More on infectious Diseases

L1 Communicable diseases

Communicable and non-communicable diseases are two broad categories that help us understand the nature and transmission of various illnesses.

Firstly, communicable diseases, also known as infectious diseases, are caused by pathogens such as bacteria, viruses, fungi, or parasites. These diseases can be spread from person to person, or through vectors like mosquitoes. Common examples include the flu, tuberculosis, and COVID-19. The transmission often involves direct or indirect contact with an infected person or their bodily fluids. It's like a chain reaction where one person passes the illness to another. There are a wide range of measures people can carry out to prevent the spread of communicable diseases, for example handwashing and sterilising water.

In contrast, non-communicable diseases (NCDs) are not caused by infectious agents and cannot be transmitted from person to person. Instead, they typically result from a combination of genetic, lifestyle, and environmental factors. Non-communicable diseases include conditions like heart disease, diabetes, and certain types of cancers. These illnesses often develop over a longer period and are influenced by factors such as diet, physical activity, smoking, and genetics. Unlike communicable diseases, you can't "catch" a non-communicable disease from someone else.

Understanding the difference between communicable and non-communicable diseases is crucial for preventing and managing health issues. While communicable diseases require measures like vaccination, hygiene practices, and quarantine to control their spread, non-communicable diseases often necessitate lifestyle changes such as maintaining a healthy diet, regular exercise, and avoiding tobacco and excessive alcohol consumption.

In the 19th century, Dr Semmelweiss investigated infection in a hospital. He compared the number of deaths of mothers on two maternity wards. On **Ward 1**, babies were delivered mainly by doctors/medical students. These doctors worked on many different wards in the hospital, and carried out dissections on dead bodies. On **Ward 2**, babies were delivered by midwives. The midwives did **not** work on other wards. It was found fewer mothers died on ward 2. Dr Semmelweiss in 1948 asked doctors to wash their hands before delivering babies and found that this dramatically reduced the number of deaths, leading to the discovery of the importance of handwashing.

Independent practice

1) What are communicable diseases, and how are they different from non-communicable diseases?
2) Explain why the flu is communicable but lung cancer is not.
3) What are pathogens, and how do they relate to communicable diseases?
4) Susan's aunt has diabetes, and Susan is worried that she will also get diabetes. Is it possible for Susan catch it off her aunt?
5) Kevin was born with a heart condition, the same one that his farther has. Is the heart condition communicable or non-communicable?

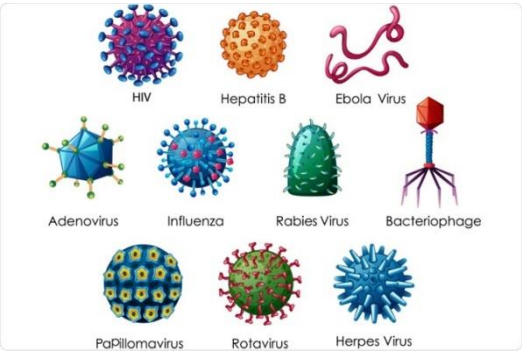
Extended writing paragraph needed.

6) How can communicable diseases be prevented.
7) Explain the importance of Dr Semmelewiss' research and how it has impacted your life.

L2 Viral Diseases

Unlike living cells, viruses aren't considered alive because they can't carry out the basic functions of life on their own. Instead, they depend on infecting host cells to survive and reproduce. As viruses live and reproduce inside of cells they are often difficult to treat, and cause damage to cells. These sneaky invaders can infect a variety of organisms, from bacteria to plants, animals, and even humans.

Viruses are incredibly small, much smaller than cells. They consist of genetic material, either DNA or RNA, surrounded by a protein coat called a capsid. . Viruses aren't made up of cells, so they don't have all the equipment that cells do to make more copies of themselves. Hence why they rely on the hosts cells.



One notorious virus that affects humans is the measles virus. Measles primarily spreads through respiratory droplets, making it easy for the virus to pass from person to person. Measles starts with symptoms similar to a common cold, such as a runny nose, cough, and fever. However, it doesn't stop there. A characteristic red rash often follows, spreading across the body. Measles can lead to serious complications, including pneumonia and encephalitis (inflammation of the brain), especially in young children or those with weakened immune systems. The good news is that measles is preventable through vaccination. The measles, mumps, and rubella (MMR) vaccine is a powerful tool in preventing the spread of the virus.

