How does the immune system protect the body from invasion?

A virus consists of a nucleic acid surrounded by a protein coat

Viruses are not cells

Depending on its type of nucleic acid, a virus is called a DNA virus or an RNA virus

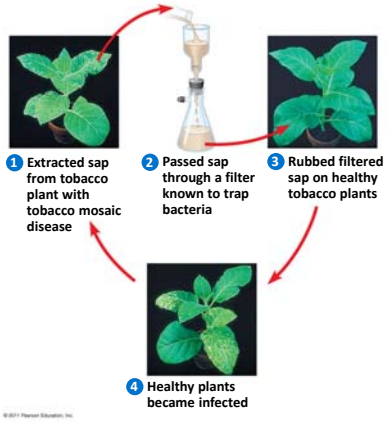
Viruses replicate only in host cells

Viruses are intracellular **parasites**

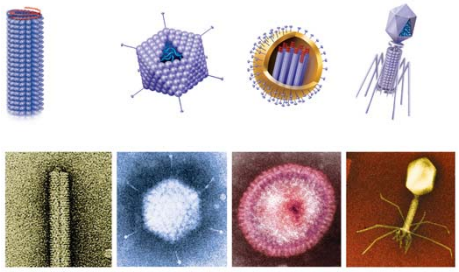
A virus is not alive

The Discovery of Viruses

- Tobacco mosaic disease stunts growth of tobacco plants and gives their leaves a blotchy pattern.
- In the late 1800s, researchers hypothesized that a particle smaller than bacteria caused the disease.
- In 1935, Wendell Stanley confirmed this hypothesis by crystallizing the infectious particle, now known as tobacco mosaic virus (TMV).



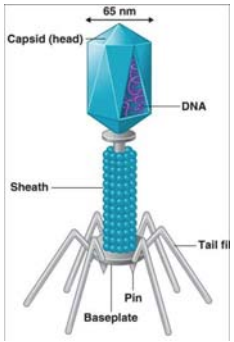
A capsid is the protein shell that encloses the viral genome



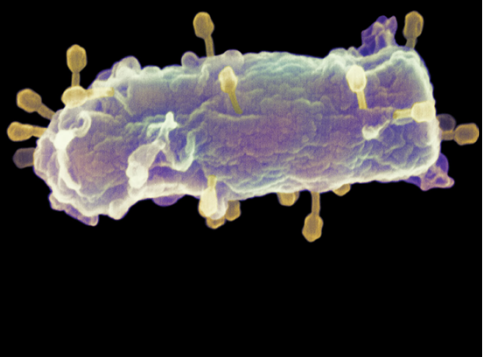
Bacteriophages, also called phages, are viruses that infect bacteria

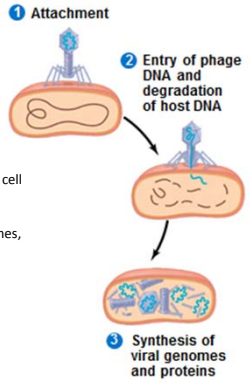
They have the most complex capsids found among viruses

Phages have an elongated capsid head that encloses their DNA



Bacteriophages can infect and take over bacteria, such as Escherichia coli

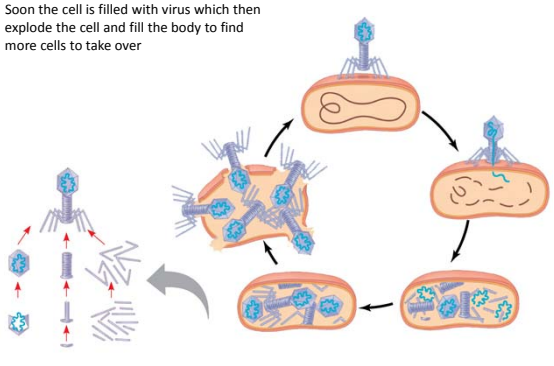




Once the viral genome has entered a cell, the cell begins to manufacture viral proteins

The virus makes use of host enzymes, ribosomes, tRNA, amino acids, ATP, and other molecules

Soon the cell is filled with virus which then explode the cell and fill the body to find more cells to take over



A cell can initiate RNA interference when it detects viral infection, which works by decreasing the influence of the virus's genetic material in relation to the cell's usual material.

The immune system also kicks into gear when it identifies a virus by producing antibodies that bind to the virus and render it unable to replicate.

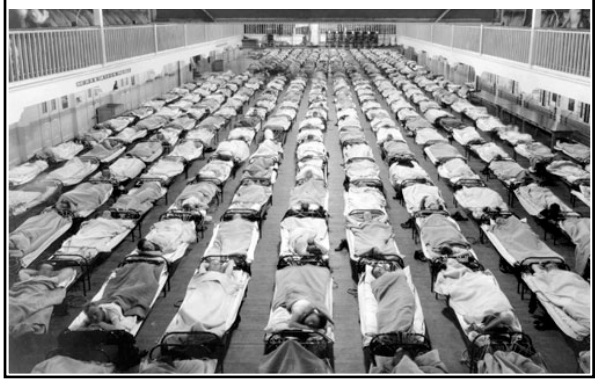
The immune system releases T-cells, which can destroy the virus.

