Biology Knowledge Organiser
B5 - Communicable diseases

Viral diseases

Measles is caused by a virus. It is spread by droplet infection: you'd catch it if you inhaled the droplets containing the virus that someone infected coughed or sneezed out. The symptoms include **fever** and a **red rash on the skin**. Measles is a serious disease – it can even be **fatal** if there are complications. So, most young children are vaccinated against measles.

HIV is a virus that can only be spread by exchange of body fluids: sexual contact or when blood is mixed – which can happen when *intravenous drug users* share needles. HIV cannot be transmitted by kissing or by droplet infection. Infection with HIV causes flu-like symptoms first, but these go away after a couple of weeks. However, the virus has not gone from body – it is living inside immune cells (white blood cells). HIV is NOT the same thing as AIDS, but AIDS can arise from infection by HIV unless treatment takes place. The treatment is **antiretroviral drugs** (so called because HIV is a type of virus called a retrovirus). Without this treatment, AIDS will occur. Here, the body's immune system is so badly damaged it cannot fight off other infections or cancers – so it is very serious.

Tobacco mosaic virus (TMV for short) is a pathogen affecting **plants**. In spite of its name, it affects many species of plant (including tomatoes – see photo). TMV causes discolouration of the leaves, giving a mosaic pattern. This hinders photosynthesis, so plants don't grow very well if they are infected by TMV.

Bacterial diseases

***Salmonella* food poisoning** is caused by a bacteria found in food, or on food where it is prepared in unhygienic conditions. The bacteria can be found in poultry (e.g. chickens), so these animals are **vaccinated** against *Salmonella* to reduce the spread of the pathogen. Inside the body, the bacteria reproduce and produce **toxins** which cause disease. **Symptoms** of *Salmonella* food poisoning include: fever, abdominal cramps, vomiting and diarrhoea.

Gonorrhoea is the name of a **sexually transmitted disease** (STD or STI), rather than the name of the pathogen. The pathogen is a bacterium that is transmitted by sexual contact, so transmission can be prevented with a barrier-type of **contraception**, like a condom. The symptoms include a thick yellow or green discharge from the vagina or penis and pain when urinating (weeing). It used to be that gonorrhoea was easily treated with an **antibiotic** (penicillin, in this case), but there are now many **resistant strains** of bacteria that cause gonorrhoea. (Resistant strains are species of the bacteria on which certain antibiotics do not work.)

ey Terms	Definitions
Fever	Disease symptom linked to raised body temperature, thanks to disruption of the normal homeostasis mechanisms.
HIV	Human Immunodeficiency Virus. A virus that uses immune cells as host cells. HIV infection causes AIDS, but if treated properly, AIDS will never develop in an infected individual.
AIDS	Acquired Immunodeficiency Syndrome. A condition in which the immune system is seriously weakened due to infection by the HIV virus.
Salmonella	A genus of bacteria that can cause food poisoning.
Discharge	A substance being produced by the body that should not be there – a sign of disease.

Fungal diseases

Rose black spot is a fungal disease that affects plants. It causes purple or black spots to develop on leaves (hence the name – see picture). The whole leaf often turns yellow and drops early (i.e. before autumn). Like TMV, the plant's growth is inhibited because the rate of photosynthesis is reduced. The fungus is spread on the wind or in water, transmitting the pathogen to other plants. Treatment options: remove the affected leaves, or use a **fungicide** (a chemical that kills fungi).

Protist diseases

Malaria is a disease caused by a *protist* (see topic 6 for a reminder). The protist has a life cycle that requires it to live inside a **mosquito** for some of the life cycle, and in the body of a mammal – like a human – for other stages of the life cycle. In the mosquito, the protist is found in the salivary glands, which is why the protist can be transmitted to a person when the mosquito sucks their blood. The mosquito acts as a **vector**. In the human, the protist causes malaria. Symptoms include recurrent (repeating) **fever** and malaria can be **fatal**. We can attempt to reduce transmission by targeting the mosquitos: preventing them breeding and avoiding bites using **mosquito nets**.

