



WHAT IS CANCER?

LESSON PLAN

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OVERVIEW

Cancer affects us all.

Around 1 in 3 people in the UK will develop cancer during their lifetime. Almost everybody will know someone (or know someone who knows someone) who has been affected by cancer at some stage in their life.

It is likely that pupils in your class may already have been affected directly or indirectly by the disease, or may be cancer patients in the future.

The aim of this lesson is to dispel some of the myths surrounding the causes of cancer. Using case studies and web-based investigation, students will become familiar with the biology of cancer and its causes, and how these are linked to lifestyle.

This lesson plan has strong links with the GCSE Science and Citizenship curricula.

CURRICULUM LINKS AND AIMS

TWENTY FIRST CENTURY SCIENCE

- You and your genes
- Keeping healthy
- Growth and development

GCSE CITIZENSHIP

- Critical thinking and enquiry

GCSE PSHE

- Healthy lifestyles

AIMS

This lesson plan introduces the following key concepts about cancer:

- There are many types of cancer
- Cancer is a disease of cells which develops due to damage to DNA
- There are preventable causes of cancer (e.g. smoking, sun exposure, diet) and non-preventable causes (e.g. inherited predisposition, old age)
- Most cases of cancer occur in people over 65
- The chances of survival increase with early detection and treatment

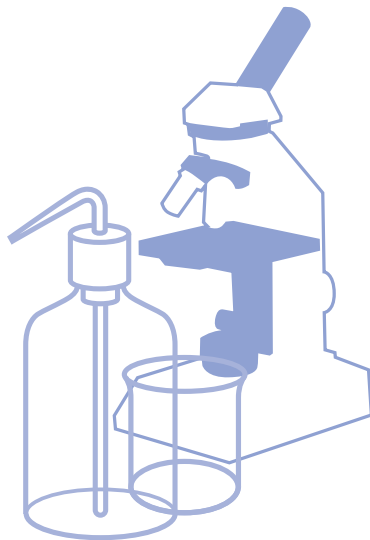
SUCCESS CRITERIA

After this lesson, students will be able to:

- Name the 3 most common types of cancer
- Split cancer causes into preventable and non-preventable
- Explain how cancer develops from damage to DNA – arranging the steps in order

PREREQUISITE

The class will already be familiar with the idea of mitosis and the cell cycle.



BACKGROUND INFORMATION FOR TEACHERS

WHAT IS CANCER?

These notes will be helpful when explaining the biology of cancer to your class.

All organisms are made up of cells. They are the smallest units of all living things.

Our bodies are made up of a hundred million million cells. You can fit 100 cells on the top of a pinhead. We have over 200 different cell types in our body – brain cells, lung cells and blood cells to name but a few.

Most cells have a nucleus, cytoplasm and cell membrane. The nucleus is the cell's "control centre". It holds the cell's DNA. Your DNA carries all the instructions needed to build your body and maintain its functions. The information stored in our DNA would fill 200 telephone directories! Each instruction is carried on a unique piece of DNA called a gene.

Our cells grow and multiply by a process called mitosis. Cell growth and multiplication is part of a continual process called the cell cycle. To move through the different stages of the cell cycle each cell has to go through a series of checkpoints. These checkpoints act a bit like traffic lights and they only give the green light to a cell that is ready to go through to the next stage in the cycle.

Only healthy cells are allowed to multiply and so the cell cycle must control which cells are allowed through. Damaged cells are stopped and either repaired or destroyed.

When a few genes in one cell become damaged, this can lead to cancer. These faulty genes may tell the cell to multiply at the wrong time, or in the wrong place. This is how cancer starts. Sometimes the cell-cycle checkpoints themselves are faulty or the damaged cells are able to side-step them.

This damage accumulates throughout our lives. It can be as the result of normal biological processes in our cells, or lifestyle factors such as smoking, an unhealthy diet, lack of exercise, overexposure to the sun or exposure to certain dangerous chemicals. Some of us also inherit a small amount of DNA damage.

