
  - US$ 25 billion

- **Hong Kong, 1997:**
  - Influenza A (H5N1)
  - Poultry slaughtering
  - US$ 22 million
SARS, Spring 2003: Economic Impact on South-East Asian Economy

Estimated costs of SARS Epidemic worldwide: US $ 60-80 Billion

- HONG KONG: Budget of US $ 15 billion to deal with consequences of SARS
- CHINA: US $ 420 million to establish a National Health Surveillance network + US$ 240 million for penniless patients
- SINGAPOUR: Program of US $ 230 million to support transportation, hotels and shops affected by the epidemic.

TOURISM INCOME

FEBRUARY MARCH APRIL MAY

LESS 40%

Estimated costs of SARS Epidemic worldwide:

Emerging and Re-emerging Zoonoses

- Zoonoses: “The diseases and infections which are naturally transmitted between vertebrate animals and man.” (WHO, 1951)

- Emerging and re-emerging zoonoses: “Zoonotic diseases caused either by totally new or partially new agents, or by micro-organisms previously known, but now occurring in places or in species where the disease was previously unknown.” (Meslin, WHO, 1992)
### ZOONOSES and the RISK of DISEASE EMERGENCE


<table>
<thead>
<tr>
<th>Infectious Organisms</th>
<th>Human Pathogens (N=1415)</th>
<th>Zoonoses (N=868)</th>
<th>Emerging Pathogens (N=175)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viruses/Prions</td>
<td>217 (15%)</td>
<td>165 (19%)</td>
<td>77 (44%)</td>
</tr>
<tr>
<td>Bacteria/Rickettsia</td>
<td>538 (38%)</td>
<td>269 (31%)</td>
<td>52 (30%)</td>
</tr>
<tr>
<td>Fungi</td>
<td>307 (22%)</td>
<td>113 (13%)</td>
<td>16 (9%)</td>
</tr>
<tr>
<td>Helminths</td>
<td>287 (20%)</td>
<td>278 (32%)</td>
<td>10 (6%)</td>
</tr>
<tr>
<td>Protozoa</td>
<td>66 (5%)</td>
<td>43 (5%)</td>
<td>19 (11%)</td>
</tr>
</tbody>
</table>

- 61% of the human pathogens are zoonotic and 12% are emerging pathogens. 75% (132/175) of the emerging pathogens are zoonotic. Overall, zoonotic pathogens are twice as likely to be associated with emerging diseases than non-zoonotic ones.

All but one of classified category A biological agents for bioterrorism and most of category B are zoonoses.

### Emerging Zoonoses

- Some Major Bacterial Etiologic Agents of New Zoonoses Identified Since 1976

  - 1976 Capnocytophaga canimorsus
  - 1977 Campylobacter spp.
  - 1982 *E. coli* O157:H7
  - 1982 *Borrelia burgdorferi* (Lyme disease)
  - 1983 *Helicobacter pylori* and other spp.
  - 1986 *Ehrlichia chaffeensis* (HME)
  - 1992 *Bartonella henselae* (Cat scratch Disease)
  - 1994 *Rickettsia felis* (Murine typhus like)
  - 1994 *E. Equi/A. phagocytophila* (HGE)
Emerging Zoonoses

• Some Major Viral Etiologic Agents of New Zoonoses Identified Since 1990
  • 1991 Guanarito virus (Venezuelan hemorrhagic fever)
  • 1993 Sin nombre virus (Hantavirus Pulmonary Syndrome)
  • 1994 Sabia virus (Brazilian hemorrhagic fever)
  • 1994 Hendra virus (Equine morbillivirus)
  • 1996 Australian bat Lyssavirus (Rhabdovirus)
  • 1997 Menangle virus (paramyxovirus)
  • 1997 Influenza virus H5N1 (Hong Kong)
  • 1998 Nipah virus (Paramyxovirus)
  • 1999 Influenza virus H9N2 (Hong Kong)
  • 2003 SARS (Coronavirus)
Emerging Infectious Diseases

- Major Factors Contributing to the Emergence of Infectious Diseases
  - Human demographics and behavior
  - Technology and Industry
  - Economic Development and Land Use
  - International Travel and Commerce
  - Microbial Adaptation and Change
  - Breakdown of Public Health Measures
    Institute of Medicine Report, 1992
  - Bioterrorism

