Biology Knowledge Organiser Non-communicable diseases (Triple Science)

Non-communicable diseases

These are diseases that are not infectious.

They affect people as a result of factors in their environment, genetic makeup or lifestyle.

Risk factors for disease

Risk factors for non-communicable diseases vary from one disease to another and some may affect more than one disease.

Some risk factors cannot be changed:

- Genes inherited from your parents
- Age

Some risk factors we are able to influence:

- Diet
- Obesity
- Fitness levels/exercise
- Smoking
- Alcohol consumption
- Exposure to carcinogens e.g. ionising radiation

The impact of non-communicable diseases

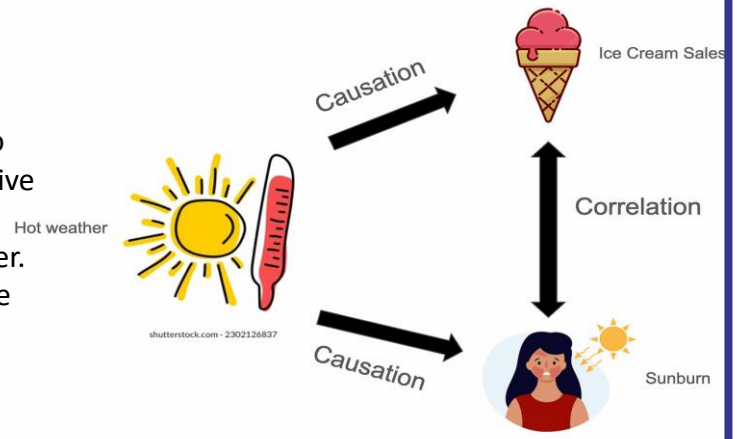
- Human impact on individual and family
- Financial costs to a family
- Local community cost through taxes or informal care
- Impact on National and global economies

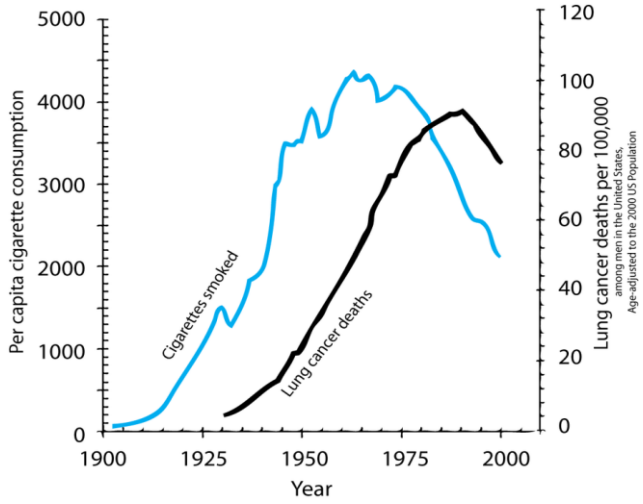
Non- communicable diseases affect far more people than communicable, so the have the greatest effect.

Correlation and causation

We often see patterns between lifestyle factors and non-communicable diseases. This is known as a correlation. However, a correlation does not prove that one thing caused the other.

As ice cream sales increase, so does sunburn. There is a positive correlation between them, but one did not cause the other. It is the hot weather that is the cause.





- Finding a correlation between lifestyle and disease is useful.
- However, doctors need to further research to find the causal mechanism. How does one factor influence another through a biological process?
- An example would be the clear causal link between smoking and lung cancer. Smoking increases the risk of getting lung cancer because you are taking carcinogens into your lungs.

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Cancer

The cells in your body divide in a particular sequence as part of the cell cycle, (you have studied this as part of the cell cycle topic).

A cancerous tumour forms when control of this sequence is lost and the cells divide in an uncontrolled way.

Tumour formation

Benign tumours:

- These are growths of abnormal cells in one place that do not invade other parts of the body.
- They can grow very quickly.
- If they cause pressure on an organ they can be life threatening, e.g. brain tumours.

Malignant tumours cells:

- These can spread around the body invading healthy tissue.
- They usually move around the body via the bloodstream or lymphatic system, making them difficult to treat.
- They lodge in another organ and form a secondary tumour.
- The tumour cells divide rapidly and live longer than normal cells. Without treatment they will often kill the organism.

Causes of cancer

- Genetic factors, (e.g. breast/ovarian).
- Chemicals known to be cancer causing agents called carcinogens.
- Ionising radiation, (eg UV exposure causing melanomas on skin).
- Virus infections, (e.g. cervical cancer caused by HPV).

Treating cancer

- Radiotherapy – targeted doses of radiation stops mitosis in cancer cells.
- Chemotherapy – chemicals are used to stop the cancer cells dividing.
- Both treatments also damage healthy cells.

