

Friday 9th February 2024

Period 2: 10Y Biology.

Title: Monoclonal antibodies.

Complete on paper or in your books – you will need to hand in this work after half term.

1. Make notes on Monoclonal antibodies – text book page 108 (copy on next page of this document).
2. Answer questions 1-2.
3. Write out the Key points in the bottom right hand corner of page 109.
4. Login to SENECA (remember to login using google) and complete the assignment named - Mr Middleton 09/02/2024 10Y Biology Period 2 Monoclonal Antibodies.

<https://app.senecalearning.com/dashboard/class/980tbliwoh/assignments/assignment/03190e95-af50-4f1b-8a6b-383b3a1ef83f>

B6.6 Uses of monoclonal antibodies

Learning objectives

After this topic, you should know:

- some uses of monoclonal antibodies
- advantages and disadvantages of using monoclonal antibodies.

At the beginning of the 20th century, Nobel Prize winner Paul Ehrlich was the first scientist to imagine a 'magic bullet' – a drug precisely targeted at a pathogen or disease. When monoclonal antibodies were first developed in 1975, doctors and scientists thought they had found the magic bullet.

Treatment of disease

Because monoclonal antibodies target a specific type of cell or a specific chemical, scientists and doctors are looking at ways to use them in the treatment of very specific diseases. Many types of cancer are still not easy to treat, and scientists are working hard to develop treatments using different monoclonal antibodies that will target specific cancers. They are increasingly successful. Currently there are three different ways of using monoclonal antibodies to treat cancers. Each has produced some cancer treatments that are being used and many more are in clinical trials. They include:

- Direct use of monoclonal antibodies to trigger the immune system to recognise, attack, and destroy cancer cells (Figure 1).

Synoptic links

You can remind yourself about the immune system and antibodies in Topic B5.9, how cancer cells grow and develop in Topic B7.2, and about clones of cells in Topic B2.3.

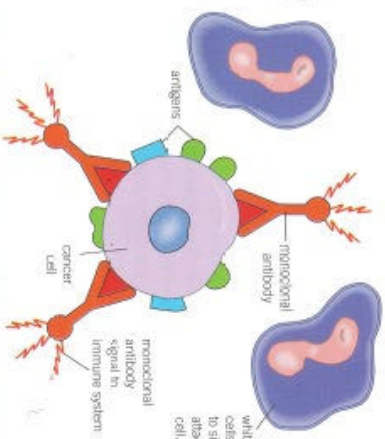


Figure 1 Monoclonal antibodies can trigger the immune system by making cancer cells more noticeable

- Using monoclonal antibodies to block receptors on the surface of cancer cells and so stop the cells growing and dividing (Figure 2a).
- Monoclonal antibodies can be used to carry toxic drugs or radioactive substances for radiation therapy, or chemicals that stop cells growing and dividing to attack the cancer cells directly, without harming other cells in the body (Figure 2b).

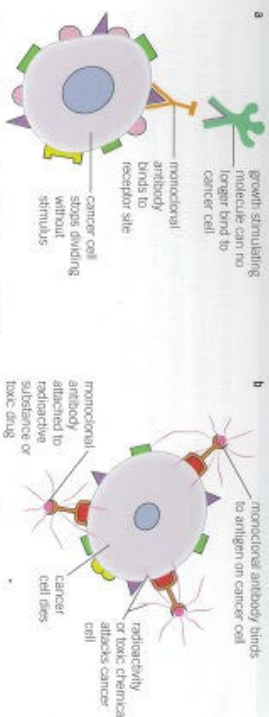


Figure 2 Monoclonal antibodies may bind to receptors on cancer cells, removing the stimulus to grow and divide (a) or may carry drugs or radioactive therapies to cancer cells (b)

Advantages and disadvantages of monoclonal antibodies

One of the biggest potential advantages of using monoclonal antibodies is that they only bind to the specific diseased or damaged cells that need treatment. Healthy cells are not affected at all. In contrast, conventional drug treatment is carried all around the body in the blood and can have a devastating effect on healthy cells as well as, for example, cancer cells. Radiotherapy treatment for cancer is targeted on the area of the body affected by the tumour but still usually affects the healthy tissue in that area as well. Another advantage is that the specificity of monoclonal antibodies means that they could be used to treat a wide range of conditions. Although at the moment monoclonal antibodies are very expensive to develop, potentially they could become cheaper to develop than conventional drugs, because all the treatments will be based on a tested technology.

Monoclonal antibody treatments are not yet as widely used or as successful as everyone hoped when they were first developed almost 40 years ago. Initially they created more side effects than expected. This was partly due to the use of mouse cells only in the formation of the hybridoma cells. The monoclonal antibodies produced were mouse antibodies, and they triggered an immune response in humans. This held back research. Now developments such as the production of mouse-human hybrid cells and the use of fractions of antibodies to carry drugs to target cells are reducing side effects. Also, doctors are now prepared for side effects and can treat the symptoms.

Producing the right monoclonal antibodies and attaching them to drugs and other compounds proved more difficult than expected. The development of more skills and technologies now means monoclonal antibodies are being used in more and more different ways. They may yet end up as the magic bullets of medicine – or at least as part of the bullet.

Key points

- Monoclonal antibodies are used in the treatment of diseases.
- They have been developed against the antigens on cancer cells.
- If a monoclonal antibody is bound to a radioactive substance, a toxic drug, or a chemical that stops cells growing and dividing, it will deliver the substance to the cancer cells without harming other cells in the body.
- Monoclonal antibodies have created more side effects than expected and are not yet as widely used as hoped when they were first developed.

- 1 Explain why people initially thought monoclonal antibodies could be used in the treatment of diseases such as cancer. (3 marks)
- 2 Explain the limitations that have been discovered in the use of monoclonal antibodies in human treatments and explain how they are being overcome. (6 marks)