
Globalization of Infectious Diseases

Origin of Some Infectious Disease Agents

Ecological Factors Influencing the Emergence of Infectious Diseases

Geography

Climate

Weather

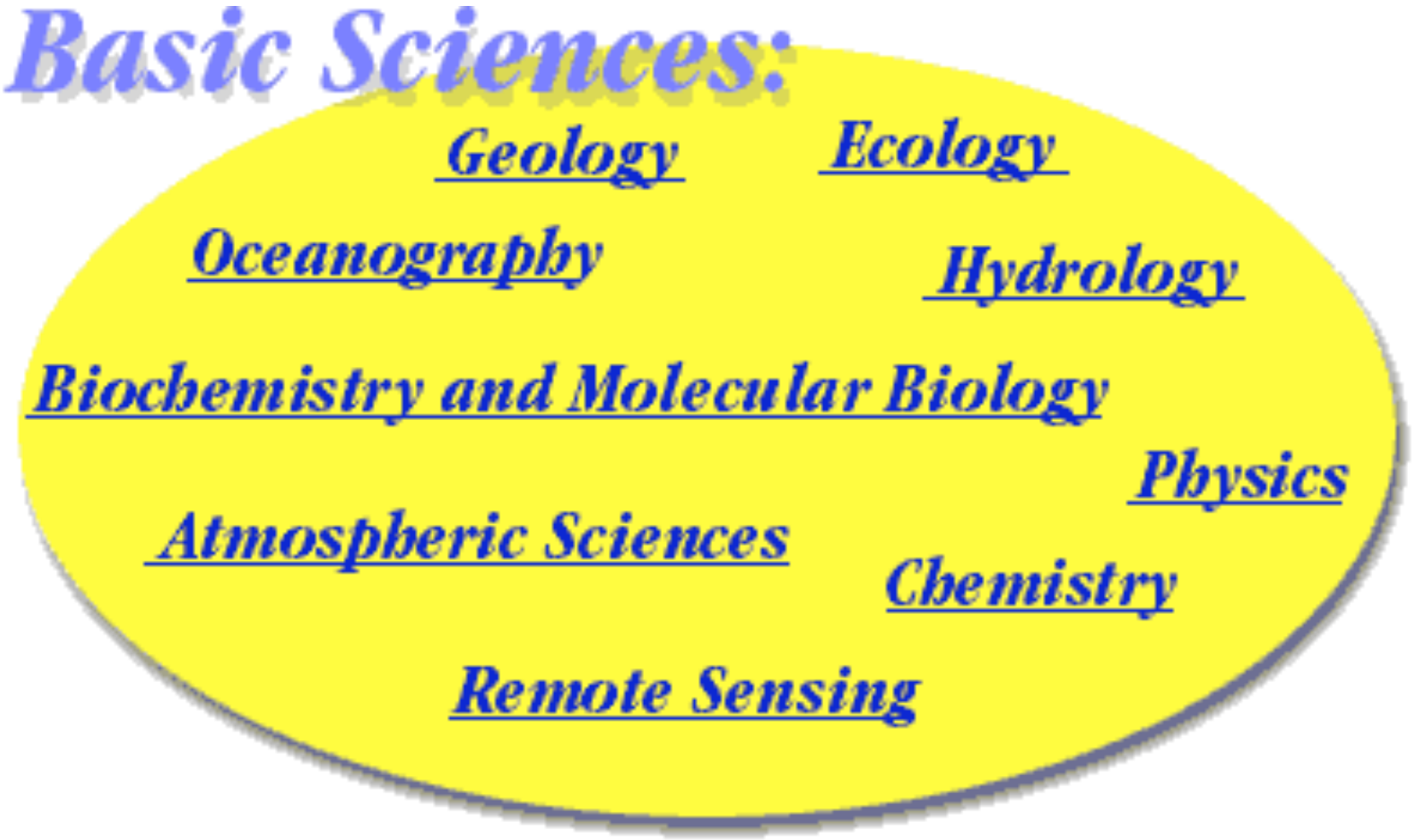
Animal Migration

Human Encroachment and Forced Migration

Natural Disasters (floods, fire, hurricanes, etc.)

Vector Biology


Basic
Science
Medical
Ecology
Applied
Science


Basic Sciences:
Geology
Ecology
Oceanography
Hydrology
Biochemistry and Molecular Biology
Physics
Atmospheric Sciences
Chemistry
Remote Sensing


Applied Sciences:
Biostatistics
Medical Sciences
Epidemiology
Anthropology
Agronomy
Environmental Health Sciences
Socio-Medical Sciences
Toxicology
Medical Geography

To learn more, log on to:

www.medicalecology.org

Host-Agent Interactions

Contact with host - route of entry

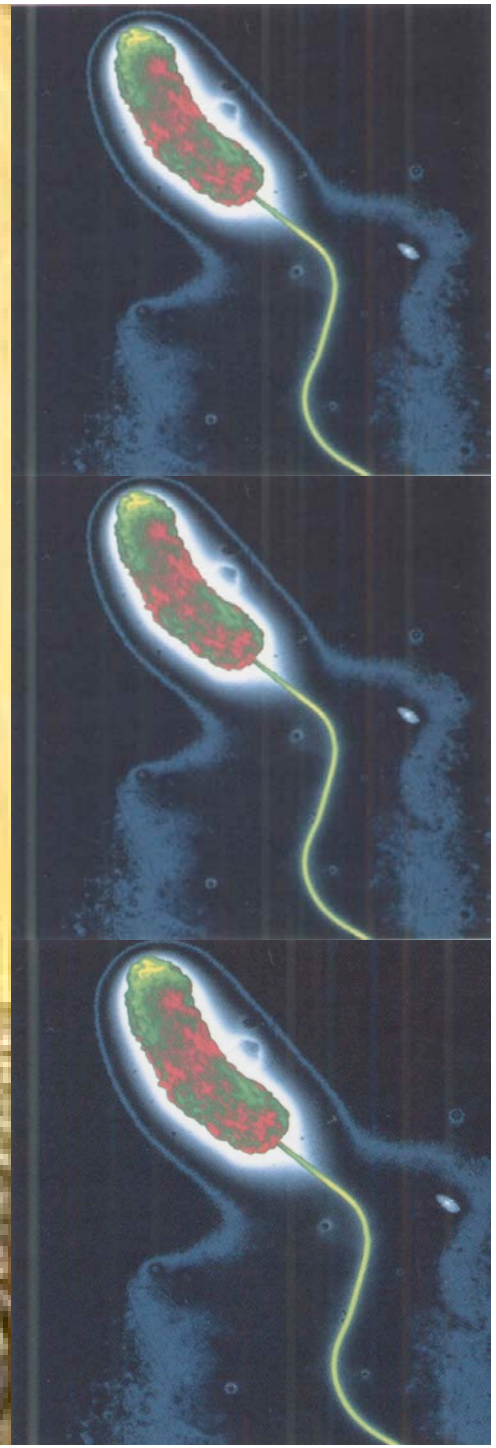
Dose - how many organisms does it take to infect?

Frequency - how often must the host be exposed?

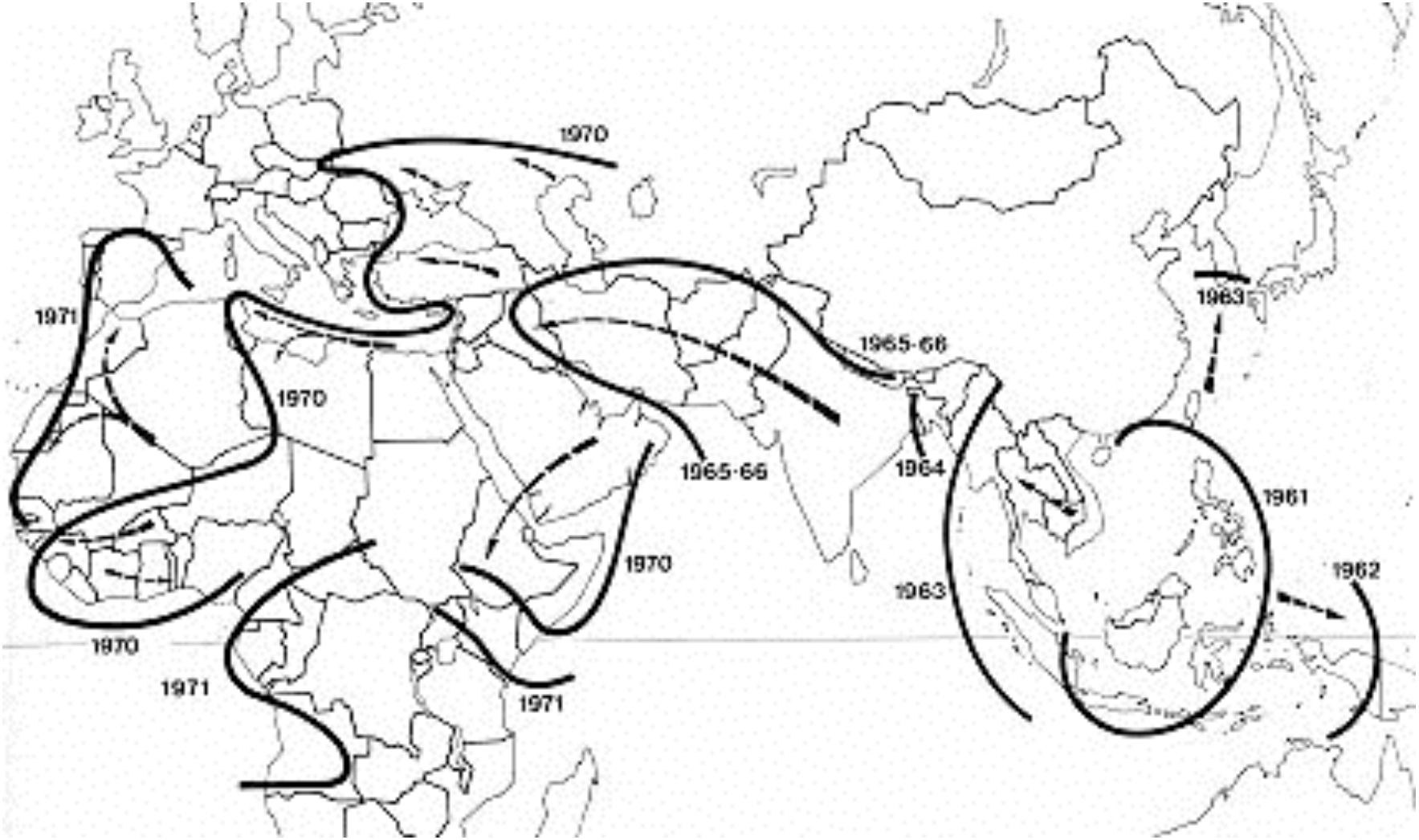
Adherence - what are the host receptor molecules

Adaptability of agent- e.g., antigenic variation, interference with host immune system

