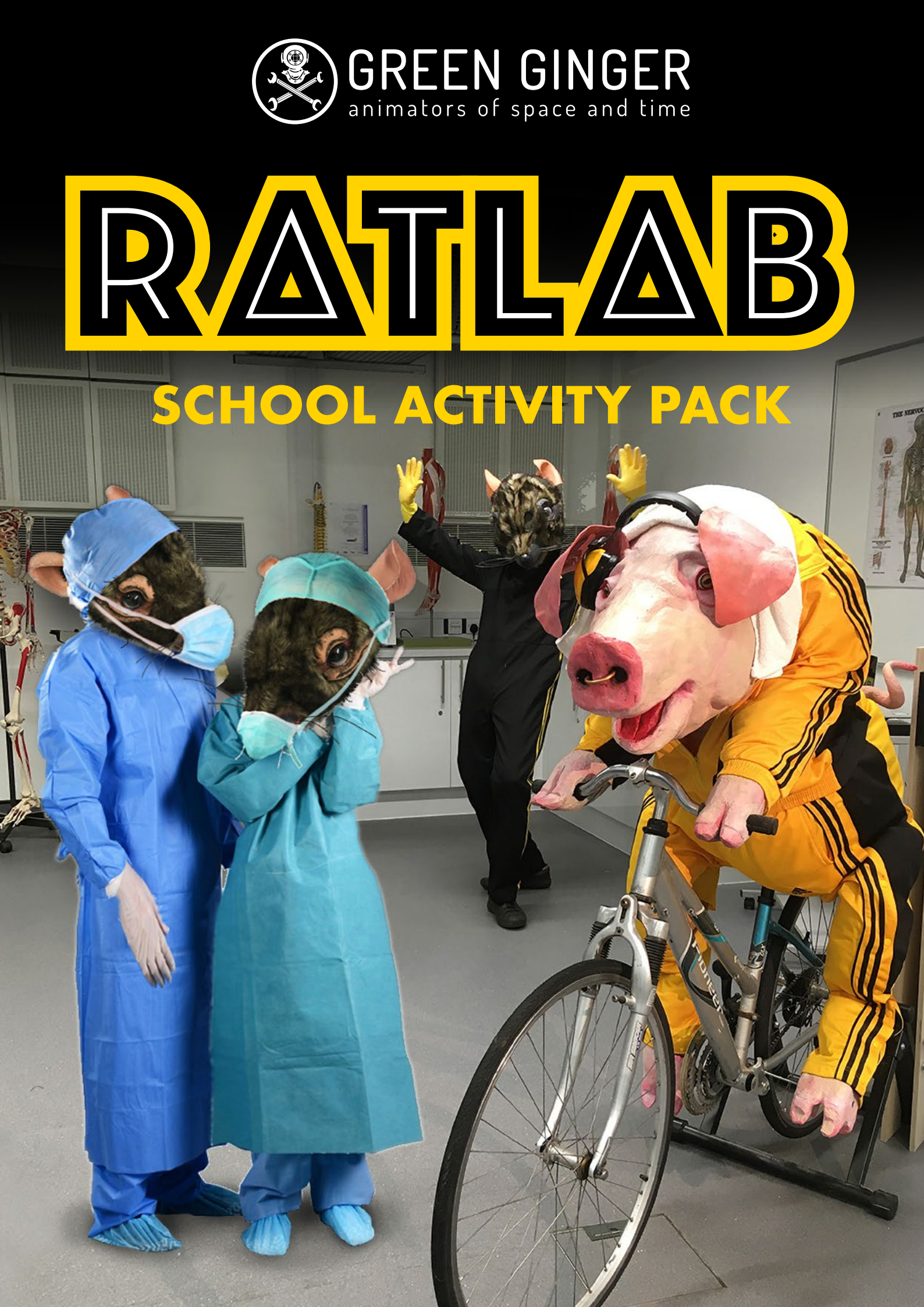
GREEN GINGER
animators of space and time

RATLAB

SCHOOL ACTIVITY PACK



WELCOME!

Welcome to the world of RATLab! In preparation for our visit to your school we have created an activity pack – our very own 'Rat Pack'! In the following pages you will discover films to watch and activities to complete, all about how extraordinary our bodies are and how exciting it can be to become an engineer.

CONTENTS

A MESSAGE FOR TEACHERS

This activity pack can be used in a variety of ways to suit your class and the equipment you have available. For example, this whole document could be emailed out, individual pages could be printed off, or you could show it on a big screen at the front of your class. There are discussion topics that you may want to lead, or things you want your class to think about individually, or exercises to complete in groups. We have put together a Google drive which contains this pack, as well as the individual worksheets. All the films mentioned here are collated together in a YouTube channel. This document also includes direct links to relevant films, whenever you see 'click here' and this symbol:

We would really appreciate your feedback to help us make excellent school activity packs in the future.

CLICK HERE FOR THE GOOGLE DRIVE

CLICK HERE FOR THE YOUTUBE LINK

INTRODUCING RATLAB

FUN FILM FACT!

Our film crew sampled a recording of pigs breathing for the soundtrack of this film!

FUN FILM FACT!

These two films were filmed in a real teaching laboratory at the University of Bath!

CLICK HERE TO WATCH EVERYDAY ENGINES

DISCUSS:

Think about your daily routine. What do you do? What do you use? Which everyday objects surrounding you now do you think have been engineered?

CLICK HERE TO WATCH WARM UP

DISCUSS:

- Can too much exercise be bad for us?
- What different ways have you learnt to warm up and cool down in PE class?
- Do different activities need different ways to warm up? Why do you think that is?
- When we drink a glass of water, how does it get supplied to different parts of our bodies?

GROUP EXERCISE:

Design a short exercise routine of gentle movements that might safely warm the body up, ready for

- entering a dance competition
- performing in a piano concert
- playing in a football match

EXERCISES FOR AFTER THE RATLAB VISIT

CREATIVE WRITING:

During our visit to your school, you will meet Ronnie and hear her story. After you have seen the show, think about what could have happened before and after her experience in surgery:

- Write a news report of Ronnie's last rugby match before her injury.
- Write a story or poem about what Ronnie does next after she's recovered in the RATLab rehab

DRAWING:

Have a go at designing your own RATLab laboratory set in an inflatable dome!

SABINA'S BONE FACTS!

BONE FACT!

Do you know how many bones there are in your body? **206**. Rats have **223** bones, and dogs have around **320**!

BONE FACT!

A joint is where your bones meet in your body.

BONE FACT!

A pig has **223** bones!

BONE FACT!

Animals that eat a balanced diet and who can exercise are likely to have stronger bones and joints.

BONE FACT!

Bone is made of calcium, phosphorus, sodium and collagen. Some of these things are very squidgy and some are really brittle, a bit like a piece of chalk and a piece of string.