Speed of Global Travel in Relation to World Population Growth

Reasons for emergence or re-emergence of zoonoses

Human population increase leading to an increased number of contacts between humans and infected animals.
Emerging Zoonoses

**Estimated Global Mobile Population**

- **International Travelers**: 698 million (WTO, 2000)
- **Migrant Workers**: 70-80 million (ILO, 2001)
- **Refugees/Uprooted People**: 22 million (UNHCR, 2002)
- **Undocumented Migrants**: 10-15 million (ILO, 2000)
- **Migrant Victims of Trafficking**: 0.7 million (IOM, 2001)

---

*SARS PANDEMIC, Spring 2003:*

Spread of a new Infectious agent through international flights.

« *Infectious Diseases will continue to emerge... »

More than 30 new infectious diseases caused millions of deaths since the mid 1970's. As for SARS, epidemiological surveillance is critical (Ebola, Africa; Avian Flu A/H7N7, Netherlands, etc.)
Coronavirus

Spread of a new Infectious agent through international flights.

In 2000, 27 million Americans travelled abroad:
- 9% visited a National Park,
- 5% camped or hiked,
- 5% visited sites of ecological interest, and
- 2% (540,000) traveled to Africa.

Incidence of Rickettsial Spotted fever was 14 cases per million for travelers to Africa. By comparison, incidence of Rocky Mountain Spotted Fever in the USA is only 2 cases/million population.
Influenza A Pandemic 1918-19

Major Epidemics will come back

Influenza pandemics* and recent outbreaks, 1918–2002

<table>
<thead>
<tr>
<th>Year</th>
<th>Colloquial name &amp; subtype</th>
<th>Affected age group</th>
<th>No. deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918*</td>
<td>Spanish flu (H1N1)</td>
<td>all ages</td>
<td>40 million</td>
</tr>
<tr>
<td>1957*</td>
<td>Asian flu (H2N2)</td>
<td>&gt; 65 and &lt; 5</td>
<td></td>
</tr>
<tr>
<td>1968*</td>
<td>Hong Kong flu (H3N2)</td>
<td>&gt; 65 and &lt; 5</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>Swine flu (H1N1)</td>
<td>all ages</td>
<td>1</td>
</tr>
<tr>
<td>1997</td>
<td>Chicken flu (H5N1)</td>
<td>all ages (18 cases)</td>
<td>6</td>
</tr>
<tr>
<td>2003</td>
<td>Chicken flu (H5N1)</td>
<td>all ages (4 cases)</td>
<td>2</td>
</tr>
<tr>
<td>?</td>
<td>Naturally occurring pandemics inevitable</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td>Deliberately caused, highly lethal outbreak feasible</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

4.5 million
**H5N1- Influenza outbreak Hong Kong 1997-1998**

One million chickens were destroyed
Imports from mainland China were stopped
Shortage of poultry occurred in HK

**Infectious diseases spread to new areas**

**Cumulative number of reported HIV cases in the Russian Federation, 1987-2001 (as of June 2001)**

- 0
- 20,000
- 40,000
- 60,000
- 80,000
- 100,000
- 120,000
- 140,000


Number of cases: 0 20,000 40,000 60,000 80,000 100,000 120,000 140,000

Russian Federation AIDS Centre
Suspected Ebola Cases, by exposure date, Gabon 1996

- **Direct exposure to chimpanzee**
- **Week 1**: 24-30 Jan. (24 cases)
- **Week 2**: 31-7 Feb. (7 cases)
- **Week 3**: 8-14 Feb. (4 cases)
- **Week 4**: 15-21 Feb. (9 cases)
Ebola hemorrhagic fever, Kikwit, Zaire, 1995 transmission pattern

January February March April May June July

Total cases = 316
Total deaths = 245 (77%)

International Notification early May

Emerging Infections: Technology and Industry
Increased International Trade of Agricultural Products.

