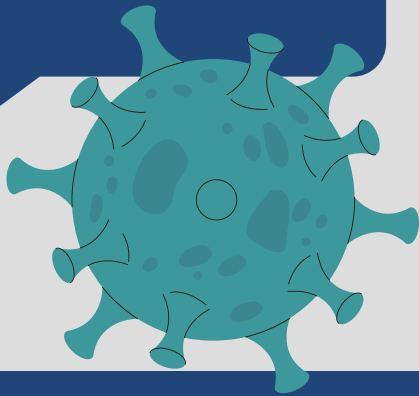




# VACCINES & VACCINATION

What is the HPV vaccine and why do I need it?



Learn about your immune system, vaccination and the HPV vaccine in this resource. Why do you get this in S1 and why do girls and **boys** get this now? Should people pay for vaccines? And how do young people across the world access these vital medicines?

## Curricular Links

SCN 3-13c: I have explored how the body defends itself against disease and can describe how vaccines can provide protection.

SCN 3-20b: Through research and discussion, I have contributed to evaluations of media items with regard to scientific content and ethical implications.

Fourth level skills: Skills and attributes of scientifically literate citizens - Demonstrates understanding of the impact of science on society.

# Background

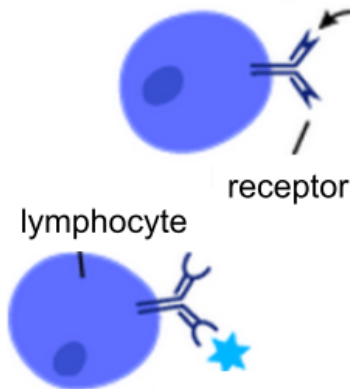
**BBC**  
Bitesize

Our immune system involves white blood cells that destroy microbes that cause disease - these microbes are called "pathogens". There are two main types of immune cells involved in destroying pathogens: phagocytes and lymphocytes.

Phagocytes: carry out phagocytosis by engulfing pathogens.

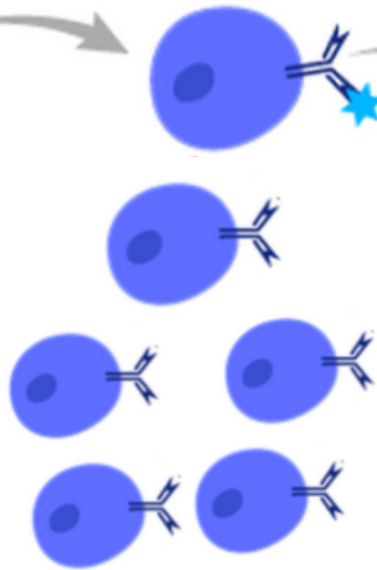
Lymphocytes: Some lymphocytes produce antibodies which destroy pathogens. Each antibody is specific to a particular antigen.

1. Lymphocyte (purple) has a receptor that binds to the pathogen (star)

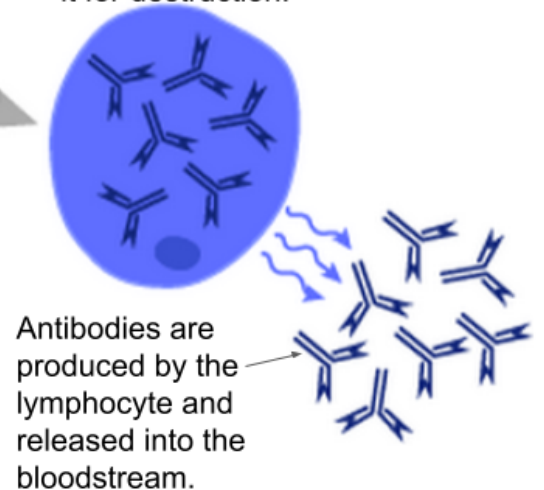


If the lymphocyte receptor is the wrong shape, it can't bind to the pathogen.

2. If the lymphocyte receptor binds to the pathogen, many copies of the lymphocyte are made.

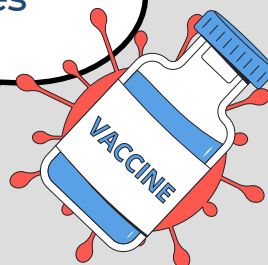


3. Each of the lymphocytes produces antibodies that can bind to a specific pathogen and target it for destruction.

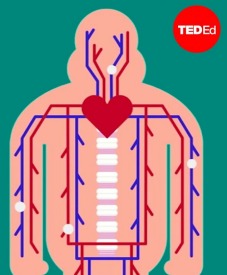


This diagram shows how a lymphocyte produces antibodies against a specific pathogen. This is a crucial part of how our immune system defends our body against specific pathogens.

