Emerging Infections

Public Awareness of Emerging Infections

Examples of new pathogenic microbes and infectious diseases recognized since 1973

- Rotavirus - 1973
- Parvovirus - 1975
- Cryptosporidium parvum - 1976
- Ebola virus - 1977
- Legionella pneumophila - 1977
- Hantavirus - 1977
- Campylobacter jejuni - 1977
- Escherichia coli 0157 - 1982
- Borrelia burgdorferi - 1982
- Helicobacter pylori - 1983
- Cyclospora cayatanensis - 1986
- Hepatitis E - 1988
- Vibrio cholerae 0139 - 1992

Medical Ecology Of Infectious Diseases

Emerging And Re-emerging Infectious Agents

A. Viruses
- SARS (Severe acute respiratory syndrome)
- West Nile
- Influenza
- Eastern Equine Encephalitis
- Hantavirus
- Ebola

B. Bacteria and rickettsiae
- Plague
- E. coli 0157
- Rickettsial pox (Rocky Mountain Spotted Fever)
- Cholera

C. Protozoa
- Malaria
- Cryptosporidium parvum
- Trypanosomiasis (African)
- Leishmaniasis

Medical Ecology: Environmental Disturbance and Disease
E-Seminar 1, The Normal Environment: How Things Got This Way
Taught by Dickson Despommier

http://columbia.edu/ci/eseminars/1111_detail.html
http://www.medicalecology.org/
Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

- Dam building
- Traditional Agriculture
- Urbanization
- De-forestation
- Irrigation
- Political unrest and open warfare
- Natural disasters and unusual weather patterns

The Ecotone*

*The edge effect

The Ecotone And Infectious Diseases

**Viruses:**
- West Nile
- Rabies
- Yellow Fever
- Lassa Fever
- Ebola
- Hanta
- Influenza

**Bacteria:**
- Cholera
- Lyme Disease

**Protozoa:**
- Malaria
- Trypanosomiasis

**Helminths:**
- Schistosomiasis

West Nile Virus

Culex pipiens:
The Major Vector For Birds And Humans

- Prefers Birds
- Bat Will Feed
- On Humans When Desperate
- During Droughts: Few Birds, Same Number of Humans

Pollution-loving Mosquito

Ubiquitously found throughout USA

2003

- United States - 8,393 cases, 184 deaths
  - Colorado - 2,477
  - Nebraska - 1,698
  - South Dakota - 989
- Canada - 845 cases, 10 deaths
- Mexico - 4 cases, no reported deaths
1999

Total Infections: 9,300
Total Cases: 62
Total Deaths: 7

2000

Total Infections: 3,150
Total Cases: 21
Total Deaths: 2

2001

Total Infections: 9,900
Total Cases: 66
Total Deaths: 9
2002

Total Infections: 623,400
Total Cases: 4,156
Total Deaths: 284

2003

Total Infections: 1,678,600
Total Cases: 8,393
Total Deaths: 184
Why The Rapid Spread West?

Prevailing Winds Are From West To East

Bird Migrations Are From North To South And Back

All Major US Highways Run East-West And North South
Roads Are Ecotones

Medical Ecology Of West Nile Virus

Epidemics Occur During:
Chronic Drought
High Summer Temperatures

Countries In Which West Nile Is Endemic*:
Israel
Southern Egypt
South Africa

* All have major deserts
Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

**Dam building:**

There are currently over 800,000 dams throughout the world, with 75,000 within the USA.

Diseases (mostly tropical) associated with dams:

1. Schistosomiasis
2. Malaria
3. River blindness (Onchocerciasis)

Schistosomiasis Was Prevalent Among Ancient Egyptians And Still Is Today

Schistosoma haematobium eggs in bladder wall

Lake Nasser and the Aswan High Dam in Egypt

Japan is schistosome-free as of 1976
The Three Gorges Dam Project In China Will Lead To A Dramatic Increase In The Incidence Of Schistosomiasis

Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

Irrigation:
1. Schistosomiasis
2. Malaria*
3. Filaria*

*Vector-borne diseases

Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

Traditional Agriculture:
Geohelminths - Hookworm, Ascaris, Trichuris

4 billion people harbor one or more species

Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

Urbanization: (encroachment into natural systems)
Rabies
Upper respiratory viruses
Lyme Disease
Arboviruses
Ebola, Lassa, Hanta
Plague

Urbanization: Atlanta 1983
Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

**Political unrest and warfare:**
- Malaria
- African Trypanosomiasis
- Leishmaniasis
- Tuberculosis

Environmental Disturbance Leads To Emergence Or Establishment Of Infectious Agents

**Natural disasters and unusual weather patterns:**

<table>
<thead>
<tr>
<th></th>
<th>Flood</th>
<th>Drought</th>
<th>Above-average PPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanta</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plague</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>West Nile</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Plague In The USA