

# Studying Viruses, their Diseases and the Immunology that Follows

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Year 13

Planning to study Virology and Immunology



# What is a Virus?

- Viruses are microbes that enter the body through orifices or open wounds.
- Viruses are made up of a center of DNA or RNA that is coated with capsid (A protective protein layer).
- They survive by entering a host's cell and replicating eventually causing cell lysis (bursting of the cell), this releases the new viruses so they can enter new cells.
- Unlike bacteria the body does not have a collection of naturally occurring viruses that are beneficial. This means that when a virus enters the body it triggers an immune response.

Fun Fact;

Viruses cannot be classed as microorganisms as they are not living



# The Immune System

## The Innate Immune System

- This is the natural barriers of the body to resist infection;
  - Skin covers the surface of the body stopping pathogens from entering.
  - Mucus in the throat and eyes traps pathogens and often contains chemicals to kill them.
  - Cilia in the respiratory system prevents pathogens from entering the body by causing coughing to bring them back up
  - If the skin is broken, then blood clots the wound and there is an influx of white blood cells to the area stop microbes entering or killing them before an infection occurs.
  - Finally if a pathogen has entered the body then the stomach acid kills many of them.

## The Adaptive Immune System

- This is the bodys response to antigens that enter the body;
  - This is caused by lymphocytes that are formed in the stem cells in bone marrow
  - B lymphocytes from the spleen divide into plasma cells (release antibodies) and memory cells (used if a second infection occurs)
  - Antibodies bind to the antigens clumping them together (agglutinate). Macrophages then engulf and digest these.
  - T lymphocytes matured in the spleen divide into T memory cells, T killer cells (cause lysis to the pathogens) and helper cells.



# Common Diseases and the Viruses that Cause them

## Viruses

- HIV (Human Immunodeficiency Virus)
- Influenza
- Measles

## Disease

- HIV is a virus that effects the immune system reducing its ability to fight infections. This is uncurable but there are medications available to prevent it from worsening and becoming AIDS.
- Influenza causes the Flu. There are many types of flu viruses that all cause similar symptoms that are often compared to having a bad cold e.g., coughing, sneezing and fevers
- Measles is most often identified by a red rash that does not fade when pressure is applied. It is most often diagnosed in children; however anyone can get infected if they are not vaccinated.

### Fun Fact;

Viruses all tend to have similar symptoms. These are not caused by the virus but are side effects of the immune response, e.g. fever



## Active

- This occurs when the body produces its own antibodies;
  - Infection causes active immunity as the memory cells contain antibodies that can rapidly be created in order to fight a second infection should it occur.
  - Vaccinations contain weakened or inactive pathogens that create an immune response without any symptoms.