Antibiotics have no effect on viruses, though vaccinations will provide immunity.

A vaccine is a biological preparation that improves immunity to a particular disease.

The vaccine stimulates the body's immune system to recognize the pathogen as foreign, destroy it, and keep a record of it, so that the **immune system can more easily recognize and destroy** any of these microorganisms that it later encounters.

Think getting the flu is no big deal?



http://www.cbsnews.com/videos/an-inside-look-at-h1n1-vaccine-production/

Disease Name	Virus Type	Organs Affected	Transmission
• Influenza	RNA	Respiratory Tract	Droplets
• Adenovirus Infections	DNA	Lungs, Eyes	Droplets, Contact Droplets
• Respiratory Syncytial Disease	RNA	Respiratory Tract	Droplets
• Rhinovirus Infections	RNA	Upper Respiratory Tract	Droplets,Contact
• Herpes Simplex	DNA	Skin,Pharynx, Genital organs	Contact
• Chicken pox (Varicella)	DNA	Skin, Nervous System	Droplets, Contact
• Measles (Rubeola)	RNA	Respiratory Tract, Skin	Droplets, Contact
• German Measles (Rubella)	RNA	Skin	Droplets, Contact
• Mumps (Epidemic Parotitis)	RNA	Salivary Glands, Blood	Droplets
• Small Pox (Variola)	DNA	Skin, Blood	Contact, Droplets
• Warts Kawasaki Disease	DNA	Skin	?
• Yellow Fever	RNA	Liver, Blood	Mosquito (Aedes Aegypti)
• Dengue Fever	RNA	Blood, Muscles	Mosquito (Aedes Aegypti)
• Hepatitis A	RNA	Liver	Food, Water, Contact
• Hepatitis B	DNA	Liver	Contact with body Fluids
• NANB Hepatitis	RNA	Liver	Contact with body Fluids
• Viral Gastroenteritis	Many RNA Viruses	Intestine	Food, Water
• Viral Fevers	Many RNA Viruses	Blood	Contact,arthropods
• Cytomegalovirus Disease	DNA	Blood, Lungs	Contact, Congenital transfer
• AIDS	Retrovirus (RNA)	T-lymphocytes	Contact with body Fluids
• Rabies	RNA	Brain, Spinal cord	Conact with body Fluids
• Polio	RNA	Intestine,Brain, Spinal Cord	Food, Water, Contact
• Slow Virus Disease	Prions	Brain	?
• Arboviral Enephalitis	Many RNA viruses	Brain	Anthropods

Poliomyelitis (polio or infantile paralysis) is an acute, viral, infectious disease spread from person to person, primarily via the fecal-oral route.

First recognized in 1840 as a disease it wasn't until 1908 that the poliovirus was identified.

Major polio epidemics started to appear in the late 19th century and it became one of the most dreaded childhood diseases of the 20th century.

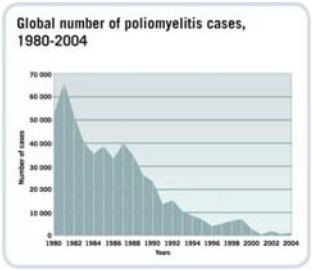
By 1910, much of the world experienced a dramatic increase in polio cases and epidemics became regular events, primarily in cities during the summer months.

These epidemics left thousands of children and adults paralyzed provided the impetus for a "Great Race" to develop a vaccine.

Two types of vaccine are used throughout the world to combat polio. Both types induce immunity to polio, efficiently blocking person-to-person transmission of wild poliovirus, thereby protecting both individual vaccine recipients and the wider community (so-called herd immunity).

The inactivated virus vaccine was developed in 1952 by Jonas Salk at the University of Pittsburgh, and announced to the world on 12 April 1955.

The Salk vaccine, or inactivated poliovirus vaccine (IPV), is based on poliovirus grown in a type of monkey kidney tissue culture (vero cell line), which is chemically inactivated with formalin. After two doses of IPV (given by injection), 90% or more of individuals develop protective antibody to all three serotypes of poliovirus, and at least 99% are immune to poliovirus following three doses.



The Los Angeles Times
May 29, 2008 Jenny Jarvie

Dianne Odell, 61, exceeded expectations after polio paralyzed her at 3. This was not her first power outage.

ATLANTA — For the first time in more than half a century, the Odell residence is quiet.

There are no squeaks and pops from the electric motor that powered an "iron lung" pumping air in and out of Dianne Odell's body. A thunderstorm knocked out the power to her home Wednesday, shutting off the massive metal machine that had helped her breathe for nearly 60 years.

It was about 3 a.m. when the electricity went out at Odell's home in Jackson, a small Tennessee town about 90 miles northeast of Memphis. An emergency generator did not start, and Odell died as her father and brother-in-law took turns pumping the iron lung manually.