Source: WTO, 2000

International trade of agricultural products multiplied by 5 since 1950

Emerging Zoonoses

Food-Related Illness and Death in the United States
(Mead et al., EID, 1999)

It is estimated that annually food borne diseases cause approximately:

• 76 million illnesses
• 325,000 hospitalizations
• 5,000 deaths.
Emerging Zoonoses

Changes in the Factors that Contribute to the Epidemiology of Food-borne Diseases
(Osterholm, 2002)

• Diet
• Commercial food service
• New methods of food production
• New or re-emerging infectious agents
• Ethnic preferences
• “High-risk” populations, especially increase of immuno-compromised individuals (up to 20%)

Emerging Zoonoses

Factors Associated with the “Globalization” of Food-borne Diseases
(Osterholm, 2002)

• Water
• Animal feeds and manures
• Workers
• Transportation
• Rodents, other wildlife, insects
• Food processing
nVCJD and Mad Cow disease (BSE)

• nvCJD newly discovered in the UK in 1995
• Fatal progressive neurodegenerative disease
• Age - 13 and 52 years of age
• BSE and nvCJD are caused by the same agent
• BSE epidemic in cattle was caused by BSE-contaminated MBM and source of exposure for humans is food
• No test to detect agent in food or living asymptomatic animals
• To control nvCJD, control the BSE epidemic
BSE and nvCJD: Potential Exposure through International Trade in the early 1990s

- Meat and Bones
- Live cattle
- Cattle feed and Beef meat for human consumption
- Blood and derivated blood products
- Pharmaceutical and Cosmetic products

Rift Valley fever Rift, Yemen et Saudi Arabia, Sept.– Oct. 2000

Infected Area
Emerging Infections: Economic Development and Land Use

Raccoon Rabies, United States, 1977-1999
(Source: F.A. Murphy, UCD)
Infectious diseases spread to new areas

Increasing occurrence of Human Monkeypox in DR Congo, 1970-2001

1970-1980

48 cases

1981-1986

338 cases

1996-2002

1,705 cases

Number and percentage of laboratory confirmed monkeypox cases, USA, 2003 (71 cases, 35 lab confirmed)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illinois (12)</td>
<td>8</td>
<td>(23)</td>
</tr>
<tr>
<td>Indiana (16)</td>
<td>7</td>
<td>(20)</td>
</tr>
<tr>
<td>Kansas (1)</td>
<td>1</td>
<td>(3 )</td>
</tr>
<tr>
<td>Missouri (2)</td>
<td>2</td>
<td>(6 )</td>
</tr>
<tr>
<td>Wisconsin (39)</td>
<td>17</td>
<td>(49)</td>
</tr>
<tr>
<td><strong>Age Group (yrs)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-18</td>
<td>11</td>
<td>(31)</td>
</tr>
<tr>
<td>19-51</td>
<td>24</td>
<td>(69)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>(51)</td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>(49)</td>
</tr>
</tbody>
</table>

Exotic Pets and Translocation

Monkeypox, USA, 2003
### Exotic Pets and Translocation

#### Monkeypox, USA, 2003

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible sources of monkeypox exposure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prairie dog(s)</td>
<td>14</td>
<td>(40)</td>
</tr>
<tr>
<td>Prairie dog(s) &amp; human cases</td>
<td>14</td>
<td>(40)</td>
</tr>
<tr>
<td>Premises housing prairie dogs</td>
<td>6</td>
<td>(17)</td>
</tr>
<tr>
<td>Premises housing prairie dogs and human cases</td>
<td>1</td>
<td>(3 )</td>
</tr>
<tr>
<td><strong>Clinical features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rash</td>
<td>34</td>
<td>(97)</td>
</tr>
<tr>
<td>Fever</td>
<td>29</td>
<td>(85)</td>
</tr>
<tr>
<td>Respiratory symptoms</td>
<td>27</td>
<td>(77)</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>24</td>
<td>(69)</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>16</td>
<td>(46)</td>
</tr>
</tbody>
</table>

**Monkeypox virus:** Cell culture, human, negative stain
Child, Marshfield Index Case: Primary inoculation site right index finger, 5/27/03. 14 days after prairie dog bites, 11 days after febrile illness, hospital day 5.

Child: Secondary lesions 5/27/03, adjacent to primary inoculation site on left hand.
Father, 6/05/03, after fevers, sweats, malaise on 5/31-6/01/03. Feels well.

**Monkeypox, USA, 2003**

Child, 6/5/03, resolving lesions.