Bones are an amazing part of the machine which is our whole body.

Bones act as levers that are powered by muscles – similar in design to human-made machines like robots.

On the next pages Georgina will show you how to conduct some fun bone experiments!

Georgina was studying towards a master's degree in Mechanical Engineering at the University of Bath, and the next three worksheets and activity walkthrough films were produced for Georgina's final year project. She was set the task of making a series of fun activities and accompanying instructions, suitable for your age group, to illustrate the basic concepts of Biomechanics. Georgina chose to become involved in this project because of her passion for Biomechanics, which she studied in the final year of her degree!

BENDY BONES

CLICK HERE TO WATCH THE BENDY BONES ACTIVITY WALKTHROUGH

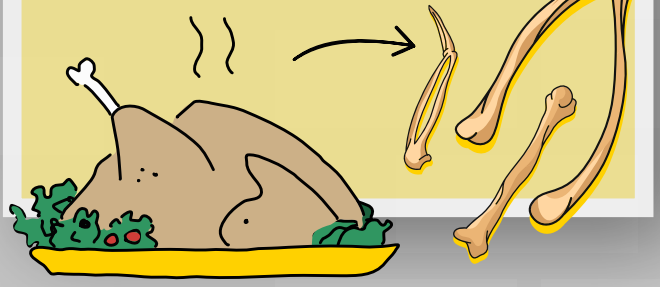
WHAT YOU'LL NEED:

- Two Chicken Bones
- Vinegar
- Kitchen Paper
- Two jars with a lid (or two bowls with cling film)
- Marker Pen

WHAT TO DO:

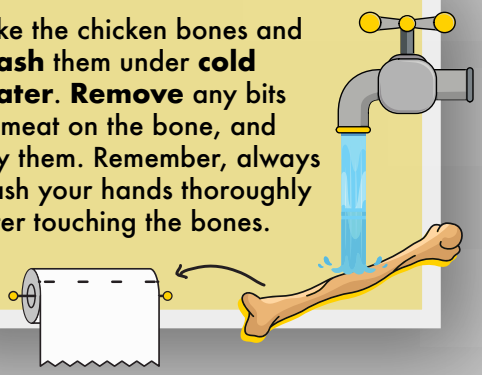
1

Ask an **adult supervisor** to **collect chicken bones,** one fresh and one from a roast dinner. Store them in the fridge until you are ready.



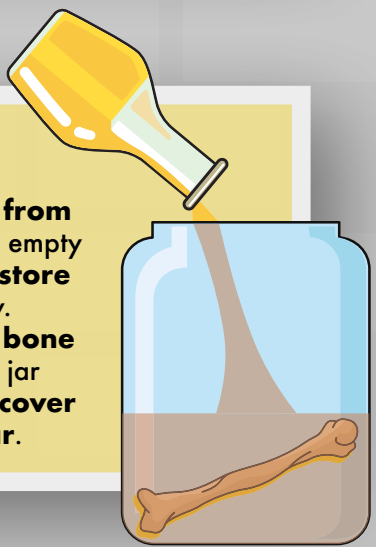
2

Take the chicken bones and **wash** them under **cold water**. **Remove** any bits of meat on the bone, and dry them. Remember, always wash your hands thoroughly after touching the bones.



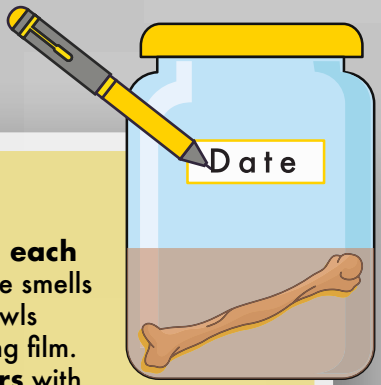
3

Place the **bone from the roast** in an empty jar, close it and **store it** out of the way. Place the **fresh bone** in the remaining jar and completely **cover it with vinegar**.



4

Put the **lid on each jar** to keep the smells in - if using bowls cover with cling film. **Label the jars** with content and date.

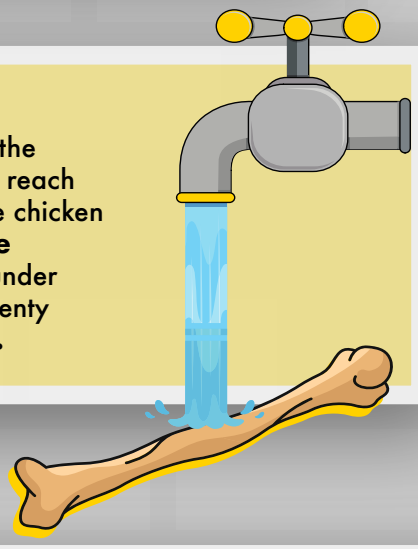


5

Leave the jars on the kitchen side for **5 days** and patiently **wait**.

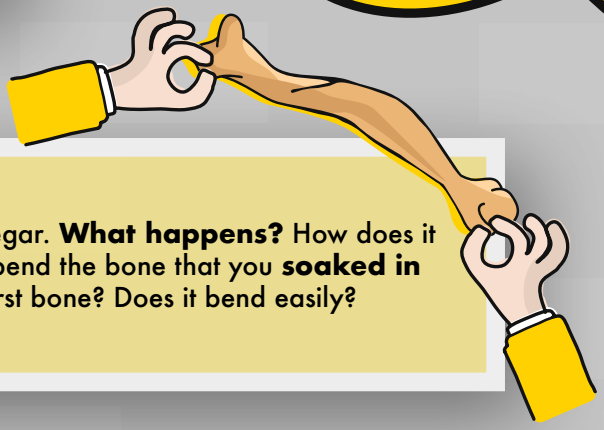
6

Take the lid off the vinegar jar and reach in and **take** the chicken bone out. **Rinse the bone** off under the tap using plenty of **cold water.**



7

Try to bend the bone that wasn't soaked in vinegar. **What happens?** How does it feel? Notice how **stiff** the bone is. Next, try to bend the bone that you **soaked in vinegar**. How does it feel **compared** to the first bone? Does it bend easily?



WHAT IF?

Have **ham or turkey** bone instead? Do they become bendy too?

Vegetarian? Try pasta instead. Does the vinegar or water make the pasta bendy first? **Why** do you think that is?

Try leaving the bones in for **two weeks**. Do the results stay about the same or does it make a significant **difference**?

WHAT'S HAPPENING HERE?

Bones are made of **calcium** and a soft material called **collagen**. Our bones get their strength from the **mineral** calcium. **Calcium keeps the bones stiff and rigid.**

Vinegar is an **acid**. Soaking the bone in vinegar **removes the calcium**, making the bone **soft and flexible**.