Dianne Odell, 61, was believed to be the nation's oldest survivor of polio to have spent almost all of her life inside an iron lung. She had been confined within the 7-foot-long, 750-pound machine ever since she was paralyzed at the age of 3 by bulbospinal polio. That was in 1950, just a few years before a polio vaccine was discovered.

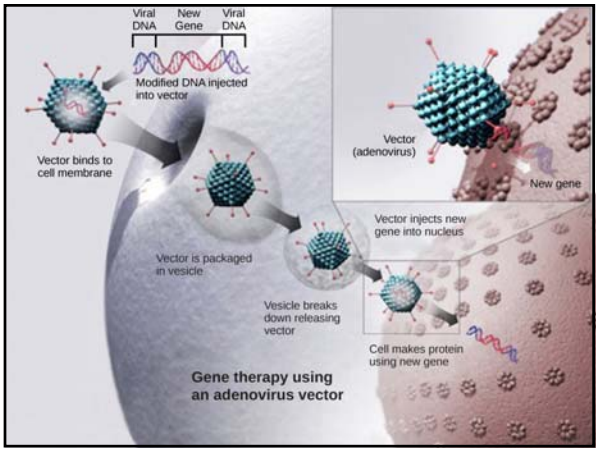
Her parents, Freeman and Geneva Odell, were determined to care for her at home, even though her entire body was encased in a cylindrical metal chamber. Only her head extended outside of it.

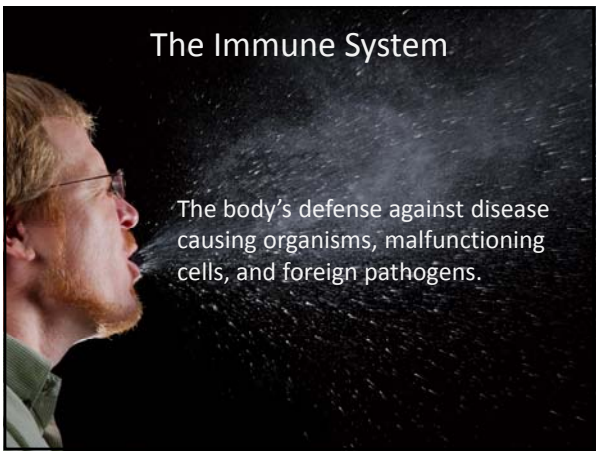
Viruses are not just used for evil.

Viruses are the vectors of choice for inserting new genes into animal cells.

When the virus reproduces within the animal cell, it also reproduces the foreign gene that it carries. The gene is therefore cloned.

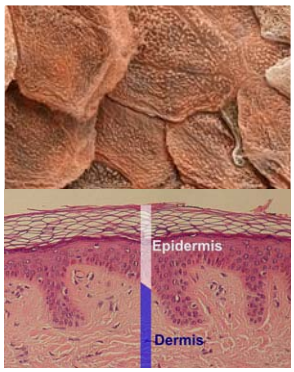
Biotechnology refers to technology used to manipulate DNA and often referred to as genetic engineering.





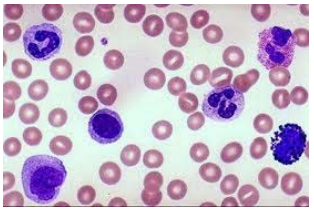
Skin is a Barrier to Infection

- The dead, outer layer of skin, known as the **epidermis forms a shield** against invaders and secretes chemicals that kill potential invaders
- You shed between 40 – 50 thousand skin cells every day!



White Blood Cells

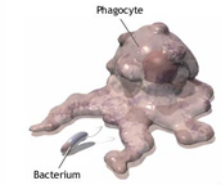
- If pathogens get inside the body, then your white blood cells begin their attack



Leukocytes (white blood cells) normally circulate throughout the blood, but will enter the body's tissues if invaders are detected

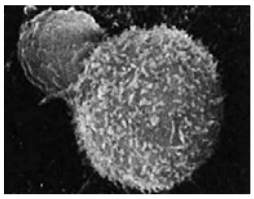
White Blood Cells

- White blood cells are responsible for eating foreign particles by engulfing them
- Once engulfed, the phagocyte breaks the foreign particles apart using the lysosomes



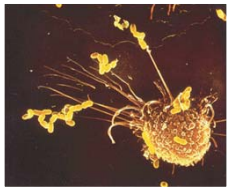
White Blood Cells
That's Mr. T-Cells to you

- T-Cells, often called killer T-cells, recognize infected human cells and cancer cells and kill them.



Antibody Production

- After the WBCs phagocytize the foreign particles and break them down they show the pieces to the T-cells, who identify the pieces and find specific B-cells to help
- B-cells produce antibodies that are equipped to find that specific piece on a new particle and attach



Specific immunity

- Specificity: based on shape recognition of cell surface antigens
- Diversity: Any shape can be recognized by a B or T-lymphocyte and trigger an immune reaction
- Memory: once a pathogen has activated the immune system, memory cells remain and will protect against a secondary infection
- Self-tolerance: the immune system does not attack itself