---

**Exotic Pets and Translocation**

**Monkeypox, USA, 2003**

*FIGURE 1. Number of monkeypox cases*, by date of illness onset — Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin, 2003*[^1]

[^1]: *N = 69 of 71 cases with known date of illness onset.*

[^1]: As of July 8, 2003.
Monkeypox virus: Animal Trace back

- All 35 confirmed human cases of monkeypox associated with prairie dogs obtained from an Illinois distributor (II-1) or animal distributors who purchased prairie dogs from IL-1.

- Prairie dogs (about 200) infected through contact with Gambian giant rats and dormice which originated in Ghana. 93 infected prairie dogs traced back to six states.
Monkeypox virus: Animal Trace back

- Introduction of monkeypox to USA: Texas animal distributor that had imported 800 small mammals from Ghana on April 9, 2003, containing 762 African rodents, including rope squirrels (*Funisciurius*), tree squirrels (*Heliosciurius*), Gambian giant rats, brushtail porcupines, dormice and striped mice.

Black flying fox

**Fruit bat (*Pteropus alecto*)**

**Range:** North to Papua New Guinea and eastern islands of Indonesia; South to New South Wales.

In 1996, this species and another the little red flying fox (*P. scapulatus*), were shown to carry a virus very closely related to rabies virus. Since then, flying foxes were also shown to carry the newly discovered Hendra and Nipah viruses.

(Source: F.A. Murphy, UCD)
Nipah virus, Malaysia, 1998

Deforestation, urbanization, increased pig production…..

Development of antibiotic Resistance

Multidrug-resistant Tuberculosis, 2001

Approximately 1% of all tuberculosis worldwide is multidrug-resistant
EMERGING, RE-EMERGING ZOONOSES

1. Dogs

• **Bacterial zoonoses:**
  - *Bartonella* infection
  - Leptospirosis
  - *Bordetella bronchiseptica* infection
  - Salmonellosis, Campylobacteriosis
  - Mycobacterial infections
  - Bites (*Capnocytophaga canimorsus*)

**Protozoan zoonoses:**
- Leishmaniasis (USA)
- Cryptosporidiosis
- Giardiasis

---

**EMERGING, RE-EMERGING ZOONOSES**

**Leptospirosis**

*In the past:* mainly serovars: *L. canicola*,
- *L. icterohaemorrhagiae*

*Mid 1990s:* Increased clinical cases in dogs in USA
  - **in California:** *L. pomona, L. bratislava*
  - **in Massachusetts, New Jersey, New York,**
  - **Michigan:** *L. grippothyphosa, L. pomona,*
  - *L. autumnalis*

*Clinical changes:* acute renal failure rather than hepatic insufficiency or coagulation abnormalities.
**A Global Threat**

*Leptospirosis outbreak among 312 participants, Eco Challenge 2000 *, Malaysia*

- Canada: 4
- USA: 10
- Brazil: 1
- Uruguay: 1
- Australia: 4
- UK: 9
- France: 4

*Expedition race, multi-sport event, 20 August - 3 September 2000, Sabah, Malaysian Borneo*

---

**EMERGING, RE-EMERGING ZOONOSES**

2. **Cats**

- **Bacterial zoonoses:**
  - *Bartonella* infection
  - *Helicobacter* infection
  - Salmonellosis, Campylobacteriosis
  - Plague (*Yersinia pestis*)
  - Mycobacterial infections
  - Bites (*Capnocytophaga canimorsus*)
  - *Chlamydia* infection

- **Viral zoonoses:**
  - Cowpox (U.K.)

- **Protozoan zoonoses:**
  - *Toxoplasma gondii* infection
  - Cryptosporidiosis
  - Giardiasis
EMERGING, RE-EMERGING ZOONOSES

3. Other pets

- **Bacterial zoonoses:**
  - *Salmonella* infections and reptiles
  - *Salmonella* infections and pet Hedgehogs
  - *Streptococcus iniae* and fish
  - *Campylobacter* and ferrets

- **Viral zoonoses:**
  - Lymphochoriomeningitis and hamsters

---

**Reptile-associated Human *Salmonella* History**

1944  First *Salmonella* sp. isolate from snakes.
1946  First *Salmonella* sp. isolate from turtles and lizards.
1963  Turtle-associated salmonellosis first described.
1972  FDA regulation requiring certification of turtles for sale as "Salmonella-free."
1974  Study shows 300,000 turtle-associated human salmonellosis cases per year in U.S.
1975  FDA bans sale of viable turtle eggs or live turtles with carapace length < 10.2 cm.
1977  CA State regulations ban sale, as above.
Number of Salmonella Marina Isolates Reported Annually and Number of Iguanas Imported Annually

