BUILD YOUR OWN VIRUS

Activity Pack

Description: Design and make a virus using genetic material (shredded paper), capsid (air dough) and protein spikes (pins or plastic pegs)

Duration of Activity: 10 mins approx.

Age: 7yrs+

Topic: Infections and Immunity

Key words: Virus, infection, disease, vaccines, genetics, capsid, protein spikes, Influenza virus, Adenovirus, Norovirus, Ebola Virus

Resources:
- Instructions and Equipment List
- Activity Worksheet
- Virus Model reference Sheets
- Virus Colouring Sheet
- MRC Lab Scale/DNA Poster
- Activity Evaluation Poster - Children

Related Activities: Build a Healthy Cell

With thanks to MRC - University of Glasgow Centre for Virus Research
Build Your Own Virus
Instructions and Equipment List

Key messages

» Viruses are tiny, and much smaller than other bugs (bacteria).
» Some viruses, when they get inside your body, make you ill.
» Scientists are working hard to stop viruses from making people and animals ill.
» Good hygiene and vaccinations can help people to avoid being made ill by a virus.

What MRC Scientists do?

» conduct research into viruses that cause human and animal diseases
» want to understand how viruses get inside our cells and make us ill
» look to find the best ways to treat and cure people and animals with diseases caused by viruses.
» investigate viruses at all scales, from their genes and proteins to the complex paths they take through populations.

Activity overview

Make a virus using genetic material (shredded paper), capsid (air dough) and protein spikes (pins or plastic pegs)

Steps

1. Participant uses Virus Reference Sheets to select a virus they wish to make or help inspire their own design
2. Participant takes some shredded paper to represent the RNA or DNA in a virus
3. Participant takes air dough, flattens it out, puts the genetic material inside and rolls it into a ball to represent the tough outer coat or capsid
4. Participant selects pins or plastic pegs to represent the glycoprotein spikes on the capsid used by the virus to grip on to cells
5. Discuss with participants what symptoms the virus causes and how to avoid it – information is listed on the Virus Reference Sheets

Important notes

» Air dough dries out when exposed to air so any pre-rolled balls need to be kept in an airtight container.
» Remind all participants to be careful when handling the pins, as they are sharp. Have hypoallergenic plasters available just in case.
» Use plastic bag to allow participants to take their virus home
Suggested Script and background information

The best way to gauge understanding of participants is to ask them questions like

» Does anyone know what a virus is?
» Does anyone know what a virus does?

Today you are going to make a virus and then look at what kind of disease the virus causes when it gets into human cells.

Viruses are tiny but powerful; if you catch a viral infection it can make you feel really unwell. Viruses are smaller than most cells, including human cells and bacteria. Plants, animals and humans can all catch viruses. Some viruses can infect both people and animals.

A virus can get into your body by going up your nose when you breathe in or pass from your hands into your mouth. Once they are inside your body, they use your cells to make more of themselves – turn cells into virus-making factories.

When you sneeze the new viruses fly back out of your nose and spread to other people. That’s how coughs and sneezes spread diseases.

Viruses may just be small packages of genetic information, but they can cause some really nasty diseases! If our cells are busy making viruses, they can’t do the job they’re meant to do, so we become ill. You are going to make a virus today and then we’ll look at what kind of disease it causes.

Scientists have developed vaccines to help protect us from many common viruses. Your body also has its own immune system and this helps to fight infection by viruses too. Medical Research Council scientists study viruses to learn how they get inside our cells and make us ill. They hope to work out how to treat people and animals that catch diseases caused by viruses.

To build your own virus you need...

» **Air dough capsid**: The air dough will form the tough outer coat of your virus. Scientists call this protective coat the virus capsid. It protects the genetic material inside and is made of lots of smaller molecules called proteins that your immune system recognises as invaders.

» **Paper DNA**: The shreds of paper represent the virus’s genetic material, the DNA or RNA that give instructions for it to hijack cells.

» **Virus spike pegs**: The pegs are the spikes a virus uses to grip onto cells and then get inside to cause infection. Different viruses have different patterns and shapes of spikes that allow them to infect different kinds of cells.

Virus Design

Use example viruses and Virus Model Reference Sheets

» **Influenza (achy)**: blue air dough, blue round headed pins and green stalk like pegs

» **Adenovirus (snotty)**: red air dough, flat topped pins with six sides, green stalk like pegs

» **Norovirus (poopy)**: yellow air dough, red mini pegs arranged in hexagonal shapes

» **Ebola (deadly)**: red air dough, long thin shape with looped end, blue mini pegs

» Others options: Herpes Simplex, Rhinovirus
Some participants get excited about the idea of inventing a new virus, this is an opportunity to explain that viruses constantly change and adapt to try to escape our immune systems.

