

The Super Cells - Lesson/Activity Plan

Access the Super Cells video here:

<https://vimeo.com/cosmicmonocle/supercells?share=copy>

Discussion 1

Introduce white blood cells and the immune system

Introduce bacteria and viruses

Play 'The Super Cells' animation (Cosmic Monocle Youtube channel)

Discuss the super cells, and examples of how microbes can help the immune system

Activities

Children can complete the workbook by answering the questions inside and using the blank spaces to draw what is being described by the workbook. Instructions for activities are inside workbooks and instruction sheets can be printed and put on tables

B cell Boy: Making Antibodies (need crafting materials e.g pipe cleaners, straws, scissors, selotape, and shapes to represent the antigens)

Mr Macrophage: Eating Microbes (need balloons, tubes, and marbles)

The Great T Cell: Making Clones (need T cell template, strips of paper (A3 cut into 4), scissors, pens)

Neutro-phil: Making Granules (need flour, salt, water, food colouring, mixing bowls, measuring cups, and spoons)

Children can rotate around tables until activities are completed and workbooks are finished.

Discussion 2

Discussion of what the children have learned about the immune system. Can they think of an example of a good and bad microbe? What does each of the super cells do?

Can the children apply what they have learned to vaccines - what is in a vaccine? How does B cell boy use antibodies when you get vaccinated and what does this mean when you get infected by the same microbe later?

End

Note: The workbook is specifically designed to be printed double sided so can be folded into an A5 book to save resources

FACT FILE

B-Cell Boy

The B cell is a type of white blood cell called a lymphocyte (said: lim-fo-site).

B cells are made in the bone marrow and then live in the lymph nodes. Lymph nodes are in your neck, armpits, and groin. If you get an infection the B cell will travel around in the blood looking for microbes.

B cells make antibodies out of protein; an antibody fits exactly with an antigen. Antigens are found on and are excreted by microbes and each type of microbe has a different antigen. When an antibody binds to an antigen, the microbe is killed! After the B cell has seen the antigen and made an antibody it will remember the shape of the antibody. So if the same microbe tries to attack - the B cell can use the antibody it has already made and kill the microbe really quickly. This is so quick that the microbe doesn't have time to make you ill. This is why you won't normally get the same illness twice! B cells can fight off bacteria, viruses, and parasites.



QUESTION

How does an antibody kill a microbe?

- a) The antibody punches a hole in the microbe
- b) The antibody releases chemicals that kill the microbe
- c) The antibody fits exactly around the antigen on the microbe
- d) The antibody eats the microbe



ACTIVITY

Make an antibody to fit exactly with the antigen on the table.
Draw your antibody here:

FACT FILE

The Great T-Cell

T cells are another type of lymphocyte (said: lim-fo-site) so they are similar to B cells.

T cells grow up in the thymus which is a gland in your neck. They have lots of training in the thymus and only the strongest are selected to leave and fight microbes.

T cells are very good at fighting viruses. Viruses are very small and must live inside other cells to survive unlike bacteria which can live outside cells. When a cell is infected by a virus it behaves differently to normal and the T cell can recognise this. The T cell can then clone itself. This means it can make lots of copies of itself and produce chemicals that kill the virus inside the cell.

QUESTION

What does 'clone' mean?

- a) a chemical
- b) a copy
- c) a parasite
- d) a body part



ACTIVITY

Clone the great T cell by folding the paper opposite ways and cut around the stencil. This will create lots of clones to fight microbes

Good And Helpful Bacteria

Not all microbes are bad! Some are very good and can help your super cells become even more super - and keep you healthy!

HERE ARE SOME WAYS THAT MICROBES CAN HELP YOUR IMMUNE SYSTEM:

1 - A helpful vaccine version of tetanus (*Clostridium tetani*) can show B cell Boy its antigens which B cell Boy will use to defeat bad tetanus bacteria

2 - Gut bacteria producing helpful vitamins for The great T cells which makes the T cells stronger and able to fight a flu virus

3 - Bacteria in the gut can tell macrophages when bad food poisoning bacteria (*Escherichia coli*) is there so the bad microbe gets eaten

4 - Friendly bacteria live on us and when you are a baby they teach the immune system how to behave properly so they can fight off bad bacteria when you're older (e.g *Streptococcus pneumoniae*)

FACT FILE

Neutrophil

A neutrophil (said: new-tro-fill) is the most common white blood cell in your blood and is one of the first cells to attack a microbe.