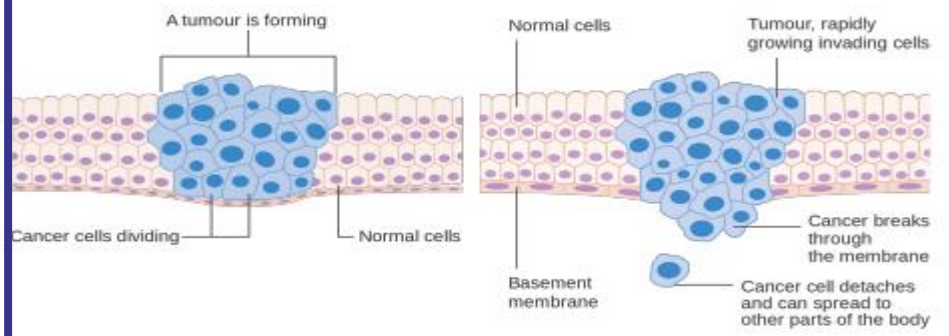

Fig 2. Malignant and Benign Tumours.

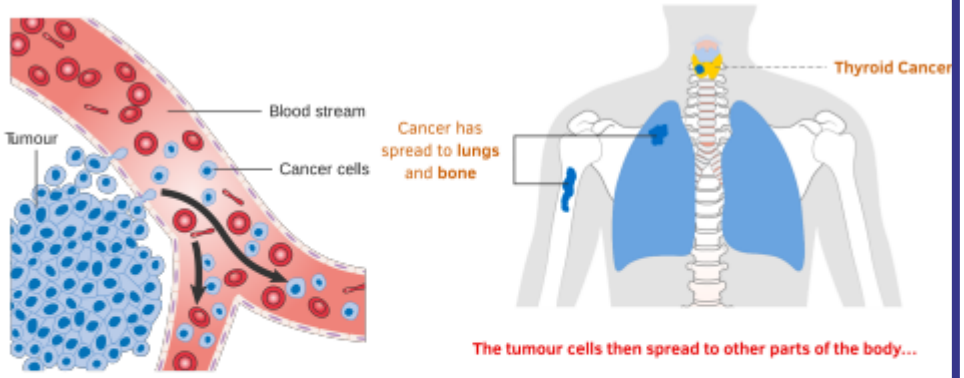

Fig 3. Metastasis. In this diagram, cancer cells have spread in the blood. These cancer cells can then go to other parts of the body and form new tumours, shown by the diagram on the right.

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Smoking and the risk of disease

Every cigarette contains 4000 chemicals that are inhaled into the trachea and lungs. Many of these chemicals are known to cause disease. The main chemicals are:

- Nicotine – this is relatively harmless drug, but is the component of cigarettes that makes them addictive.
- Carbon monoxide – this is a toxic gas. It attaches to haemoglobin in blood cells instead of oxygen. This can lead to a shortage of oxygen and breathlessness.
- Tar – this is a sticky black chemical that accumulates in the lungs and causes bronchitis. The alveoli walls can breakdown, reducing the surface area for gas exchange and causing COPD. Tar is also a carcinogen.
- Toxic chemicals– cilia move mucus, bacteria and dust away from the lungs. They are anaesthetised by chemicals in smoke causing pathogens, dust and mucus to build up, resulting in coughing.

Smoking during pregnancy

Increased carbon monoxide in the blood means the fetus may not get enough oxygen to grow properly. This can cause premature births, low birth weight and stillbirths.

Smoking and the heart

Biological processes show a causal link between smoking and Cardiovascular disease, (CVD).

- Smoking increases heart rate
- Narrows blood vessels
- Increases the risk of clot formation
- Increased blood pressure

The combination of these increases chance of heart attacks and strokes.

Diet, exercise and disease

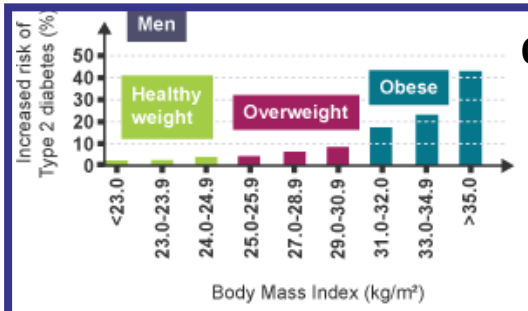
If you eat more food than you need, then the excess is stored as fat. This is needed as an energy store and protection for organs, but too much will result in obesity. This can lead to heart disease and type 2 diabetes.