Use MRC Lab Scale/DNA Poster to show the relative small size of a virus.

**Influenza virus:** causes flu and swine flu

**Symptoms:** body aches, sore throat and joints, coughing and sneezing, feeling hot then cold, headache, tiredness, blocked or runny nose, nausea and vomiting.

A flu vaccine helps to protect people from this virus. If you do catch the flu you can help to stop it spreading by washing your hands and using a tissue when you cough and sneeze.

**Adenovirus:** causes colds

**Symptoms:** runny nose – green snot and coughing

There is no vaccine for the common cold – to stop catching or spreading this virus wash your hands and do not let anyone sneeze of cough on you! Tell them to use a tissue.

**Norovirus:** causes an upset tummy

**Symptoms:** diarrhoea and vomiting

Norovirus spreads quickly especially where there are lots of people close together in schools, hospitals or on boats. People who have caught norovirus should not prepare food for others until they are better.

**Ebola virus:** causes Ebola

**Symptoms:** It causes a severe, often fatal, disease in humans. Symptoms include bleeding, diarrhoea, fever, vomiting and weakness.

Outbreaks of the virus have occurred only in Africa. The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.

Currently there is no licensed treatment or vaccine for the Ebola virus. Hospital treatment is based on giving patients intravenous fluids to stop dehydration and antibiotics to fight infections. Strict medical infection control and rapid burial are regarded as the best means of prevention.
Further information

There are more viruses on Earth than stars in the visible universe. If we could lay all the viruses end-to-end they would stretch 100,000 light years.

Most viruses are harmless to humans. Others cause diseases, such as influenza, the common cold, smallpox, measles, mumps, chickenpox, AIDS, hepatitis and some kinds of cancer.

Viruses do not move by themselves. They are carried. Coughs, sneezes, digestive waste, water, touch and biting insects can all carry viruses and spread them. They survive on surfaces for some time.

Viruses are not made of cells, unlike all (other) forms of life. They consist of proteins and nucleic acids. Proteins are the building blocks of living things. Nucleic acids are the building blocks of genes - the recipes for proteins.

Antibiotics do not work against viruses. Vaccination does. People who receive a vaccine - if one has been found - protect themselves and others. Smallpox was ended by vaccination.

Viruses reproduce fast when conditions are right for them. Your body can contain 100 trillion influenza viruses when you suffer from flu. That’s over 10,000 times more viruses than there are people on the planet.

Viruses are tiny organisms at the edge of life. Some scientists say they are alive. Others insist they are simply sets of instructions.

Examples of some common diseases and the virus that causes it:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken Pox</td>
<td>Varicella zoster</td>
</tr>
<tr>
<td>Cold Sores</td>
<td>Herpes simplex</td>
</tr>
<tr>
<td>Chest Infection</td>
<td>Respiratory syncytial</td>
</tr>
</tbody>
</table>

For further information visit MRC Research
Build Your Own Virus
Equipment List

Staging
This activity is best conducted on tables that participants can stand or sit around

Required
- Air dough – Various colours a piece about the size of a golf ball per virus
- Shredded paper – to represent genetic material
- Mapping pins – Various to represent protein spikes
  - hexagonal heads - various colours
  - push pins - circular heads - blue & red
  - Stalks/straight spikes - green
- Airtight bowls to store air dough (one for each colour)
- Petri dishes – to hold mapping pins
- Polybags small sealable – to carry viruses home
- Virus Model Reference Sheets – print and laminate

Optional
- Worksheet - one per participant
- Virus Colouring Sheet
- MRC Lab Scale/DNA Poster
- Lab coat - one per participant
- Activity evaluation poster - children
Today you are going to make a virus and then look at what kind of disease the virus causes when it gets into human cells.

Viruses are tiny but powerful, if you catch a viral infection it can make you feel really unwell. A virus can get into your body by going up your nose when you breathe in or pass from your hands into your mouth. Once inside, the virus takes control of your cells to make more copies of itself. When you sneeze the new viruses fly back out of your nose and spread to other people. That's how coughs and sneezes spread diseases.

Scientists have developed vaccines to help protect us from many common viruses. Your body also has its own immune system and this helps to fight infection by viruses too. Medical Research Council scientists study viruses to learn how they get inside our cells and make us ill. They hope to work out how to treat people and animals who catch diseases caused by viruses.