Calcium is needed to make our **bones strong**. If our bones are too flexible, they do **not support the weight** of our **body** or the stress from our muscles pulling on them. That's why we need a **healthy diet that contains calcium**. Foods that contain a lot of calcium are milk, cheese, leafy greens and soy products.

BRITTLE BONES

CLICK HERE TO WATCH THE BRITTLE BONES ACTIVITY WALKTHROUGH

WHAT YOU'LL NEED:

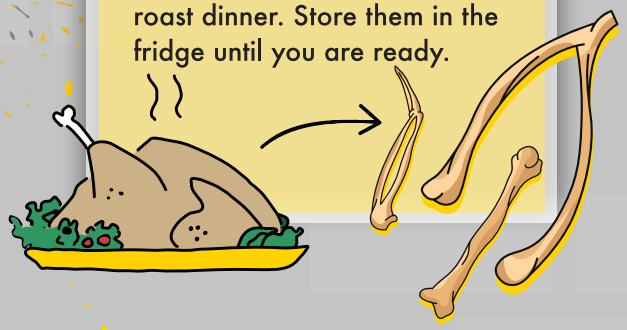
- Two Chicken Bones
- Kitchen Paper
- Timer
- Oven
- Baking Tray
- Oven Gloves

This activity will require **adult supervision** due to using an **oven**.

WHAT TO DO:

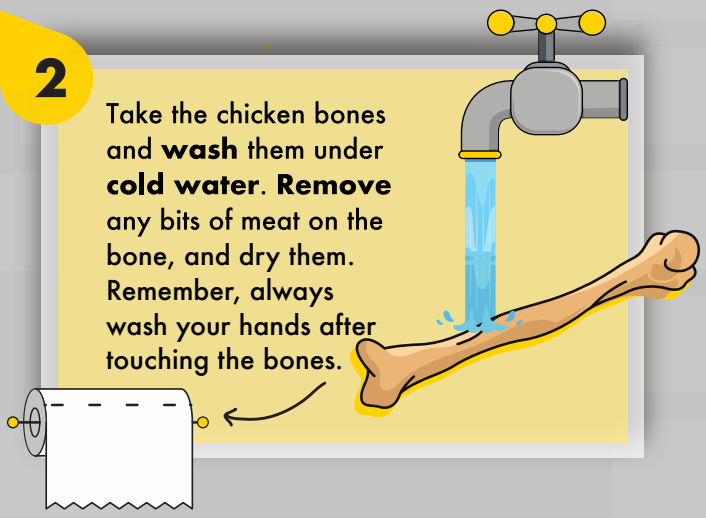
1

Ask an **adult supervisor** to **collect chicken bones** from a roast dinner. Store them in the fridge until you are ready.



2

Take the chicken bones and **wash** them under **cold water**. **Remove** any bits of meat on the bone, and dry them. Remember, always wash your hands after touching the bones.

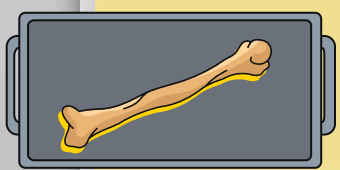


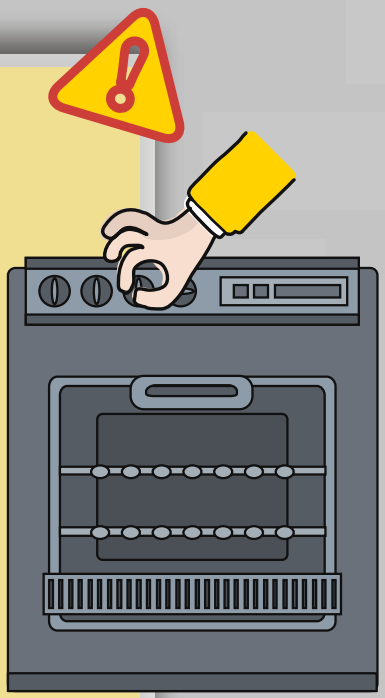
3

Ask an adult to **preheat** the oven to 120°C.

With the help of an adult, put **one** of the bones on a **baking tray and bake** it in the oven at 120°C.

Set the other bone aside.





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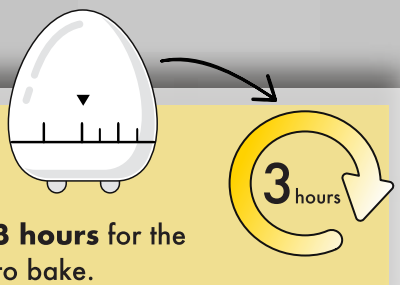
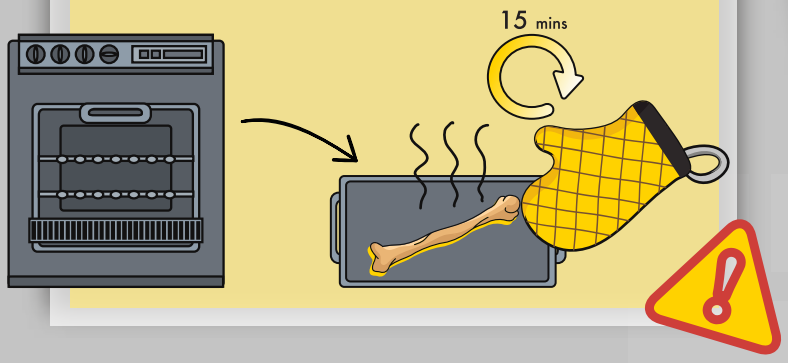


Wait **3 hours** for the bone to bake.

5

With help of an adult, remove the **tray** from the oven and let the bone **cool down** for at least 15 minutes until you can touch it **without burning yourself**.



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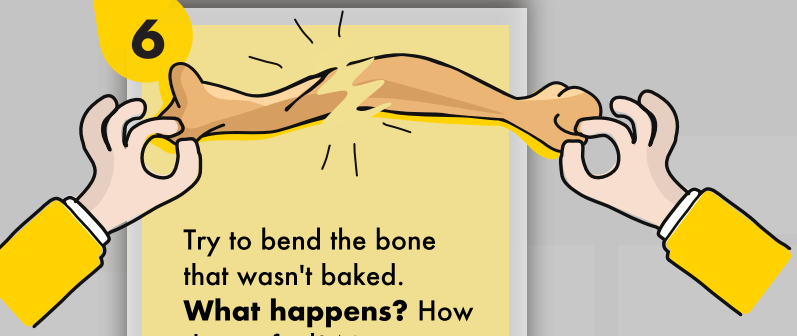


Try to bend the bone that wasn't baked. **What happens?** How does it feel? Next, try to bend the bone that you **baked**. How does it feel **compared** to the first bone? **What happens when you try to break it in half?**

WHAT'S HAPPENING HERE?