Human Immunodeficiency Virus (HIV) is a viral infection that attacks the immune system, compromising its ability to defend the body against infections and diseases. Transmitted through unprotected sexual contact, blood transfusions, and sharing of needles, HIV can lead to Acquired Immunodeficiency Syndrome (AIDS) if left untreated. The virus targets CD4 cells, crucial components of the immune system, gradually weakening the body's defences. Early symptoms may include flu-like symptoms such as fever, fatigue, and swollen lymph nodes. While there is no cure for HIV, antiretroviral therapy (ART) helps manage the virus, allowing people with HIV to lead healthy lives. Prevention, including safe practices and awareness, plays a vital role in controlling the spread of HIV.

Tobacco Mosaic Virus (TMV) is a plant pathogen known for its distinctive impact on tobacco plants. This virus causes mosaic-like patterns on leaves, hindering photosynthesis and stunting plant growth. TMV is highly contagious and can spread through direct contact or contaminated tools, posing a significant threat to crops.

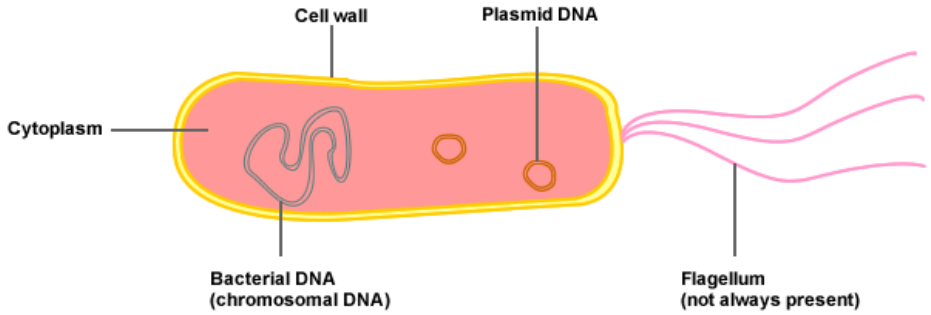
Independent practice

1. Why is measles less of a concern now than in the past?
2. Explain why a person with AIDs are frequently hospitalised.
3. HIV stigma is negative attitudes and beliefs about people with HIV and was particularly apparent in the 80s. People used to refuse physical contact with HIV patients for fear of catching HIV, explain why this fear was unfounded.
4. Suggest why global pandemics caused by viruses (eg the coronavirus pandemic) could become more common.
5. Explain the impact of TMV on plant growth.

   Extended writing questions (paragraph needed)
6. Explain how to prevent the spread of measles, and why some disease prevention methods will not work.
7. Explain how the spread of HIV can be controlled.

L3 Bacterial Diseases

Bacteria are unicellular prokaryotic organisms. This means they consist of only one cell and do not contain a nucleus. Often bacteria will not only have free DNA but will also have rings of DNA known as plasmids. The diagram below shows the structure of a bacterial cell.



Bacteria, while often tiny and unseen, play significant roles in the world of biology. Some bacteria are helpful, aiding in processes like digestion, while others can cause infections. Antibiotics can be used to treat bacterial infections, but due to increasing use there is a rise in antibiotic resistance. Salmonella and gonorrhoea are two examples that showcase the diversity of bacterial infections, each with its own story and impact on human health.

Salmonella

- Salmonella is a type of bacteria notorious for causing foodborne illnesses. Imagine enjoying a delicious meal, and suddenly you fall ill with symptoms like nausea, vomiting, stomach cramps, and diarrhoea. That might be the work of Salmonella.
- These bacteria primarily enter the body through contaminated food or water. Undercooked poultry, eggs, and unpasteurized dairy products are common culprits. Once inside the body, Salmonella sets up camp in the intestines, leading to the uncomfortable symptoms mentioned earlier.
- Our immune system recognizes Salmonella as an intruder and launches a defence, but these bacteria are cunning. They have mechanisms to resist our body's efforts, making them persistent invaders. In severe cases, Salmonella infections can lead to dehydration and may require medical attention.
- Prevention is key in the fight against Salmonella. Cooking food thoroughly, especially poultry and eggs, and practicing good hygiene, like washing hands and utensils regularly, can significantly reduce the risk of infection. Also, being cautious with food storage and avoiding raw or undercooked foods can be vital in preventing a Salmonella showdown.

Gonorrhoea

- Gonorrhoea, a sexually transmitted infection caused by the Neisseria gonorrhoeae bacteria.
- Gonorrhoea is transmitted through sexual contact with an infected person.
- This bacterial invader often goes unnoticed, as many infected individuals may not experience symptoms initially. When symptoms do appear, they can include painful urination, abnormal discharge, and pelvic pain. However, some people may carry the bacteria without showing any signs, unknowingly spreading it to others. If left untreated, gonorrhoea can lead to more severe complications, such as pelvic inflammatory disease in females and infertility.
- Detecting gonorrhoea early is crucial. Regular testing, especially for sexually active individuals, helps identify and treat infections promptly. Antibiotics are commonly used to combat the bacteria, but the increasing resistance of Neisseria gonorrhoeae to antibiotics underscores the importance of responsible antibiotic use and ongoing research to develop new treatment strategies.

Independent practice

1. State and explain if bacteria cells are prokaryotic or eukaryotic.
2. Suggest why salmonella is more commonly known as food poisoning.
3. Why might gonorrhoea go unnoticed in some individuals?
4. Suggest how a person can minimise their risk of catching gonorrhoea.
5. Explain the importance of early detection in treating gonorrhoea.

Extended writing questions

6. Compare and contrast Salmonella and gonorrhoea.
7. Why is it crucial to stay informed about antibiotic resistance, especially concerning bacterial infections like gonorrhoea?

L4 Fungal Diseases

Fungal diseases are illnesses caused by fungi, microorganisms that belong to a separate kingdom from plants and animals. These diseases can affect various organisms, including humans, animals, and plants. Fungi thrive in warm and moist environments, making them particularly troublesome in areas with these conditions.

In humans, fungal infections can manifest on the skin, nails, and internal organs. One common example is athlete's foot, a skin infection caused by a fungus that thrives in damp places like swimming pools and locker rooms. Another well-known fungal infection is ringworm, which affects the skin, scalp, and nails.

Fungi can also impact plants, causing diseases that affect crops and, consequently, food production. For instance, powdery mildew and rust are common fungal infections that can devastate crops like wheat and barley. Farmers must implement preventive measures and use fungicides to protect their crops from these diseases.

Rose black spot is a common fungal disease that affects rose plants. Identified by dark black spots with fringed edges on leaves, it weakens the plant by reducing its ability to photosynthesise. This can result in yellowing and premature dropping of leaves, ultimately hindering the rose's growth and blooming. To combat this pesky ailment, ensure good air circulation around your roses, prune infected leaves promptly, and consider using fungicides. Regular inspection and care will keep your roses healthy and vibrant, allowing them to flourish and bring beauty to your garden.

Animals are not exempt from fungal infections either. In veterinary science, ringworm is a common concern among domestic animals like cats and dogs. Additionally, there are fungal diseases that can affect livestock, leading to economic losses for farmers.

Preventing fungal diseases involves maintaining good hygiene practices, especially in areas prone to moisture and warmth. Regular cleaning and proper ventilation help create an environment less favorable for fungal growth. In human health, maintaining a strong immune system through a balanced diet and healthy lifestyle choices is crucial for preventing fungal infections.

Treatment for fungal diseases often involves antifungal medications. These drugs target the specific mechanisms of fungal cells, inhibiting their growth and spread. However, effective treatment may vary depending on the type of fungus and the severity of the infection.

Independent practice

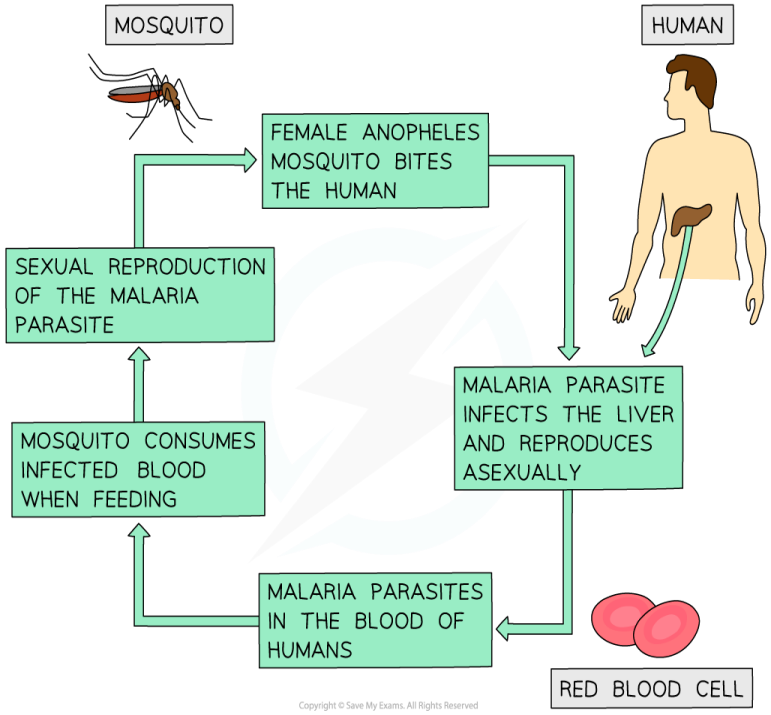
1. What kingdom will the ringworm pathogen belong to?
2. Explain why bathrooms often get mould growing in them.
3. Where does photosynthesis occur in plant cells?
4. Explain how rose black spot reduces photosynthesis.
5. How do fungal diseases in livestock lead to economic losses for farmers?
6. Explain how to prevent fungal infections in humans.

Extended writing (Paragraph needed)

7. Compare fungi to both bacteria and viruses.
8. Explain how and why it is vital for farmers to prevent the spread of fungal pathogens in their fields.

L5 Protist

Malaria, a significant global health concern, is a parasitic disease transmitted through the bites of infected mosquitoes. Malaria is NOT caused by mosquitoes, the mosquitos are vectors that carry the disease. Malaria is caused by the Plasmodium parasite. Malaria poses a threat to millions of people worldwide, particularly in tropical and subtropical regions.



The life cycle of the Plasmodium parasite involves two hosts: mosquitoes and humans.

Asexual reproduction is reproduction involving only one parent.

Sexual reproduction is involving two parents.

Common symptoms of malaria include fever, chills, and flu-like symptoms, which can escalate to severe complications if left untreated. The severity of the disease is often linked to the Plasmodium species causing the infection, with P. falciparum being the most deadly.

Malaria prevention strategies encompass both mosquito control and personal protection. Insecticide-treated bed nets and indoor residual spraying target mosquitoes, reducing their ability to transmit the parasite. Additionally, antimalarial medications, such as chloroquine, are employed for both treatment and prevention.

A challenge in combating malaria lies in the parasite's ability to develop resistance to antimalarial drugs, necessitating ongoing research for effective solutions. Moreover, the development of a malaria vaccine is a promising avenue to control the disease on a larger scale.

An additional challenge to fighting against malaria is that is common in many poorer countries in the tropical and sub tropical areas, where there are not the resources to treat malaria. Malaria's impact extends beyond health, affecting socio-economic conditions in endemic regions. The burden falls disproportionately on vulnerable populations, hindering economic development and perpetuating a cycle of poverty.

Independent practice

1. What causes malaria.
2. What role do female Anopheles mosquitoes play in the transmission of malaria?.
3. If malaria isn't diagnosed and treated quickly, it can be fatal. Suggest why some people are not diagnosed quickly.
4. Malaria can lead to anaemia, which affects red blood cells. Suggest and explain the symptoms of anaemia.
5. What challenges are associated with combating malaria.

Extended writing (paragraph needed)

6. Describe the life cycle of the Plasmodium parasite, including its hosts and key stages.
7. Describe and explain how to prevent the spread of malaria.

