Biology Knowledge Organiser
B5/7 - Diseases

Cancer – a non-communicable disease

Cancer is a non-communicable disease. There are many types of cancer, but they all involve changes in cells (**mutations**) that lead to the cells growing and dividing in an uncontrolled way. Normally, the **cell cycle** (see topic 6) controls cell growth and division, so the body only replaces lost cells. However, in cancer, the control mechanisms are broken and cells divide out of control, producing a mass of cells called a **tumour**.

- **Benign tumours** are growths of abnormal cells, but these do not invade other parts of the body. This is because the tumour is restricted to one area and often surrounded by a membrane. This makes them much less dangerous than **malignant tumours**.
- **Malignant tumours** cause cancer as you'd normally think of it. The cells grow out of control and invade nearby tissues. When mutated cells break off the tumour and get into the bloodstream, the cancer can spread around the body. The mutated cells can then cause more tumours, elsewhere. These are called **secondary tumours**.

In terms of risk factors for cancer, some are very clearly identified (like smoking as a risk factor for lung cancer). There can be **genetic** risk factors for some types of cancer (so the risk factor is inherited from the parents).

Communicable diseases and pathogens

Communicable diseases are sometimes called infectious disease, since they always result from an infection by a **pathogen**. All organisms can be infected by pathogens, so all organisms can suffer from communicable diseases (yes, including plants, and even bacteria can be infected by viruses!). You need to know details of specific diseases (next page), but here is a general description of how each kind of pathogen causes disease:

- **Bacteria** can cause disease if they enter our bodies. They **reproduce** rapidly and can release poisonous chemicals, called **toxins**, that damage our cells. Examples of diseases caused by pathogenic bacteria include cholera, tuberculosis (TB) and food poisoning.
- **Viruses** need a host to survive. They cause disease symptoms by reproducing **inside** cells, and bursting the cell from the inside. This releases them, so they can be passed onto other host cells or other people (e.g. by coughing or sneezing out mucus that contains the viruses).
- **Fungi** can also cause disease, by growing on living tissue (for example, athlete's foot is caused by a fungus).
- **Protists** can cause disease, as they can live in host organisms. A good example is the malarial protist, that causes malaria.

Key Terms	Definitions
Mutation	Change to DNA, altering its function (this is not necessarily dangerous). In cancer, a specific mutation causes cells to divide uncontrollably.
Protist	Whole kingdom of organisms, including some that cause disease.
Transmission	The passing of a pathogen from one organism to another, leading to the spread of communicable (infectious) disease.
Host	The organism that a pathogen lives in or on. When you have a cold, you are the host for the cold virus.

Spread of communicable diseases is caused by the transmission of pathogens

A big problem with pathogens is that they can be passed from one host to another, so the disease they cause can spread. See the table for the methods by which pathogens can be **transmitted**.

We can attempt to reduce the transmission of pathogens by: vaccinating people; destroying vectors (e.g. killing mosquitos with pesticides); being hygienic (i.e. washing our hands!); isolating people who are infected in special hospital wards.

Direct types of transmission	Indirect types of transmission
Direct contact e.g. shaking hands or kissing	A vector (animal) carries the pathogen e.g. mosquitos carry the pathogen that causes malaria
Sexual contact	Droplet infection: droplets of mucus containing a pathogen are sneezed or coughed out by an infected person, and breathed in by someone else. We can also say the pathogen is airborne.
From mother to foetus over the placenta	Waterborne – the pathogen infects water and moves between people when they drink the water

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Health and disease

Health is the state of physical and mental wellbeing. So, 'good health' involves good physical and mental wellbeing. 'Poor health' involves problems with one or both aspects. Diseases are major causes of ill-health. Diseases can be classified as **communicable** (can be passed on, as they are caused by **pathogens**) and **non-communicable** (cannot be passed on). Other factors affect health: such as diet, lifestyle, stress, and genetic inheritance, for instance. Often, ill-health is caused or made worse by an interaction of different factors. Some examples:

- If their immune system has a defect, someone is more likely to suffer from communicable diseases, since their body will be worse at fighting pathogens.
- Some viruses, which live inside cells, can trigger cancers. For instance, the HPV virus can trigger cervical cancer (hence the vaccine in year 9 for girls).
- Severe physical health problems can lead to mental health problems, such as depression.
- Immune reactions to infection by a pathogen can trigger allergic reactions, like skin rashes or asthma.

Non-communicable diseases (B7 - Non communicable diseases)

Diseases that are **not** caused by pathogens – non-communicable diseases – are often linked to many different **risk factors**, and these factors may interact to increase the risk. These risk factors may come from someone's lifestyle, or from substances in their body or substances in their environment. In some cases, the link between a risk factor and a particular disease is very clear: we know the risk factor *actually causes* the disease. For other risk factors, we know the linked diseases but not really how the risk factor causes them.

Here are some causal links we do know:

- Poor diet, lack of exercise and smoking have a proven link to **cardiovascular disease**.
- Obesity can cause type 2 diabetes.
- Alcohol causes liver damage and damages brain function.
- Smoking causes lung cancer and other lung diseases (like emphysema).
- Smoking and drinking alcohol during pregnancy causes problems in unborn babies.
- Carcinogens, such as *ionising radiation* (next topic), can cause cancer.

It is important to realise that while these risk factors are real, they don't guarantee the disease. E.g. not ALL obese people will get type 2 diabetes; however, being obese greatly increases the risk of developing the disease.

Key Terms	Definitions
Disease	Any condition that reduces health/causes ill-health.
Communicable	Type of disease that can be passed on. These diseases are caused by **pathogens**, such as viruses. Be clear that the pathogen is the microorganism, and the disease is the collection of symptoms resulting from infection by the pathogen.
Non-communicable	Describes diseases that are not caused by pathogens and cannot be passed on. These are often caused by many factors acting together, known as **risk factors** for the disease.
Pathogen	A microorganism that can infect another organism (a host) and cause disease in that organism. E.g. bacteria and viruses.
Risk factor	Any factor that increases the chance of developing a non-communicable disease, such as smoking or diet.

Using data to discover risk factors

Risk factors aren't always obvious: it requires scientific research to find out what factors are linked to what disease. For many years, people smoked cigarettes thinking it was perfectly healthy (including doctors!). However, research by a scientist called Richard Doll showed that increased use of tobacco in the UK was linked to increased **incidence** of lung cancer (incidence is just how many people get it), as the graph shows (from his 1950 publication). He **sampled** the population and found this **correlation** between the risk factor (smoking) and the disease (lung cancer).

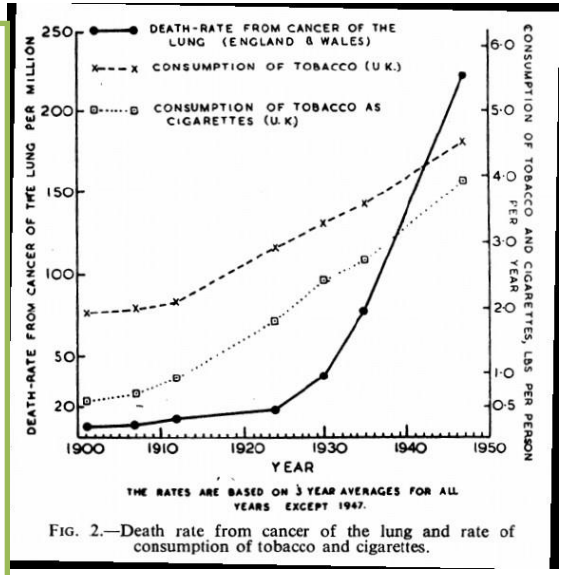

FIG. 2.—Death rate from cancer of the lung and rate of consumption of tobacco and cigarettes.