

Natural Disasters

Lecture 34

Topic 2: Pandemic Diseases

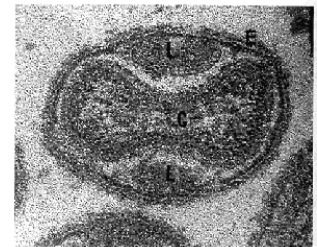
Text Source Today:

None.

Topic 2: Pandemic Diseases

- ♦ **Outbreak:** when a group of people in a **small** geographic area become ill with an infectious disease
- ♦ **Epidemic:** when an infectious disease spreads beyond a **local population**, lasts longer, and reaches people in a **wider** geographic area
- ♦♦ **Pandemic:** when an epidemic spreads around the world

- **Smallpox:** an infectious disease unique to **humans**, caused by either of two variants, *Variola major* (mortality rate **20-40%**) and *Variola minor* (mortality rate **1%**).



- **Smallpox** starts with a distinctive rash that progresses to **pus-filled blisters** and can result in disfiguration, blindness and death; it is transmitted primarily by direct contact with droplets from saliva or a sneeze, and from contact with clothing worn by someone with the disease.

- ♦ **Smallpox** may have been the very **first pandemic**, having emerged in human populations about **10,000 BCE**. The disease itself is believed to have appeared in **agricultural** settlements in northeastern **Africa**. May have caused the **Antonine Plague** (165-180 CE).

- **Smallpox** was responsible for killing an estimated 400,000 Europeans **each year** during the 18th century. During the 20th century, it killed an estimated **300-500 million** people.

- ◆ Through a successful worldwide **vaccination program** throughout the 19th and 20th centuries, the World Health Organization (**WHO**) certified the **eradication** of **smallpox** in **December 1979**. To this day, **smallpox** is the only **human** infectious disease to have been **completely eradicated**!

- By international agreement, the **main stores of smallpox virus** are kept securely (?) at the **CDC**'s headquarters in Atlanta, GA and at a similar institute in Moscow, Russia.

- ◆ **Bubonic Plague – “The Black Death”:**

a disease caused by the rod-shaped bacterium *Yersinia pestis* (mortality rate **30-75%**); the infection usually results from the bite of an infected **flea found on rodents, such as rats and mice**; two rarer forms, pneumonic plague and septicemic plagues, have a **near 100%** mortality.

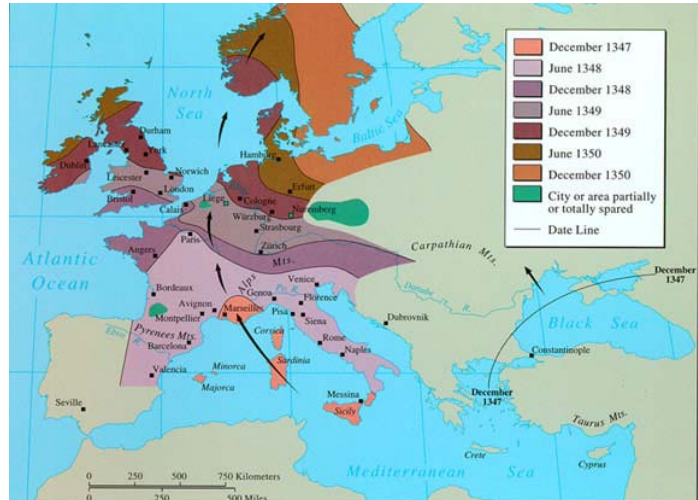


- The term “bubonic” refers to the characteristic **buboes** (enlarged lymph nodes around arm pits, neck and groin) and the “black” refers to the blackening of the skin through **hemorrhaging** under the skin.

- The first recorded case of the **Plague** was in China in **224 BCE** and may have moved west with Mongol armies and

traders. The **Plague of Justinian (541-750 CE)** started in Egypt and spread from there. It reduced Europe's population by around **50%** between **550** and **700 CE**.

♦ The **Plague** returned to Europe in late **1347 CE**, possibly from **Italian merchant ships** fleeing fighting in the Crimea and those returning from the international trade routes from China, known as the "*Silk Road*." During the next **6 years**, the **Plague** killed an estimated **75 million** people worldwide and **25-50 million** in Europe (over half of Europe's total population at that time)!

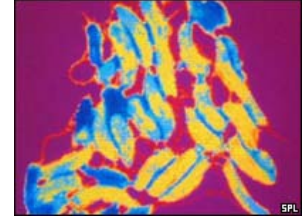


♦ **Plague** is thought to have returned **every generation** with varying virulence and mortalities, through wars and trade, until the **1700s**. The Third Pandemic of the **Plague** resurfaced around **1855**, beginning in central Asia, and then spread worldwide and ended in **1959**. Over **12 million** died in China and India alone.

♦ It was not until the late **1890s** that scientists deduced that **Plague** disease **vector** to humans was by **infected fleas**.

● **Plague** is **still around today**. The **WHO** reports 1000-3000 **cases every year**. The last epidemic outbreak of **Plague** in the U.S. was in Los Angeles in **1924-25**. Modern **antibiotics** are effective against **Plague**, but if an infected person is not treated promptly, the disease is likely to cause illness or death.

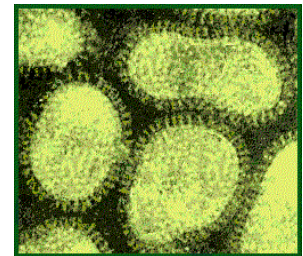
♦ **Cholera:** an infectious gastroenteritis caused by the bacterium *Vibrio cholerae* (mortality rate **50-70%**); it is almost always transmitted by water or food that has been **contaminated by human waste**; it causes profuse watery diarrhea that leads to rapid dehydration and if not treated, death.



