

Good health is complete physical and mental well-being. It is about feeling good and having a positive frame of mind. **Mental health** is as important as physical health.

The major causes of physical and mental ill health include:

- **Disease**
- **Diet**
- **Stress**
- **Life situations.**

Diseases are disorders that affect part or all of an organism. They can be **communicable**, like measles and HIV, or **non-communicable**, such as cancer and cardiovascular disease.

Risk factors:

Diet, exercise, type of workplace, sexual habits, smoking, drinking and drug-taking.

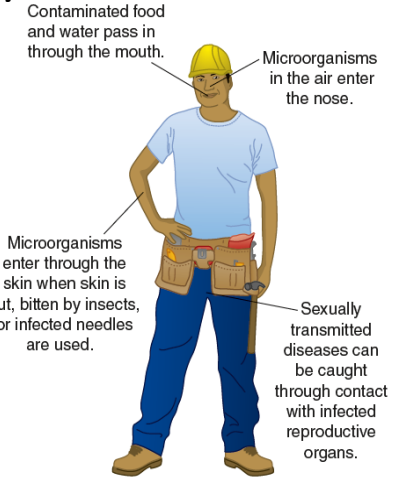
Non-communicable diseases may be caused by the interaction of a number of factors:

- Factors involved in cardiovascular disease may be diet/obesity, age, genetics and exercise.
- Lung disease factors are smoking and cleanliness of the environment.
- Alcohol, diet/obesity, genetics, drugs and viral infection may be involved in liver disease.
- Genetics, diet/obesity and exercise may affect Type 2 diabetes.

Pathogens are microorganisms that cause infectious disease. Examples are pathogens: bacteria, viruses, fungi and protocists.

Pathogens enter by:

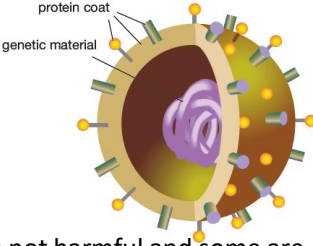
Type of pathogen	Example of disease – How is it spread?
Bacteria	Cholera - Water Salmonella – Uncooked food Dysentery - Vector
Fungi	Athlete’s foot - Contact
Virus	Influenza(flu) – Bodily fluids HIV – Sexually transmitted
Protocist	Malaria – Vector (Mosquito)



Viruses are very small pathogens. They are not living cells. They have a strand of genetic material inside a protein coat. **The genetic material replicates inside host cells to make new viruses, which are then released.**

Examples:

1. Measles
2. HIV
3. TMV - Plants



Many **bacteria** are not harmful and some are actually very useful. We use them to make cheese and yoghurt, to break down our waste and make medicines. Some bacteria, however, are pathogens and cause diseases, infecting both plants and animals.

Examples:

1. Salmonella
2. Gonorrhoea



Treatment:

1. Antibiotics

Diplocarpon rosae is a parasitic **fungus** that causes black spot on roses. It needs warm, wet conditions to grow and spread; British summers are ideal.



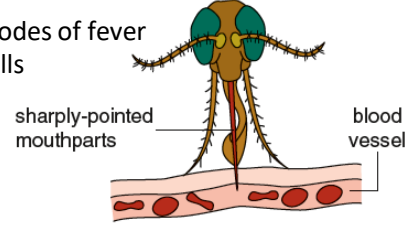
Treatment:

1. Immediately removing infected dropped leaves from the soil and burning them
2. **Pruning** shoots in the spring and burning all cut stems
3. Not composting infected leaves and stems treating infections with fungicides to kill the pathogen
4. Putting manure or **mulch** around the plants in spring to prevent fungal spores reaching the stems.

The pathogens that cause **MALARIA** are called **protists**. Protists are single-celled organisms. The protist that causes malaria is called *Plasmodium*. For part of its lifecycle it lives in human blood.

Symptoms:

1. Recurrent episodes of fever
2. Sweats and chills
3. Muscle pains
4. Headaches
5. Diarrhoea
6. Cough.



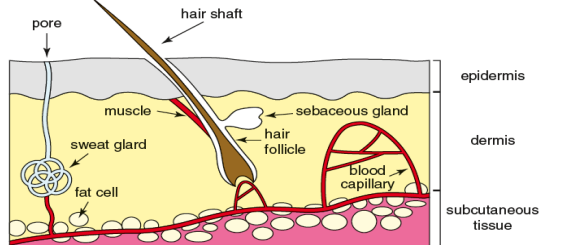
Malaria is controlled by breaking the lifecycle of the vector or by avoiding contact with it.

Control measures include:

- Spraying pools of water with insecticide to kill the mosquitoes
- Draining stagnant water pools
- Spraying pools with oil to prevent the larvae from breathing
- Using mosquito nets to avoid bites
- Taking drugs to kill the protist in the blood.