Neutrophils are very good at killing bacteria and parasites but they can't kill viruses because they hide inside living cells. Neutrophils can get into parts of the body that other cells can't so they can fight microbes in hard to reach places.

Neutrophils kill microbes by producing granules which are mixtures of chemicals. And they can also eat some microbes although not as many as a macrophage! Granules can have different effects but a lot of them destroy the outside of the microbe or cause swelling which calls other super cells to come and fight.

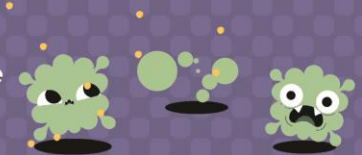
Did you know? Pus is mostly made out of dead neutrophils!

QUESTION

What cell is the most common type of white blood cell?



- a) B cell
- b) macrophage
- c) T cell
- d) neutrophil



ACTIVITY

Make granules out of play-dough, you can use different combinations of colours to make different granules. How many can you make?

FACT FILE

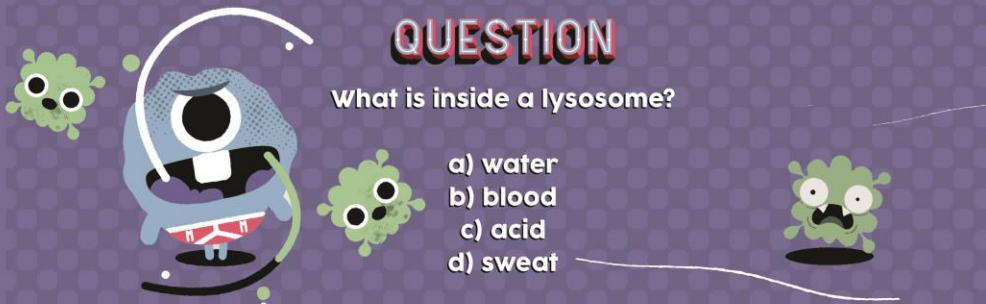
Mr. Macrophage

Macrophages get their name because 'macro' means 'big' and 'phage' means 'eat' - so they're big eaters!

Macrophages can digest anything from bacteria and cancer-causing cells, to dead cells and harmful chemicals. Macrophages are found all over the body and are able to call other cells over to them to help them fight microbes.

Inside a macrophage is a lysosome (said: lie-so-zome) that is filled with really strong acid and this is how macrophages can digest microbes just like your stomach digests food. A macrophage can eat 100 microbes before it's full!

Macrophages are one of the first immune cells to arrive to an infection so they will always try to fight the microbes off first, sometimes the microbes can escape from the macrophages though which is why there are different immune cells to help them!



QUESTION

What is inside a lysosome?

- a) water
- b) blood
- c) acid
- d) sweat

ACTIVITY

Fill up a balloon with marbles until you can't fill any more. Is this number of marbles more or less than the number of bacteria a macrophage can eat?

FACT FILE

Vaccines

Vaccines are made by removing the antigens from a microbe or collecting the toxins and then injecting them into your body or they will change the microbe so it has antigens but can't make you ill. This means that the immune cells can make antibodies and learn about the microbe that these came from without you getting ill. Afterwards, if that microbe did infect you then your immune cells will already know how to fight it so they will be able to kill it before it makes you ill. So vaccines protect you from certain illnesses. Sometimes people might be allergic to something in the vaccine so they shouldn't have them - but vaccines are safe for everyone else and they stop you getting ill from really naughty microbes!

There are lots of vaccines that you should have during childhood, you should check if you've had them all: diphtheria, tetanus, whooping cough, polio, measles, mumps, rubella and more!

Also there are vaccines that are only given to people that need them e.g if you are going on holiday to a country where there is a certain disease. Hepatitis, cholera, and typhoid are vaccines that you might get if you are traveling to a new country.

QUESTION

Which of these are vaccines that should be given to all children on the NHS?

- a) diphtheria
- b) polio
- c) measles



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THE SUPER CELLS

How bacteria and your immune system
work together to keep you healthy

NAME: