



EDINBURGH INTERNATIONAL  
SCIENCE FESTIVAL  
**generation science**

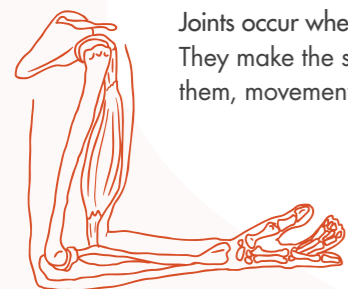


## The Science behind the Show

The musculoskeletal system comprises the bones, joints, muscles and tendons.

There are 206 bones in our skeleton. Together they allow us to move, provide structure to our bodies and protect our internal organs.

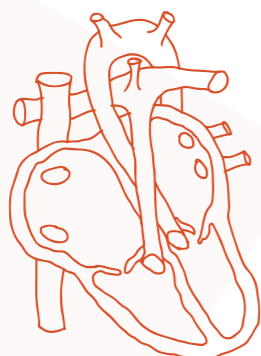
Muscles pull on the bones, allowing us to move. The human body has more than 650 muscles. They are connected to the bones by tough, cord-like tissues called tendons, which allow the muscles to pull on the bones.



Joints occur where two bones meet. They make the skeleton flexible — without them, movement would be impossible.

The circulatory system is composed of the heart and blood vessels, including arteries, veins, and capillaries.

The heart is the main organ in the circulatory system. It is a hollow, muscular pump whose main function is to propel blood throughout the body.



The circulatory system works closely with other systems in our bodies. It supplies oxygen and nutrients to our body while at the same time helping the body get rid of waste and carbon dioxide.

The respiratory system is responsible for taking oxygen from air into the body, while also enabling the body to get rid of carbon dioxide from air by breathing out. It includes the nose, trachea and lungs.

The diaphragm plays a lead role in breathing. Located at the bottom of the ribcage, it is a muscle that moves downward when we breathe in, enlarging the chest cavity and pulling air in through the nose or mouth. When we breathe out, the diaphragm moves upward, forcing the chest cavity to get smaller and pushing the gases in the lungs up and out of the nose or mouth.

The digestive system is made up of the mouth, stomach, small and large intestines plus other abdominal organs such as the liver and pancreas.

Digestion is a process which breaks down food into smaller and smaller pieces until our bodies can access and use the nutrients it contains. The nutrients that come from our food (including carbohydrates, proteins, fats, vitamins, and minerals) pass through channels in the wall of the intestine and into the blood. The blood works to distribute these nutrients around the rest of the body. The waste parts of food the body can't use are passed out as poo.

## BODY BUILDERS

### Welcome to Generation Science!

Brought to you by the Edinburgh International Science Festival, our shows and workshops spark pupils' curiosity and bring science to life.

### What we do

Each show or workshop is fully equipped and delivered by trained science communicators. We create fun, interactive environments where everyone gets out of their seats and gets involved. Our inspiring demonstrations and engaging activities are linked to the Curriculum for Excellence, explaining key concepts in a unique and memorable way.

#### Event Description

Body Builders is an interactive show which explores the main organs of the body, describes their main functions and delves into the role of healthy eating in maintaining their function. In this funny and fast-paced show, we join Doctor Watson and Nurse It Better on their rounds at our Touring Teaching Hospital where he meets and treats a variety of patients with common ailments. Here, pupils will discover the basics of the musculoskeletal, circulatory, respiratory and digestive systems and discover ways to stay healthy.

#### Curriculum Links

Body Builders complements the following experiences and outcomes:

**SCN1-12a:** By researching, I can describe the position and function of the skeleton and major organs of the human body and discuss what I need to do to keep them healthy.

**SCN2-12a:** By investigating some body systems and potential problems which may develop, I can make informed decisions to help me maintain my health and wellbeing.

#### Learning Outcomes

- Describe the importance of the musculoskeletal system, with reference to bones, joints, muscles and tendons.
- Name key parts of the digestive system and recall the process of digestion.
- Identify the importance of a balanced diet in maintaining health.
- Underline key parts of the circulatory system and recall how the heart pumps blood around the body.
- Describe the respiratory system, with reference to lungs, diaphragm and alveoli.
- Identify the importance of exercise in maintaining a healthy heart and lungs.