Cholera



Cholera Pandemics



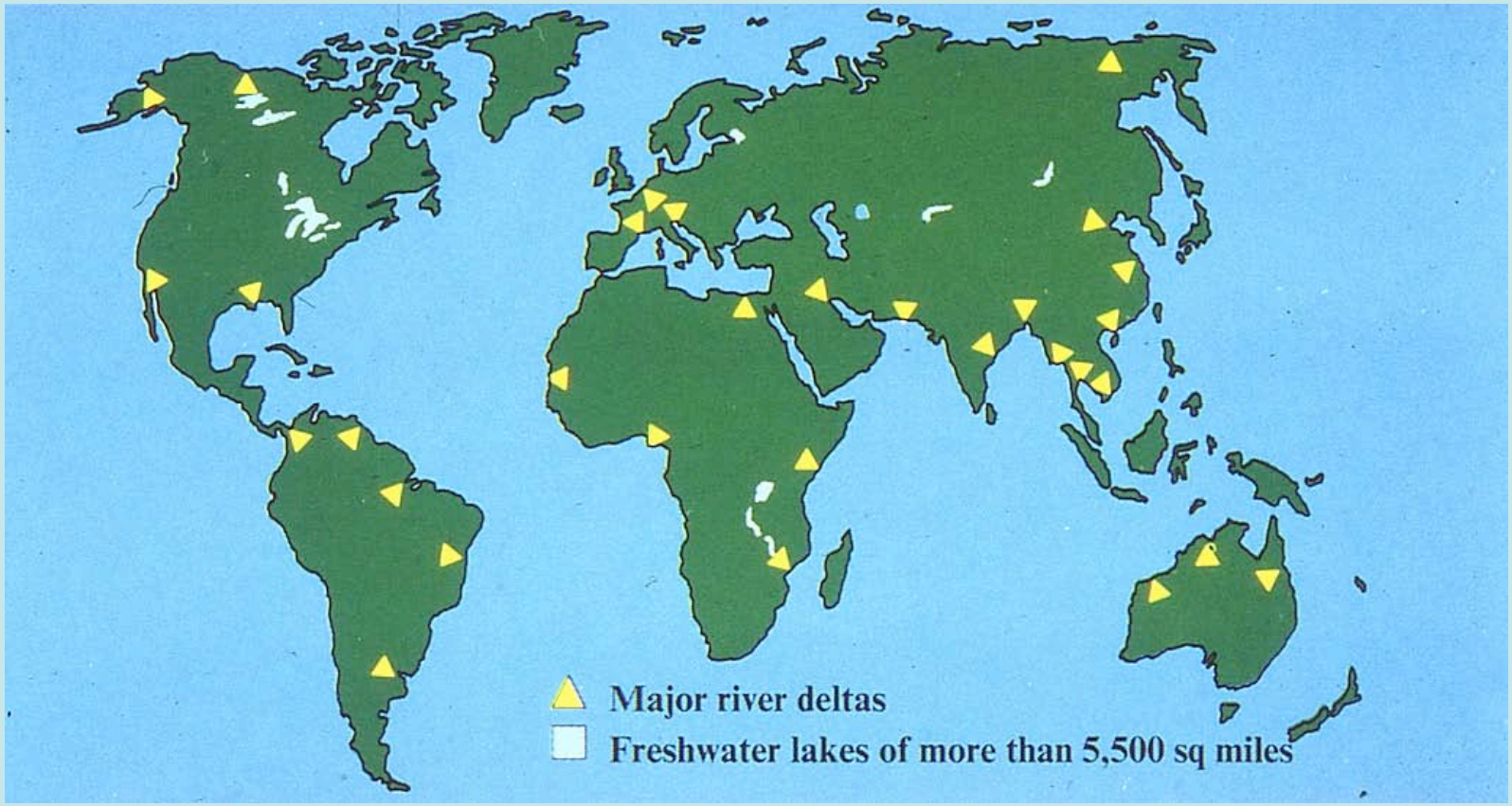
Cholera

Then and Now

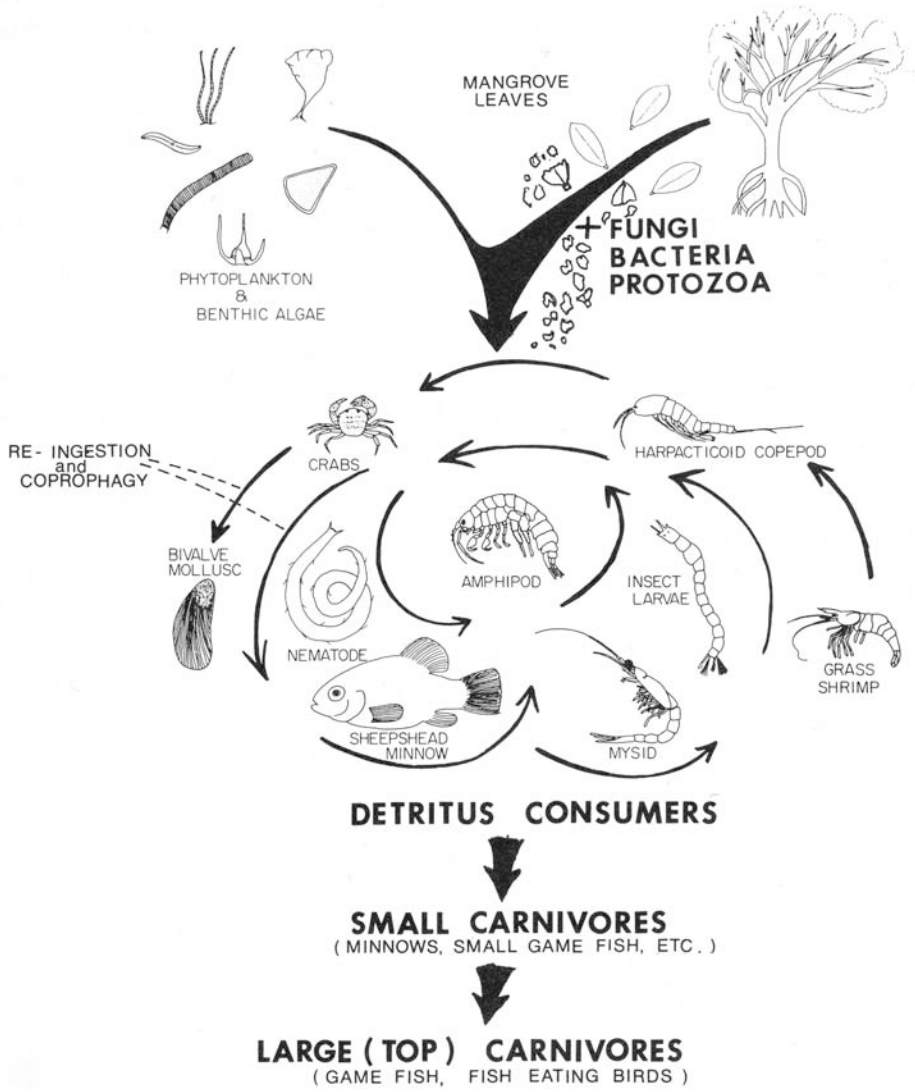
John Snow

Rita Colwell

Distribution Of Estuaries



Trophic Relationships Of The Mangrove Estuary

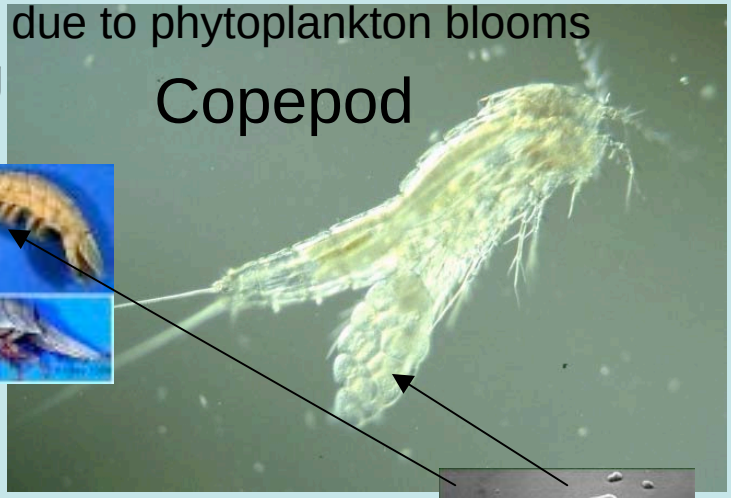


From: E. Odum *Fundamentals Of Ecology*

Ecology of Cholera Epidemics

Numbers increase during monsoons due to phytoplankton blooms

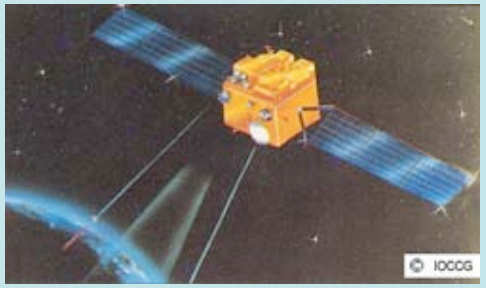
Filter-feeding crustacea



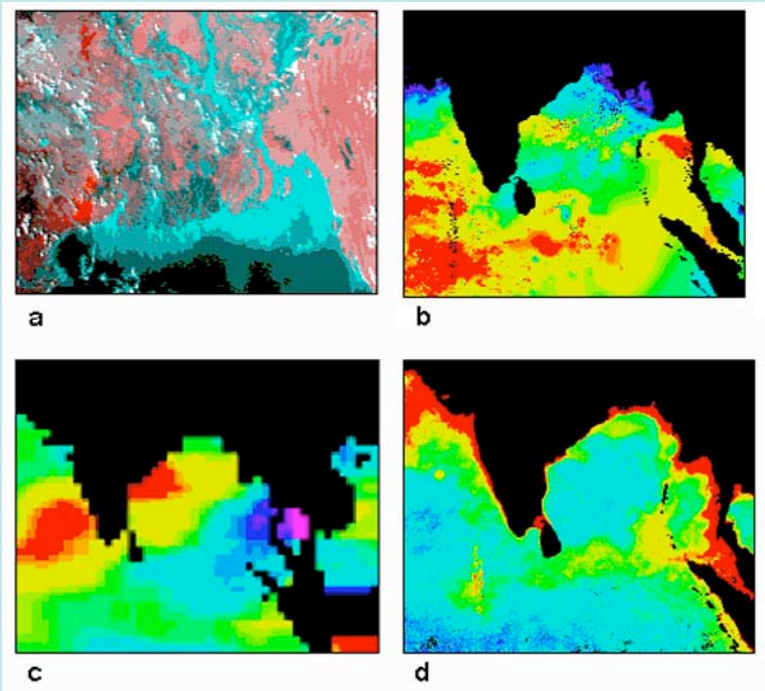
Throw net fishing for crustacea after the monsoons in Bay of Bengal

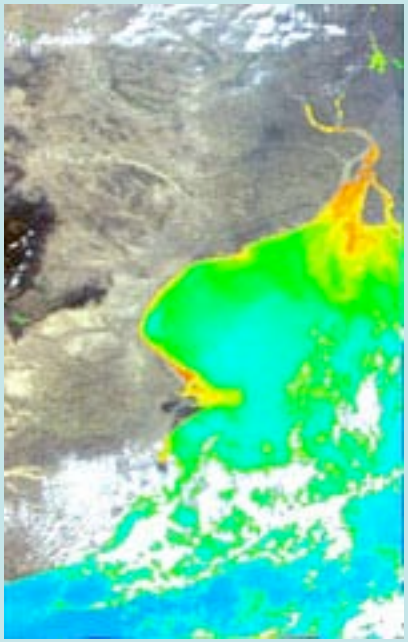
Fecal contamination of freshwater and human activities