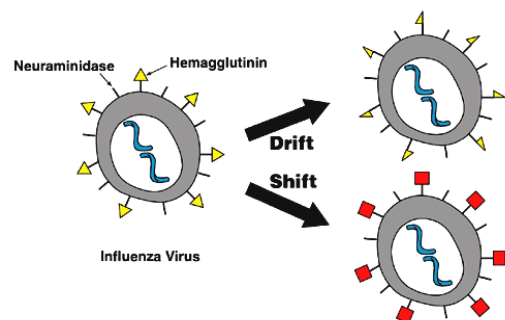
● **Cholera** is a relatively **new** disease. The first pandemic was from **1816-1826** spreading from India to China and the Caspian Sea. There were six more pandemics, the last one began in **1962** in Indonesia and affected ~100 countries into the **1970s**.

♦ **Cholera** is not a problem today in **developed** countries, but remains a major public health problem for **developing** countries, due to **poverty and poor sanitation**. This is common disease that follows **natural disasters** that disrupt **water** systems.

● **Influenza:** an infectious *orthomyxovirus* (mortality rate: **0.1%** for seasonal flu; **2-20%** for pandemic flu) that is readily spread by **aerosol droplets**, or through contact with bird droppings, nasal secretions or **contaminated surfaces**.



● There are three basic types of flu virus: **A, B and C**. **Type A** affects humans and animals, can be moderate to severe, and is susceptible to **antigenic shift** (an abrupt and large genetic change of the surface antigens). **Type B** is a

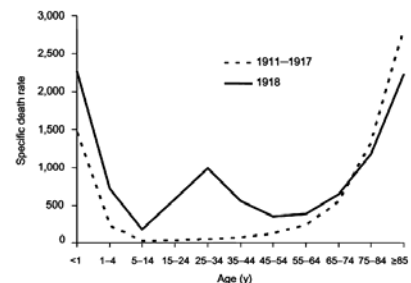


milder disease that affects primarily human children. **Type C** is so mild, it rarely gets reported. All flu types can experience **antigenic drift** (slow and minor genetic change).

- Each type of flu is further characterized by an enumeration scheme for **H (Hemagglutinin)**: usually from 1-3, but up to 14 varieties are known) and for **N (Neuraminidase)**: from 1-9).
- The first recorded flu pandemic was in **1580**, emerged from Africa and spread across Europe; since then:
 - “Asiatic (Russian) Flu”, 1889-90: **H2N8** or **H2N2**
 - “Spanish Flu”, 1918-19: **H1N1**
 - “Asian Flu”, 1957-58: **H2N2**
 - “Hong Kong Flu”, 1968-69: **H3N2**
 - “Swine Flu”, 2009: **H1N1**
 - “Avian (Bird) Flu”, 2???: **H5N1**

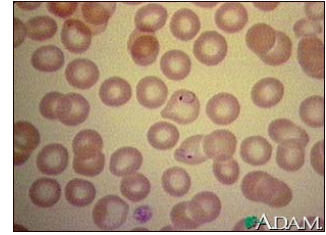
◆ “Spanish Flu”, March 1918 to June 1920: spread to nearly every part of the world (including the Arctic and remote Pacific islands), caused by an **unusually virulent and deadly strain** of **H1N1**. An estimated **500 million** people became infected, which was roughly **one-third** of the world population at the time! An estimated **50-100 million** people died, more than in **World War I** and possibly, more than the **Black Death**!

- There are **~36,000** seasonal flu-related deaths every year in the U.S., mostly the very young (< 2) and the very old (>70) with chronic health problems. The **1918-19** strain of **H1N1** was unusual in that it killed mostly **young adults, aged 20-40**.



- Other current pandemics:

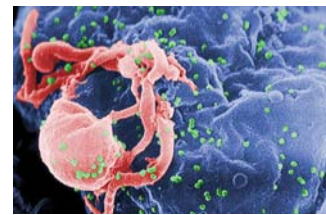
♦ **Malaria:** a disease caused by four main species of the *Plasmodium* parasite, delivered by the female **anopheles mosquito**.



- **Malaria** has been around for thousands of years and currently affects more than **90** countries and **~500** million people. It is **endemic** (constantly present) in the tropics, and in **sub-Saharan Africa** (which accounts for **~90%** of all **malaria** cases).

Malaria causes **1-2 million** deaths annually (and accounts for **25%** of all deaths of children under the age of 5). It is curable, but most countries lack an effective public health system.

♦ **HIV:** a form of retrovirus called *Lentivirus* causes **AIDS** in humans, in which the **immune system** begins to fail, leading to life-threatening opportunistic infections.



 • Since its discovery in **1981**, **AIDS** has killed more than **25 million** people, a third of the deaths occurring in **sub-Saharan Africa**. **HIV** infects **~0.6%** of the world's population.

♦ **Ebola:** a common term for a group of viruses belonging to *Ebolavirus*, a *viral hemorrhagic fever* (VHF) with a mortality rate as high as **50-90%**.

There is no vaccine or treatment, but due to its **extreme virulence**, if contained, will run its course and not spread. Since **1976** outbreaks have only been in **sub-Saharan Africa**. The current ongoing epidemic in **west Africa** has claimed over **11,200** lives!

