Horrible Science World Presents:

Excellent Experiments and Awesome Activities.

The following experiments and activities are taken from the 'Horrible Science' series of books published by Scholastic, and are divided into the different Zones that the character Billy Miller visits in the Birmingham Stage Company play 'Horrible Science'.

The journey Billy goes on through Horrible Science World in order to understand science is a good way of introducing the subject of scientific enquiry. Only by developing his knowledge, skills and understanding is Billy able to survive Horrible Science World and save the day.

This often involves investigation and trying things out (eg: pushing the button before pulling the lever to control gravity in the Gravitarium) and collaboration (Eg: Billy and the scientists working together to make a circuit.) This is further underlined by the involvement of the audience throughout the play – he needs our help as co-collaborators and co-learners if he's going to triumph.

Links can be made across the scenes in the play to encourage creative thinking (Eg1: the fact that bacteria live inside us is introduced by the Big Bacteria, and then picked up again in Frankenstein's Lab, as the reason we get stomach gas. Eg2: metal being a good conductor and used in the circuit in Act 1 makes it a potentially dangerous material inside the Thuderdome)

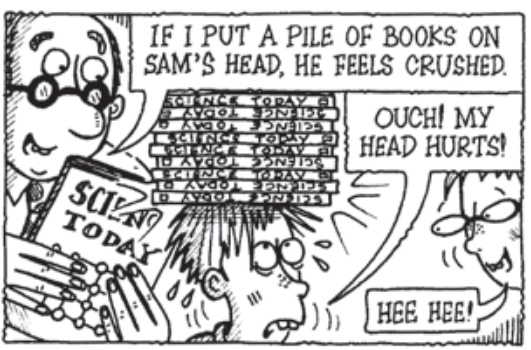
The activities and experiments for each zone contain an introduction suggesting further links with the play, and suggestions for how they could be used in helping pupils discover more behind the science in the story.

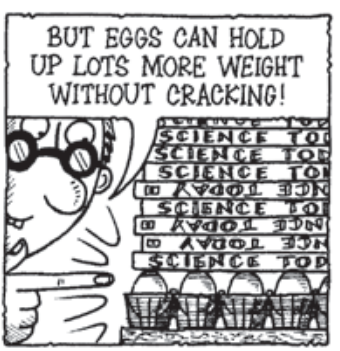
Foul physics experiments

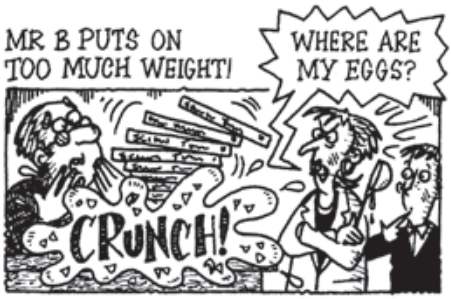
Physics can make you physic-ally sick. It's the sickening science of forces and energy and electricity and magnetism and light and sound and heat and, well, I could go on and on. But if I did, it would take you 20 years to read this programme and you'd need a dumper truck to take it home from the theatre. So I'll sum up physics by saying it's about everything that makes the universe tick. And that's more than enough – as you'll be finding out…

The Really Rotten Kids in… Egg-speriment

What's in an egg? Well, it's a sort of spacecraft for baby chickens to live and grow in until they're ready to hatch. And it comes complete with a gloopy yolk and white for the chick to feed on. But the egg also has a tremendous science secret. It can withstand amazing weights – as Mr Bunsen is about to show us…







While Mr Bunsen is making a hasty *eggs-it*, I've just got time to say that the next experiment will show you what makes eggs so strong… Over to you, Sam!

How I tested eggs

by Sam

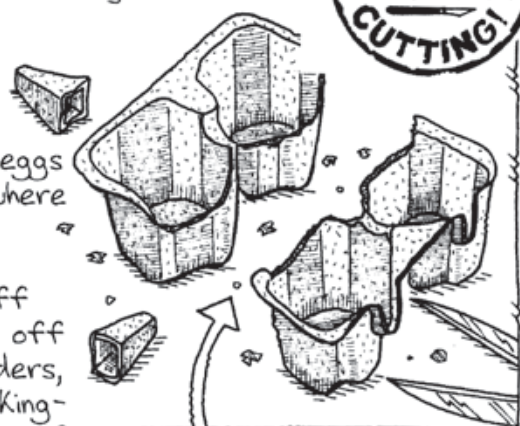
WHAT I NEEDED:

An egg box and four eggs
Scissors
Some heavy books. (Ideally they should all be the same size and have the same number of pages.) I borrowed science text books from my friends.
Scales
A pencil and paper

WHAT I DID:

1. I took out the eggs and put them somewhere safe.

2. I cut the lid off the egg box. I cut off two of the egg holders, then I cut the sticking-up bits off the base of the box. Finally I cut the base in half.