### Some Useful Links

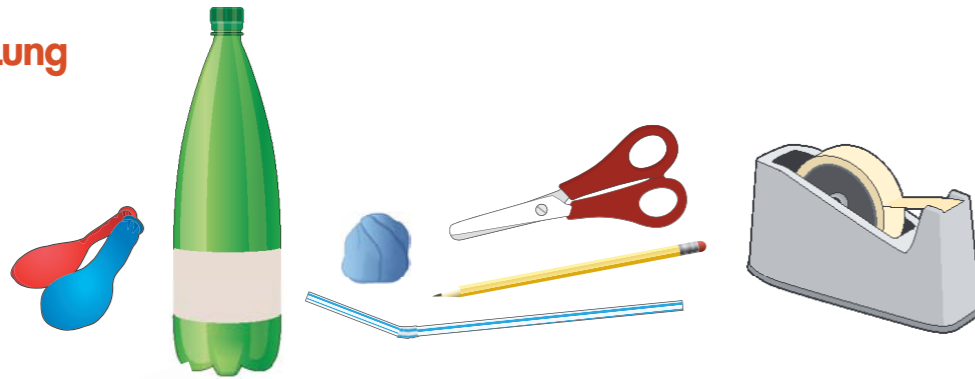
[www.csiro.au/en/Education/DIY-science](http://www.csiro.au/en/Education/DIY-science)  
[kidshealth.org/kid/htbw/](http://kidshealth.org/kid/htbw/)

## FOLLOW-UP CLASSROOM ACTIVITY 1

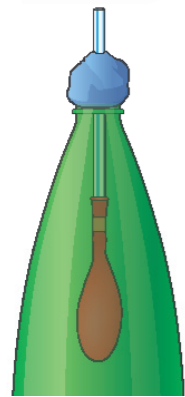
### Make Your Own Lung

#### You will need:

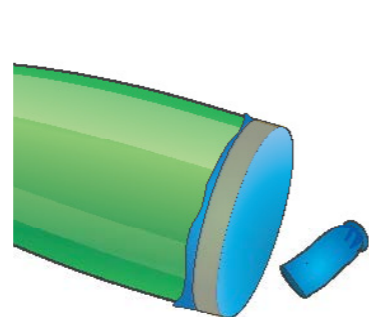
- Empty 500ml drink bottle
- Drinking straw
- 2 Balloons
- Scissors
- Tape
- Plasticine or Blu-tac
- Pencil



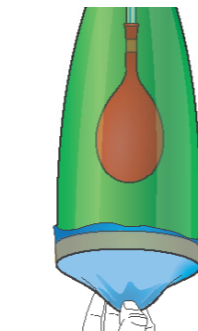
1. Remove the top of the bottle and then cut the bottle in a quarter.
2. Make a blob of plasticine big enough to cover the top of the bottle and keep it airtight. Push the pencil through the plasticine to create a hole. Mould your plasticine onto the bottle top.



3. Securely tape one of the balloons over one end of the straw so it is airtight. Feed the straw up through the bottom of the bottle and the hole in the plasticine until the balloon is inside the bottle. Once in place, squeeze the plasticine to secure the straw so it is airtight.



4. Cut off the tube section of the other balloon and discard it. Stretch what's left over the bottom of the bottle and tape it in place, sealing the edge, ensuring the balloon can't slip and is airtight.



**To operate:** Pull down on the stretched balloon.

What happens to the balloon inside the bottle? Let go of the balloon or push it back in and watch it again.

**Extension:** Try taping two straws together, making two holes in the plasticine and using two balloons inside your model to show how the air flows in and out of two lungs.

#### Explanation

This model demonstrates how our lungs work. When you pull on the stretched balloon, the other balloon should inflate and when you let go it should deflate. In our body our lungs operate in a similar method.

To take a breath in our diaphragm pulls down and the chest cavity is enlarged. This causes the air pressure in the chest to drop because the volume has increased, but the amount of gas is the same. Higher pressure external air rushes into our mouths and lungs to equalise the pressure, inflating our

lungs. When the diaphragm moves back up, it forces the chest cavity to get smaller, pushing the air back out again.

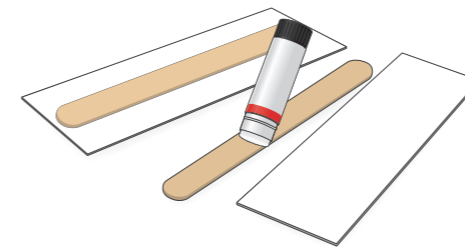
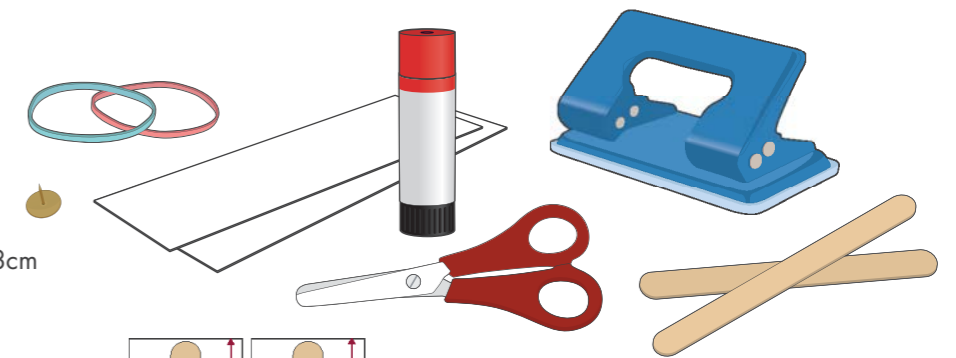
In our model the bottle is our chest cavity, the stretched balloon our diaphragm, the straw our mouth and the other balloon our lungs.