How does the body DEFEND itself?

- Your skin acts as a barrier and produces antimicrobial secretions via glands in the skin.
- The nose traps particles that may contain pathogens.
- Your trachea and bronchi secrete mucus, which traps pathogens.
- The stomach produces acid, which kills the majority of pathogens that enter via the mouth.
- Platelets (cell fragments in your blood) start the clotting process at wound sites. Clots dry to form scabs, which seal the wound.

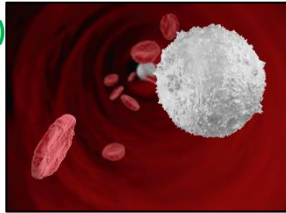


White Blood Cells – The Immune System

The immune system recognises and destroys **pathogens** that enter the body. White blood cells are an important part of the immune system. They attack invading pathogens.

If a pathogen enters the body, white blood cells defend it by:

1. Engulfing pathogens (phagocytosis)
2. Producing antibodies
3. Producing antitoxins.



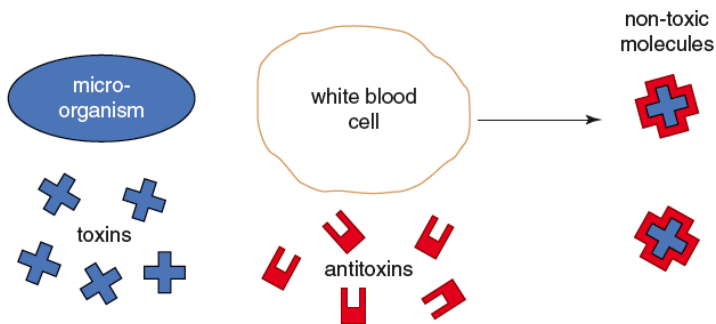
Engulfing pathogens is illustrated below:



- 1 A phagocyte moves towards a bacterium.
- 2 The phagocyte pushes a sleeve of cytoplasm outwards to surround the bacterium.
- 3 The bacterium is now enclosed in a vacuole inside the cell. It is then killed and digested by enzymes.

Antibodies have to be a specific shape to fit on to the antigen of the pathogen. This then locks on to the pathogen to attack it!

Pathogens make us feel ill because they release toxins into our body. White blood cells, produce **antitoxins** to neutralise toxins made by the pathogen. Antitoxins **combine** with the toxin to make a safe chemical. Antitoxins are specific to a particular toxin.



Useful Drugs

A drug is any chemical that alters how the body works. Medicines contain useful drugs. Many medicines do not affect the pathogen that makes you ill. They just relieve the symptoms caused by the infection, for example, **painkillers** and cough medicines. Other medicines work inside the body to kill bacterial pathogens: these are **antibiotics**, for example, **penicillin**.

The zone of inhibition is shown here which shows that the antibiotic is working.



If a **bacterium** cannot be killed by an antibiotic, it is **resistant** to that antibiotic. A prescribed course of antibiotics has the correct amount to kill the bacterial pathogen completely. This is why you must always take the complete antibiotic course!

A **vaccination** introduces a small quantity of an inactive or dead form of a pathogen into the body to protect us from disease.

White blood cells produce antibodies to fight the 'infection' but we don't actually become ill. When live pathogens of the same type infect you, your immune system starts to protect you immediately.

Different **vaccines** are needed for specific **pathogens**. For example, polio, whooping cough, flu and HPV (human papilloma virus) all have a different vaccine.



How do VACCINATIONS work?

- **White blood cells** detect antigens on the dead or inactive pathogen; they produce a specific antibody for these antigens
- **Antibodies** lock onto the antigens
- **White blood cells** 'remember' the shape of the antigens
- When there is a real infection due to a live pathogen entering the body, WBC's instantly recognise the pathogen because it has the same antigens as the vaccine
- WBC's quickly make many specific antibodies
- Antibodies lock onto the pathogens and kill them before they have a chance to make you feel ill. This is **immunity**.

Drug Testing

Double-blind trials are when patients are allocated randomly to groups, so that doctors and patients do not know, until the trial is complete, if they are taking:

- The new drug (this is the test group)
 - A **placebo** (a treatment that does not contain the drug). This is the control group.
- Clinical trials must not be influenced by the people involved in them, whether patients, doctors or employees of pharmaceutical companies. Sometimes, people feel better just because they think they will if they take a medicine. This is the '**placebo effect**'.

Plant diseases

Tobacco mosaic virus (TMV). TMV affects many plants including tomatoes. Symptoms are:

- Mottling or discoloured leaves
- Curled leaves

Defences – Thorns and hairs, leaves droop when touched, produce poison and antibacterial chemicals!