THIS IS WHAT THE EGG BOX LOOKED LIKE AFTER I'D FINISHED CUTTING IT UP

3. I put the eggs in each half of the base with the small ends pointing up. I laid the two halves on a table.

4. Next, I weighed one of the books and noted the weight. I laid the book on top of the eggs.

5. I piled books on top of each other until the eggs cracked.

WHAT I FOUND:

1. The eggs held up all the heavy science text books and I had to borrow some more from Nathan.

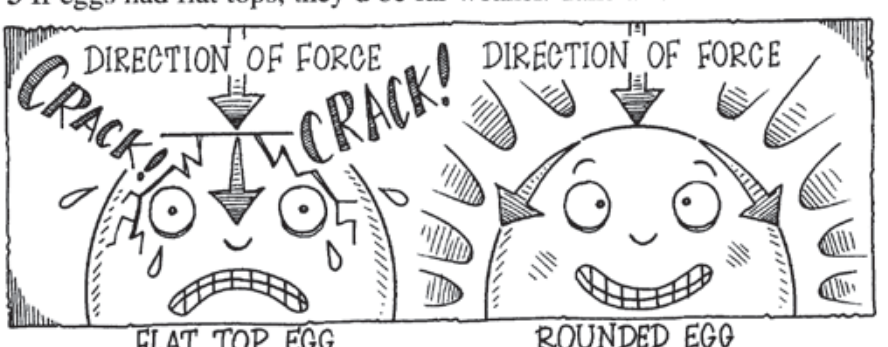
2. When the eggs broke, the yolks went all over the books. But it was OK because the text books were pretty messy already.

The science behind the experiment

1 An egg is surprisingly strong – it has to be, to protect the cute little baby chick growing inside it.

2 The ends of an egg are rounded. When you put a book on top of an egg, the curved top takes the force and spreads it around the egg's sides. There's less force pressing on the top of the egg – so the egg can take a weight of 22.7 kg without cracking…

3 If eggs had flat tops, they'd be far weaker. Take a look at this…



The Fatal Forces Zone

Physical processes.

The idea of ‘gravity going crazy’ inside the Fatal Forces Zone can be used as a starting point for exploring the whole idea of forces as being ‘pushes’ and ‘pulls’. These activities can then feed back in to a wider discussion on the pulling force of gravity, exploring the subject in more detail. (Eg: the fact that how much things weigh on earth is a measure of gravity’s pull.)

The range of forces demonstrated in the experiments show how forces affect lots of things in our daily lives, (**How a bolas works**, **How to juggle** and **The inertia of an egg**).

The fact that the earth’s gravity affects the moon in space, as well as objects down here on earth, provides a good example that Newton’s Laws of motion are universal. The experiments **A moving moment** and **The force of a wall** demonstrate Newton’s Laws, and also introduce the fact that forces are measured in Newtons (N).

The **force of gravity** experiment is said to have been undertaken by Galileo, when he proved that objects of the same size and shape will always fall at the same speed, under the influence of gravity. This experiment is a good way to introduce the main features of a scientific experiment – trying to find something out, predicting what will happen, making it a fair test, recording observations and measurements, and then drawing conclusions from the results.

The following experiments are taken from the books ‘Fatal Forces’ and ‘Famously Foul Experiments’.

A moving moment

You will need:
Clean plastic tube 30 – 45cm long, with an opening 1.2 – 2cm across. Or you could use a piece of A4 paper.
Pen
Sticky tape and scissors
A piece of stiff paper 12 x 16cm

What you do:
1 Roll the piece of stiff paper lengthways around the pen and secure it with sticky tape to make a tube shape. This is going to be your dart.
2 Make a nose cone for your dart by wrapping sticky tape around one end of the dart to block it up.
3 The plastic tube is going to be your launch tube. Alternatively, simply roll the A4 paper lengthwise around your dart. You'll need to make your launch tube a little wider than the dart. Secure the launch tube with sticky tape.
4 Place the dart in the tube, take a deep breath, and… fire!

Horrible Health Warning:
Never aim your dart at another person (or the cat)

What happens:
When you blow through the launch tube the dart whizzes out of the other end.

Why?
It's all explained by Isaac Newton's Laws of Motion.
Newton's First Law of Motion – an object that isn't affected by a force stays where it is. A force makes the object move in a straight line until another force affects it. So the dart stays still when not in use. When you fire the dart it flies off in a straight line until the force of gravity pulls it down.
Newton's Second Law of Motion – forces can make an object change speed or direction. So although your breath makes the dart zoom off, the dart is slowed by the force of air rubbing against it.

The force of a wall

You will need:
Yourself
A wall

What you do:
Stand with the left side of your body – foot, leg, hip and shoulder – touching the wall. Push against the wall. Now try to raise your right foot.

What happens:
You can't!

Why?
The wall is pushing back, and if you raise your right foot the wall will push you over! Newton's Third Law of Motion says that if you apply a force to anything it will push back just as hard!