If our immune system can do this, why do we need vaccines to protect us from disease?

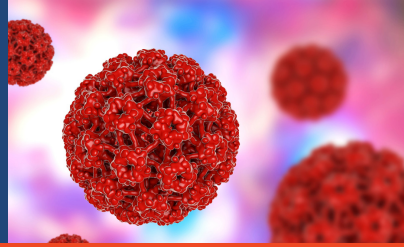


HOW DOES YOUR  
**IMMUNE  
SYSTEM  
WORK?**



Click the image above for a great video on how the immune system works.

Some pathogens cause serious disease. A good example of this is HPV, or human papillomavirus. HPV is a very common virus and there is a lot of research to show that carrying this virus makes it more likely that a person will develop cancer.

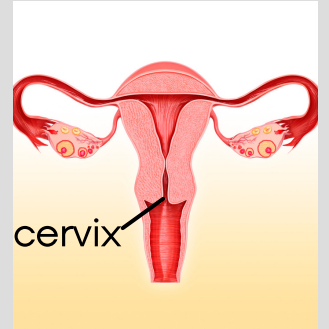


Watch this [video](#) from Public Health Scotland



Although the symptoms may not be immediate, HPV can lead to cancers such as:

- head and neck cancers
- cervical cancers (in females)
- anogenital cancers, e.g. anal and penile cancer; cancer of the vagina and vulva [1].



Head and neck cancers are most common in males and affect about 1300 people in Scotland every year.

Cervical cancer is the most common cancer in women under 35 years of age in Scotland.

The HPV vaccine has reduced cancer-causing HPV in young women in Scotland by 90%.

Anyone can catch HPV and pass it on. The virus is usually spread through intimate sexual contact and condoms do not provide complete protection.

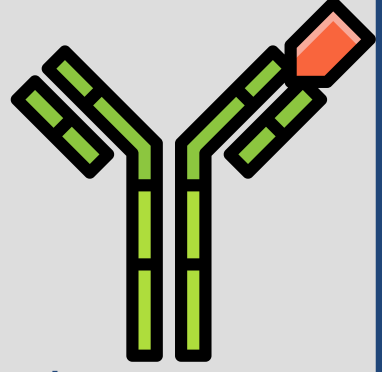
So let's come back to this question: If our immune system can fight the pathogen, why do we need vaccines to protect us from disease?

Our immune system will fight the pathogen AFTER we become infected. So the increased risk of developing cancer as a result of HPV infection still remains, even after our immune system fights off the pathogen.

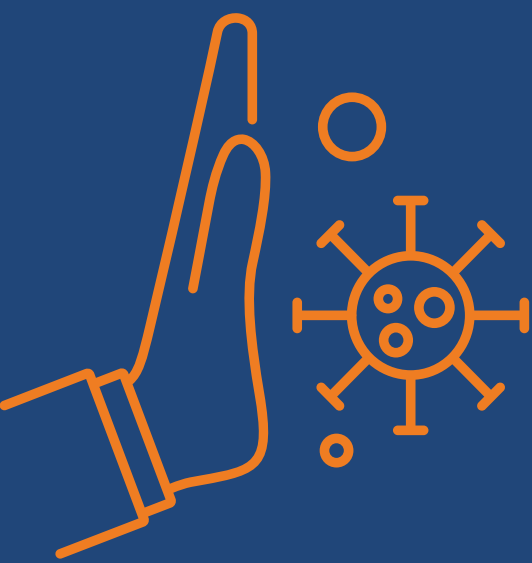


Gardasil 9 is the HPV vaccine used in the NHS vaccination programme since the 2021/2022 academic year [2]. The vaccine contains highly purified non-infectious proteins for 9 types of HPV (6, 11, 16, 18, 31, 33, 45, 52 and 58), giving protection against all of these [3]. Types 16 and 18 cause most cervical cancers in the UK.

You will **not** become infected by HPV when you get the vaccine. But the proteins in the vaccine will stimulate your immune system. Lymphocytes with receptors that bind to the proteins in the vaccine will become activated and make antibodies.



These antibodies, produced in response to the harmless proteins in the vaccine, will protect you against HPV infection in the future.