To build your own virus you need...

Air dough capsid: The air dough will form the tough outer coat of your virus. Scientists call this protective coat the virus capsid. It is made of lots of smaller molecules called proteins that your immune system recognises as invaders.

Paper DNA: The shreds of paper represent the virus's genetic material, the DNA or RNA that give instructions for it to hijack cells.

Virus spike pegs: The pegs are the spikes a virus uses to grip onto cells and then get inside to cause infection. Different viruses have different patterns and shapes of spikes that allow them to infect different kinds of cells.

1. Choose a piece of air dough, some strips of paper and coloured pegs.
2. Wrap the shreds of paper, your virus’s genetic material, inside the air dough. Now the genetic material is protected.
3. Stick the pins into the air dough to make spikes, these will help your virus infect a cell. Arrange them evenly around the capsid.
4. Look at the virus key to see which disease your virus causes.

Virus Key

Influenza virus: causes flu and swine flu
Signs of flu infection: body aches, sore throat, coughing and sneezing, feeling hot then cold, fever, headache, blocked or runny nose, nausea and vomiting.
A flu vaccine helps to protect people from this virus. If you do catch the flu you can help to stop it spreading by washing your hands and using a tissue when you cough or sneeze.

Adenovirus: causes colds
Signs you have caught adenovirus: runny nose, green snot and coughing.
There is no vaccine or cure for the common cold yet. The best way to stop it spreading is to wash your hands and to use a tissue to blow your nose.

Norovirus: causes sickness and diarrhoea
Signs of Norovirus: you will be sick and have lots of diarrhoea.
Norovirus spreads quickly especially where there are lots of people close together on boats or in hospitals or schools. People who have caught norovirus should not prepare food for others until they are better.

VIRUS FACTS

Viruses can’t survive for long outside a living cell
Plants, animals and humans all catch viruses
Some viruses can infect both people and animals
WHICH VIRUS HAVE YOU MADE?

Herpes simplex: causes cold sores

**Symptoms:** Fluid filled blisters on tongue, lips and inside mouth, pain when swallowing, fever, bad breath, loss of appetite, low energy

**How to avoid herpes simplex:** Don’t kiss anyone who has a cold sore!

Influenza: causes flu & swine flu

**Symptoms:** Body aches, sore throat and joints, coughing and sneezing, feeling hot then cold, fever and fatigue, headache, blocked or runny nose, nausea and vomiting

**How not to catch an influenza virus:** Be vaccinated. Always wash your hands and if people sneeze or cough ask them to use a tissue

Adenovirus: causes colds

**Symptoms:** Runny nose – green snot and coughing

**How not to catch an adenovirus:** There is no vaccine for the common cold – To stop catching or spreading this virus wash your hands and don’t let anyone sneeze or cough on you! Tell them to use a tissue

Norovirus: causes an upset tummy

**Symptoms:** Diarrhoea and vomiting

**How not to catch an norovirus:** This virus spreads quickly especially when lots of people are together at school, hospitals or on boats. To prevent catching or spreading this virus wash your hands before eating. And if you have norovirus you should not prepare food for others until several days after you are well

Scientists at the Medical Research Council study viruses to learn how they get inside our cells and make us ill. They hope to work out how to treat people who have diseases caused by viruses.
INFLUENZA VIRUS: causes flu and swine flu

Symptoms: body aches, sore throat and joints, coughing and sneezing, feeling hot then cold, headache, tiredness, blocked or runny nose, nausea and vomiting.

A flu vaccine helps to protect people from this virus. If you do catch the flu you can help to stop it spreading by washing your hands and using a tissue when you cough and sneeze.
ADENOVIRUS: causes colds

**Symptoms:** runny nose – green snot and coughing

There is no vaccine for the common cold – to stop catching or spreading this virus wash your hands and do not let anyone sneeze or cough on you! Tell them to use a tissue.
NOROVIRUS: causes an upset tummy

Symptoms: diarrhoea and vomiting

Norovirus spreads quickly especially where there are lots of people close together in schools, hospitals or on boats. People who have caught norovirus should not prepare food for others until they are better.
EBOLA VIRUS: causes Ebola

Symptoms: It causes a severe, often fatal, disease in humans. Symptoms include bleeding, diarrhoea, fever, vomiting and weakness.

Outbreaks of the virus have occurred only in Africa. The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission. Currently there is no licensed treatment or vaccine for the Ebola virus.