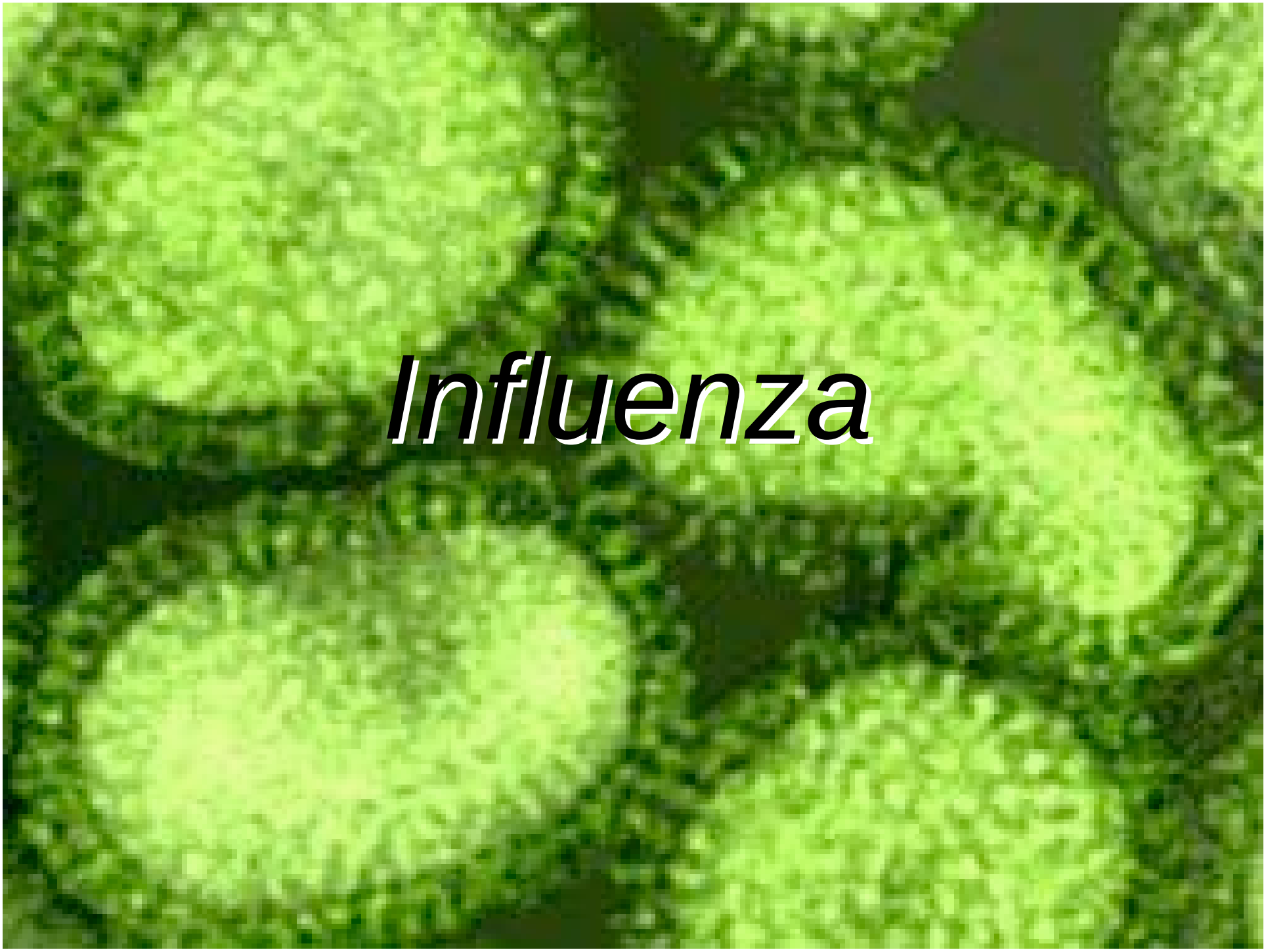
Monsoons



1. lower the salinity of the estuary
2. bring nutrients to the estuary
3. raise the ambient water temperature of the estuary



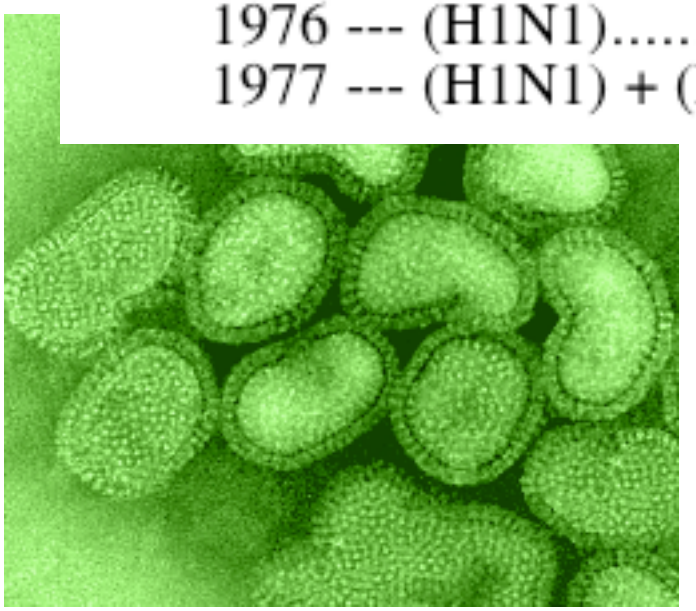



Influenza

Common and Not So Common Strains of the Influenza Virus

Influenza A Evolution

1874 --- (H3N8)
1890 --- (H2N2) .....Pandemic
1902 --- (H3N2)
1918 --- (H1N1).....Pandemic
1933 --- (H1N1).....First strains isolated
1947 --- (H1N1).....Variation detected
1957 --- (H2N2)....."Asian" Flu pandemic
1968 --- (H3N2)....."Hong Kong" Flu pandemic
1976 --- (H1N1)....."Swine" Flu, non-epidemic
1977 --- (H1N1) + (H3N2)....."Russian" Flu epidemic

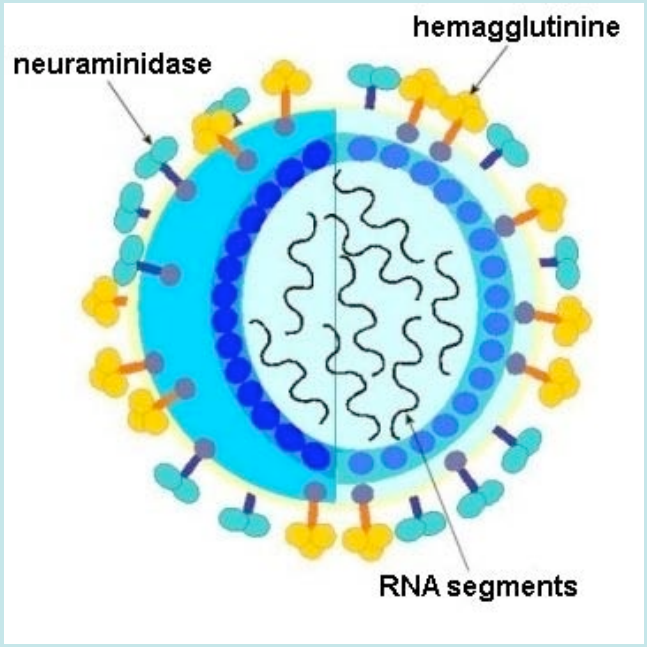


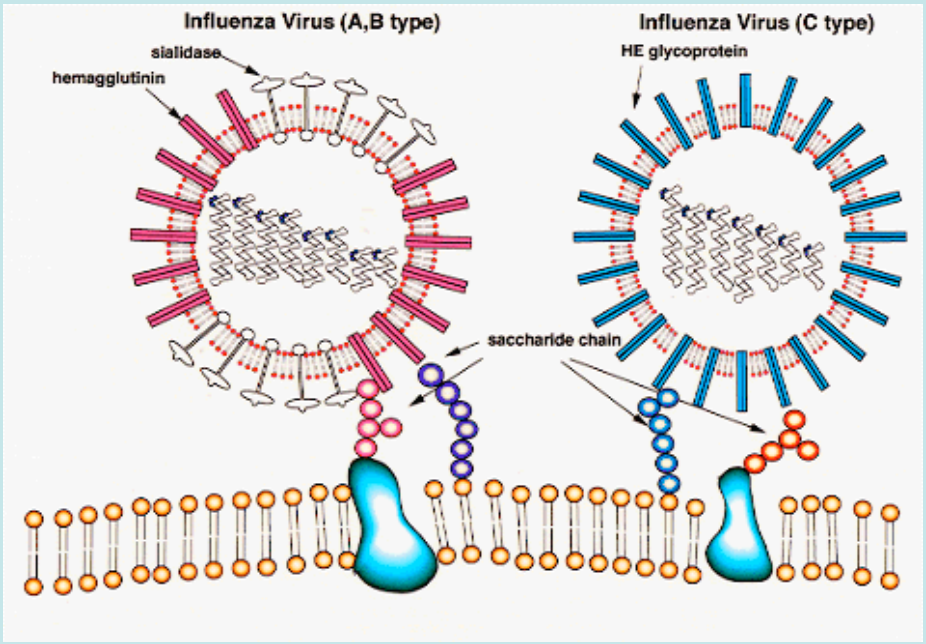
H5N1 - 2004 “Avian” influenza
All ages susceptible


In 1918-1919, Influenza killed some
40-100 million people, worldwide

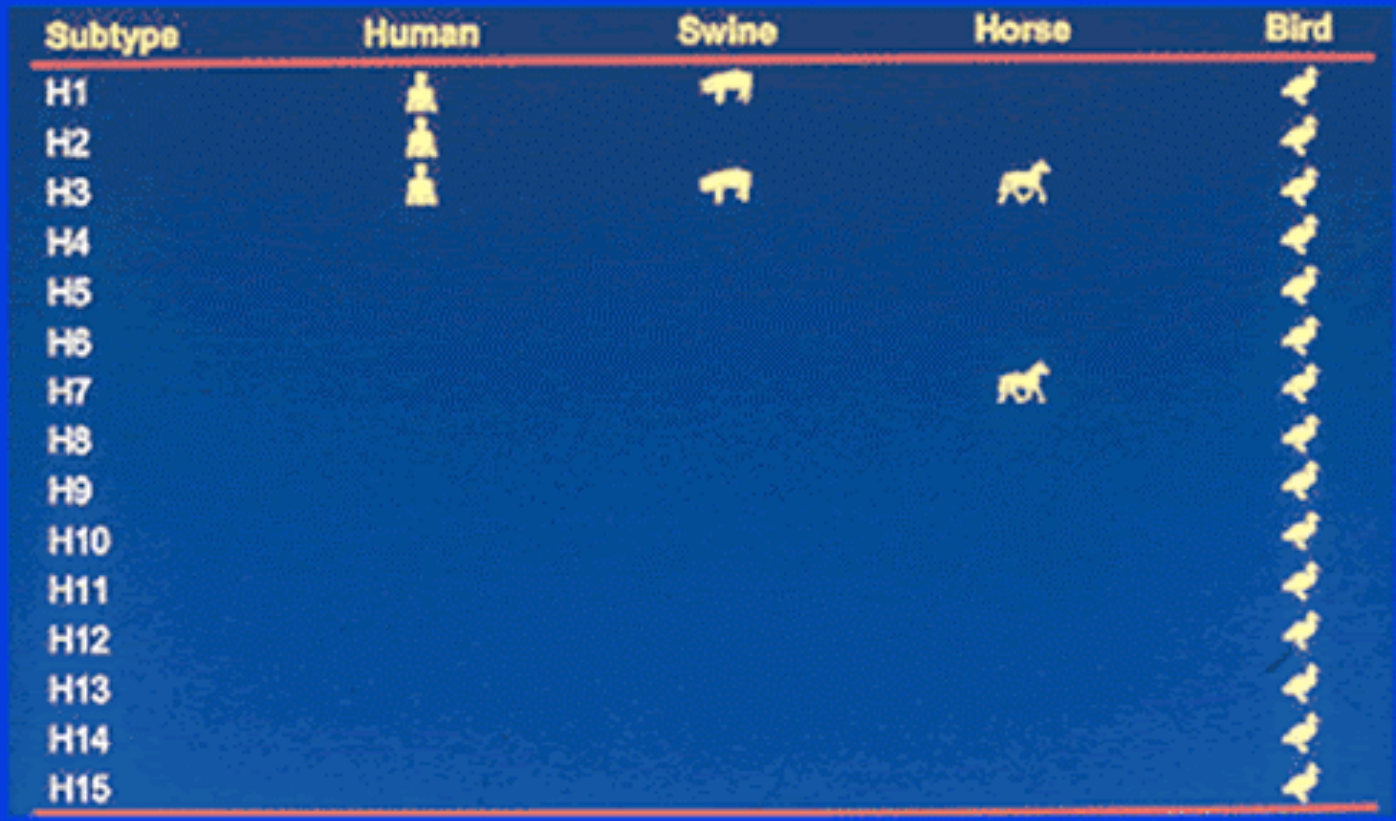
Influenza Virus:

Structure and Function

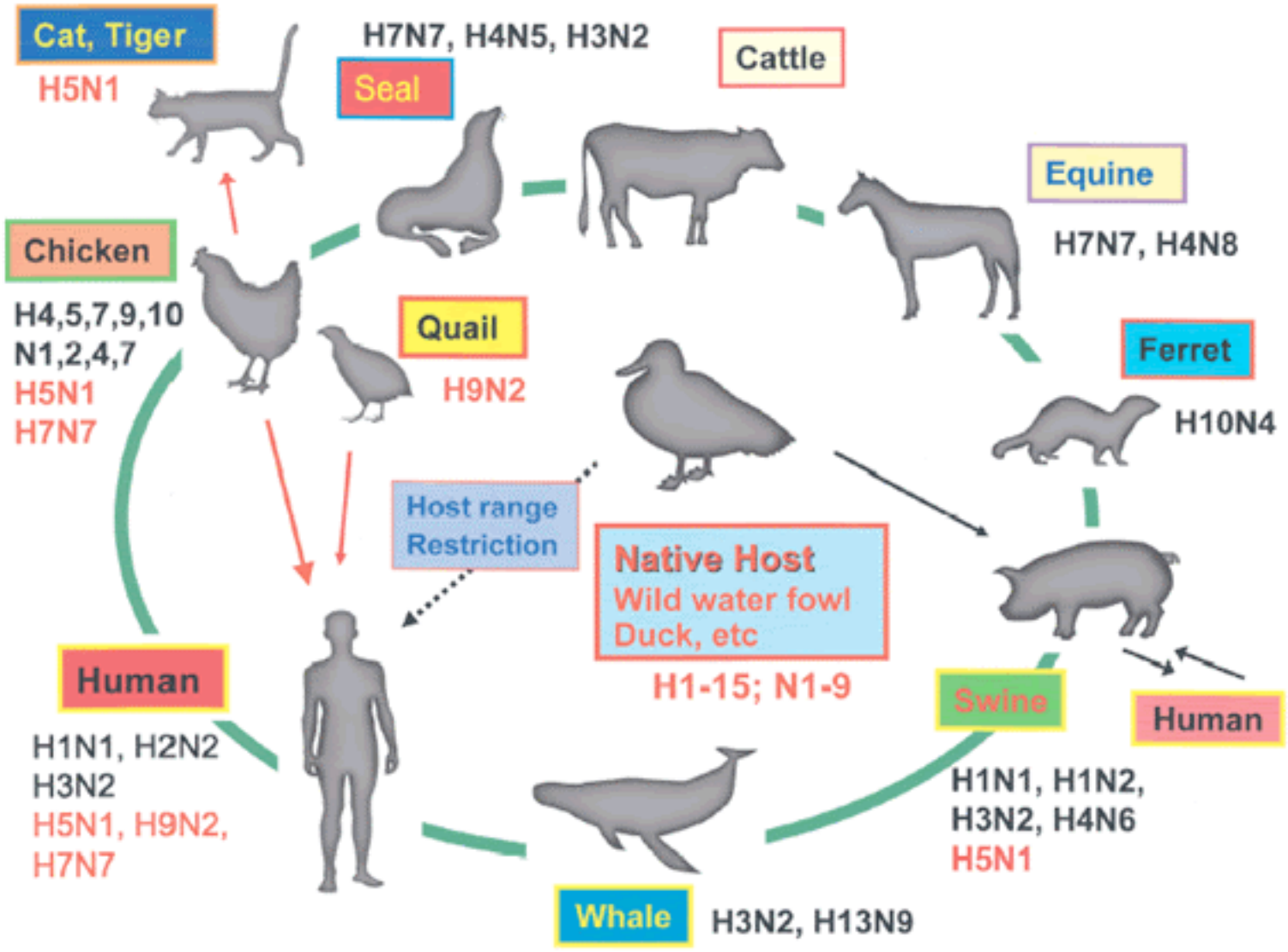




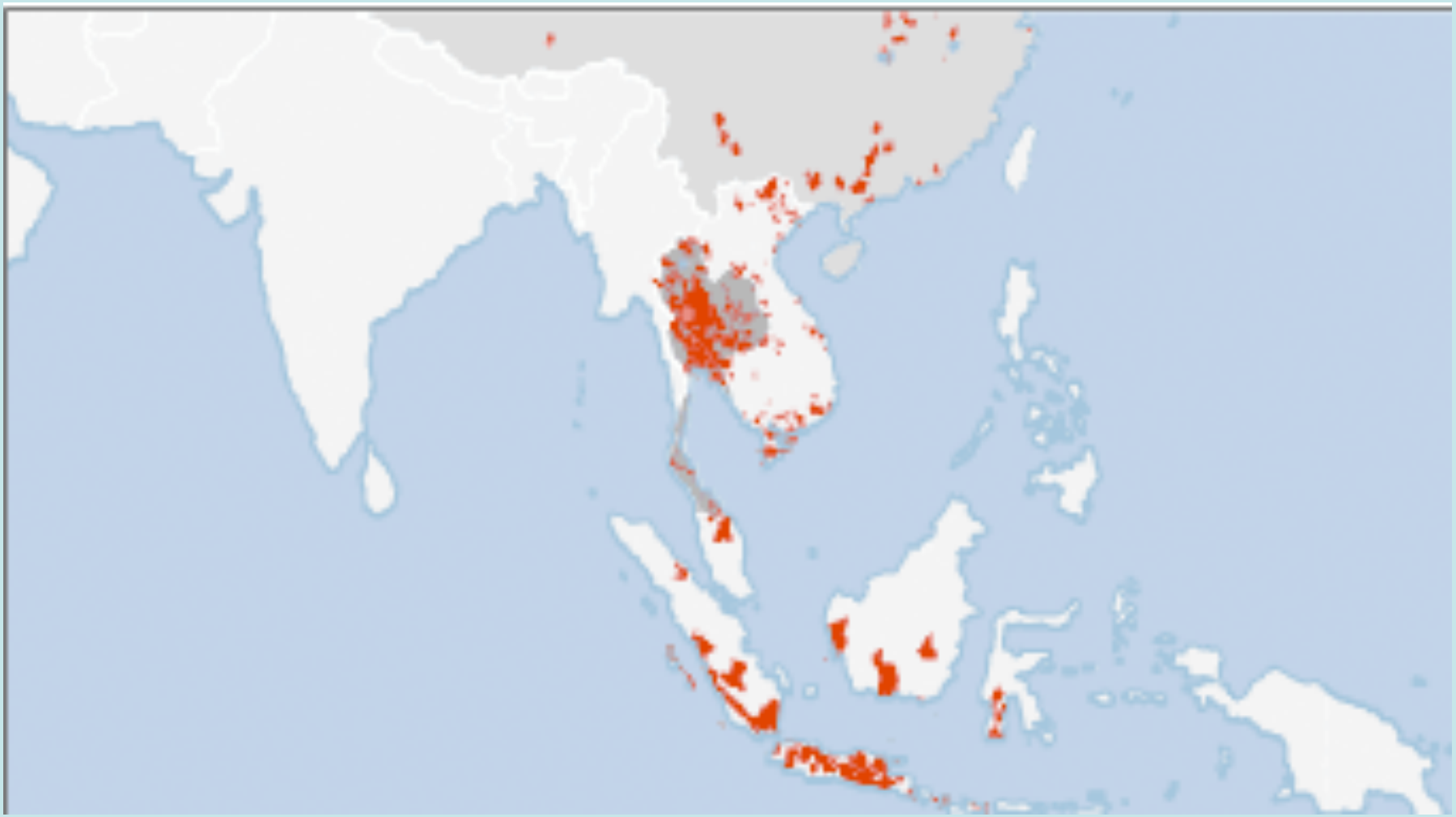
Hemagglutinin Subtypes of Influenza A Virus



Adapted with permission from Levine AJ. *Viruses.* 1992;165.

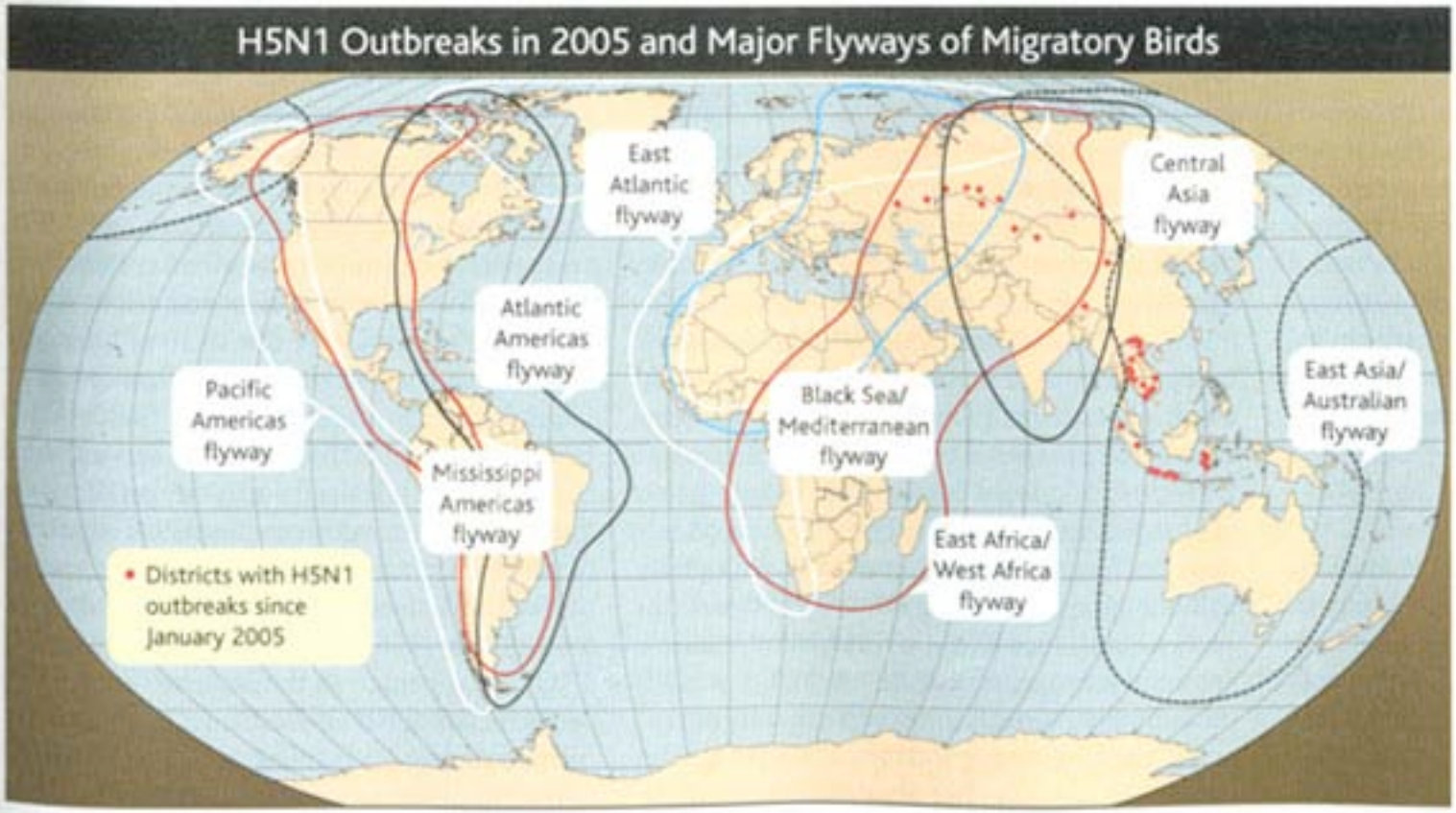

Cat, Tiger
H5N1
H7N7, H4N5, H3N2
Seal
Cattle
Equine
H7N7, H4N8
Chicken
H4,5,7,9,10
N1,2,4,7
H5N1
H7N7
Quail
H9N2
Ferret
H10N4
Host range
Restriction
Native Host
Wild water fowl
Duck, etc
H1-15; N1-9
Human
H1N1, H2N2
H3N2
H5N1, H9N2,
H7N7
Swine
H1N1, H1N2,
H3N2, H4N6
H5N1
Human
Whale
H3N2, H13N9

Spread of Avian Influenza Virus



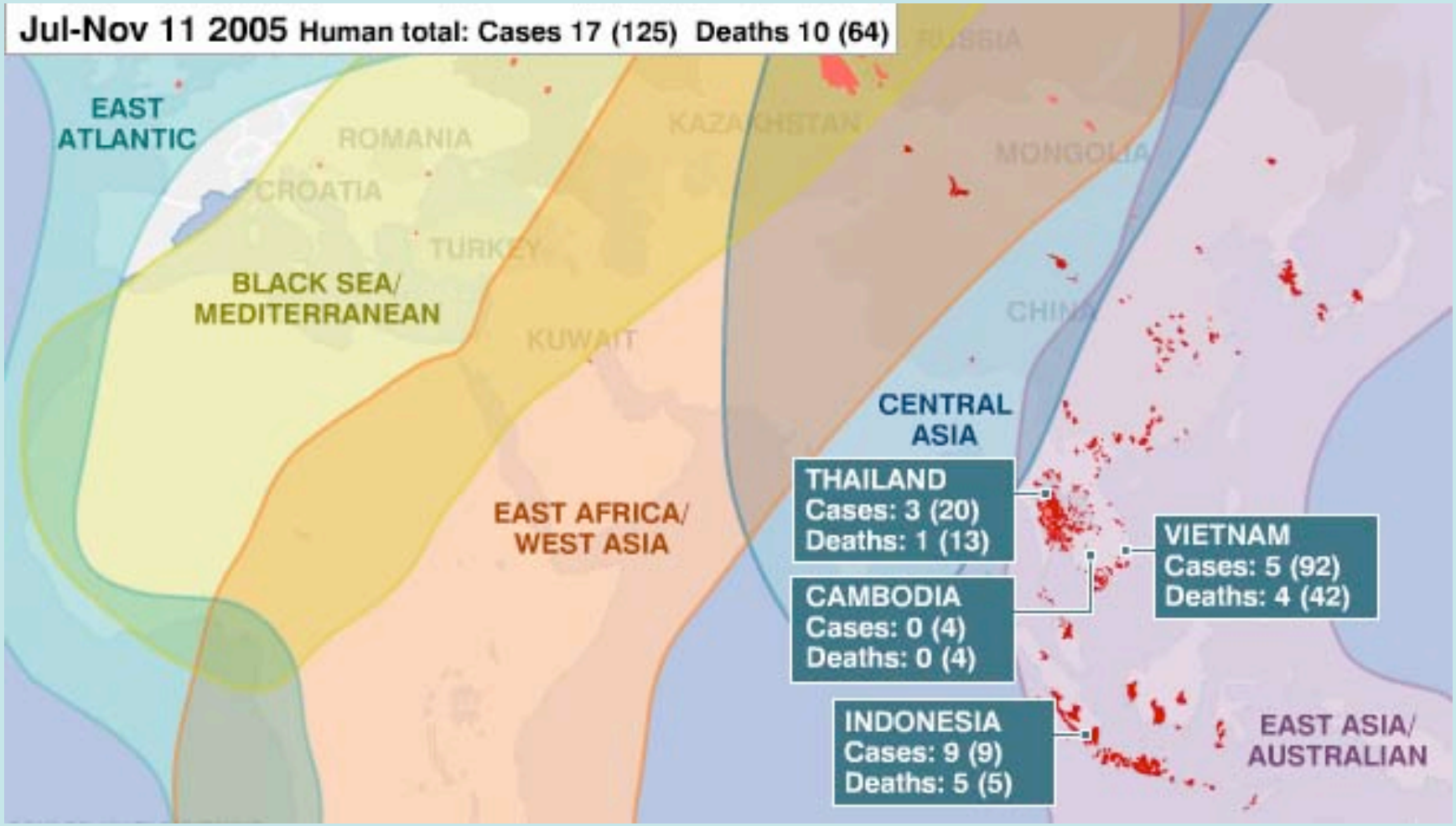
Courtesy BBC


Asian Waterfowl Flyways



On the fly. Flyways might seem to connect the dots of H5N1 outbreaks, but the timings and locations aren't a perfect fit with known migratory patterns.

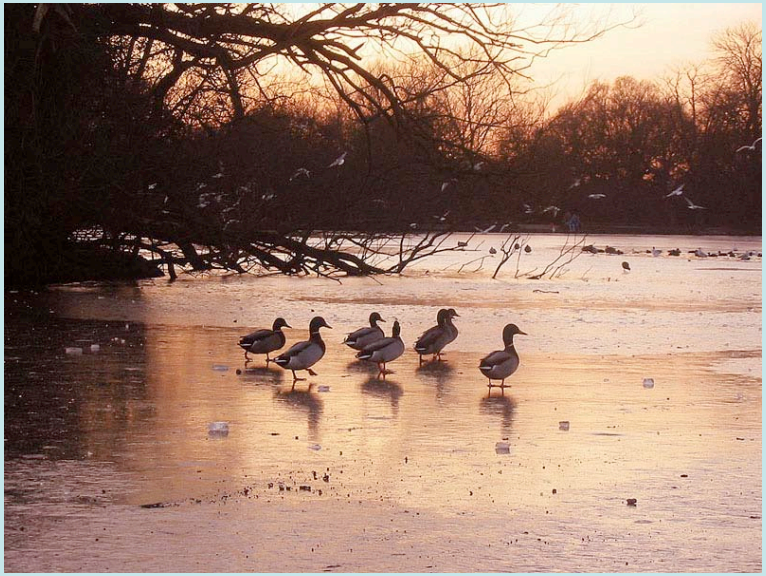
Human Cases

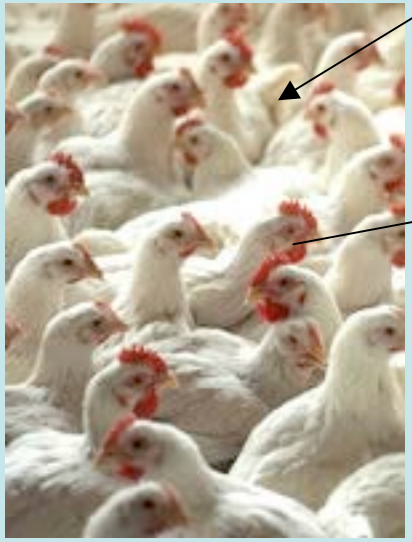


Courtesy BBC

Hanoi Chicken Farmer Going to Market

Courtesy Andrew Rosenblatt





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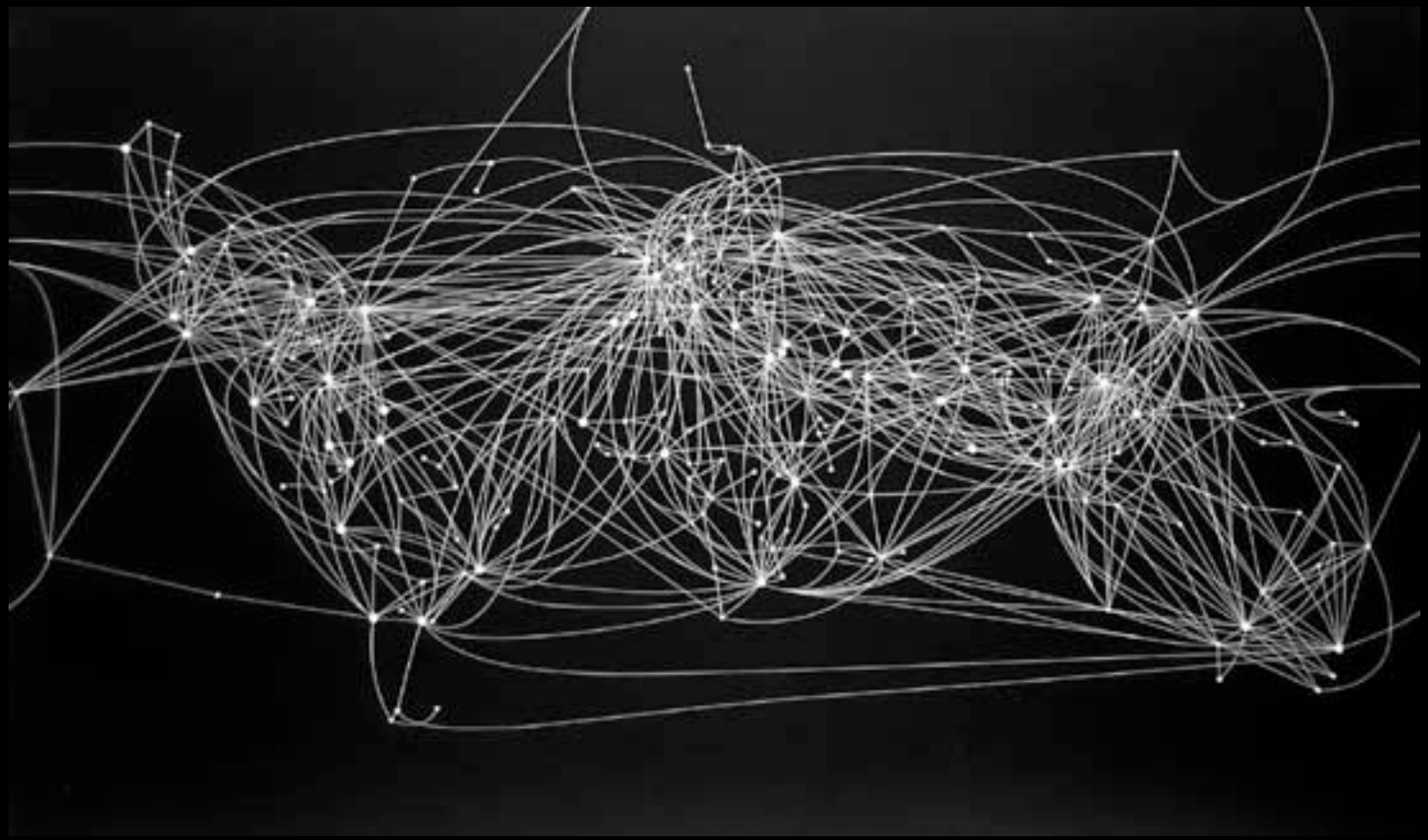
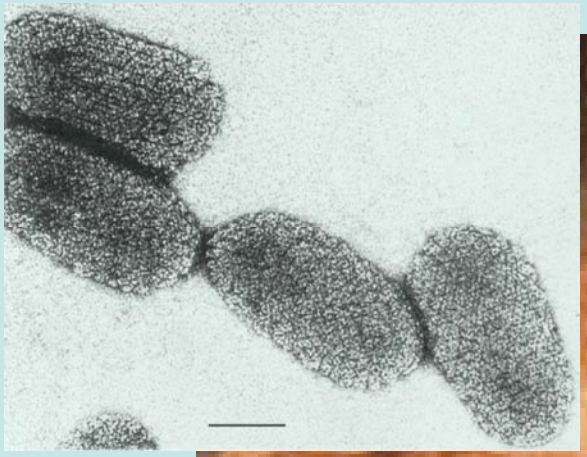
What will happen next?