The force of gravity

You will need:
Parcel tape and scissors
Bucket about 24cm high
Larger bucket
Metal ballbearing
Marble or rubber ball of the same size as the ballbearing
Notebook and pencil
Plank of wood 2.5 metres long and at least 12cm wide
Two strips of wood – ideally as long as the plank
Stopwatch or watch with a second hand
Good friend or adult

What you do:
1 Turn the smaller bucket upside down and rest one end of the plank on it.
2 Using the parcel tape, stick the strips of wood to make a narrow lane running down the plank. The gap between the two strips of wood should be wide enough to allow the balls to easily roll down the plank between them. This is going to be your ball-run.
3 Place the larger bucket on its side at the end of the plank to catch the balls when you roll them down.
4 Ask the friend or adult to time first the marble, and then the ballbearing, as you roll them down the ball-run.
5 Note their times. You may want to try a few more tests.

What happens?
Both balls take the same time to reach the end of the plank. The heavier ball isn't faster.

Why?
Objects of the same size and shape fall at the same speed under the influence of gravity. Heavy objects don't fall faster.

How a bolas works

You will need:
Two balls of Blu tak each 2.5cm across.
A piece of strong string or twine 52cm long.

Horrible Health Warning!
1 Practise throwing your bolas outside in a wide open space, never indoors.
2 Use a small tree for your target practise, and not your small brother/sister/cat/dog!

What you do:
1 Wrap a ball of Blu tak around each end of the string.
2 Squeeze the Blu tak to make sure it is holding the string securely.
3 Now you can practise throwing it. Hold the string between your thumb and fingers half-way between the two balls. Whirl the string round your head. Let go.

What happens?
The bolas flies straight until centripetal force wraps the bolas around the target.

Why?
When you release the string, the momentum of the bolas makes it fly off in a straight line in the direction it was heading when you let go. When it hits the tree, centripetal force on the string wraps the bolas around the trunk.

How to juggle

You will need:
Yourself
Something to juggle with. Three balls small enough to fit in your hands would be good. Or you could try rolled up socks.
Plenty of space
A mirror

Safety note:
When you are learning to juggle try to resist the urge to use your granny's priceless antiques, food (especially at meal times) and living creatures such as hamsters, goldfish, small brother and sisters, etc.

What you do:
1 Stand in from of a mirror with your elbows tucked close to your body and your hands level with your waist. Place your legs apart with your knees slightly bent.
2 Take a deep breath, let it out slowly, and relax. Now, without looking at your hands… throw one ball gently up and over your head. Notice how it falls in an arc under the influence of gravity. Catch the ball in the palm of your other hand. Keep your eyes in the top part of the ball's flight.
3 Now try it with two balls. Throw one ball up as before. When the ball is just about to drop, throw your second ball up from the other hand. Ideally the second ball should pass just under the first ball.
4 OK, this takes practise. Better practise now to get it right.
5 This is where it gets *really* hard. Three balls. Sure you want to try? OK. Hold two balls in one hand and one in the other. Repeat Step 3.
6 Now here's the clever bit. When ball 2 is just about to drop, throw ball 3 up and try to get it to pass under ball 2. Meanwhile catch ball 1 and throw it up just when ball 3 is about to drop. Easy!
7 Fantastic, keep going! Juggling is a great way to see how forces affect balls in the air.

The inertia of an egg

You will need:
A plate
A raw egg
A hard-boiled egg

What you do:
1 Gently spin the raw egg on the plate.
2 To stop the egg touch it with your finger
3 Gently lift your finger up.
4 Now repeat steps 1 – 3 with the hard boiled egg.

What happens?
When you lift your finger, the raw egg continues to spin.

Why?
The word inertia describes how things stay the same. Motionless things stay idle and moving things carry on until another force gets in the way (that's Newton's First Law – see 'A moving moment' experiment, below). When you stop the raw egg, inertia keeps the egg white inside spinning. And this starts the entire egg spinning again when you lift your finger. The inside of the hard-boiled egg is hard, of course, so the white doesn't have its own inertia.

The Shocking Electricity Zone

Materials and their properties

These experiments link everyday experiences like getting a static shock from a woolly jumper, to the awesome power of lightning in a thunderstorm.

The giant circuit Billy makes inside Horrible Science World is a good way to link the topic of electricity and electric circuits with conductors and insulators. The **how to make lightning** activity demonstrates this with the metal in the radio aerial, and links up with the lighting storm that Billy experiences inside the Thunderdome at the end of the play.

The following experiments are taken from the books 'Shocking Electricity' and 'Famously Foul Experiments':

The Really Rotten Kids in… Tricky flickers

An educational tour of a cinema turns into a nightmare for Mr Bunsen. But at least he tells the kids what films do to their brains!