Around **30%** of our bones are made of **collagen**. Collagen is a **protein** that gives bones **flexibility** and also helps bones to **resist pulling and stretching forces**. It does this by **holding minerals like calcium** together in our bones.

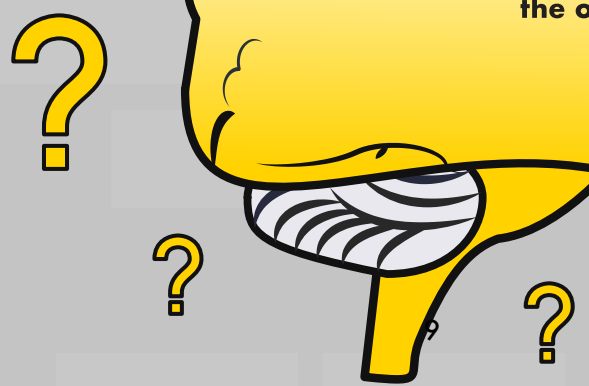
Baking the bone **breaks down** collagen. Without collagen, the bone is **brittle and easily breaks**. That's why the bone snapped after it was baked.

If the bones in your body lacked collagen, they would break easily. We can **maintain healthy bones** by eating **protein-rich** foods like chicken, eggs, fruit and dairy products.

WHAT IF?

Have **ham or turkey** bone instead? Do they become brittle too?

Does the **size** of the bone affect how **long** it needs baking until it becomes brittle? **What is the optimum time?**



JUICY JOINT 1

BALL & SOCKET

WHAT YOU'LL NEED:

- Orange
- Grapefruit
- Knife
- Kitchen Roll
- 2 Forks

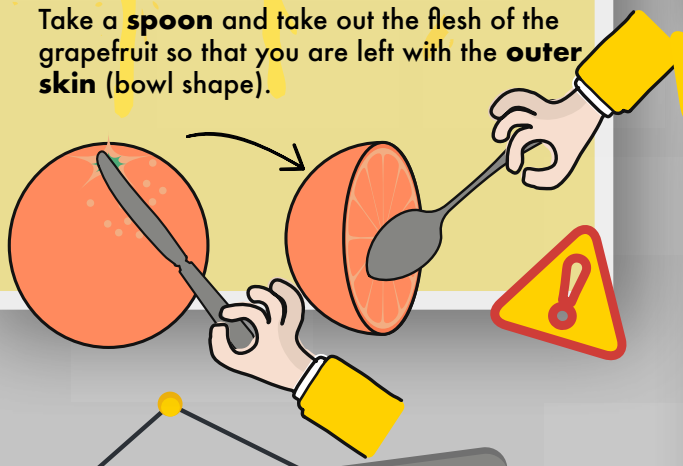
This activity will require **adult** assistance due to **cutting** fruit with a **knife**.

CLICK HERE TO WATCH THE JUICY JOINT BALL AND SOCKET ACTIVITY WALKTHROUGH

1

Select two pieces of fruit that are **similar sizes** one slightly larger than the other. Ask an **adult supervisor** to cut the grapefruit in **half**, but **keep** the **orange whole**.

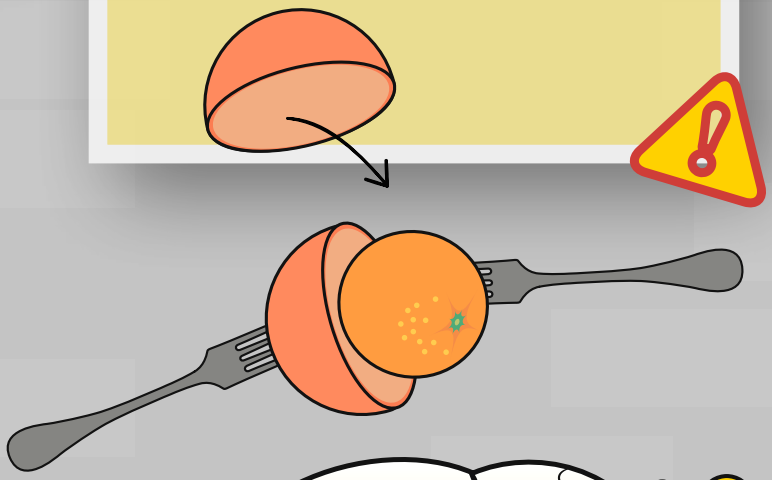
Take a **spoon** and take out the flesh of the grapefruit so that you are left with the **outer skin** (bowl shape).



1

Ask an **adult supervisor** to put a fork into the skin of the grapefruit and then another fork into the whole orange.

Try **moving** the orange in the grapefruit. How does the orange **move inside** the grapefruit? Is it easy to move the two?



WHAT'S HAPPENING HERE?

A **joint** is the part of the body where **two or more bones meet** to allow movement. There are six types of moving joints in our body. They have varying shapes which allow for **different types of movement**. In this activity, we made a **ball and socket joint**.

In this type of joint, one bone has a smooth, **ball-shaped** head that fits into a **cup-like socket** on the other end - just like in our activity where the orange is the ball-shaped head and the grapefruit is the cup-like socket. The juice from the grapefruit is like the **synovial fluid** that acts as a **lubricant** in our joints and allows the joint to **easily slide**.

The ball and socket joint allows **rotation in all directions** this joint is the **most** moveable in our body. Examples of ball and socket joints in the body are the **hip** and the **shoulder**. The ball and socket joint in the shoulder allows you to move your arm in a circle and the hip and socket joint in the hip allows you to kick a ball while running!

The hip has a **deep socket** like the grapefruit and orange. This makes it **stable**. The shoulder has a **shallow socket** more like - a golf ball on a tee. This is **less stable** the ball could easily fall off. Around a ball and socket joint, there are **ligaments and muscles** to help keep the ball in the socket.

How could you make the joint **less stable**? What could you **cut** away?

WHAT IF?

MAKE YOUR OWN RAT MASK!

WHAT YOU'LL NEED:

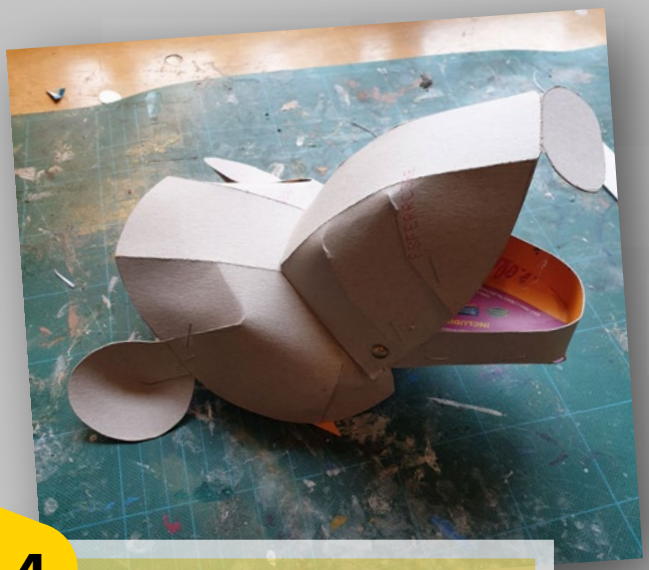
- Pritt stick
- Scissors
- Stapler or hot glue gun
- Sharp pencil
- Split pins
- Rubber
- Acrylic paint & brushes

WHAT TO DO:

1 Print these pages onto A4 paper, pritt stick your print outs onto a cereal box. Cut out the pieces and score along the dotted lines. Punch the holes out using a sharp pencil with a rubber behind.

2 Staple the nose onto the face pattern piece.

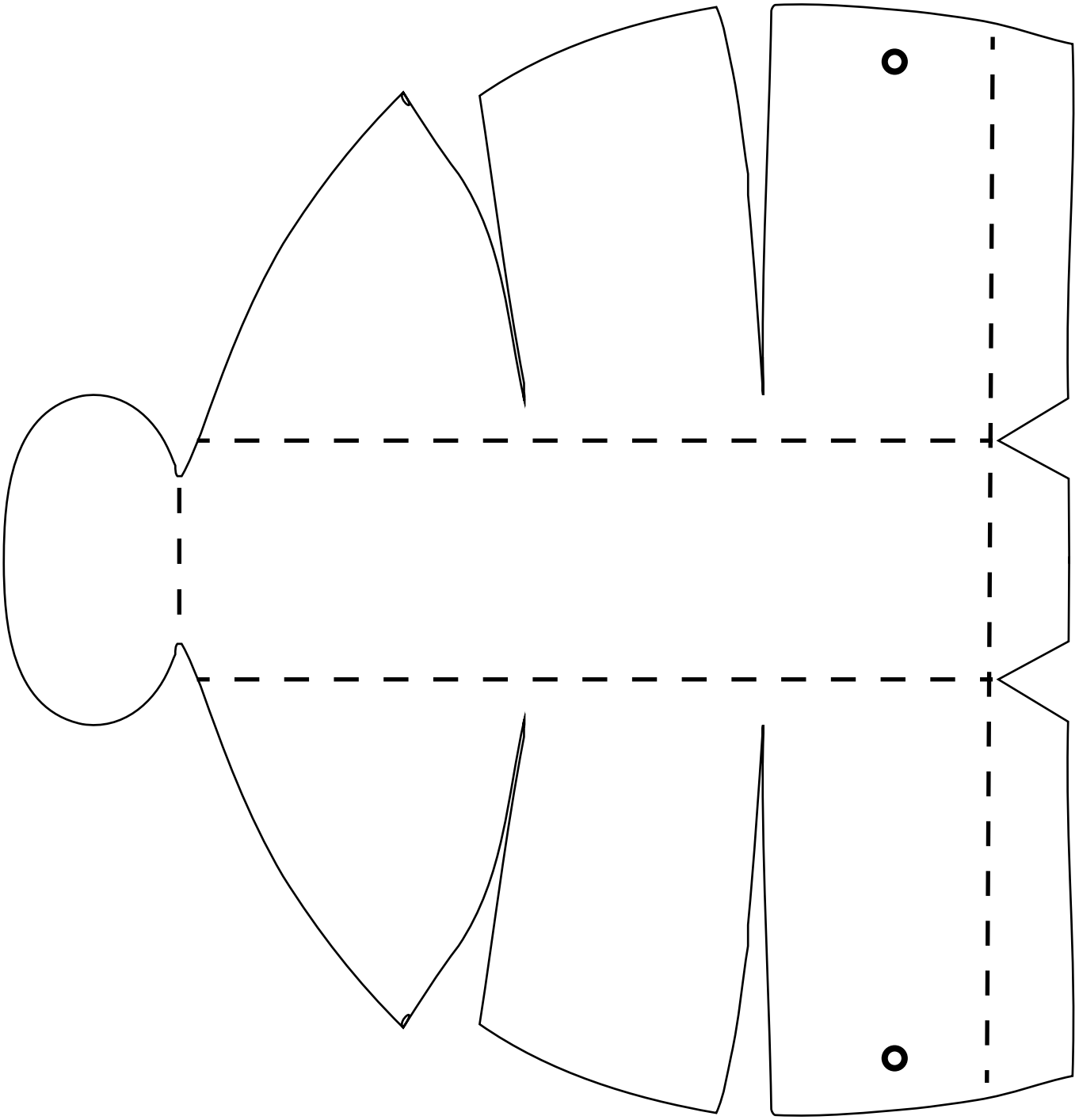
3 Staple all the darts together and staple together the jaw

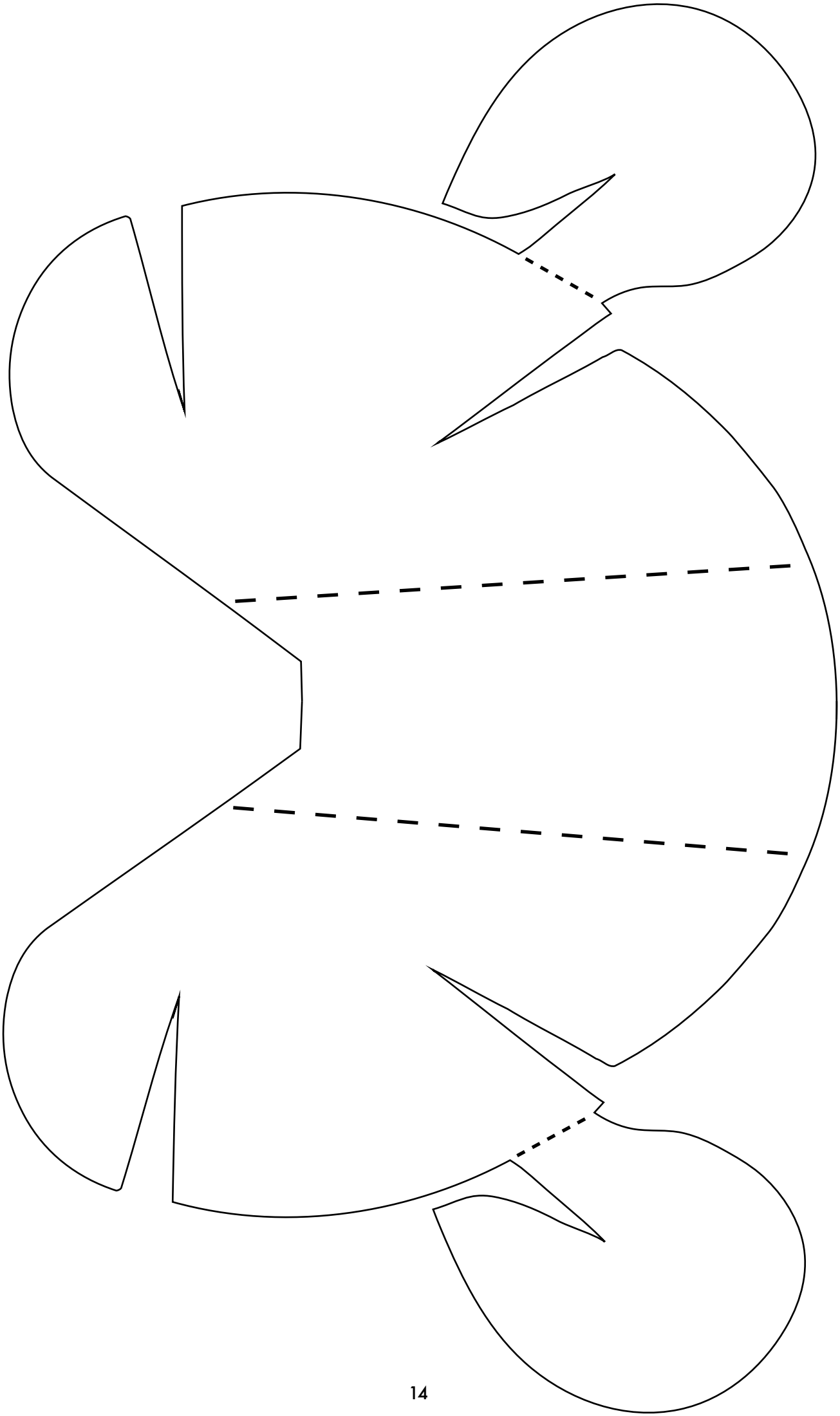


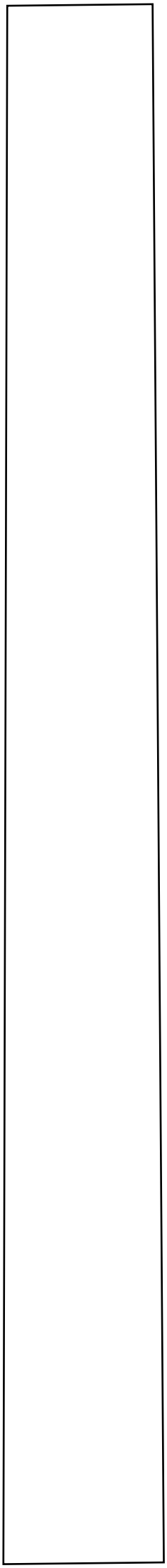
4 Attach the jaw to the nose by poking a split pin through the holes you made

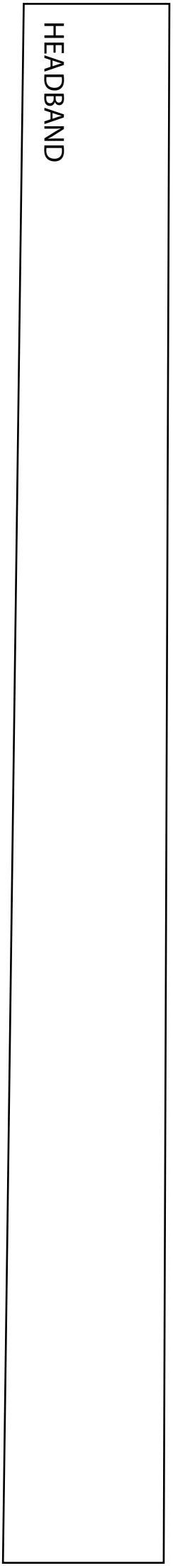
5 Measure your head and staple the strips together to make a headband that fits you, staple your head band to the back of your rat mask.

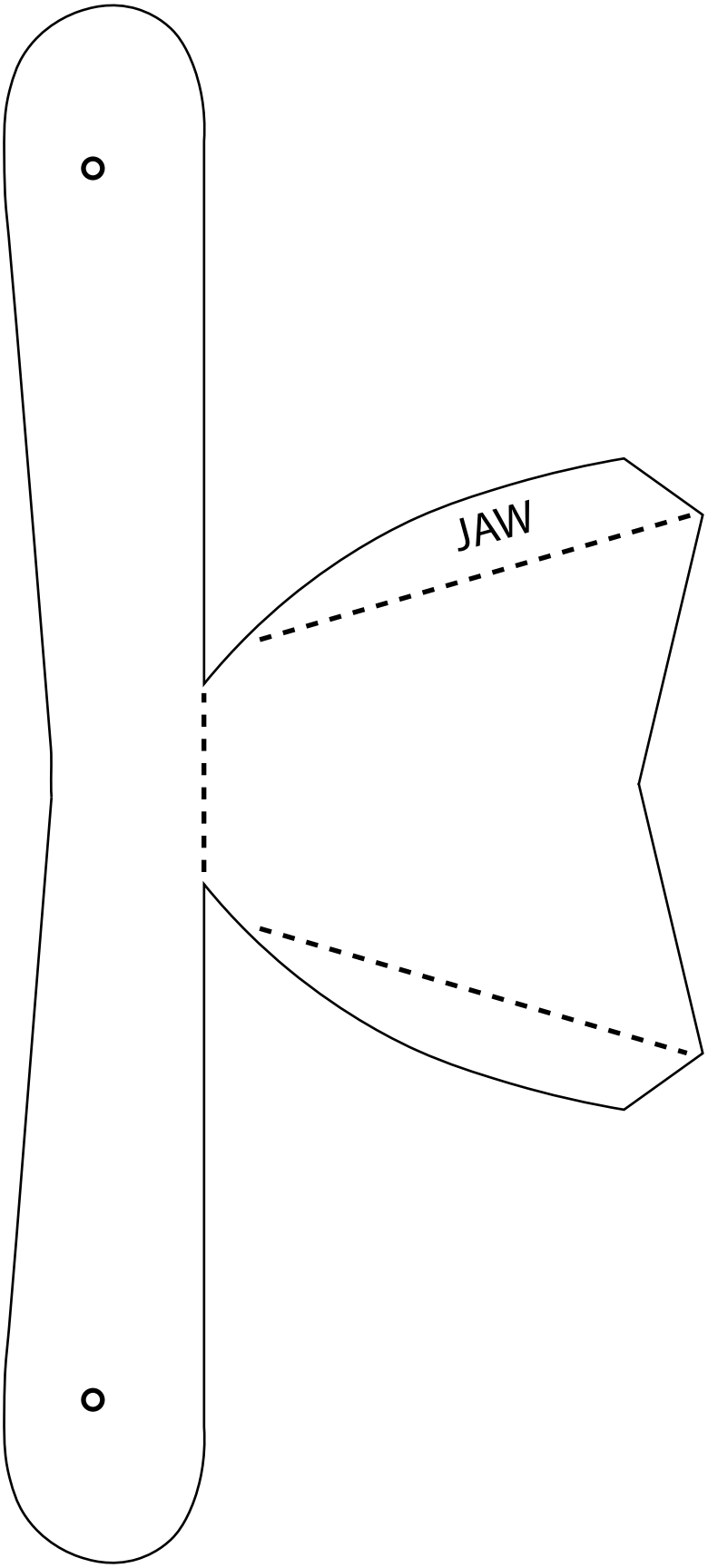
6 Now you can paint and decorate! You can design more rat features using the leftover cardboard, the recycle bin is a great place to find bits, bobs, bottle tops and straws to add your own personality








HEADBAND


JAW

MAKE YOUR OWN PUPPET!

Green Ginger are a theatre company, based in Bristol, who create shows with puppets in them. We love puppets so much; we are even based in an artist's studio called 'Puppet Place'. Anyone can learn how to master the basics of puppeteering – in fact we always say that playing with toys and using your imagination to come up with your own stories with them, is where everyone we know starts!

Below is a simple guide to making your own walking puppet, to begin experimenting with 'tabletop puppetry' – this literally means having a puppet that fits on a standard table!

A SIMPLE, WALKING TABLE-TOP PUPPET FOR ONE PUPPETEER

by Green Ginger's Chris Pirie

All ages from 4 years with minimal adult assistance.

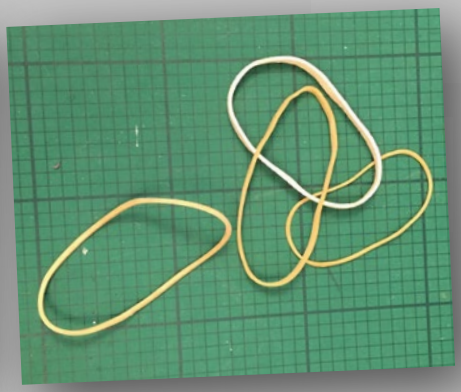
THINGS YOU WILL NEED

2 long-ish socks

can be mismatched but roughly the same length

2 cups (500g) of dried food

(rice, lentils, beans etc) in two sealed bags



2 Elastic Bands

these may be useful but are not essential

WHAT TO DO:

1. Fill each sock with 250g of dried food. You can put elastic bands above the lumps if you wish, though it's not essential.

2. Tie the socks together with a simple knot at their open ends; you could also experiment with elastic bands.

3. Holding the knot as its head, pull it upwards while holding one of the two 'feet' on the table. This gives tension through the body. Try and maintain this stretch as you do the next steps.

4. Playfully practice taking small steps with one foot and then moving the head in the same direction. With tiny adjustments, the other foot can take steps of its own, using the momentum or energy created by the movement of the head and first leg.

ACTIVITIES:

- Walk from one end of a table to the other
- Does your puppet walk in an unusual way? Play with different ways to get from one end of the table to the other
- Pair up with another person and walk both your puppets across the table in opposite directions
- Can you create a voice, or sound effect, that your puppet might make whilst they walk?
- Create a short 2-minute scene in pairs or threes, where your puppets begin separately, meet in some way, and then move together

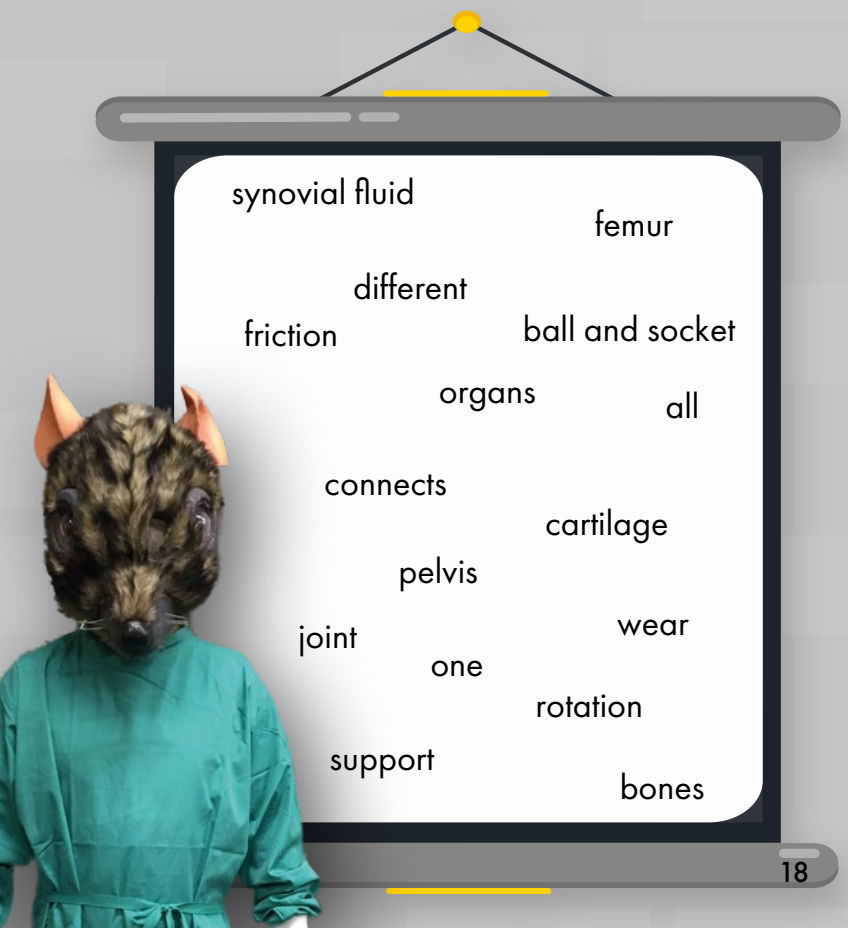
JOINTS WORKSHEET

1 Fill in the missing words.

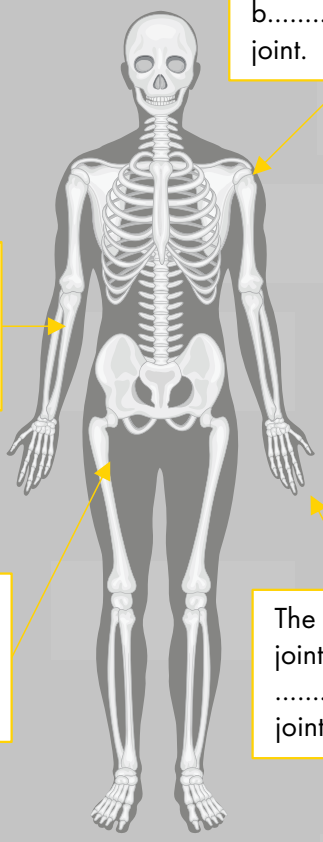
The skeletal system works as a ..... structure for your body. It gives the body its shape, allows movement, makes blood cells, provides protection for ..... and stores minerals. Joints are the places where ..... meet. Most joints can move and allow ..... types of movement.

One example of a ..... is our hip. This is where the upper leg bone called the ..... meets with the ..... When you walk or kick a ball you are using your hip joint. The hip joint is a ..... joint. A ball and socket joint is the most moveable joint in our body and allows ..... in ..... directions. Another example of a joint is our elbow joint. This ..... our lower arm to or upper arm. The elbow joint is a hinge joint that only allows rotation in ..... direction. This allows us to bend and straighten our arm.

The end of bones, where joints are formed, we have ..... This is a smooth substance that reduces friction and wear. A lubricant called ..... also reduces friction.



2



The s..... joint is a b..... joint.

The e..... joint is a h..... joint.

The ..... joint is a ..... joint.

The ..... joint is a ..... joint.

JOINTS WORDSEARCH

D B N E H Q M C B F B E Q R O I O K E S
V G J R K K L A S J B O O N A J X I E G
V M L G Q V L W S R B T T C V Y V C T U
B N O S C L N E V T A W P C Q M R K C F
H J W B Y I J A N T B Y H S E P G E B Y
G L W B V K B R I H M E M E P L I I V E
M S W Q A X T O W V Q V O Y E J D D T Y
S T V R Z F N E N O J S M R A C S Q C D
U C M I W N L D L X X K M J D O N T M V
E E V L N K S K P Z X P E L V I S B M K
F N F P H F H S N C V D W V F U Y K C T
T N S A C R E F N F T N N E S Q X Z O N
Z O F K C I B J Q A L M G Q F H Z X M K
N C S R M C J D O A G A W M R Y Z C A R
Z H K E P T T O I F L R F T E K C O S F
V W H D N I L V I I T U O E B Y H E X L
F L U I D O O K T N M T M J M V P K N F
R V Z Q A N B R O U T R O P P U S P Q Q
M I S V Y F A J I V F T T R Z D R I S G
U R V S Q C S B E I U H X Y L X J C S B

Ball
Bones
Cartilage
Connects
Femur
Fluid
Friction
Joint
Organs
Pelvis
Rotation
Socket
Support
Synovial
Wear

LEARN THE RAT RAP!

Before RATLab visits your school, have a go at learning the hook to the Rat Rap using these guide tracks to help you. Then you will be able to join in during the RATLab show!

CLICK HERE FOR THE GUIDE TRACKS

MUSIC FACT!

The backing track was created from scratch especially for RATLab out of samples – this is called sampling.

You take the catchy part of another track, play around with it, add a new melody, and this altogether forms the identity of a fresh new song!

Cos every mammal on the planet has a skeleton
Muscles and cartilage, ligaments and tendons
On the outside we may seem different
But underneath the skin it's all the same components

Yes every mammal on the planet has a skeleton
Muscles and cartilage, ligaments and tendons
On the surface we may seem different
But inside you'll see there's similar systems

Our RATLab has some really high-tech equipment in it, including motion capture (or 'mo-cap') which is used by biomechanical engineers to understand how the body is moving. To do this, small white dots are stuck to the skin, or skin-tight clothing, of a person, who are then asked to repeat their activity in the lab, such as running on a treadmill, or cycling on an exercise bike. This is filmed by several cameras, which are picking up those white dots, and then a computer programme maps out the movement. The engineers can then study what movement is causing the injury, and help find better equipment, physiotherapy, or movement techniques to improve performance or recovery from injury.

The team at the University of Bath even changed the rules of international rugby using their research, to make the game safer by reducing the impact on players through how the 'scrums' are formed.

Our RATLab character, MC La Brat, is very passionate about their research in mo-cap – so much so they created a rap to tell us all about it!

ABOUT GREEN GINGER

Green Ginger is an international theatre company based in Bristol, UK. Founded by Terry Lee in 1978, it creates memorable experiences for worldwide audiences through highly visual and accessible productions. The company has toured extensively from the Far East to South America, and the Arctic to the Indian Ocean.

Green Ginger collaborates with arts organisations of all scales, offering its vast experience in design, fabrication, and performance of innovative and accessible puppetry solutions. Major clients have included BBC, Channel 4, Fiery Angel, Welsh National Opera and Aardman Animations. Green Ginger is dedicated to developing the artform of puppetry and is active within various support organisations in this respect. The company meets its commitment to helping early-career artists through workshops, masterclasses and CPD activity, and the company's Artistic Director Chris Pirie teaches and mentors at universities and colleges throughout Europe.

"Green Ginger will make you gasp with the scale of its theatrical imagination, its highly developed sense of the bizarre and the brilliance of its puppetry technique"

Lyn Gardner, The Guardian

RATLab is created in partnership with University of Bath.

Green Ginger acknowledges the core Creative Team on the project:

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Project Lead (University of Bath)

Dr Elise Pegg
(University of Bath)

Dr Dario Cazzola
(University of Bath)

Dean Veall
(University of Bath)

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Artistic Director, Lead Designer & Fabricator

Aileen Gonsalves
Performance Director

Lorna Rees
Dramaturgy & Script Development

Kate McStraw
Creative Producer

Thea Woodrow
Project Manager & Engagement Producer

Nick Willsher
Puppet Design & Fabrication

Em Spoor
Mask & Puppet Fabrication

Jonathan Eve
Sound & Music Design

Adam Laity
RATLab films creator

Georgina Beardsmore
Activity films & worksheets

JPDL
Rap creator

Helga Brandt
Marketing Lead

Martin Bonger
Performer

Kim Heron
Performer

Rae Alexander
Performer

Berry den Breeje
Technical Stage Manager

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Royal Academy of Engineering

UNIVERSITY OF BATH

Orthopaedic Research UK

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ARTS AWARD

Green Ginger is proud to be an Arts Award Supporter. Arts Award's unique qualifications support young people to grow as artists and arts leaders, inspiring them to connect with and take part in the wider arts world. RATLab will help young people working towards their Arts Award Discover and Arts Award Explore, and offers them the opportunity to experience the work of Green Ginger and their artists through a live theatre performance at their primary school, and post-performance Q&A.

For more information please visit: **www.greenginger.net/ratlab**

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