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Culturing (growing) microorganisms

If conditions are right (correct temperature, plenty of nutrients etc.), bacteria can double their population as often as every 20 minutes. This is because each bacterial cell can make two cells this often, through **binary fission**. It is often useful to deliberately grow microorganisms: for example, to investigate antibiotics or disinfectants. However, you want to only grow the type of microorganism you are trying to study. Without proper care, your **culture** is easily **contaminated**, because there are microorganisms everywhere in the environment. 'Proper care' involves using **aseptic technique**.

Aseptic technique to prepare an uncontaminated culture

Here's how to prepare an uncontaminated culture:

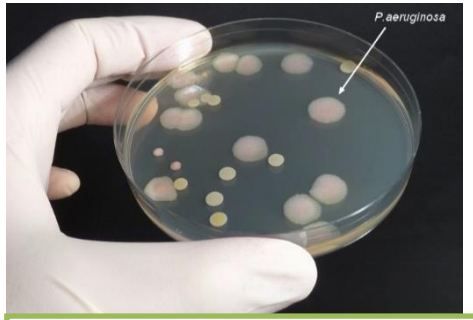
1. Sterilise the Petri dishes and **culture media**. This ensures that there are no microorganisms present at the start.
2. **Inoculating loops** are used to transfer bacteria to the culture medium. These loops are passed through the flame of a Bunsen burner to sterilise them before collecting the bacteria you want to study.
3. After transferring the bacteria under study to the culture medium, the lid of the Petri dish is secured on with tape to prevent other microorganisms from entering. It is stored upside down to prevent condensation flooding the bacteria.
4. The culture is incubated (in schools at 25°C) to allow the microorganisms to grow.

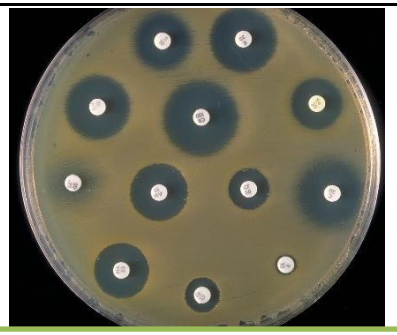
Looking at the results

On the agar plate, bacteria can grow as circular **colonies** or as a **lawn**. The colonies tend to be circles, so you can find their cross-sectional area using $A = \pi r^2$ (area of a circle equation). See first photo for examples of colonies.

On the second photo, a lawn culture has been grown. The small white discs of paper placed on the lawn were soaked in solutions of antibiotic or disinfectant. The antibiotic/disinfectant diffuses into the agar gel and, if it works, it kills the bacteria nearby. This leaves a clear area on the agar plate. Again, the clear area can be calculated since they are circular. The larger the clear area, the more effective the antibiotic/disinfectant on the type of bacteria that's been grown.

Key Terms	Definitions
Culture	A population of microorganisms that has been deliberately grown to study.
Binary fission	How bacteria multiply. One bacterial cell divides into two, forming two identical cells.
Contamination	When unwanted bacteria (or other microorganisms) mix in with the bacteria you are trying to grow.
Aseptic	Without contaminating microorganisms
Culture medium	Substance on which microorganisms are grown, which provides them with nutrients. E.g. agar gel, nutrient broth.
Inoculating loop	Equipment used to transfer microorganisms (e.g. bacteria) to a culture medium for growth and study.
Agar plate	A Petri dish filled with agar gel.
Colony	A population of bacteria. Colonies look like circles of growth in an agar plate.
Lawn culture	An agar plate spread evenly with bacteria. This is useful for testing antiseptics/antibiotics.
Mean division time	The average time it takes for a type of bacteria to divide once, under certain conditions.





The size of bacterial populations

If you know how quickly bacteria divide (mean division time) and how long they've been incubated, you can calculate the population size by working out how many division cycles have occurred.
e.g. the mean division time = 20 min and they've been incubated for two hours. 6 cycles of division have occurred. Say we started with 1 cell. 1 → 2 → 4 → 8 → 16 → 32 → 64, or $2^6 = 64$. When the numbers get very large, standard form is useful.