World Air Routes

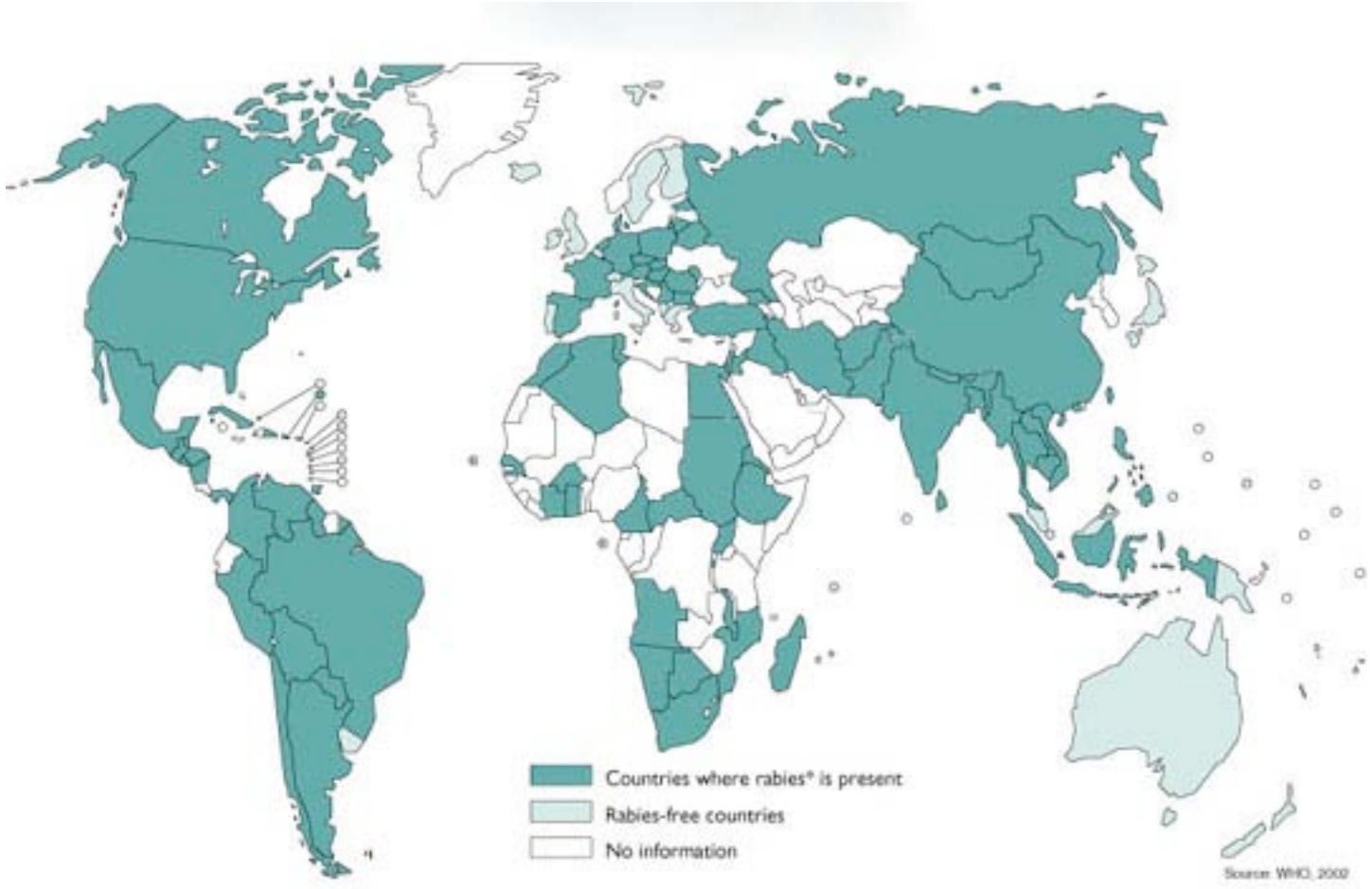


Rabies



Cross Sectional
RNA
Envelope
(Membrane
bilayer)
Matrix
Protein
Ribonucleoprotein

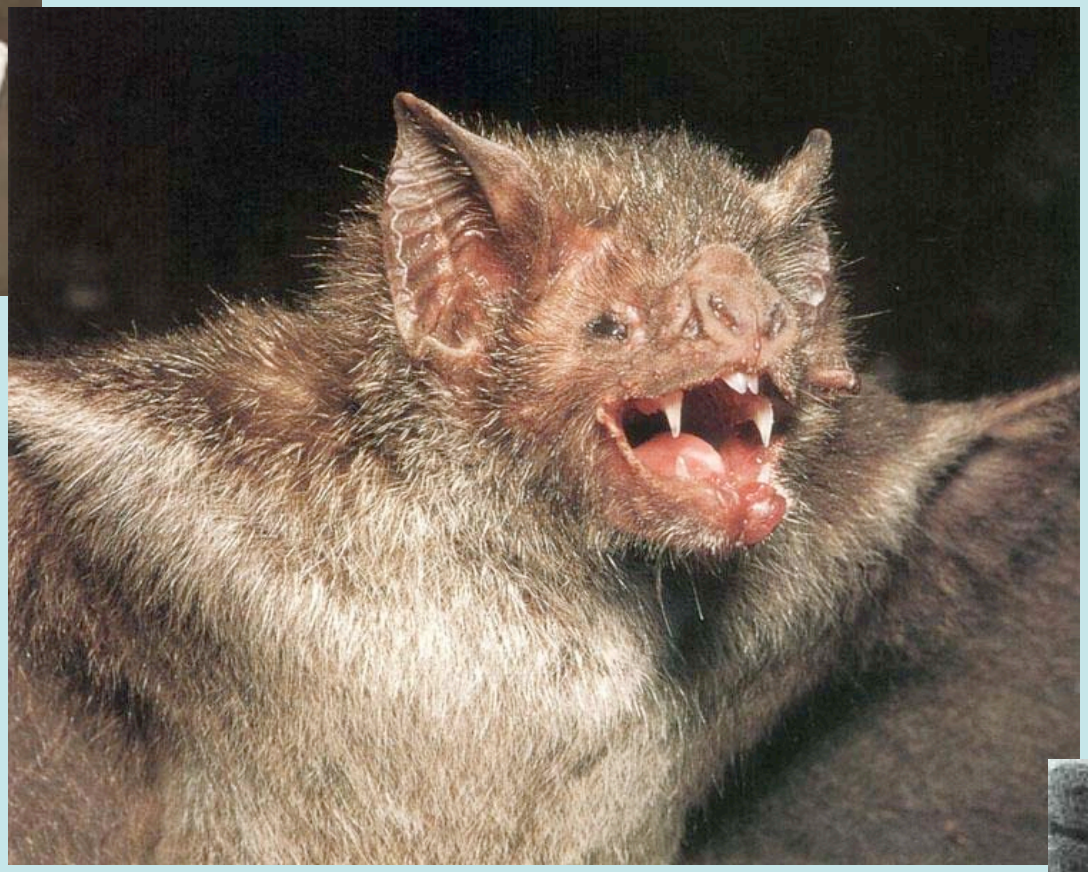
World Distribution of Rabies



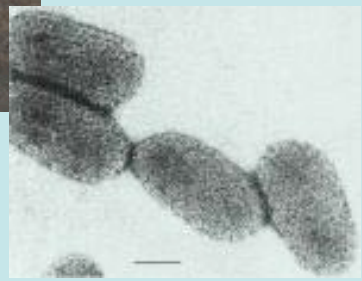
*Rabies in this manual is defined as a disease caused by *Lyssaviruses* belonging to serotype/genotype 1.

Rabies vectors and carriers

Bella Lugosi:
Patron Saint of
all bat species



Vampire Bat



rabies virus

Did you know?
30% of all mammalian species are bats

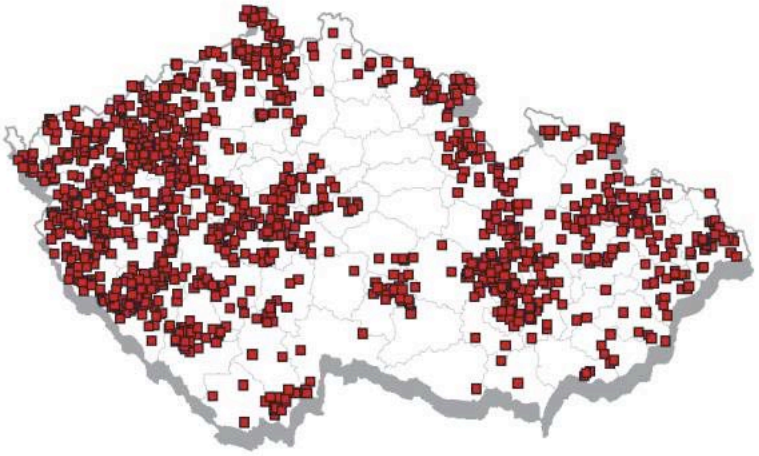
ProMed: Oct 27th, 2005
From: Luciano Goldani <rsf4805@via-rs.net>

Hematophagous (vampire) bats are proliferating because of forest devastation in the state of Maranhao, northeastern Brazil. 20 cases of fatal rabies have been clinically documented. The population in the area is protecting their houses with wire nets to prevent bat bites.

Dr. Luciano Goldani
Infectious Diseases Unit
Universidade Federal do Rio Grande do Sul
Brazil

Live virus vaccine in oral baits

Rabies Cases in the Czech Republic in 1989



Rabies Cases in the Czech Republic in 2002

Control of rabies by oral bait-vaccine

3.1 Rabies Situation and Rabies Controlin the Czech Republic 2000 – 2002

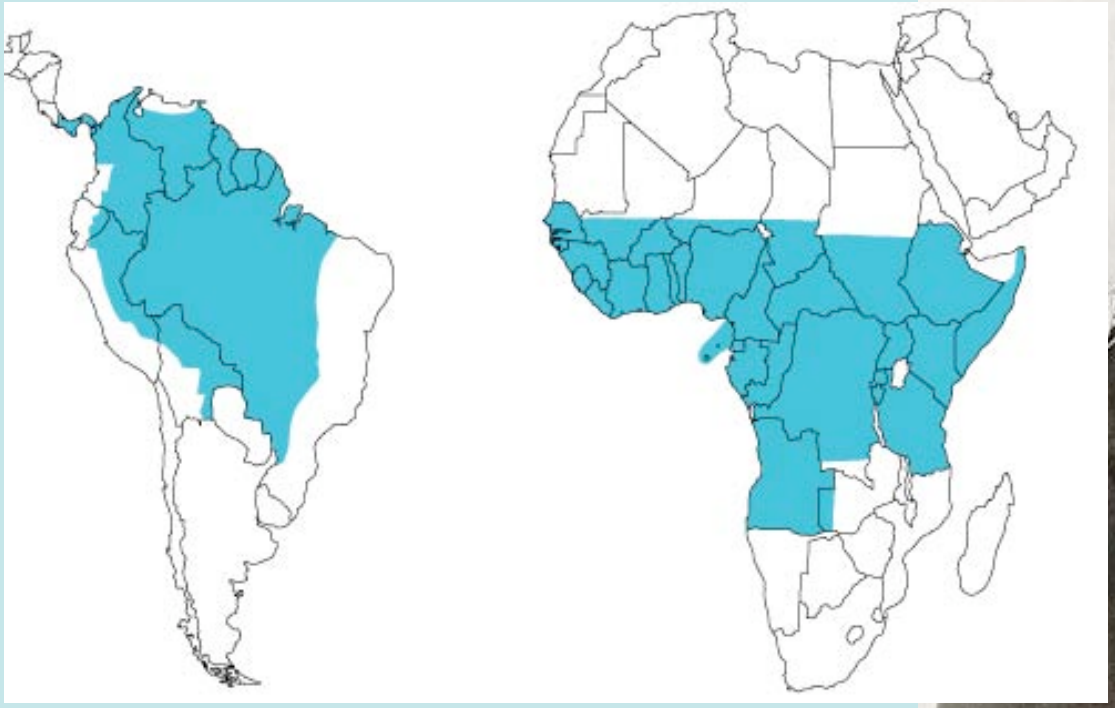
by O. Matouch[1] and J.Vitásek[2]
[1]State Veterinary Institute, Liberec 30, CZ
[2]State Veterinary Administration, Prague, CZ