# Immunity

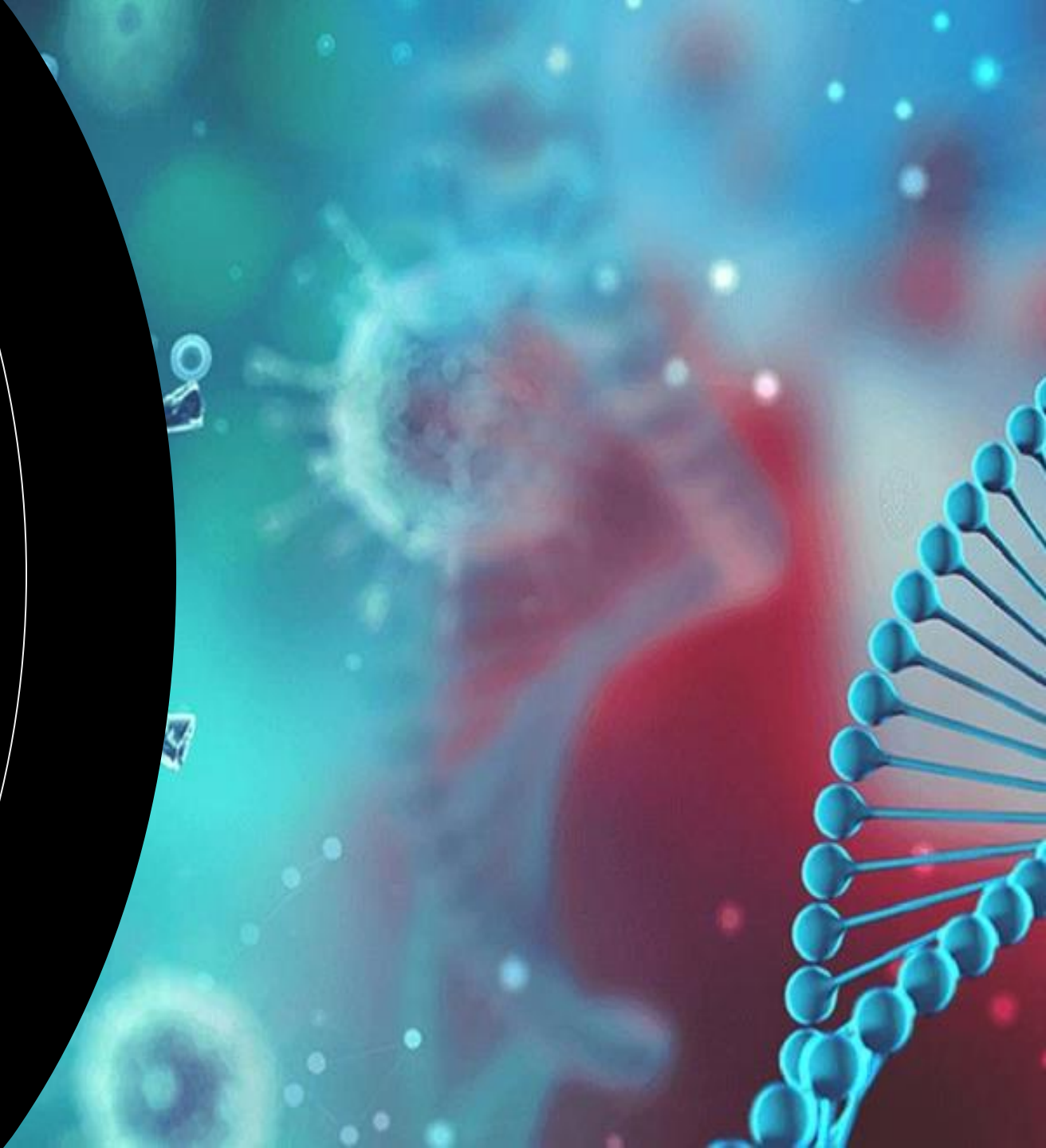


## Passive

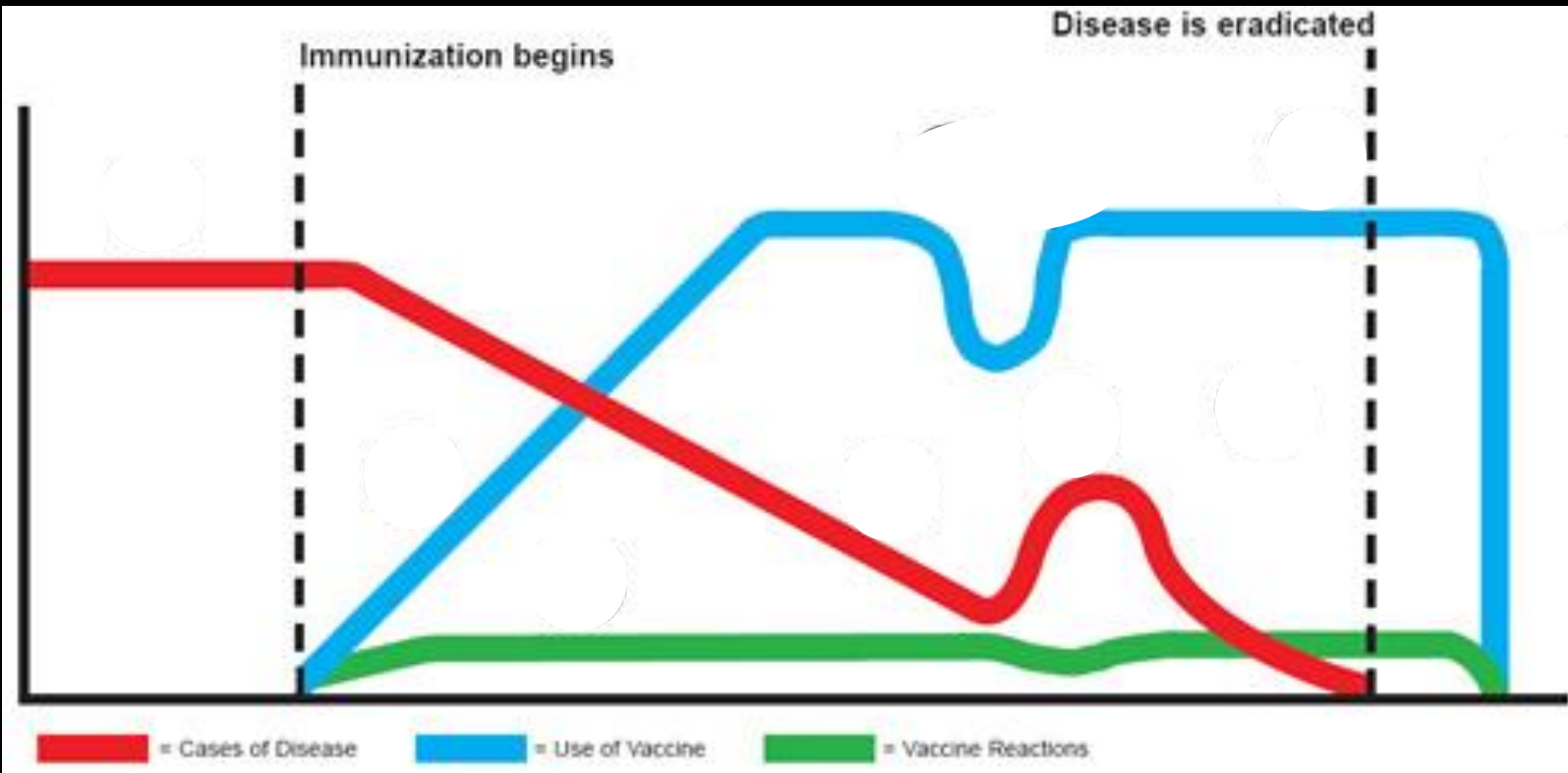
- Antibodies that are not created by the individual but given to them;
  - Antibodies are small enough that they can be transferred across the placenta from the mother to the foetus.
  - They are also found in breast milk, mainly the colostrum (first milk produced) to protect the baby before it develops its own immune system