Pediatrics 1997;99:399-402
New and Exotic Pets, Hunting Pens and Game Translocation

- **Translocation of infected animals:**
  - bats and rabies
  - Exotic pets (Gambian Rats) and Monkeypox
  - brucellosis and reindeer
  - echinococcosis and foxes

- **Translocation of susceptible animals:**
  - ostriches and emus and Western Equine Encephalitis

- **Hunting pens:** rabies and raccoons

- **New and exotic pets:**
  - salmonellosis and iguanas, African pygmy hedgehogs
  - Egyptian bats and rabies
Emerging Zoonoses

Emerging Bacterial Zoonoses and the Immunocompromised Individuals.

- Salmonellosis, Campylobacteriosis
- *Rhodococcus equi, Bordetella bronchiseptica*
- Bacillary angiomatosis (*Bartonella henselae, B. quintana*)
- Fish tank Granuloma (*Mycobacterium marinum*)
- Dog bites (*Capnocytophaga canimorsus*)

**Infectious agent**: *Capnocytophaga canimorsus* (formerly DF-2, dysgonic fermenter). Commensal organism within the oral cavity of the dog (16%). Fastidious Gram negative rod.

**Epidemiology**

*C. canimorsus* is a common bacterium present in dog mouth. 103 human cases reported between 1976 and 1996. Following dog (91%) or cat (8%) exposure, mainly bites (54%) or scratches (8%).

Underlying conditions: 61% of cases >50 year-old, splenectomy (33%), alcoholism (24%), neoplastic/ hematologic disease, immunosuppression (5%).
Dog Bites *Capnocytophaga canimorsus*

Clinical signs
- No major sign in non-immunocompromised patients
- Septicemia, shock, disseminated intravascular coagulation in immuno-compromised patients

Clinical features
- Fever (90%), septicemia (94%), septic shock (40%), disseminated intravascular coagulation (32%), meningitis (13%), renal failure (15%), gangrene (14%), thrombocytopenic purpura (14%), cardiopathy (11%), ARDS/Pneumonia (10-12%), endocarditis (7%)….

Letality: 30%

Emerging Zoonoses: Why Now?
- Better tools for diagnosis of fastidious organisms: The Molecular Microbiology Revolution: Hantavirus, Bartonella, etc…
- Epidemiological studies, outbreak investigation
- Surveillance systems: Hantavirus, influenza, leptospirosis, Hendra and Nipah viruses.
- Wildlife studies have revealed new pathogens; new studies done on interaction between wildlife reservoir and domestic animals/humans
- Increased interest in vector borne diseases i.e., tick-borne infections: Ehrlichioses, Lyme, etc.
A global threat

A new reality

- The risk of deliberate release of infectious agents to cause harm.

Biotechnology is becoming widely available, while world tensions and conflicts remain.

Emerging Infectious Diseases: different risks, different response

From mad cows to chickens, primates and bats
Emerging Zoonoses

- Knowing is not enough; we must apply.
- Willing is not enough; we must do.

(Goethe)

Emerging Zoonoses: Control and Prevention

- Recognition
- Investigation
- Collaboration: Interagency structures
- Advanced structures for diagnosis & surveillance
- International & interdisciplinary interventions
- Applied epidemiological and ecological research: Field-trained specialists: Epidemic Intelligence Veterinary Public Health Officers
- Education: Training, technology transfer
- Information/Communication
Emerging Zoonoses: Control and Prevention

• **Recognition**: Emerging zoonotic infections first need to be identified.

Traditional approach: identification of a human health problem leading to identification of problems in domestic or wild animal populations (i.e. Rift Valley fever, Q fever, chlamydiosis).

New approaches: identification of a health problem in animals that could be associated with human disease (West Nile virus, USA, 1999).

  investigation of potential pathogens in wildlife leading to identification of new reservoirs: Lyssavirus in bats, Australia, *Brucella* spp. in marine mammals.