HOW I MADE A WICKED FLICKER BOOK

by Sam

WHAT I NEEDED:

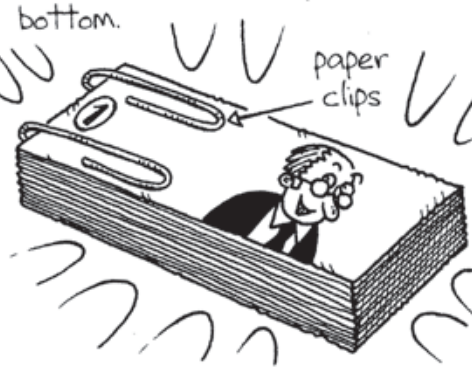
The cartoons over the page
A thin sheet of card
Two paperclips and some scissors

WHAT I DID:

1. My mum photocopied the cartoons on the next page. She had to photocopy them on a piece of thin card. I could have traced them or even drawn them myself...

2. I cut out each of the cartoon boxes and put them in a pile. These were the pages of my flicker book. Cartoon number 1 was on top and number 16 was at the bottom.

3. I used the two paperclips to hold the pages together.



4. I flicked through the book I'd made...

WHAT I FOUND:

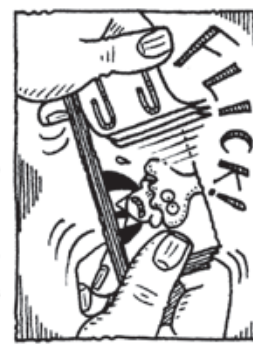
WOW! I saw a mini-movie of Mr Bunsen getting a bowl of Mrs Gloop's custard poured over his head. I showed it to everyone at school and they thought it was wicked! But then Mr Bunsen saw it and he gave me extra science homework as a punishment.

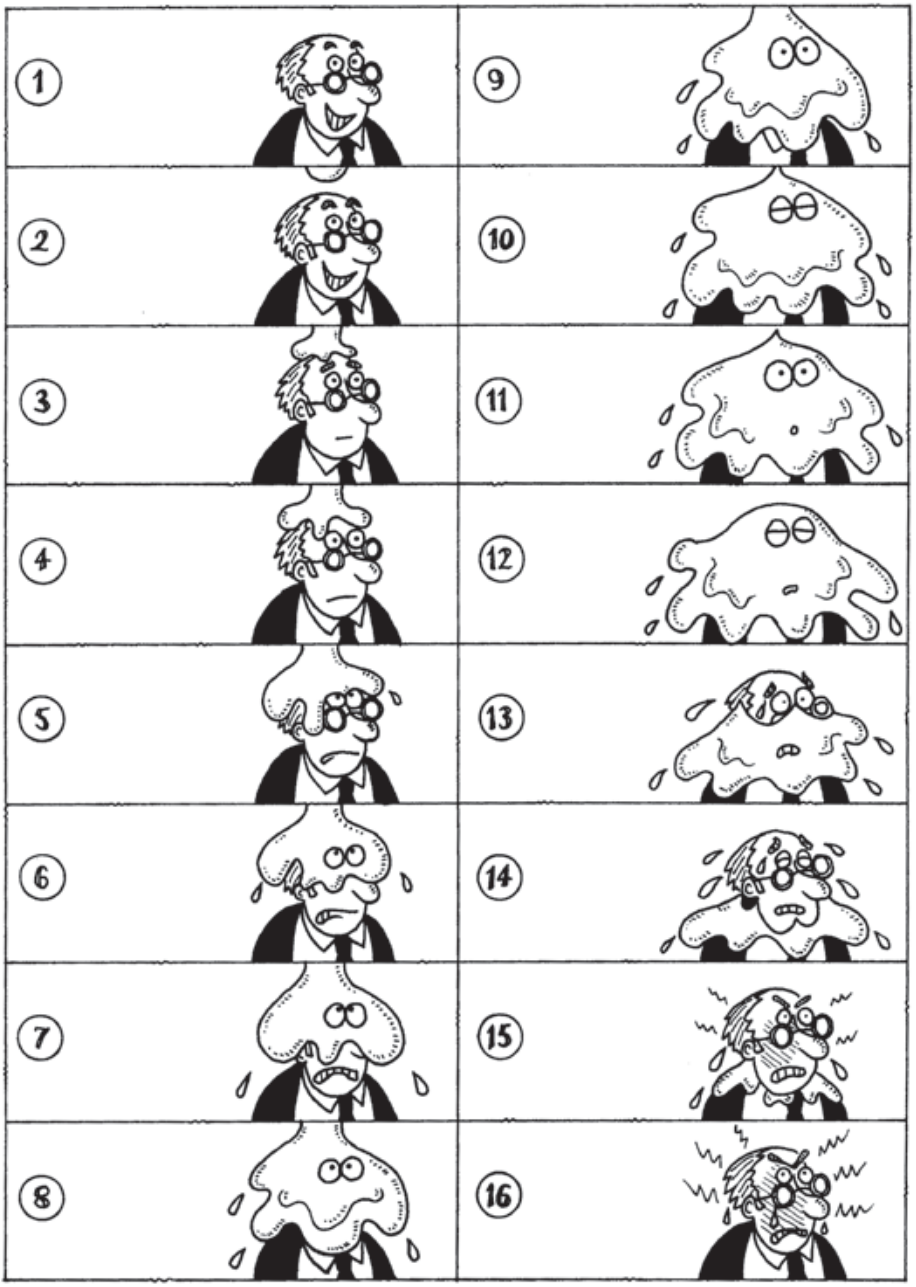
The science behind the experiment

1 Mr Bunsen's already explained the scientific basics in the cartoon story.

2 When you see a film, your brain takes in the whole scene and then tries to makes sense of what's going on.

3 But, as Mr Bunsen said, everything's moving so fast that the brain sees a single moving picture rather than thousands of separate pictures.