1. Oral vaccination of foxes

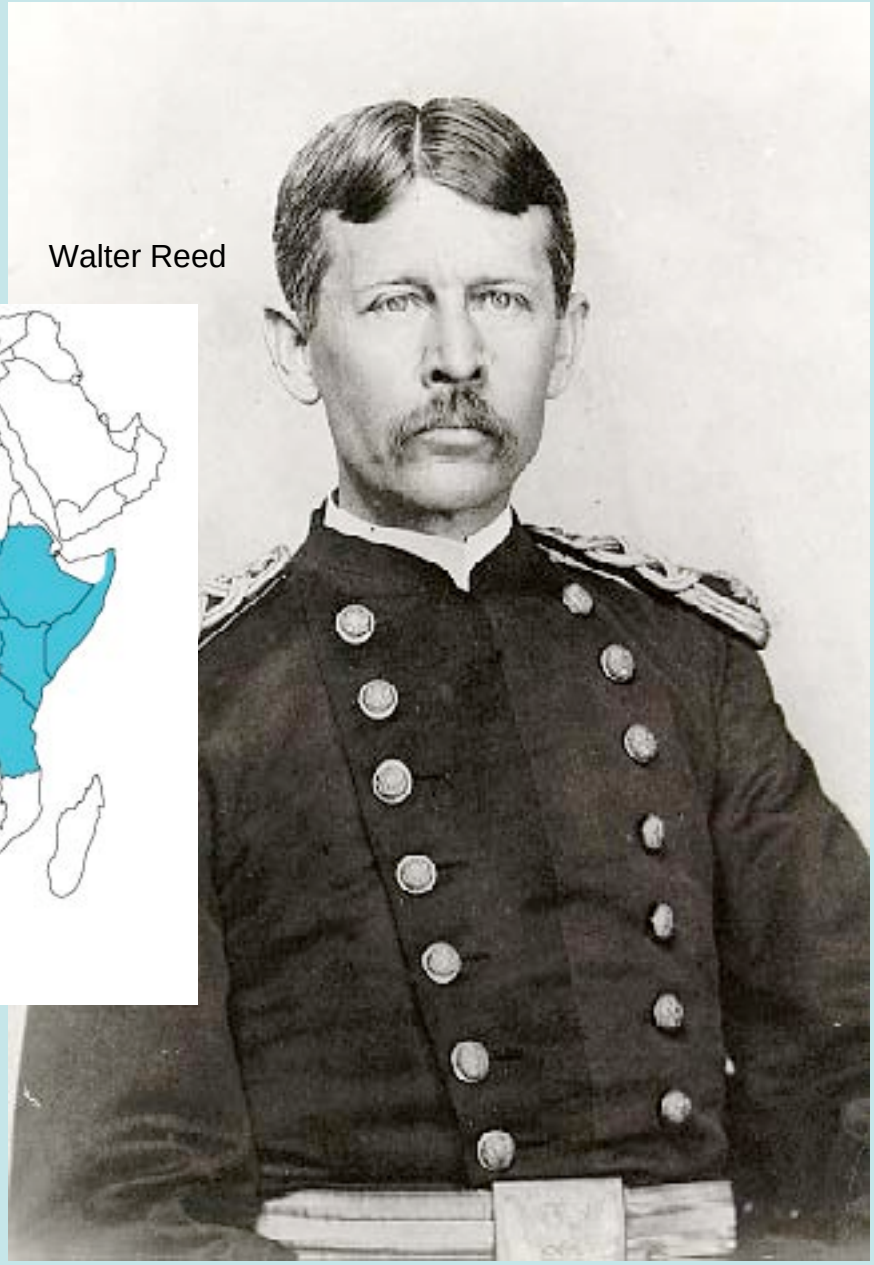
The field trial of oral immunization of foxes was started in the Czech Republic in spring 1989. The first application of the oral rabies vaccine (SAD B19-Tübingen) was carried out in the districts Klatovy, Domazlice, Tachov adjacent to the German border in spring 1989. During the course of the next campaigns the treated area was extended covering 44 districts in autumn 1992. In the autumn 1993 the whole territory of the Czech Republic, with exception of rabies free districts bordering Germany, was included.
Since 1992 only the Czech made vaccine LYSVULPEN manufactured by BIOVETA Ivanovice with the SAD Bern vaccine virus strain has been used in the Czech Republic.
The "Bavarian model" was applied during all vaccination campaigns. Voluntary hunters distributed the vaccine baits by hand in their hunting preserves. The strategy of two vaccination campaigns per year, one in spring and one in autumn, was applied. From 1996 aerial distribution of the vaccine baits was selectively used on a restricted territory (4 - 6 districts). In the last years, the aerial vaccination was extended to 50% of the treated territory (29 districts) in 2002 (See Map). More than nineteen million of vaccine baits were used from 1989 till the autumn 2002.

Yellow Fever

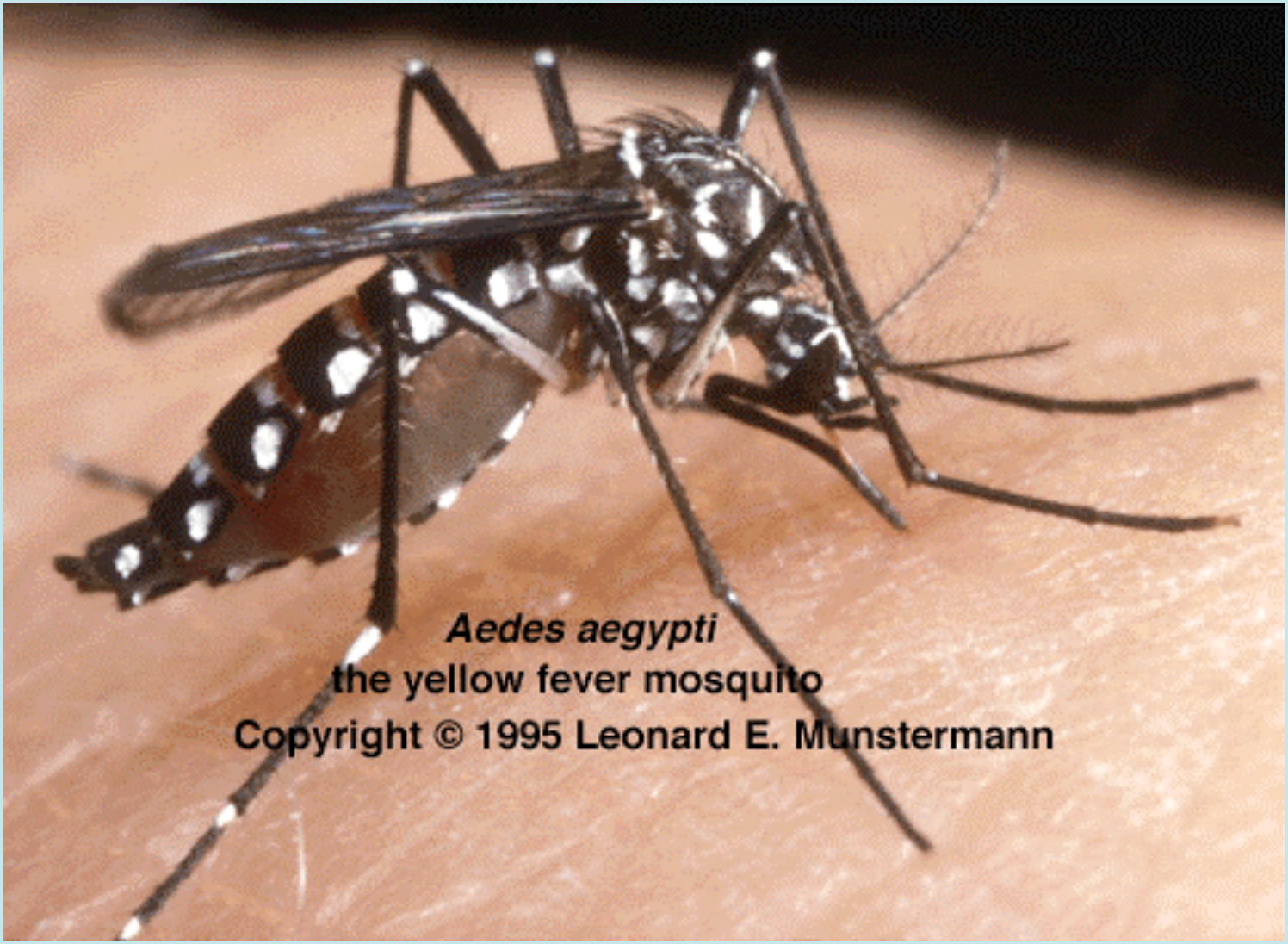
Distribution of Yellow Fever



Walter Reed

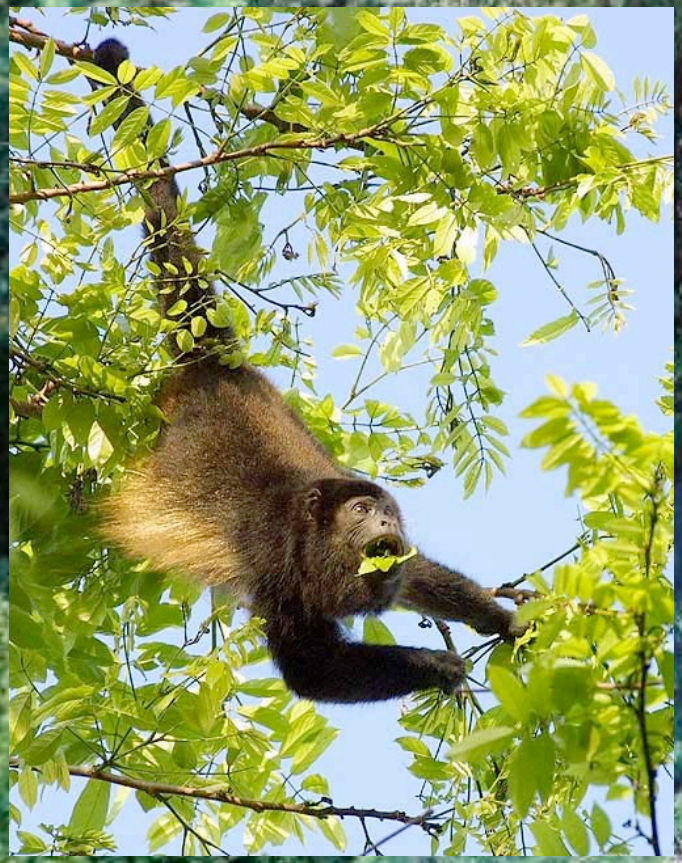


“A man, a plan, a canal. Panama”