The road to cancer is extremely complex. None of these events alone will lead to cancer – a cell needs to accumulate a certain amount of damage for it to become a cancer cell. They then multiply out of control to form a lump, or tumour.

Because we accumulate damage to our DNA over time, cancer is generally a disease of old age.

Sometimes cancer cells can break off from the main tumour and enter the bloodstream. This allows the cancer cells to travel around the body and may lead to a second cancer forming in another place – a process that is called metastasis. Cancer can also spread via the lymphatic system. Lymph is a clear fluid that circulates around the body's tissues and contains the white blood cells.

Once a cancer has spread to other parts of the body, it is much harder to treat. That is why early detection is so important to ensure successful treatment and to improve the chances of survival – which is why we have screening programmes for breast cancer, for example.

FURTHER RESOURCES

On our website follow the useful links for this lesson plan to read more about how cells work and what happens when cells go wrong.

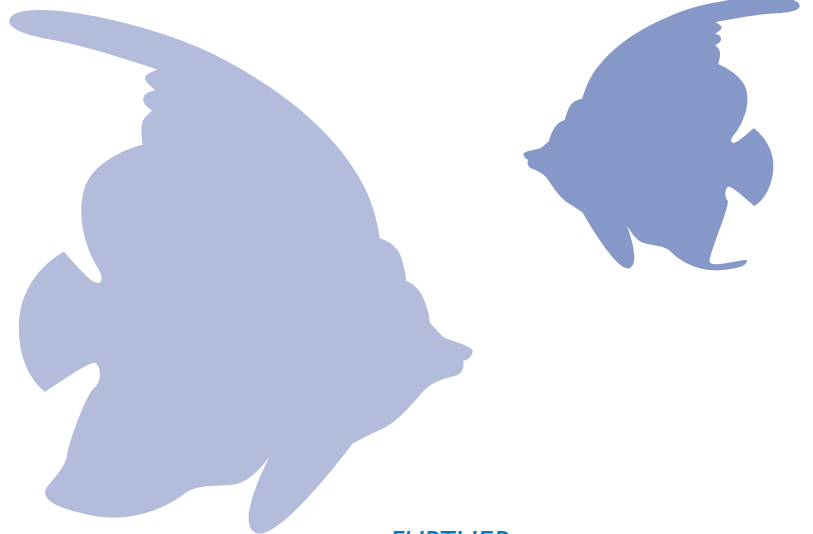
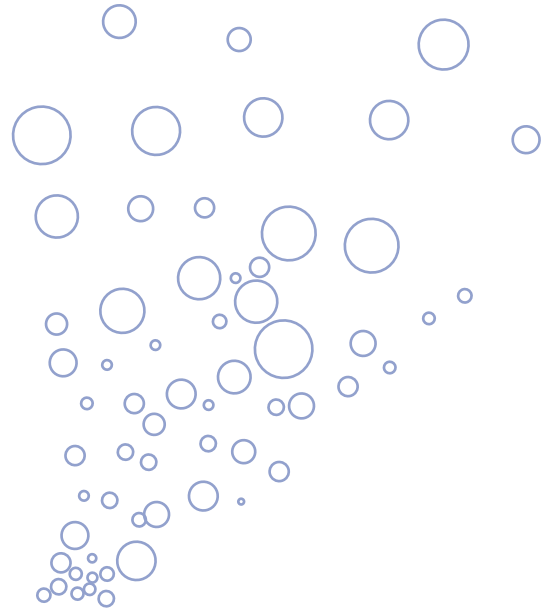
CHILDHOOD CANCER

Students may ask you about childhood cancer.

Although children can get cancer, it is very rare. More than 289,000 people are diagnosed with cancer every year. Of these, only around 1,500 cases are diagnosed in people before the age of 15, which is a very small number. The risk of a child in Britain being diagnosed with cancer before the age of 15 is very low – about 1 in 500 (compared to 1 in 3 adults).

Childhood cancer is different to adult cancer and the causes are largely unknown. This is why it may be better not to discuss it in the lesson as it may get confusing for the students.