---

Emerging Zoonoses: Control and Prevention

• **Investigation**

  Collaborative field work of multidisciplinary teams with the support of expert staff scientists and advanced laboratories with molecular biological and immunological technologies.

  “Shoe-leather” epidemiology initially to determine main risk factors and potential reservoirs, leading to preventive measures: Hantavirus, Americas, Nipah virus, Malaysia.

New approach: Inventory of pathogens carried by various wildlife species, especially when encroached with human habitat: opossums reservoirs of *Rickettsia felis*, murine typhus, *sarcocystis neurona*. 
Disease Surveillance Networks in Asia

- Mekong Basin Disease Surveillance (MBDS)
- Pacific Public Health Surveillance Network (PPHSN)
- APEC
- SEAMIC
- ASEAN
- SEANET
- EIDIOR

Monitoring the Temporal Patterns of Cholera Transmission Risk

AvHRR
AvHRR-SST
TOPEX-SSA
SeaWiFS-Chl-a
Emerging Zoonoses: Control and Prevention

- Collaboration: Interagency Structures

- Need for a scientific bridge between various disciplines: zoology, ecology, ornithology, geography, veterinary and human medicines... as illustrated by the early “West Nile fiasco” bird disease? or human disease?... Which agency is in charge?

- Interface between Public Health and Veterinary Public Health at local, national and international levels.

Need for Applied and Basic Research in Emerging Infectious Diseases

- Biology
- Informatics
- Nanotechnologies
- Mathematics
Emerging Zoonoses: Control and Prevention

• Advanced structures for diagnosis and surveillance, international and interdisciplinary interventions: Know-How, availability and flexibility

• Applied epidemiological and ecological research: Field-trained specialists: Epidemic Intelligence Veterinary Public Health Officers
  Fellowships, training grants, PhDs

• Develop training in molecular epidemiology:
  The microchip revolution: on site instantaneous multitests

The need for infectious disease control: 2003

• The right balance between:
  – Unknown infectious disease risks: stockpiling and distribution systems of drugs and vaccines for deliberately caused infectious diseases
  – Known infectious disease risks: increasing access to drugs and vaccines and strengthening national capacity for prevention and control
Emerging Zoonoses: Control and Prevention

- **Education:** Training, technology transfer.
- **Information/Communication**
  - Enhance communication of information
  - Use diverse communications methods
  - Establish partnerships to ensure rapid implementation of prevention measures
  - An on-line journal for new and emerging disease information

(Source: F.A. Murphy, UCD)

Influenza A(H5N1), Hong Kong 1997: a first attempt at global surveillance and pandemic planning

- **Unknown influenza virus isolated**
- **Virus identified, WHO Collaborating Laboratories (Netherlands/CDC)**
- **Epidemiological investigation and containment, humans and poultry in Hong Kong; intensified surveillance worldwide**
- **Preparation for vaccine production WHO Collaborating Laboratories**

- May 1997
- August 1997
- September 1997 to January 1998
- September 1997 to April 1998
Emerging zoonoses: Conclusions

- Not major killer or disabling diseases -
- transmission cycles complex - animal reservoirs control and elimination difficult
- no top priorities for public health
- medical impact in terms of morbidity & mortality underestimated in all countries
- recognised potential for global spread
- economic impact considerable
- social impact significant
- consequences on public health enormous

Control and Prevention of Emerging Zoonoses:

CONCLUSIONS

- Discovery-to-control continuum: discovery/recognition, epidemiologic field investigation, etiologic investigation, diagnostics development, focused research, technology transfer, training and outreach, prevention, control and elimination, if possible.
- What made it possible? Better diagnosis tools, awareness (especially of the wide wildlife reservoir), readiness, establishing surveillance systems, collaboration and technology transfer.
- What should be next? Increased awareness and improved curriculum in VPH/ Zoonoses for DVM students. Develop a group of field-trained specialists.

- A rapid communication system
- A wide-ranging legal authority
- A way to get full participation of everyone involved and to deal with “turf battles” (who gets the credit?)
- A coordinated response to the media and a professional response to public misperceptions
- A progressively redefined case definition (for clinical and epidemiological purposes)
- A locally updated clinical management guidelines
- A locally updated biosafety management guidelines
- Reagents and diagnostic technology transfer to local sites
- A way to shift from emergency to regular response mode.