### How is the vaccine given?

The vaccine is given as two injections into the upper arm. The two injections are given at least 6 months apart. Both doses are required to provide full protection [2].



### Who will get the vaccine in Scotland?

You will receive 2 doses of the HPV vaccine: the first is given when you're 12-13 years old (usually in S1) and then the 2nd dose is given about 6-24 months later [2].

## HELP CARD



# Immunity

- Human beings and other animals, such as your pets, can easily become ill because they get infections from **microbes** such as **bacteria** or **viruses**.
- We rely on cells within our body to help us to fight these infections and although we may become ill, we usually recover and become well again.
- The cells which do most of this infection-fighting for you are in your blood and they are called **white blood cells**.
- One type of white blood cell produce special little Y-shaped proteins called **antibodies**. These antibodies find the microbes which are causing the infection, lock onto them, and destroy them.
- If you get certain type of infections, such as chicken pox, your white blood cells fight the infection by producing antibodies exactly the right shape to join with the chicken pox virus. Your white blood cells also produce special memory cells which stay in your blood and are ready to fight any further infections with chicken pox. We would then say you have **immunity** to chicken pox.
- Another way in which you can get immunity to an infection is through **vaccination**.

Let'sTalk

Photo: Sura Nualpradid/FreeDigitalPhotos.net

## HELP CARD



# Vaccines and Vaccination

- In many countries children are vaccinated when they are young to prevent them from getting certain diseases. Vaccines make our white blood cells produce antibodies without us having to become infected with the actual disease.
- If the person who has been vaccinated then comes into contact with the disease itself, their body will recognise it and immediately produce the antibodies needed to fight it.
- If enough people in a community are vaccinated against certain diseases, then it is more difficult for that disease to get passed between those who aren't vaccinated. Some diseases have been eradicated (got rid of completely) in this way so that they no longer exist anywhere. An example is smallpox, which is why you no longer need to be vaccinated against it.
- You are likely to have been vaccinated against diseases such as measles, rubella, mumps, tuberculosis, polio, tetanus and diphtheria.
- It's not just people who get vaccinated against disease; our farm animals and pets are also vaccinated to prevent them from getting diseases such as rabies and tetanus.

Let'sTalk

Photo: graur razvan ionut/FreeDigitalPhotos.net

# Let's Talk about Vaccines

Task 1: In groups of 4-6, discuss the following questions.

Why do you get vaccinated?

Name any vaccines you have heard of

What does it mean if someone says that you have immunity against a disease?

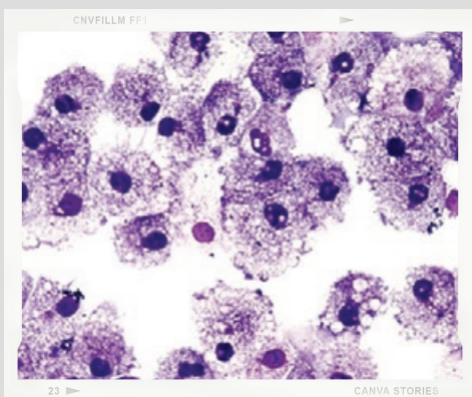
Why do you receive the HPV vaccine?

Have you heard about HPV? Who gets this vaccine? Girls used to get this and now boys too. Why?

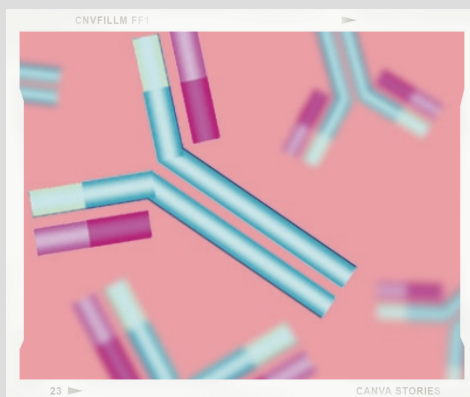
Why do you think you receive the vaccine in S1?

# Let's Talk about Vaccines

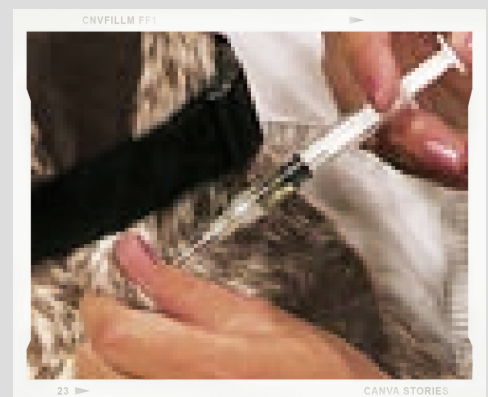
**Task 2:** Read the Background Information and Help Cards in your group. Explain something about each of the pictures below. Share your findings with the rest of the class.



