Causes of cancer

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How do cancer cells come about?

The body is made up from millions of tiny cells. Different parts of the body such as organs, bones, muscles, skin and blood are made up from different specialised cells. Most cells have a centre called a nucleus. The nucleus in each cell contains thousands of genes which are made up from a chemical called DNA. The genes are like codes which control the functions of the cell. For example, different genes control how the cell makes proteins, or hormones, or other chemicals. Certain genes control when the cell should multiply, and certain genes even control when the cell should die.

Most types of cell in the body divide and multiply from time to time. As old cells wear out or become damaged, new cells are formed to replace them. Some cells normally multiply quickly. For example, you make millions of red blood cells each day as old ones become worn out and are broken down. Some cells do not multiply at all once they are mature - for example, brain cells. Normally, your body only makes the right number of cells that are needed.

Sometimes a cell becomes abnormal. This occurs because one gene (or more) in the cell becomes damaged or altered. The abnormal cell may then divide into two, then four, then eight, and so on. Lots of abnormal cells may then develop from the original abnormal cell. These cells do not know when to stop multiplying. A group of abnormal cells may then form. If this group of cells gets bigger, it becomes a large clump of abnormal cells called a tumour.

What causes cancer?

We all have a risk of developing cancer. Many cancers seem to develop for no apparent reason. However, certain risk factors are known to increase the chance that one or more of your cells will become abnormal and lead to cancer. Risk factors include the following:

Chemical carcinogens

A carcinogen is something (chemical, radiation, etc) which can damage a cell and make it more likely to turn into a cancerous (malignant) cell. As a general rule, the more the exposure to a carcinogen, the greater the risk. Well-known examples include:

- **Tobacco**. If you smoke, you are more likely to develop cancer of the lung, mouth, throat, oesophagus, bladder and pancreas. Smoking is thought to cause about 1 in 4 of all cancers. About 1 in 10 smokers die from lung cancer. The heavier you smoke, the greater the risk. If you stop smoking, your risk goes down considerably.
- **Workplace chemicals** such as asbestos, benzene, formaldehyde, etc. If you have worked with these without protection you have an increased risk of developing certain cancers.

Age

The older you become, the more likely it is that you will develop a cancer. This is probably due to an accumulation of damage to cells over time. Also, the body's defences and resistance against abnormal cells may become less good as you become older. For example, the ability to repair damaged cells, and the immune system which may destroy abnormal cells, may become less efficient with age. So, eventually one damaged cell may manage to survive and multiply out of control into a cancer. Most cancers develop in older people.

Lifestyle factors

Diet and other lifestyle factors (and, as mentioned, smoking) can increase or decrease the risk of developing cancer. For example:

- If you eat a lot of fruit and vegetables you have a reduced risk of developing certain cancers. The exact way in which they protect against cancer is not fully understood. These foods are rich in vitamins and minerals, and also contain chemicals called antioxidants. They may protect against damaging chemicals that get into the body. We should all eat .
- Red meat:
    - There is strong evidence that eating a lot of red meat (such as beef, pork and lamb) increases your risk of bowel cancer and stomach cancer.
- Processed meat:
    - Processed meat also increases your risk of cancers, especially bowel cancer.
    - Processed meat means meat that has been transformed through salting, curing, fermentation, smoking or other processes, eg bacon, salami, chorizo, pepperoni and all types of ham.
- The risk of developing certain cancers is increased by lack of regular exercise or drinking too much alcohol.

Obesity
Research has shown that many types of cancer are more common in people who are overweight or obese, including cancers of the breast, bowel, lining of the womb (endometrium), oesophagus, pancreas, kidney, liver, stomach, ovary, thyroid, myeloma, and brain (meningioma).

Radiation
Radiation is a carcinogen. For example, exposure to radioactive materials and nuclear fallout can increase the risk of leukaemia and other cancers. Too much sun exposure and sunburn (radiation from UVA and UVB) increase your risk of developing skin cancer. The larger the dose of radiation, the greater the risk of developing cancer. **But note**: the risk from small doses, such as from a single X-ray test, is very small.

Infection

Some germs (viruses and bacteria) are linked to certain cancers. For example, people with persistent infection with the hepatitis B virus or the hepatitis C virus have an increased risk of developing cancer of the liver. Another example is the link between the human papillomavirus (HPV) and cervical cancer. Most (possibly all) women who develop cervical cancer have been infected with a strain (subtype) of HPV at some point in their lives. Another example is that a germ (bacterium) called *Helicobacter pylori* is linked to stomach cancer.

One research study estimated that about one in six cancers - two million a year globally - are caused by largely treatable or preventable infections. They estimated that four infections - HPV, *H. pylori*, and hepatitis B and C viruses - accounted for 1.9 million cases of cervical, stomach and liver cancers in 2008. Most of these were in the developing world. Initiatives such as immunisation against HPV and hepatitis B are helping to combat these infections.

But, most viruses and viral infections are not linked to cancer.

Immune system

People with a poor immune system have an increased risk of developing certain cancers. For example, people with AIDS, or people on immunosuppressive therapy.

Your genetic makeup

Some cancers have a strong genetic link. For example, in certain childhood cancers the abnormal gene or genes which may trigger a cell to become abnormal and cancerous are inherited. Other types of cancer may have some genetic factor which is less clear-cut. It may be that in some people their genetic makeup means that they are less resistant to the effect of carcinogens or other factors such as diet.

Most cancers are probably due to a combination of factors

Not everybody who has contact with a potential cancer-causing substance (carcinogen) or has an unhealthy lifestyle will develop cancer. For example, not all smokers develop cancer of the lung. In fact, we are all probably exposed to low doses of carcinogens a lot of the time.

The body has certain mechanisms which may protect us from developing cancer. For example, it is thought that many cells which are damaged by carcinogens can repair themselves. Also, the body's immune system may be able to destroy some types of abnormal cells before they multiply into a tumour. Perhaps one carcinogen may only damage one gene, and two or more genes may need to be damaged or altered to trigger the cells to multiply out of control.

In many cases it is likely that there is a combination of factors (such as genetic makeup, exposure to a carcinogen, age, diet, the state of your immune system, etc). These may play a part in triggering a cell to become abnormal, and allowing it to multiply out of control into a cancer.

Further reading

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