# Mutations and how it can effect vaccines

- The reason that you must get the flu vaccine ever year is because the Influenza virus mutates via antigenic drift in which two viruses join to form a third new virus.
- This means that the antibodies from the memory cells are no longer complementary, therefore the previous year's vaccine is useless as it cannot stop a new infection.
- Instead of a much shorter secondary infection you have to restart with a primary infection with all the symptoms.
- When creating the yearly vaccine they look at previous years flu pattern to see what types might be most prevalent that year. Due to the mutations this isn't always accurate and doesn't always prevent all types of flu so even if you are vaccinated you may still catch the flu.



# How Vaccines Affect Infections



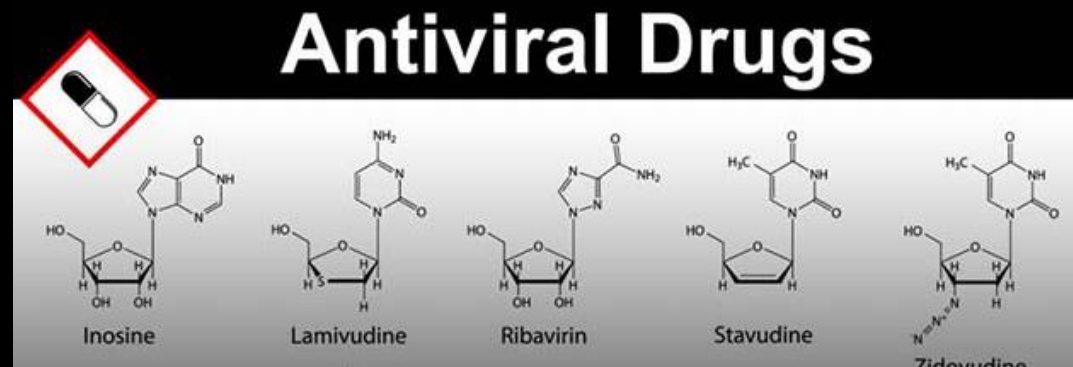
- Vaccines are the most effective way of fighting viruses; this is shown by the graph. When vaccines are introduced the cases of diseases drop significantly.

- If the vaccine is stopped too quickly a rise in cases can occur as a second wave.

- However, if there are no cases the vaccine can be stopped and the disease has been eradicated, for example Smallpox.

# Antiviral Medication

- Antiviral medication is very difficult to create as they often harm the host cells in the process.
- Some have however been created. They often do not kill the virus but instead stop the virus from reproducing in a host cell by inhibiting certain enzymes. This means that lysis is avoided and the virus doesn't spread.





# Pandemic VS Epidemic

- An epidemic is an outbreak that spreads quickly and affects many individuals at the same time.
- For example, the Ebola virus affected mainly African countries and killed more than 11,000 people between 2013 and 2016.
- A pandemic crosses geographical borders and affects a large percentage of the population.
- For example, the Corona Virus has had a worldwide effect killing over 400,000 people.

# Virology and Immunology

- I'm really looking forward to studying this course in university as it is an ever-changing subject, with new viruses emerging constantly.
- My aim is to finish my degree then do a masters before going into lab work with the aim of studying viruses to find vaccines.
- Thank you for the opportunity to give you an insight into the world of viruses, diseases and immunology.