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How to make clingfilm move

You will need:
Two pieces of new clingfilm 10cm x 2cm
A clean dry comb
Blu tak
Some clean hair

What you do:
1 Hold a piece of clingfilm in each hand. Try to bring the two pieces of clingfilm together. Notice what happens.
2 Stick a piece of clingfilm to the end of a table so the clingfilm hangs downwards. Now comb your hair quickly and strongly four times. Quickly point the teeth of the comb towards the strip of clingfilm and hold it close but not touching. Notice what happens.

What happens?
The pieces of clingfilm don't want to touch, but the clingfilm does want to touch the comb.

Why?
The atoms of the clingfilm are short of electrons. This means they are positively charged and give out positive forces. Two positive forces push against each other and that's why the pieces of clingfilm move apart. The comb rips electrons off your hairs and the force from these electrons (negative charge) pulls in the positively charged atoms in the clingfilm.

How to make lightning

You will need:
A radio with the aerial extended
A balloon
A thick woollen jumper – a woollen rug or scarf will also do.

What you do:
1 Wait until it gets dark or use a darkened room with the lights out. This experiment works best in complete darkness.
2 Rub the balloon on the wool about ten times. Put it near or touching the aerial.

What happens:
You see tiny sparks.

Why?
These are electrons stripped off the wool, jumping from the balloon to the radio aerial. The sparks are basically tiny flashes of lightning.

How to hear lightning

You will need:
The same equipment from the ‘how to make lightning’ experiment.

What you do:
1 Switch the radio to AM and make sure it’s not tuned to any station.
2 Turn the volume down very low.
3 Repeat Step 2 from the first experiment, and listen.

What happens:
You hear a quiet pop.

Why?
You are listening to electrons jumping from the balloon to the radio aerial. If you switch on the radio during a thunderstorm tuned in this way you will hear the same noise but this time it will be made by lightning.

A Magnet Motor

You will need:
A balloon
Four round magnets
A bar magnet
Sticky tape
Tape measure
Drawing pin
String and scissors
A doorway

What you do:
1 Blow up the balloon and tie the end.
2 Use sticky tape to stick the round magnets, evenly spaced, around the middle of the balloon.
3 Make sure the magnets have the same pole facing outwards – you can check this by touching each round magnet with one end of your bar magnet. You need to use the end of the round magnet that pushes away the bar magnet. Use the tape measure to check the magnets are the same distance apart.
4 Tie the string to the balloon. Use the drawing pin to hang the string and balloon from the top of the open doorway.
5 Gently stroke the air 2 – 3cm from the balloon magnets with the same end of your bar magnet.

What happens:
The balloon starts to spin round.

Why?
Every magnet has a north and south pole. The magnetic force always comes from the north pole and goes to the south. If you push two north or two south poles together, the force will push them apart. The magnetic forces push the balloon around to the next magnet and so on – making the balloon spin.

The Microscopic Monsters Zone

Life processes and living things; the interdependence of organisms

Bacteria can be used to explore the other micro-organisms that surround us, which can only be seen with a microscope, such as viruses.

The presence of micro-organisms in daily life is illustrated by their feeding on the grass in the **How to provide a snug, cosy home for bacteria** activity, and it also references the fact that bacteria break down living organisms, returning nutrients to the soil that helps in food production.

These experiments support the Big Bacteria scenes in Act 1, especially the song sung by Bertie the Bacterium – ie. that not all bacteria are harmful, and some bacteria do things which are helpful to humans.

The **What dust is made of** activity is a very good way to illustrate the microscopic world that surrounds us all the time, without needing a microscope.

The following experiments and activities are taken from the book 'Microscopic Monsters'

How to provide a snug, cosy home for bacteria

You will need:
A jar filled with water
Some grass and a pair of scissors
Cling film and a pin

What you do:
1 Cut the grass into pieces and add it to the water.
2 Cover with cling film and use the pin to make tiny holes in the top.
3 Leave the jar in a warm place for a week.

What do you notice?
The liquid has gone cloudy.

Why?
The cloudiness is made by millions of bacteria plus algae and fungi guzzling the grass. The microbes were on the grass and in the air before you sealed the jar. Get an adult to empty the jar in an outside bin and wash it down an outside drain.