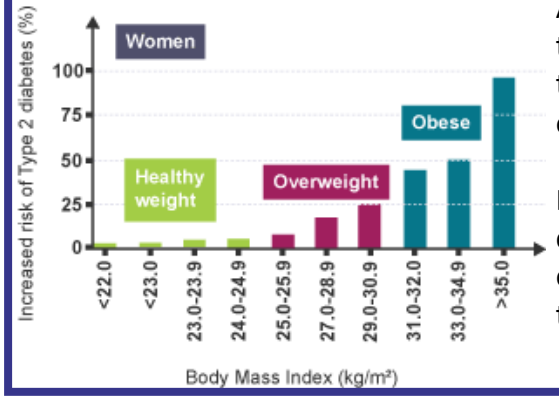
Exercise and health

Some of the causal mechanisms that explain why exercise helps to keep you healthy:

- You will have more muscle tissue which means a higher metabolic rate and less likely to be overweight.
- This reduces chance of arthritis, diabetes and high blood pressure.
- Blood cholesterol will be lower which reduces risk of fatty deposits in the coronary artery and so reduces chance of heart disease.

Obesity and type 2 diabetes





Type 2 diabetes is when your body doesn't make enough insulin, or your body cells stop responding to insulin.

Age and genetics are involved, but there is overwhelming evidence that being overweight and not exercising are risk factors.

It can lead to problems with circulation, kidney function, eyesight and may eventually lead to death.

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Alcohol and health

Alcohol, (ethanol) is a commonly used social drug it is toxic and addictive, but the liver can usually metabolise it before damage is caused to the body.

Effects of alcohol

Ethanol is absorbed easily from the gut to the blood and then affects the nervous system, making thought processes and reflexes slower than normal.

- Small amounts – feel relaxed, cheerful and reduces inhibitions
- Larger amounts – lack of self control and judgement.
- Excessive amounts – unconsciousness, coma and death.

Alcohol and pregnancy

Alcohol can lead to a variety of physical, developmental and behavioural effects on the fetus. The most serious is alcohol syndrome – the fetus:

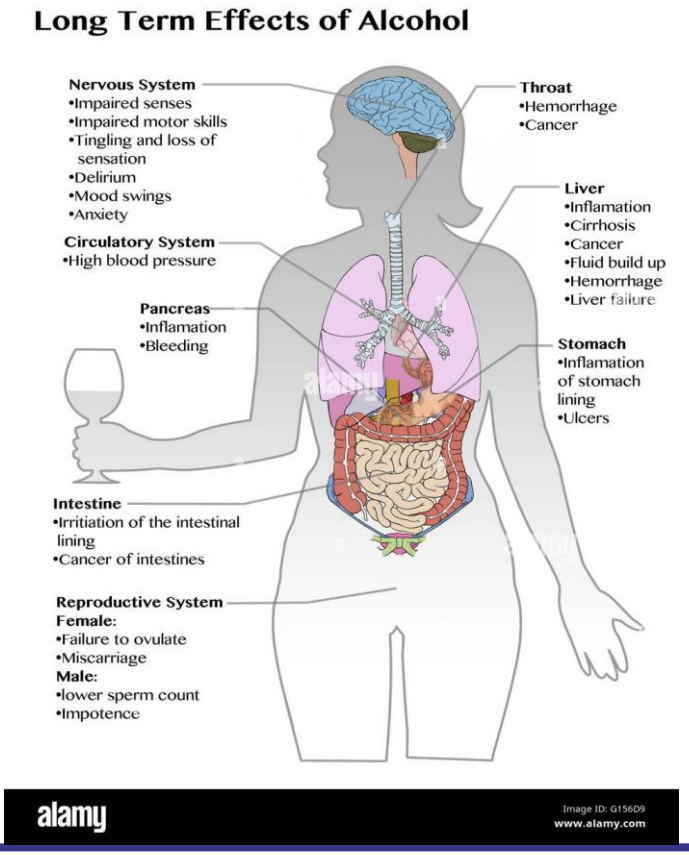
- is smaller in size
- has a smaller brain with fewer neurones
- will have long-term learning and behavioural difficulties
- has distinct facial features

Brain and liver damage

Alcohol addiction can result in long term damage to the liver and brain:

- Cirrhosis of the liver. Active liver tissue is destroyed and replaced with scar tissue that cannot carry out liver functions.
- Alcohol is a carcinogen, so can cause liver cancer.
- Brain damage can result in loss of brain structures and function.

All the above can lead to death. They can be caused by long term drinking or shorter periods of very heavy drinking.



Other carcinogens – ionising radiation

Radioactive materials are a source of ionizing radiation. Radiation can cause mutations in DNA that can result in cancer. Sources of ionizing radiation are:

- UV from sunlight- increases risk of skin cancer
- Radon gas – found in certain soils and granite rocks
- Medical and dental x-rays
- Nuclear accidents that spread ionizing radiation over large areas.