The outlook for children diagnosed with cancer is generally very good – today, more than 7 out of 10 children with cancer are successfully treated, compared to less than 3 out of 10 in the 1960s.



FURTHER RESOURCES

Our website has more information on children's cancer – use the useful links for this lesson plan to find out more.

ACTIVITIES

EXERCISE 1 THOUGHT SHOWER – CANCER TYPES

This is a warm up activity to find out what the students already know about cancer.

Questions to ask the class – either as a whole or in smaller groups – are:

- What is cancer?
- Who gets cancer?
- What types of cancer are there?

Write 3 headings on the board:

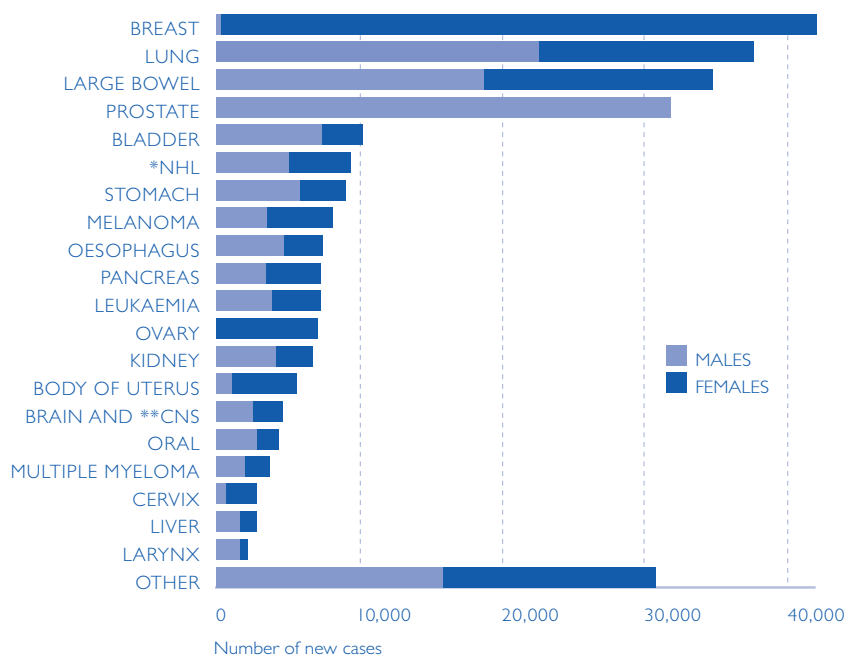
What? Who? Types?

And then add the ideas under the appropriate heading.

Once the students have listed as many types of cancer as they can, ask them which have they heard of most? They will probably answer breast and lung. The reason for this is that these are more common cancers than others. There are in fact over 200 different types of cancer, but the most common in the UK are breast, lung, bowel and prostate.

Rearrange their suggestions in order of most common cancer type.

The 20 most common cancers in the UK, 2002



*NHL - Non Hodgkin's Lymphoma
**CNS - Central nervous system

FURTHER RESOURCES

On our website follow the useful links for this lesson plan to read the latest cancer statistics.

EXERCISE 2

CASE STUDIES – CANCER CAUSES

The aim of this activity is to let students discover the most common causes of cancer, and at what age cancer usually develops.

Split the class into groups and give each group a copy of the case studies.

Note: Case study 6 (about cervical cancer) is important to include if you are planning to introduce the topic of vaccines at a later date (“Cancer and viruses” lesson plan) but can be omitted for a less advanced group of students.

The groups should read the case studies and use the information to complete the mindmap. They should include:

- How old the person was when they developed cancer
- What they think the possible causes were

Mini whiteboards could be used for this activity, or students could be given large pieces of paper and pens on which to draw their mindmap.

The groups should feedback their ideas to the rest of the class, again under two headings:

- Age?
- Possible cause?