What dust is made of

You will need:
A shaft of sunlight. (Draw some dark curtains allowing only a gap of 15cm). Alternatively, wait until night and use a small bright torch.

What you do:
1 Face the light.
2 Brush your hands through your hair, brush your hands over your arms, then lift your shirt and give it a shake.

What do you notice?
A cloud of shiny dots comes off you.

Why?
The dust specks are clumps of dead rotting flesh crawling with germs! And they're all around you because you made them – they're your skin!

Scientific note:
Specks of dust are some of the smallest things you can see. They're just 20 micrometers across (10,000 micrometres is 1 cm) and not much larger than bacteria. They're floating around all the time but you can't see them unless the light glints on them.

The Blood, Bones & Body Bits Zone

Life processes and living things; the interdependence of organisms

The **How to make cholera cures** activity illustrates how harmful bacteria cause diseases, as represented by Grimey the Big Bacterium in the play. It can also be used to discuss medicine as a way of fighting disease, and that in the past, some things which were thought to be cures didn't actually work (Eg. like some of those in Monster Boy's very old medicine book). The real-life 'horrible' cure of maggots is a good way to counterbalance this, and to introduce the way that progress in science sometimes occurs.

The ease with which diseases are spread is demonstrated in **How speaking spreads flu**, and also provides a way to link up with the themes of hygiene and micro-organisms, as seen in the giant bathroom scene in Act 2.

Several of these experiments link up with and expand on Billy's adventures in the lab of Baron Frankenstein. These include human body organs and their positions and basic function, the anatomy of the skeleton, and the different types of teeth we use to eat. (**The inside-out body).**

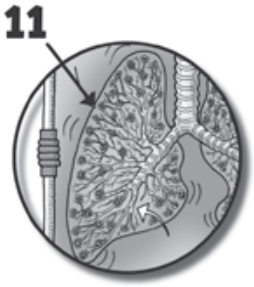
A more detailed look at digestion and what happens to the food we eat inside our stomachs is featured in **What bile juice does to fats**, **How enzymes work**, **How stomach acid protects guts** and **Have you got the guts?**

Billy's eating of a carrot can be used as a link to nutrition and healthy living, as demonstrated in the **Test your body: Getting a-head** activity.

The following experiments are taken from the books 'Disgusting Digestion', 'Deadly Diseases' 'Body Owner's Handbook' and 'Beastly Body Experiments.'

SPOT THE HORRIBLE BODY BITS QUIZ

Here are a selection of horrible bits and pieces; can you match the name of the body part with its correct picture.



A Bacterium
B Liver
C Tongue
D Cochlea
E Lump of poo
F Spot
G Cartilage
H Flask of urine
I Sperm
J White blood cell
K Mouth
L Lungs
M Fractured humerus
N Earwax
O Lens from eyeball
P Kidney

Answers:

1 D
2 N
3 J
4 H
5 I
6 C
7 A
8 F
9 K
10 E
11 L
12 B
13 M
14 P
15 O
16 G

What bile juice does to fats

You will need:
Washing-up liquid
A bowl of warm water
Cooking oil

What you do:
1 Pour a little cooking oil into the water. The oil will float on the water. This is like the fat in your intestines.
2 Add a drop of the washing-up liquid representing the bile juice. Give the mixture a rapid stir.

What happens?
The oil, washing-up liquid and water mix together in lots of little bubbles.

Why?
The washing-up liquid (bile juice) breaks up the cooking oil (fats) so that it mixes easily with the water (liquid in your intestines). In this form it's far easier for the gut walls to take it into your bloodstream.

How enzymes work

You will need:
A hardboiled egg. (Ask an adult to boil the egg for six minutes.) Cool the egg and peel off the shell.
Biological washing powder
A jar and tablespoon

What you do:
1 Add eight tablespoonfuls of warm water to the jar.
2 Ask an adult helper to put on protective gloves and mix in one tablespoonful of washing powder. They should stir the mixture until the powder disappears.
3 Add a piece of boiled egg white (not the yellow yolk).
4 Wrap the jar in a towel and leave it in a warm place such as an airing cupboard for two days.

What happens?
Take a look at the piece of egg white. The egg has got smaller.

Why?
The washing powder contains enzymes that break down the protein in the egg into smaller chemicals that dissolve in the water. This is exactly what happens in your guts.