## FOLLOW-UP CLASSROOM ACTIVITY 2

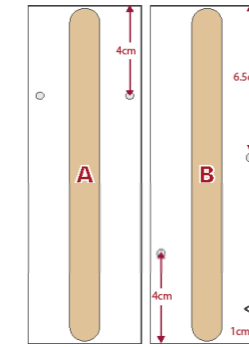
### Make a Muscle

#### You will need:

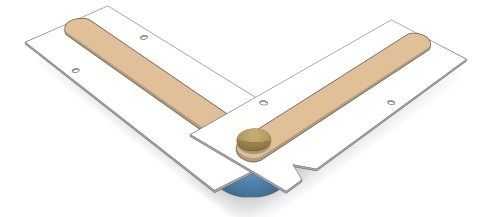
- 2 pieces of stiff card or cardboard cut to 15cm by 5cm
- 2 lollipop/craft sticks
- 2 rubber bands – diameter approx. 8cm
- Hole punch
- Drawing pin
- Scissors
- Glue stick



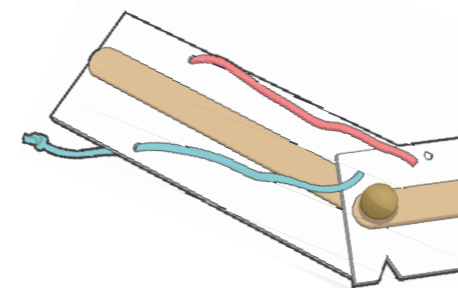
1. Glue each lollipop stick to the centre of each piece of card.



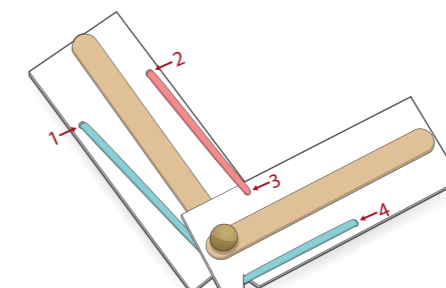
2. Use the diagram to measure and mark where the four holes are to be made and use the hole punch to make them in these positions. Use the scissors to cut a triangular notch as shown in the diagram on card B.



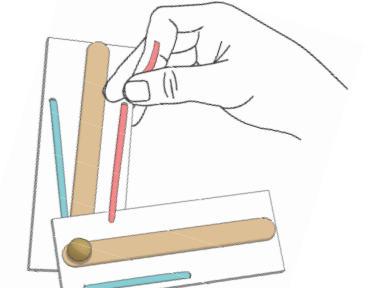
3. Place the bottom of lollipop stick B over the bottom of lollipop stick A. Push a drawing pin through both overlapping lollipop sticks to attach them. (Try using plasticine or blu-tac behind the lollipop sticks as this makes it easier and safer).



4. Cut both the rubber bands once. Thread each band through one of the holes on card A and tie each in a knot at the back so they can't move out of the holes.



5. Have the lollipop sticks at approximately 100° angle to one another. Thread the rubber band from hole 1 through hole 4 and tie off in a knot at the correct length to keep the arm at this position. Run this rubber band through the notch in card B. Put the other elastic band through hole 3 and tie off at the correct length.



6. Move the arm by pulling on the rubber bands. Pulling on one rubber band makes the arm bend, while pulling on the other makes the arm straighten.

Decorate your arm by drawing or labelling on bones, muscles and tendons.

#### Explanation

The human body has over 650 muscles. In this activity we can examine how the system in our upper arms causes the arm to move.

The elastic bands are acting a little bit like our muscles and the lollipop sticks

like our bones. When we want to move our arm, our brain sends a signal to the muscle making it contract so it gets shorter and fatter. Muscles are attached to the bones with tendons and when the muscle contracts, it pulls on the bone causing it to move.

To move the arm back again, another muscle must contract to make a movement in the opposite direction.