Their answers will look something like this:

CASE STUDY	AGE	POSSIBLE CAUSE?
1	70	Smoking, old age
2	35	Inherited
3	65	Unhealthy diet, lack of exercise, old age
4	74	Unknown (biological processes), old age
5	69	Overexposure to sun, old age
6	35	Infection with a particular virus (HPV)



Then discuss themes developing from this. It should be obvious that:

- Most of the case studies developed cancer over the age of 65
- There are preventable and non-preventable causes

It should also be clear that only a small proportion (the actual figure is 5%) of cancer cases are attributable to an inherited gene defect.

Also, as you will see from case study 5, there isn't always a clear cause, and this should be emphasised to the class. A healthy lifestyle can reduce our chances of getting cancer in later life. But, it is also important to explain to your students that there are no guarantees – cancer can still happen to anyone and healthy people develop cancer too. But by keeping healthy, we reduce the chances of this happening.

Ask the group to go back to their mindmaps and underline preventable and non-preventable causes in 2 different colours. Then feedback to the class again.

Their answers should look like this:

PREVENTABLE?

Smoking
Unhealthy diet
Lack of exercise
Overexposure to sun
Infection with a particular virus (HPV) – case study 6

NON-PREVENTABLE?

Inherited
Age
Unknown (biological processes)

EXTENSION WORK

Encourage students to list the advantages and disadvantages of the case studies' lifestyles. For example, for Peter:

GOOD – active job, enjoyable job, early cancer diagnosis
BAD – too much exposure to the sun

This type of extension work will allow students to debate different aspects of people's lifestyles and to realise that people may not fall into a 'good' or 'bad' category, but somewhere in between.



EXERCISE 3

BIOLOGY – HOW DOES THIS LEAD TO CANCER?

This part of the lesson focuses on the biology of cancer. How does cancer develop?

Use the information in the Background section or on our website to explain the biology of cancer to the class.

If students are very able, this could be made into a web-based investigation. Students can read the information in the Latest from the Lab section of our Youth and Schools website and feedback what they have learnt about the biology of cancer to the rest of the class, in response to prompts by the teacher.

Alternatively, the website can be used to reinforce the material explained by the teacher.

The Road to Cancer worksheet is designed to consolidate what the students have learnt and to show that they have understood the main points regarding cancer biology.

KEY CONCEPTS

- Cancer is a disease of cells.
- Explain that cancer develops when cell division (mitosis) goes out of control.
- Cancer is a disease of old age.



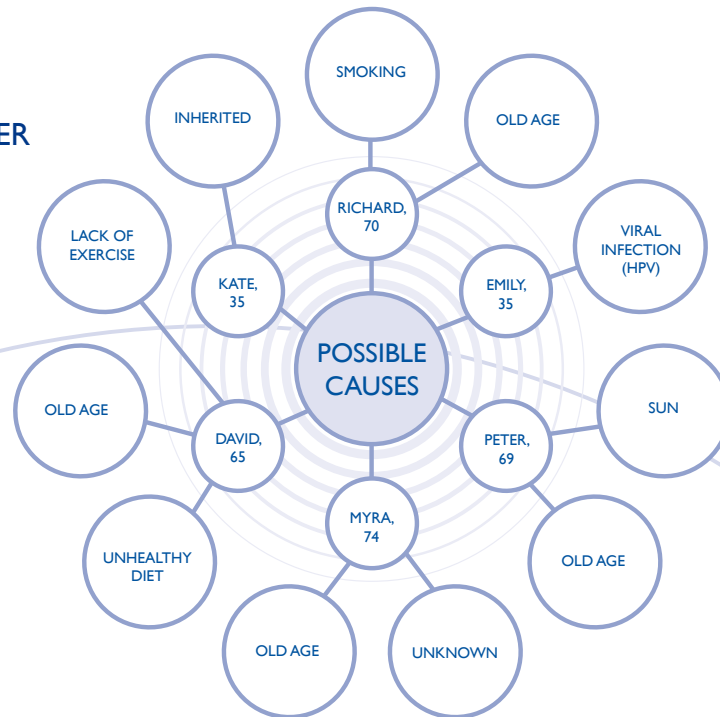
EXERCISE 4: QUIZ

End the lesson with a quiz to consolidate what was learnt in the lesson. This could either be done individually as a worksheet or you could split the class into teams. This can either be a “closed-book” quiz, or students can use the Latest from the Lab section of the website to find the answers.