How stomach acid protects guts

You will need:
Three glasses or jars
Yeast (the dried variety is fine)
Vinegar
Baking powder
Sugar
Three teaspoons

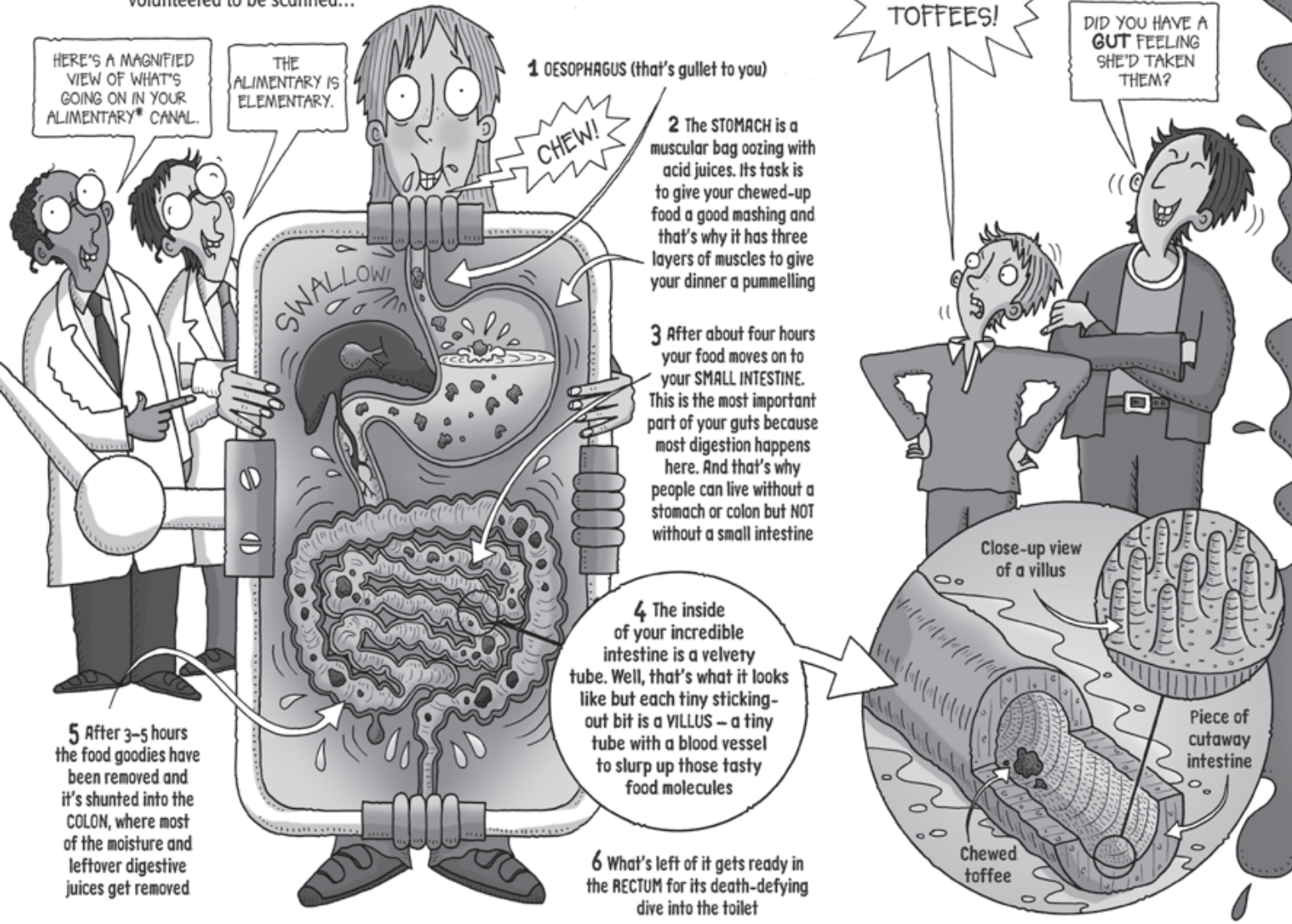
What you do:
1 Label the three glasses A, B and C.
2 Fill each with warm water and add three tablespoons of vinegar to B and C. Then add a heaped teaspoonful of baking powder to C and stir well until most of the froth has gone.
3 Add a teaspoonful of yeast and a heaped teaspoonful of sugar to each jar. Stir well.
4 Place the glasses in a warm place for an hour.

What do you notice?
Glass A and C contain milky beige-coloured liquid, and if you put your ear to the glasses you can hear a fizzing sound.

Why?
In A and C the yeast is multiplying like cholera germs and the fizzing is the carbon-dioxide gas that is given off as the yeasts feed. The acid vinegar in B has killed most of the yeast and the sample is now a vile green colour. The acid in C was weakened by the baking powder. When your stomach acid is weak, perhaps because you've drunk lots of water, cholera germs survive to wreak havoc in the guts.

YOUR GURGLING GUTS

The shrinking scientists are keen to see digestion in action and the girl has volunteered to be scanned...



*Posh science word for the guts.

Dreadful digestion details

Your stomach has a problem. In order to break up the food molecules and kill germs it contains dilute hydrochloric acid. This dissolves bacteria but it can dissolve you too. To save you from this unpleasant fate, your stomach is lined with slimy mucus, but even so its cells are always being digested. In the past minute ONE MILLION of your stomach cells have been turned into goo by your hungry stomach juices!