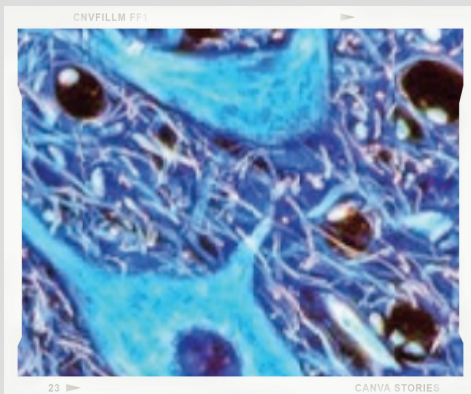
White blood cells



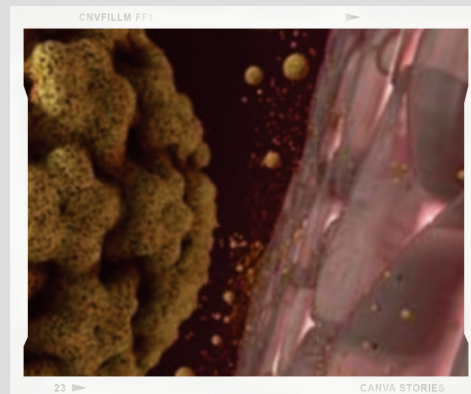
Antibodies



Animal vaccines



Memory cells



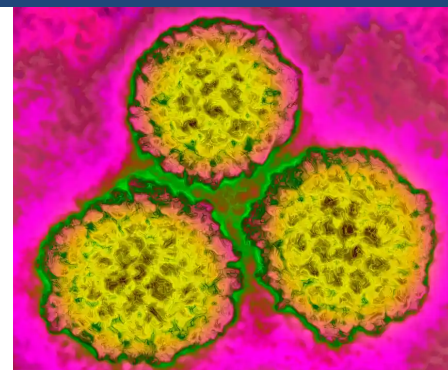
Cervical cancer

Invite a STEM ambassador into your classroom to share their experience of their working world. Charlotte Pritchard is a government vet who supports the health and welfare of Scottish livestock so they are protected from serious disease outbreak. Could Charlotte support a classroom activity on vaccination? Use the [STEM learning website](#) to post a request for a STEM ambassador.

**Task 3:** Read this newspaper article, written in 2021. Imagine you are sat with a group of your friends and you are all due to have your HPV vaccine next week. You read this article and one of the boys says "why are we getting this if it protects against cervical cancer?" How would you reply?

## 'It's incredible': HPV vaccine saves thousands of women from cervical cancer, UK study shows

**Rates have fallen 62% in women offered the HPV jab between the age of 14 and 16, and 34% for older teenagers**



The NHS vaccination programme to prevent cervical cancer has so far stopped thousands of women from developing the disease and experiencing pre-cancerous changes to cells, a study has found.

In the first proof that the programme launched in England 13 years ago is saving lives, the Cancer Research UK-funded study found that cervical cancer rates in women offered the vaccine between the ages of 12 and 13 (now in their 20s) were 87% lower than in an unvaccinated population.

Researchers said cases in this age group, which are rare, dropped from about 50 per year to just five.

There were also reductions in cervical cancer rates of 62% in women offered vaccination between the ages of 14 and 16, and 34% in women aged 16 to 18 when vaccination was introduced.

Experts looked at data from the human papillomavirus (HPV) immunisation programme using the vaccine Cervarix, which was given to girls on the NHS from 2008 to September 2012.

A different vaccine, Gardasil, is now used for the programme, and is given to girls and boys aged 12 and 13.



**Task 4:** Read the statements below about the HPV vaccine. In groups, decide if you agree or disagree.

**agree** | **disagree**

Boys should be vaccinated as well as girls.

Let's Talk



**agree** | **disagree**

Vaccination should take place in primary school.

Let's Talk



# agree | disagree

12 years old is too young to be vaccinated.

Let's Talk



Photo: Sura Nualpradid/FreedigitalPhotos.net

# agree | disagree

This vaccine should be compulsory.