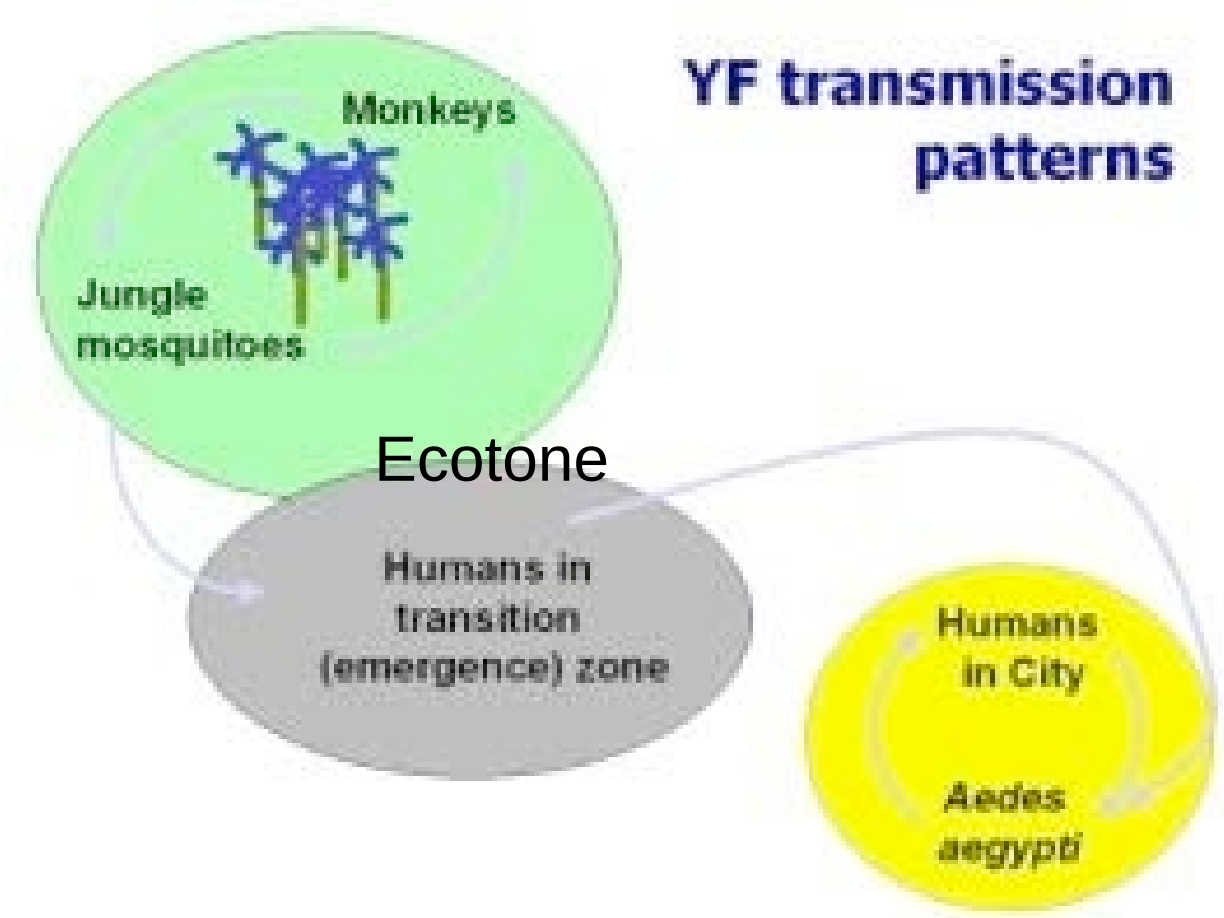

Aedes aegypti
the yellow fever mosquito
Copyright © 1995 Leonard E. Munstermann

Panama Canal: The Early days

Canopy Transmission
By *Haemogogus sp.*



Ecology of Transmission Of Yellow Fever



Occupations at High Risk

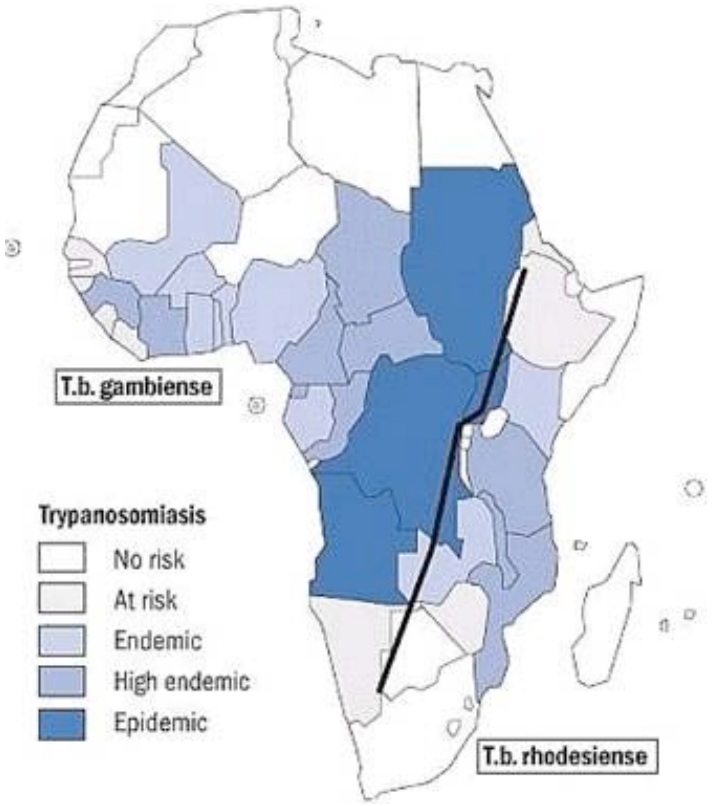
Rubber

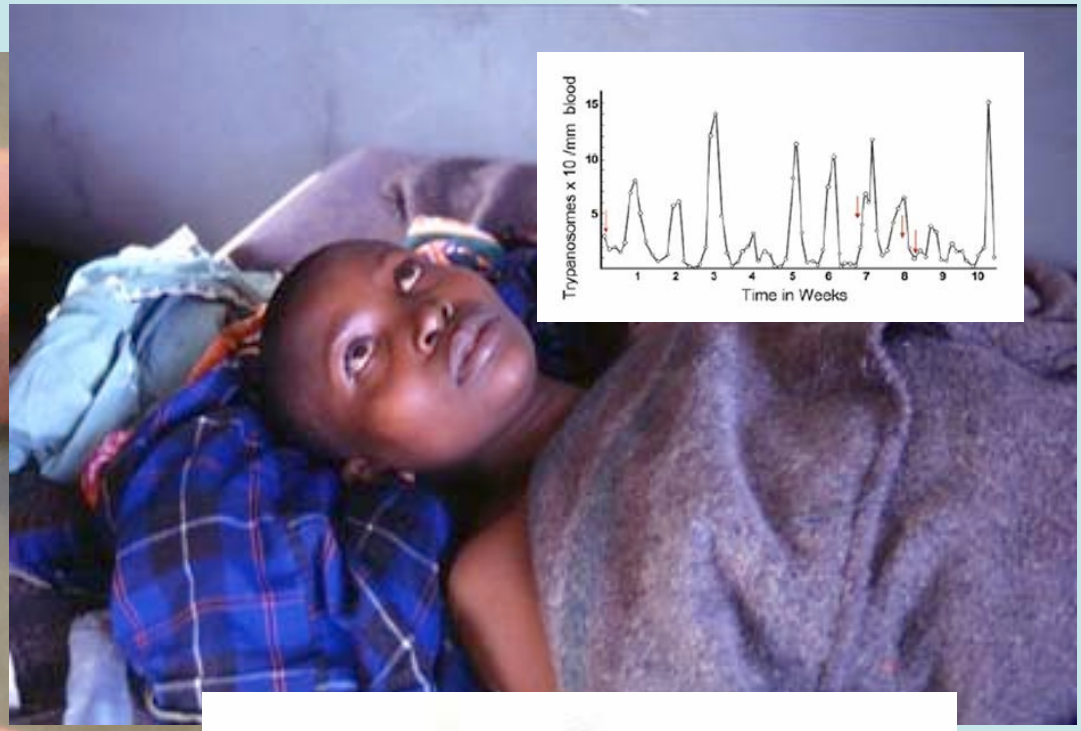
Sugar cane

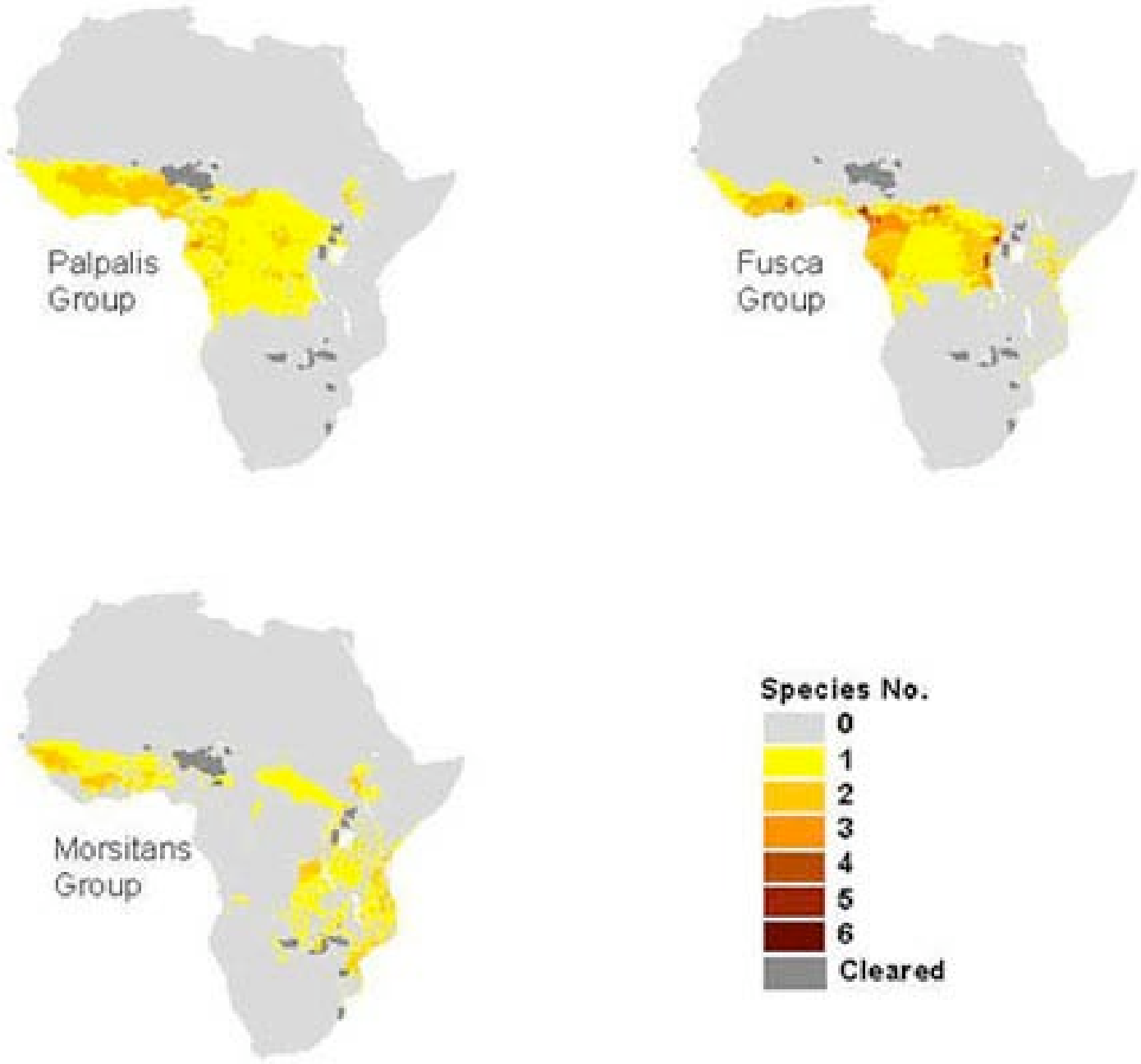
Coffee

Revolutionary

African Trypanosomiasis




Trypanosomes x 10 /mm blood
15
10
5
1
2
3
4
5
6
7
8
9
10
Time in Weeks


Palpalis
Group
Fusca
Group
Morsitans
Group
Species No.
0
1
2
3
4
5
6
Cleared

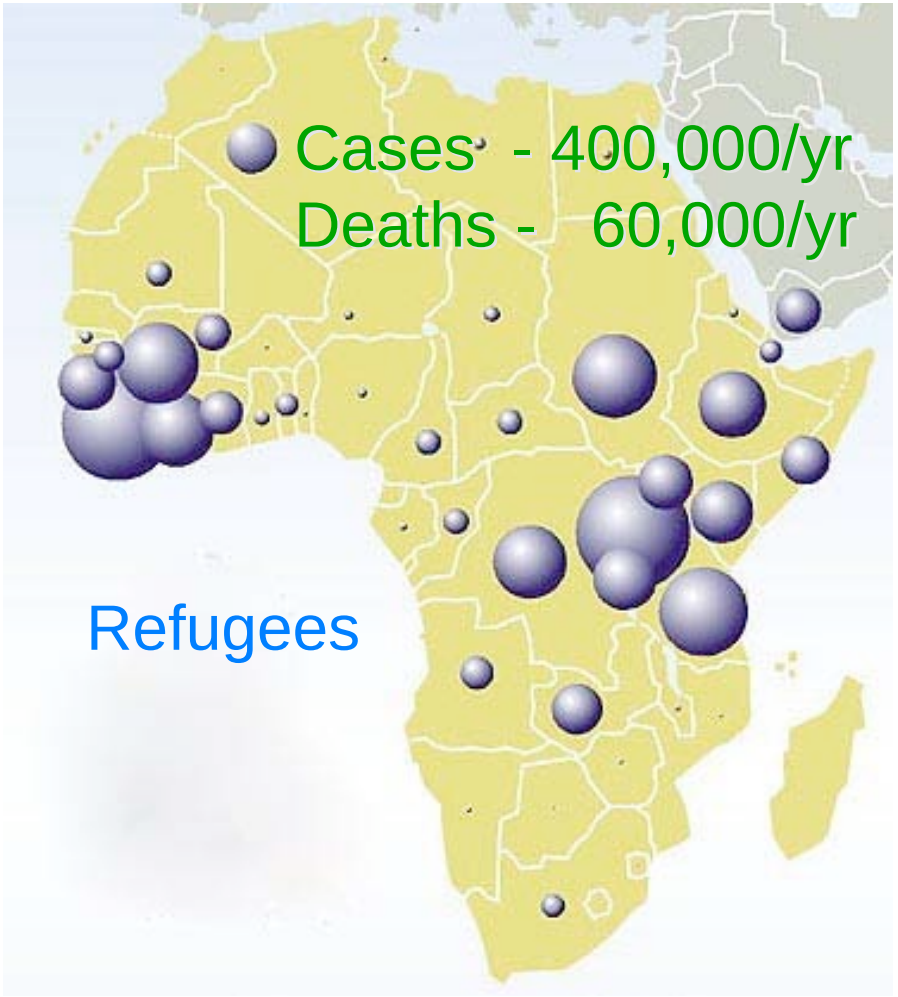
East African Savanna

West African River

Riverine Tsetse and agriculture

Civil Unrest and War - 2005

Liberia
Côte-d'Ivoire
Sudan
Ethiopia
Nigeria
Sierra Leone
Guinea
Ghana
Burundi
Burkina Faso
Cameroon
Gambia
Rwanda
Swaziland
Mauritania
Zambia
Central African Republic
Namibia
Democratic Republic of Congo



What's Next??

Without a global ecological perspective
on infectious disease transmission,
we will forever remain sitting ducks!