Alternatively, the quiz can be set as homework. When going through the quiz, get the students to explain to the rest of the class why they have chosen their answers.

ANSWERS

EXERCISE 2 CASE STUDIES - CANCER CAUSES



EXERCISE 3 THE ROAD TO CANCER

8. Cell division is a natural process that is needed for the growth, repair and replacement of cells in our body.

2. It is a tightly controlled process, which is regulated by the DNA in our cells.

7. A person accumulates damage to their DNA throughout their lives.

10. Damage can accumulate by preventable causes, such as smoking, or unpreventable causes, such as inheritance.

5. There needs to be a certain amount of damage to the DNA of a healthy cell to make it a cancer cell.

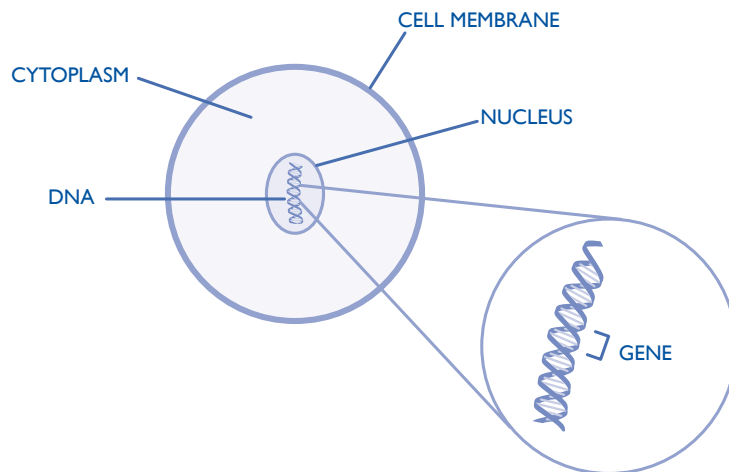
3. This is because the genes that repair DNA and the genes that cause faulty cells to self-destruct are damaged.

9. Cancer cells divide out of control to form a tumour. Unlike healthy cells, cancer cells are immortal and will keep on dividing.

4. When a tumour has reached a certain size, cancer cells can break off and spread through the blood to another part of the body.

1. This is called metastasis.

6. Once a cancer has metastasised, it is harder to treat. So the chance of survival greatly increases with early detection and treatment.



EXERCISE 4 - QUIZ

1. a) old age
2. b) when cells divide out of control
3. c) both
4. c) metastasis
5. c) both
6. a) in the blood and lymph
7. b) 200
8. Breast, lung, bowel
9. True
10. True

EXERCISE 2: CASE STUDIES

CASE STUDY 1 – RICHARD JONES

Richard Jones lived in Manchester. As a postman, he was always very active as he got lots of exercise delivering the mail. Richard enjoyed being outside and getting up early, even in deepest darkest winter.

He was particularly fond of his two grandchildren – Jack and Harry – who he took to the football every Saturday. Richard had been a heavy smoker all his life. A few weeks after his 70th birthday, he developed shortness of breath and went to the doctor. It turned out he had lung cancer.

CASE STUDY 2 – KATE FITZGERALD

Katie Fitzgerald comes from Dublin. She has two children – George and Sarah – and a busy full time job as a journalist for the Irish Times. She loves her job as Features Editor and is always at her computer.

Kate eats organic food, and goes swimming twice a week. Both Kate's mum and gran died of breast cancer. Kate developed breast cancer when she was 35, but because it was diagnosed early, she was successfully treated and now carries on her busy life.



CASE STUDY 3 – DAVID MACDOUGALL

David MacDougall was 65 when he found out he had bowel cancer. It had never occurred to him that he may develop cancer. He had an international reputation as an award-winning chef in Edinburgh's Balmoral Hotel.

But David didn't just enjoy cooking food – he also loved eating it. Haggis and sausages were his absolute favourite, and he ate them three times a day. The doctor had told him he should be careful with his weight, and eat a more balanced diet, but David found it hard to change.

CASE STUDY 4 – MYRA SINGH

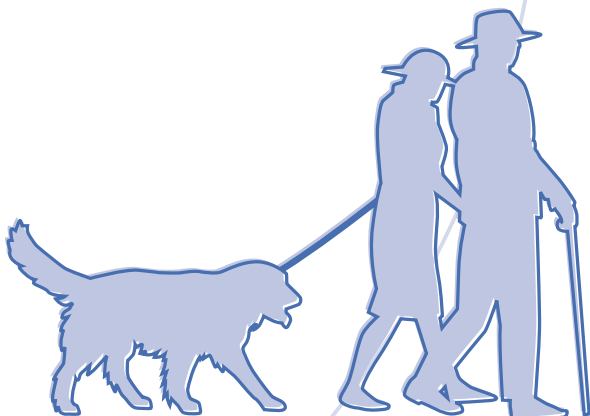
Myra Singh lived in a little cottage in the countryside. Myra was a retired primary school teacher and lived with her two cats, Moggy and Jess. She enjoyed knitting, painting and going for long walks.

She always ate healthily, took plenty of exercise, and didn't smoke. In 1999, Myra developed breast cancer. She died just before her 75th birthday.

CASE STUDY 5 – PETER ARNOLD

Peter Arnold had worked in the construction industry all his life. He had started there straight from school in 1950 when he was 16. Most days, he was out on building sites, often in the heat of the day. He loved his job and worked his way up to site manager. He also loved his rugged, sun-tanned looks.

When Peter was 69, he noticed a patch of skin on his arm that looked unusual. He went to the doctor and was diagnosed with skin cancer. Luckily, he was treated early and is now fully recovered.



CASE STUDY 6 – EMILY RICHARDS

Emily Richards has a husband called Paul, who is an accountant, and two young children, Gemma and Charlotte. Emily works as a nurse in the local hospital. Last year, when she was 35, Emily had an abnormal result when she went for a smear test. A smear test is when a doctor takes a sample of cells from the cervix (the neck of the womb). They examine the cells under the microscope to see if they are showing any signs of becoming cancer cells.

Women are invited to go for smear tests every 3–5 years from their early twenties until their early sixties. Emily was sent for further tests and had some abnormal cells removed from her cervix – left untreated, they could have become cancer cells.

The doctor said the cells had become abnormal as a result of infection with a virus called HPV. Because Emily attended her cervical screening appointments, doctors were able to spot any unusual changes in her cells quickly and treat her successfully. Emily and her family are looking forward to going camping in the South of France next summer!

EXERCISE 4: QUIZ

1 - Cancer is generally a disease of...

- A - Old age
- B - Childhood
- C - Middle age

2 - How does cancer develop?

- A - You can catch it from someone
- B - When cells divide out of control
- C - From a blood transfusion

3 - The causes of cancer are:

- A - Preventable
- B - Non-preventable
- C - Both

4 - Cancers can spread to a different part of the body. This is called:

- A - Mitosis
- B - Mutation
- C - Metastasis

5 - To have the best chance of survival, it is important cancer is

- A - Diagnosed early
- B - Treated early
- C - Both

6 - Cancer cells spread to other parts in the body:

- A - In the blood and lymph
- B - Through the air
- C - By osmosis

7 - How many types of cancer are there?

- A - 20
- B - 200
- C - 2000

8 - Name the 3 most common cancers (in order).

- Bowel
- Breast
- Lung

9 - True or false: It is possible to inherit a predisposition to a certain type of cancer.

- True
- False

10 - True or false: Cell division is a natural process, needed for the growth, repair and replacement of cells in the body.

- True
- False