Let's Talk

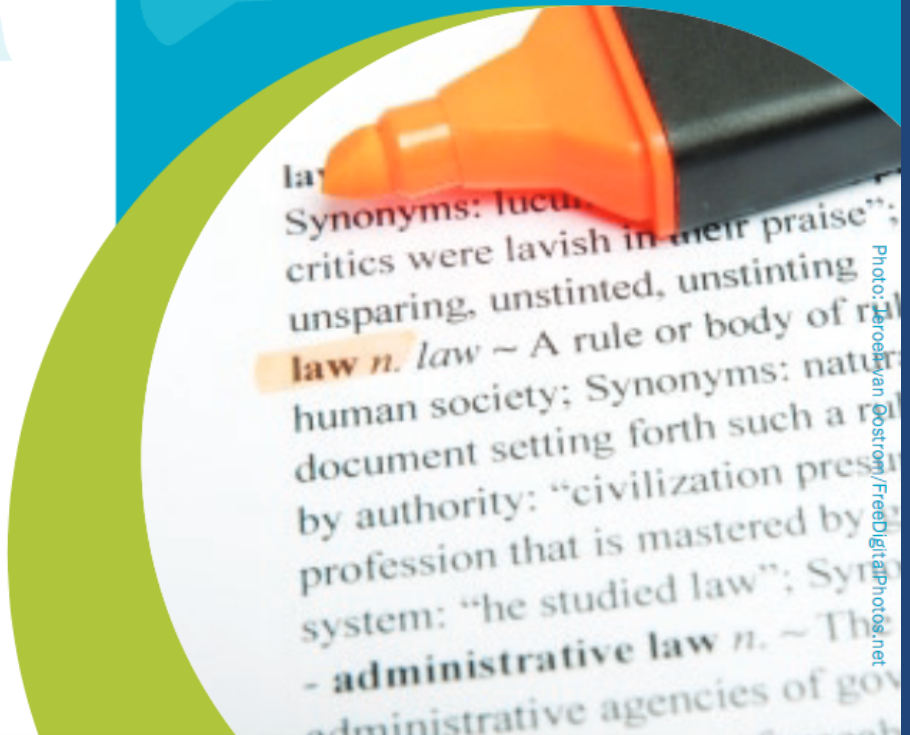


Photo: Jeroen van Oostrom/FreedigitalPhotos.net

# agree | disagree

People who can afford it should pay for this vaccine.

Let's Talk



Photo: Gregory Szarkewicz/Freedigitalphotos.net

# agree | disagree

Vaccines such as this should be available all over the world.

Let's Talk



Photo: Arvind Bakaramani/Freedigitalphotos.net

# agree | disagree

Rich countries should pay for poor countries to have this vaccine.

Let's Talk



# agree | disagree

You should be able to pay to have this vaccine if you miss the government's cut-off because you are too old.

Let's Talk





# YOUNG STEM leader

led by **sserc**



Could you embed the Young STEM Leader Programme into your curriculum? The non-formal YSL4 award focuses on the positive impact of STEM including collaborative and teamworking skills, as well as how STEM can change the world for the better. Let's explore how the YSLP could work in this resource.

## DISCOVER

Explore the meaning of STEM and its impact on the development of vaccinations across Scotland and the wider world. What would life be like without vaccines? Do you think the media / social media influences our views on vaccines?



## CREATE

What have you learned about the HPV vaccination programme in Scotland? How does vaccination work? Why is it important? Could you build a website to educate others about the vaccine and showcase this at an assembly for S1 pupils before they get their HPV vaccine?

## INSPIRE

What does it mean to be inspired? Consider inspirational individuals or groups who work on vaccine development or on the delivery of vaccination programmes. Can you inspire your audience with your activity in the same way?

## LEAD

The YSL4 award allows you to lead an activity or event you have designed, either yourself or as part of a team. Think about the skills, qualities and behaviours required to create and deliver your inspirational STEM activity.

If the YSLP is for your class, sign up for [Tutor Assessor Training](#) on the Young STEM leader programme website. You will gain access to a full range of resources to support your learners through the award.

# REFERENCES

[1] NHS Scotland (2021), "Get protected against cancers caused by HPV", Public Health Scotland, ISBN 0486 9/2021; available [here](#).

[2] NHS (2019), HPV vaccine overview, available [here](#).

[3] EMC (2021), Patient Information Leaflet: Gardasil, available [here](#).

Video from Public Health Scotland to support the HPV Vaccination Programme by the NHS in Scotland is available [here](#).

