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Level 3 Health and Social Care: Principles and Contexts

Types and causes of infection

PATHOGENS

Pathogen / Pathogenic - a microorganism that causes, or can cause, disease

A pathogen or infection is a biological agent that causes disease or illness to its host. Pathogens cannot be seen by the naked eye and therefore present increased difficulty in controlling and managing the potential outbreaks of infection.

Heath and care setting management has a responsibility to ensure that its workforce is adequately trained. This should be specific to the healthcare setting on the potential presence of pathogens and the prevention of pathogen spread.

This includes all staff, including those providing a direct role such as doctors, nurses, GPs and dentists, and those providing supporting roles such as contractors, cleaners, kitchen staff, etc. Educating personnel has its challenges due to varied levels of understanding; however, **the greatest challenge is often in the provision of adequate risk limitation strategies for visitors who could introduce pathogens into the healthcare environment**.

BACTERIA

VIRUSES

FUNGI

PROTOZOA

PATHOGENS: **BACTERIA**

- ★ Bacteria are **small, single-celled organisms**.
- ★ They are found almost everywhere and, while many are non-pathogenic and therefore harmless, performing a necessary function in the body such as those in the intestines, which aid digestion, a number can cause significant and serious diseases.
- ★ 'Bad' bacteria can affect humans as they can cause disease by infecting individuals or they can cause food spoilage.
- ★ On the human body are flora (bacteria and organisms) which can be either normal – always present and do not cause a disease – or transient – opportunistic flora that cause disease.

BACTERIAL LIFE CYCLE

Bacteria reproduce through a process called binary fusion. The bacterium (one single cell of bacteria) divides into two identical cells; each contains the exact same DNA. These two cells then each divide into two to make four, the four then further divide.

If the conditions are optimal for growth, this can occur every 20 minutes.

BACTERIAL REQUIREMENTS FOR GROWTH

In order to survive and thrive, bacteria require an environment that contains nutrients and water, as a high percentage of the bacteria consists of water. Some bacteria are aerobic, which means they require oxygen to survive, and some are anaerobic, which means they do not require oxygen. Some bacteria create spores. These are capable of withstanding some negative physical and chemical conditions, which means they are difficult to destroy. These spores then become active when conditions are right.

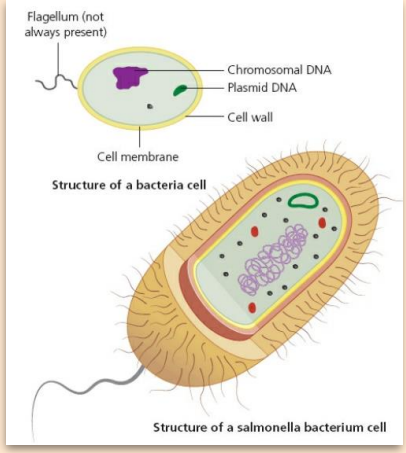
BACTERIAL STRUCTURE

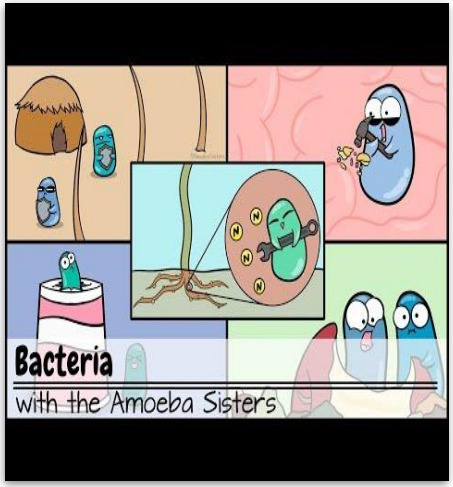
Bacteria do not have a nucleus; but they do have DNA, a cell wall and membrane. Some have a flagellum, which is a tail that helps it to move along.

Bacteria cause pathogenic disease by releasing harmful toxins.

Bacteria come in different shapes:

- ★ cocci - oval shaped
- ★ bacilli - rod and spiral shaped





EFFECT OF TEMPERATURE ON BACTERIAL GROWTH

Bacteria grow and reproduce more quickly when they are warm.

When bacteria are cold, for example between 0°C and 5°C (fridge temperature), they grow more slowly. Very cold temperatures, below –18°C, will render the bacteria dormant but not kill the microorganism.

Extreme high temperature will kill bacteria.

Different bacteria have different optimal growth temperatures. Bacteria that affect the body tend to grow best at temperatures between 20°C and 40°C.

PATHOGENS: **BACTERIA**

Examples of disease caused by bacteria

Bacteria and general information	How it is spread	Signs and symptoms	Treatment and prevention
Tuberculosis • Caused by the bacteria *Mycobacterium tuberculosis* • This condition mainly affects the lungs • It usually develops slowly	Spread through inhaling droplets from an infected person.	A cough that lasts for over 3 weeks and brings up phlegm. The cough may contain blood. Pyrexia. Weight loss and extreme tiredness. Night sweats. The lymph nodes in the body may have swellings which are not reducing in size.	Antibiotics normally for 6 months. A hospital admission is not always necessary. Can be cured with treatment, but can be fatal if not treated. A vaccination called the BCG (Bacillus Calmette-Guérin) is given to individuals in high-risk areas and some groups such as health and social care practitioners.
Salmonella poisoning • Affects the gastrointestinal system	Eating contaminated food.	• Diarrhoea • Stomach cramps • Vomiting • Fever	Symptoms usually last from 4 to 7 days. Most people recover without treatment. Some require treatment for dehydration. Prevention is through effective hand hygiene and adequate storage, preparation and cooking of food.
Staphylococcus Cause a wider range of infections which vary in severity and affect the skin and soft tissues or an invasive infection. Examples include: impetigo, a skin infection; and septic arthritis, which is when the bacteria enter a joint causing infection and inflammation. It can occur in any joint, but knees and hips are the most commonly affected.	***Impetigo***: affects the skin and is easily spread through close contact with another individual who has the condition. ***Septic arthritis***: bacteria enter an open wound and travel in the bloodstream to the joint. Certain groups are more at risk of developing septic arthritis such as those that have injured a joint or had recent surgery.	***Impetigo***: Red sores appear normally around the nose and mouth. The sores then burst. ***Septic arthritis***: Pain, swelling and redness in the area.	***Impetigo***: Antibiotic cream or tablets can be used for treatment. Prevention is through not sharing towels or flannels used by someone with impetigo and avoiding touching the area. ***Septic arthritis***: Treatment is with antibiotics.

PATHOGENS: **VIRUSES**

WHAT IS A VIRUS?

A **virus** is a tiny, infectious particle that lives inside living organisms. The particle is too small to be seen with the eyes, and it's made of DNA (genetic material that's like a string of directions) and a protective coating. It doesn't eat, breathe, or move on its own. In fact, a virus can only survive if it's inside a living thing, called a **host**, and the only job of the virus is to replicate (make copies of itself).

WHAT DOES A VIRUS DO?

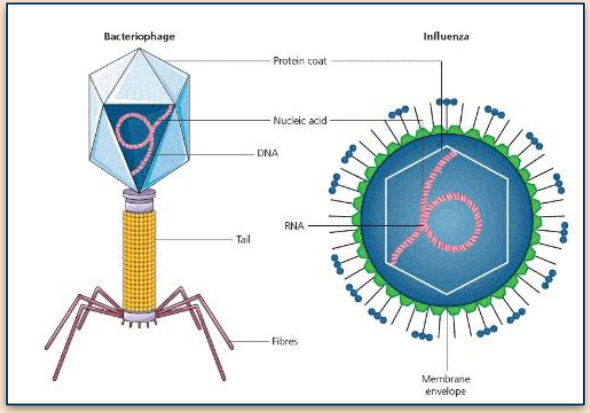
A virus can't move on its own. So how does it travel? Basically, viruses are hitchhikers, catching a ride on their hosts. That's why viruses spread so easily through touch. Say you have the flu and wipe your nose with the back of your hand, then you shake someone's hand. You can pass the virus onto that person's hand. Viruses can also float and move through air. That's why it's so important to cover your mouth when you cough!

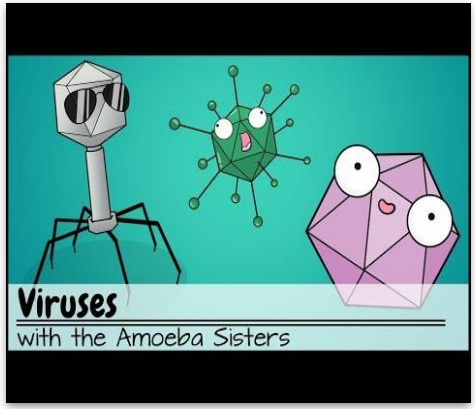
A virus is very sneaky and, just like a robber can break into a bank, a virus can break into a cell. Once inside that cell, the virus attacks the control centre of the cell, called the nucleus. Now, the virus is in charge.

The virus turns the nucleus of the cell into a virus-making machine. It inserts its directions (which tell the cell how to make more viruses) into the nucleus, which makes copy after copy of these directions - just like a printer!

Once the cell is full of the new, tiny viruses that it made, it explodes. This sends hundreds of new viruses out into the body to do the exact same thing to other cells. Soon, the virus has made millions of copies of itself inside the host.

VIRAL STRUCTURE





Viruses are constantly changing. As the virus replicates itself, small changes are made. Initially these changes do not change the virus significantly but, over time, the changes are significant enough for the human immune system to not recognise. Therefore an individual can become ill from the common cold or influenza more than once, as different viruses cause the infection.

PATHOGENS: **VIRUSES**

Examples of disease caused by viruses

Virus and general information	How it is spread	Signs and symptoms	Treatment and prevention
Influenza (flu) A common condition that has similar symptoms to a cold, but is more severe and longer lasting	• Tiny droplets spread by coughing or sneezing. • The droplets can remain in the air and then settle on a surface	• High temperature • Tiredness and weakness (the individual will feel so exhausted it will be difficult to get out of bed) • General aches and pains	• Vaccinations are available, which must be given annually as the virus changes • Management of symptoms, e.g. paracetamol • Some limited evidence for the use of antiviral medication, but this is not routinely administered
Measles A highly infectious viral illness. It is uncommon in the UK due to vaccination programmes, however incidences have been rising in recent years	• Carried on tiny droplets that are breathed, coughed or sneezed out • It is also possible to catch measles through touching an object that has been contaminated	• Cold-like symptoms • High temperature • Sore and red eyes • Red-brown blotchy rash	Contact GP - measles is a notifiable disease, but individuals should ensure they contact the GP surgery before arriving to avoid infecting other individuals. A combined vaccine to prevent measles, mumps and rubella is offered to all children as part of The Routine Schedule. Some symptoms can be treated with paracetamol, for example.
Mumps A disease that causes painful swellings at the side of the face	Infected drops of saliva that can be inhaled or picked up from surfaces	• Swellings at the side of the face • Headaches • Joint pain • High temperature	Contact the GP - mumps is a notifiable disease • Rest • Paracetamol/ibuprofen • A combined vaccine to prevent measles, mumps and rubella is offered to all children
Human immunodeficiency virus (HIV) is a virus that attacks the immune system and weakens the body's ability to fight infection and disease. Acquired immune deficiency syndrome (AIDS): an individual is considered to have AIDS when the body is not able to fight infection and disease as the immune system has become very badly damaged. Not everyone who has HIV will develop AIDS.	HIV is found in the body fluids of an infected person such as semen, vaginal, anal fluids, blood and breast milk. Sexual contact is the most common way of acquiring HIV. A health and social care practitioner in certain situations, such as when using sharps and having a sharps injury, can increase the risk of transmission.	Individuals may have a short, flu-like illness initially (e.g. fever, sore throat and a rash), then there may be no symptoms for several years. As HIV progresses and causes immune system damage (which may take up to 10 years) there are several symptoms such as weight loss, diarrhoea or recurrent infections.	• Early identification and diagnosis is critical as there is no cure, but treatment is available • Antiretroviral drugs can help stop the HIV virus replication, keeping the level of HIV low • Regular blood tests are required to monitor the progression of the condition • Using condoms to prevent transmission through sexual contact • Avoiding sharing needles

PATHOGENS: **FUNGI**

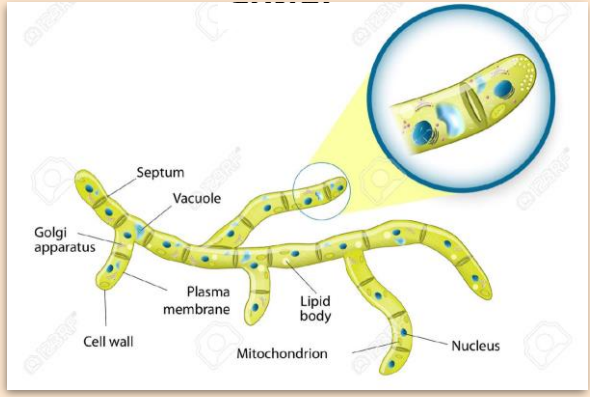
STRUCTURE AND LIFE CYCLE

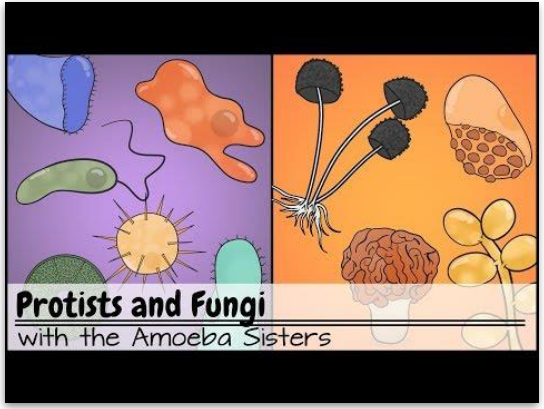
Fungi can be single-celled or complex multicellular organisms; only a small number cause disease in humans. They live on dead and living cells and cause irritation and damage to the cells.

The body of a fungus is called a mycelium, which has fine threads called hyphae. These hyphae release digestive enzymes. The enzymes work to digest and absorb nutrients to help growth. Some of the hyphae branches grow into the air and spores form on these aerial branches.

These spores enable the fungus to reproduce.

FUNGAL STRUCTURE





PATHOGENS: **FUNGI**

Examples of disease caused by fungi

Fungus and general information	How it is spread	Signs and symptoms	Treatment and prevention
Athlete's Foot A fungus that usually appears between the toes	Can be spread to other people by touching the infected skin or coming into contact with contaminated surfaces.	The skin may appear itchy, red, dry and cracked or white, soggy and cracked.	Treatment: • Antifungal creams which can be bought at a pharmacist • Hands should be washed after application Prevention: • Good foot hygiene such as keeping feet clean and dry, not sharing towels, socks or shoes with others • Avoid walking around barefoot in places where the infection can spread easily, for example showers and swimming pools
Candida is a fungus that can sometimes cause thrush, which can affect the vagina, mouth, penis or skin (usually where folds of skin come together such as the armpit)	Opportunistic infection from candida fungi, i.e. when the conditions are right, the fungus will reproduce. Growth of fungi requires moisture, nutrients such as sugars for food and low temperatures. High temperatures will lead the fungi to be inactive.	Penis - irritation, discharge and redness of the head on the penis. Vagina - itching and soreness in vaginal area, discharge, stinging sensation when urinating. Oral - white patches in the mouth that can be wiped off, leaving a red area that may bleed; painful burning sensation. Skin - red and painful rash which may then scale over with curd-like substance.	Treatment: • Antifungal medications (oral or topical, e.g. cream or ointment) • Blood sugar levels in diabetes should be kept under control Prevention: • Clean skin and genital areas with plain unperfumed soaps, as some soaps and shower gels contain irritants • Avoid tight-fitting underwear • Rinse mouth after meals • Visit dentist for check-ups • Remove dentures at night