L6 Human Defence Systems

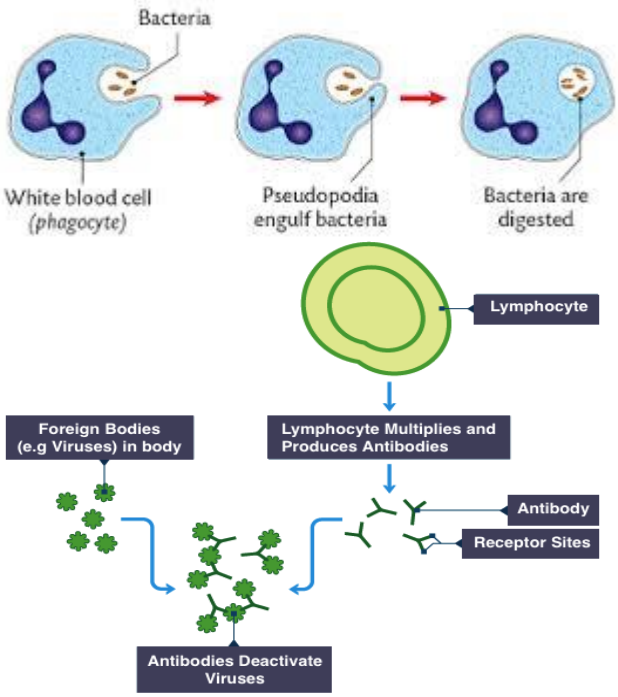
Humans live in a world surrounded by potential pathogens. Like all other organisms we have evolved defence systems to prevent us from getting ill. These defence systems are in two groups: specific and non-specific.

Non-specific defence systems: these are working all the time to prevent us from pathogens.

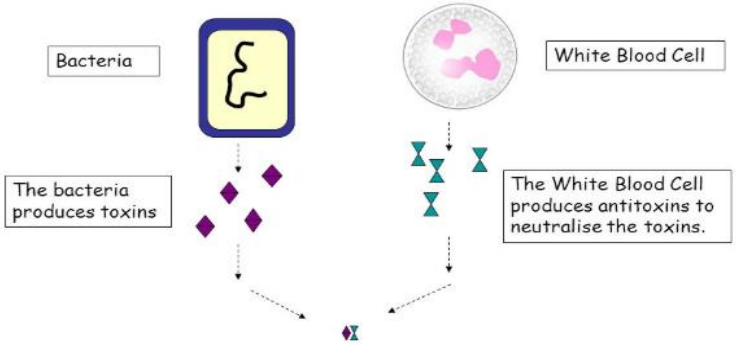
- Skin: Provides a protective barrier that prevents pathogens entering the body
- Nose: Contains tiny hairs that trap pathogens
- Trachea and bronchi: Contain ciliated epithelial cells which move mucus up to the nose. The mucus traps pathogens.
- Stomach: Contains acid. The acid destroys pathogens that are eaten

Specific defence systems: these are the immune system and they are aimed at destroying invaders

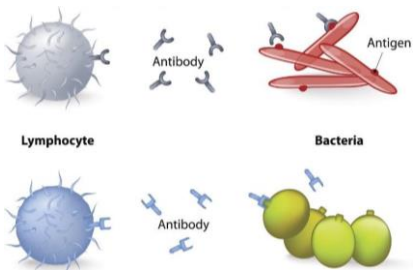
- **Phagocytosis**: White blood cells called phagocytes ingest (take in) pathogens, digesting them with enzymes so they cannot make you ill. Once the phagocytes have ingested as many pathogens as possible they die. Their dead cells form around a cut as puss
- **Antibody production**: White blood cells called white blood cells produce antibodies. These target specific pathogens and help to destroy them. Antibodies are specific to a particular pathogen and can be rapidly made again should re-infection happen.



- **Antitoxin production**: White blood cells can also produce antitoxins. These bind to the toxins made by bacteria and prevent them hurting your cells.



Once some of the White blood cells have begun producing antibodies and antitoxins others stay ready as **memory cells**. This means they can respond quickly if they are introduced to the same pathogen again. The immune system can adapt over time and build up a 'memory' of past infections. This means that over time you become more resistant to pathogens.



Independent practice

1. Why does the stomach contain acid?
2. If a person receives a cut on their skin, why should they put a plaster on?
3. What is an antigen?
4. Explain why white blood cells need to make different antibodies for different pathogens.
5. Compare antibodies to antitoxins.
6. What are memory cells.
7. Some people are immunocompromised due to poor production of white blood cells. Suggest what the consequences will be for the person.

Extended writing (paragraph needed)

8. how the non-specific defence systems protect the body against infection.
9. Explain how white blood cells protect us from invading pathogen.?