BACTERIA VS. VIRUS

Bubonic Plague vs. Polio
### Background information

#### Bubonic Plague
- Bubonic plague is best known as the “Black Death”.
- Bubonic Plague infected China in early 1300’s later spread to Western Europe and Asia.
- 25 million people, one third of Europe’s population, died from the bacteria.
- The Bubonic Plague did not disappear until early 1600’s.

#### Polio
- Polio is regarded as the simplest significant virus.
- Epidemics of Polio began in Europe and the U.S. around 1900.
- The 1940’s and 1950’s were the worst Polio epidemic years.
- 1952 was the worst year of the epidemic with 3,145 deaths in the U.S.
- There are 3 types of the Polio Virus
  - Mahoney
  - Leon
  - Lansing
Since 25 million total deaths occurred in Europe as a result of poor sanitation and low standard of living, **what do you think the effect would be on the economy?**
To answer the question...

- Different people were affected by the plague:
  - Aristocrats- because agricultural prices dropped, their money and power was now endangered.
  - Serfs- because of the deaths of so many people, they found their work of tilling land was in high demand raising wages, improving conditions of their employment.

- Because of this sickness, people learned to use better hygiene than before.
Because Polio struck so many young people in the U.S. in the 1940’s and 50’s how do you believe it could have affected the economy?
When this generation grew up, the outcome would be evident in the work force. The number of people with jobs would be smaller because

- The population would be smaller
- The people that were well enough to work were weakened by the virus
- The amount of people well enough to work would be older, and more healthy people (who had not been exposed to the virus as young children) would be forced to work beyond retirement age.
Compare and Contrast Economic Impact of Bubonic Plague and Polio

Compare

♦ From both illnesses the society learned lessons:
  / bubonic plague: people learned to be more sanitary
  / polio: vaccine was discovered

***These lessons affected the economy because they resulted in decreased incidence of both illnesses.***

Contrast

♦ The bubonic plague greatly affected people of all ages, which affected the economy at the time and in the future.

♦ Polio affected some generations more than others, so most effects were seen later (when those generations were introduced into the work force.)

***The times in which the illnesses affected the economy were different because the age groups in which the illness was affecting was different.***
Structure of the Bubonic Plague bacteria

- **Genome**
  - genetic material
  - DNA

- **Membrane**
  - Ribosomes
  - Cytoplasm

- **Cell Wall**
  - Inner phospholipid
  - Piptidoglycan
  - Outer lipopolysaccharide layer

- **Pilus**
Structure of the Poliovirus

- **RNA genome**
  - single stranded positive-sense, about 7500 nucleotides long

- **Protein Capsid**
  - Contains 60 protein subunits, the outer part of the virus
  - protect the fragile RNA genome

**Enveloped Proteins** -

- **Matrix Proteins**
  - internal proteins that connect internal nucleocapsid

- **Glycoproteins**
  - transmembrane proteins

- **Transport Channel**
  - protein-lined channel through the envelope, which enables the virus to alter the permeability of the membrane
Taxonomy of Bubonic Plague and Polio

Bubonic Plague
- **Phylum:** Proteobacteria
- **Class:** Gammaproteobacteria
- **Order:** Enterobacteriales
- **Family:** Enterobacteriaceae
- **Genus:** Yersinia
- **Species:** Y. bubonic

Polio
- **Family:** Picornaviridae
- **Genus:** Enterovirus
- **Species:** E. poliovirus
Function of Bubonic Plague bacteria

- First the bubonic plague bacteria attaches to fleas, then these fleas attach to rats.
- During the time when the plague was very common (1300 and 1400’s), people were unhygienic and lived in very cramped spaces. As a result, the rats would come in contact with the people and infect them with the bubonic plague bacteria.
- Another way that the plague spread was by not disposing of the dead properly. People would keep the dead in their homes for funeral and spread the bacteria around to the people who came to see the dead.
What do you think people did to get rid of the bacteria, based on the last slide?
The bacteria has no vaccine, so this is what we think people did to limit the spread of the bubonic plague:

- Burn the dead right after they died
- Move away from people that were infected
- Make sure rats did not get into their homes or in contact with them at all

**Bring out your dead**
The polio virus gets into the body usually through digestive system. It then makes its way from the cells of the intestine to the brain, spinal cord and neck area. (Attacking the nervous system). The individual virus will attach itself to a cell (its host) with the many receptors it has. It then causes weakness, paralysis in the legs, arms, and eventually the lungs.
What do you think paralysis of the lungs would cause?
Paralysis* of the lungs means that the person would not be able to move or function their lungs, causing breathing problems.

For this problem 2 things were used:

- Iron Lung – a very expensive machine that maintained artificial breathing over a long period of time, used for very severe cases of lung paralysis
- Rocking Bed – a bed that went back and forward to aid breathing in more minor cases of lung paralysis

* Paralysis: complete or partial loss of function especially when involving the motion or sensation in a part of the body
Reproduction of Bacteria

- Reproduction can happen as fast as every 20 minutes.
- There are two types of bacteria reproduction
  - Sexual
    - Two bacteria exchange genetic material and the product will have a mix of parents genes. This is called Conjugation.
  - Asexual
    - One bacteria makes an exact replica of itself. This is called Binary Fission.
Reproduction of Virus

- Viruses do not go through cell division because they are acellular.
- Instead they attach themselves to a host cell and produce multiple copies of itself.
- At the same time that the virus is affecting the cell negatively, the virus can be reproducing with the help of the host cell.
- The effects that the virus is having on the cell while the cell is helping the virus to reproduce are cytopathic.
Compare and Contrast
Reproduction of Bacteria and Virus

**Compare**
- Bacteria and viruses both can use another thing to reproduce. Bacteria can reproduce with another bacteria, and viruses can reproduce by using a host cell.

**Contrast**
- Bubonic Plague can either reproduce with another bacteria or by itself, whereas polio does not have any options. Polio *needs* to be attached to a host cell to reproduce.
QUIZ

- How many types of polio were there?
  - Can you name one of them?
- What insect spread the bubonic plague?
  - What animal did this insect further spread the bacteria to?
- Define lung paralysis?
  - Name and explain one way they treated lung paralysis.
- How did the bacteria affect the serfs?
  - How ‘bout them aristocrats?
- Bubonic Plague was also known as black ______?
- Which of the two (bacteria or virus) needs a host cell to reproduce?
  - What did the other (bacteria or virus) need to reproduce?
- How does polio usually enter the body?
- What age group was most affected by Polio?
  - In what ways did this age group being struck polio, affect the economy?