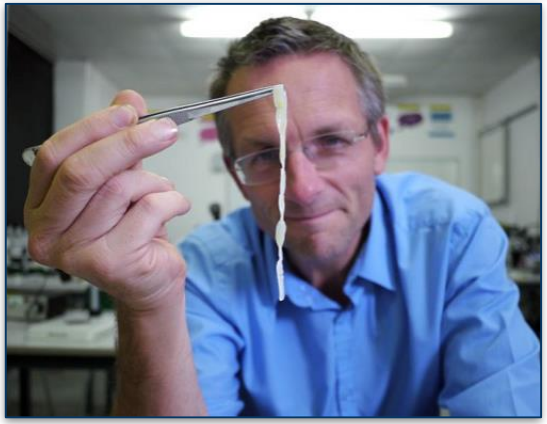
PATHOGENS: **PROTOZOA**

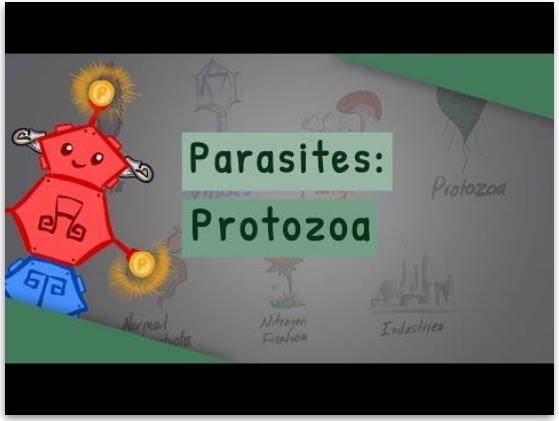
STRUCTURE AND LIFE CYCLE

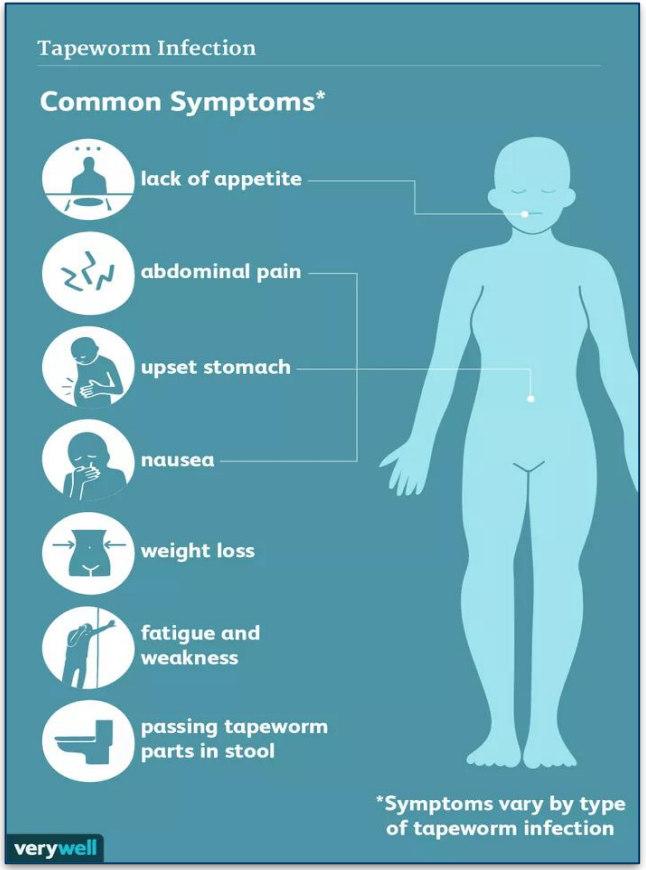
Protozoa are single-cell organisms and live in a wide range of habitats; many are harmless, but some cause disease.

Protozoa are mobile and their structure supports movement. There are four types which are divided on the basis of their movement:

- Amoebas have thread-like extensions on their cell membrane and use these to assist movement; amoebas are able to engulf their food and are single-celled microbes.
- Flagellates have a whip-like extension, which enables them to move through liquid environments.
- Ciliates have cilia which move in a wave to help movement.
- Sporozoans are specifically shaped to help pierce and enter host cells.







PATHOGENS: **PROTOZOA**

Examples of disease caused by protozoa

Protozoa and general information	How it is spread	Signs and symptoms	Treatment and prevention
Plasmodium Causes malaria, a serious tropical disease. There are four different species of the plasmodium. It is found in more than 100 countries, including large areas of Africa, Asia and South America.	From the bite of an infected mosquito. One bite is all it takes to become infected. According to the WHO, 3.2 billion people – almost half of the global population – are at risk of malaria. In 2015, there were around 214 million malaria cases and roughly 438,000 deaths attributed to malaria.	• High temperature, which may be intermittent • Sweats and chills • Vomiting and diarrhoea • Muscle pains • Symptoms appear between 7 and 18 days after becoming infected, but can take up to a year to appear	• Medical attention is advised. Malaria can be treated • Antimalarial medication is used to both treat and prevent malaria. • Prevention is paramount if travelling to an infected area. Prophylactic medication, using insect repellent, wearing loose-fitting clothes with sleeves and trousers in the early evening and night.
Schistosomiasis is also known as bilharzia. It is an infection caused by schistosoma (parasitic worms) that live in freshwater in certain tropical and subtropical areas.	• Swimming, paddling or showering and washing with infected water; the larval form of the worm penetrates the skin. • The larvae then grows into adult form in the body's blood vessels.	• High temperature • Diarrhoea • Joint pain • An itchy, red, blotchy and raised rash • Many people are unaware they are infected for months or years	• Praziquantel medication, which destroys the worms.
Giardiasis An infection of the digestive system caused by parasites called Giardia intestinalis, This is widespread in certain parts of Sub-Saharan Africa, Central and South America, Turkey, Romania and some others.	• When an individual with the parasite goes to the toilet, some of the parasites enter the sanitation system. • Another individual will contract the condition through drinking water that has been contaminated by the infected faeces.	• Stomach cramps • Diarrhoea • Nausea • Loss of appetite • Flatulence	• Hand hygiene. • Avoid drinking untreated water.
Toxoplasmosis A common condition that often has no symptoms caused by Toxoplasma Gondii (T. Gondii)	T. Gondii is found in the faeces of infected cats. It is ingested by humans if there is opportunistic infection, for example, getting hands contaminated from touching cat litter and then not washing them.	There are often no symptoms as the immune system can fight the infection. May experience flu-like symptoms. It can be problematic in pregnancy and for individuals with weakened immune systems.	Most cases do not require treatment as symptoms often do not appear. Individuals with weakened immune systems or pregnancy require treatment with medication.