And if that sounds sick-making just wait until you read what happens when digestion goes wonky. Let's imagine that loads of bacteria or their poisons (toxins) invade your guts. Your small intestine protests by sending what's left of your dinner back to your stomach. But your stomach doesn't want it and opens its valves at both ends. The half-digested food whizzes past the stomach and, helped by your strongly squeezing diaphragm muscle, up it comes with a generous squirt of stomach acid.

But not all of it. Your colon has a plan of its own. If it detects toxins or other nasties it goes into reverse and squirts water instead of sucking it up. Then it squeezes out the watery goo, and the revoltingly runny results get you running to the loo.

How to make cholera cures

Cure A
You will need:
A tea bag
Some mustard
A mug
A teaspoon

What you do:
1 Fill the mug with boiling water (grab an adult and ask them to help)
2 Dunk the tea bag quickly in the water
3 Add a level teaspoon of mustard and stir well
4 Allow five minutes to cool and try a sip (OK, you can sniff it instead!)

Cure B
You will need:
A mug
Some sugar
Some salt

What you do:
1 Fill the mug with boiling water (ask an adult to help again)
2 Add a heaped teaspoonful of sugar and a quarter of a level teaspoon of salt and stir well.
3 Allow five minutes to cool, and then taste.

Which cure do you think works the best?
Cure B. It's based on a mixture invented in Dacca, Bangladesh and Calcutta in the 1960's. It's designed to replace lost sugars and salts in the body and the boiling kills cholera germs in the water. This treatment has saved thousands of lives – it reverses the drying out so that the patient's white blood cells can kill off the cholera germs.
Cure A is a traditional Spanish remedy and, like many old remedies, it's useless.

Scientific note:
Cholera is caused by a type of bacterium called a vibrio that lives in slightly salty water like estuaries. The effects of cholera include vomiting, diarrhoea and dehydration, and if not treated promptly, death.

How speaking spreads flu

You will need:
Yourself
A good supply of spit (drink a glass of water first)
A mirror

What you do:
1 Press your nose against the mirror
2 Say the word “SPIT” loudly.
3 Say ‘DRY’ loudly.

Which letters leave the most spit on the mirror?
‘SPIT’. The movement of your tongue as you speak letters such as the P and T in ‘SPIT’ actually sprays spit. The drops of spit could be hiding millions of flu viruses.

Test your body: Getting a-head

You will need:
A slice of wholemeal bread
A sliced hard-boiled egg
Some cress
A sliced tomato
Butter or margarine
An adult helper

Horrible Health Warning:
Get your adult helper to do all the chopping, boiling and slicing.

What you do:
1 Lay the bread on a plate and spread a little butter or margarine on it. Only “a little” because your body doesn’t need too much fat.
2 Arrange the cress as “hair” at the top of the slice.
3 Use two slices of egg as “eyes”.
4 Cut a slice of tomato in half to make a sad or happy mouth
5 Scoff the lot!

You should find:
The head contains all the food fuels your body needs. The bread contains carbohydrates, the egg has protein, the butter has fat and the bread, tomato and cress contain roughage.

The inside-out body

You will need:
White swing-bin liner with tie handles
Scissors
Water-based felt pens (black, brown, green, yellow and red)
The 'Beastly Body Experiments' book, or a picture showing the positions of the human internal organs (see Step 3 below)
Red T-shirt (not essential)
Tape measure
Damp cloth to wipe away any errors

What you do:
1 Pull a swing-bin liner off the roll. Use the tape measure to measure from the bottom of your neck to 5cm below your hips. Measure the same distance on the bin-liner and mark it with the pen.
2 Use the scissors to cut off the bottom edge of the bin-liner below your mark.
3 Study the picture of internal organs on page 10 of Beastly Body Experiments (or a picture of basic internal human anatomy). The organs you could include are: heart, lungs, diaphragm, spleen, gall bladder, stomach, large intestine, small intestine, bladder.
4 Copy the picture on to one side of the bag. To do this you need to open the bag up and lay it flat on a table. It's best to outline the body bits in black and wipe away any mistakes with the damp cloth.
5 When your body bits are drawn you can colour them in with felt pens. Wait for the ink to dry.
6 It helps if you wear a red or pink T shirt for this step. Carefully put on the body overall with your arms through the tie holes.

What happens:
The picture of the insides fits perfectly over your own body and matches where your real body bits are hidden under your skin.

Horrible Health Warning:
Younger scientists will need adult assistance to help them with measuring and cutting. Never ever put polythene bags over your head, and keep them away from little brothers and sisters who might try this!

Have you got the guts?

You will need:
An old pair of tights
Scissors
Small bowl
A balloon (ideally pooh coloured)
Large bowl of water (or potty if you want to be especially revolting)
Olive oil
30cm of string
Tape measure
A plastic clip, of the kind used to clip shut sandwich bags. If you haven't got one try using a large paper clip.

What you do:
1 Fill the balloon with water until it's about 6 cm across and 15 cm long. Knot the end so that the water can't escape.
2 Knot one leg of the tights as close to the top of the leg as you can. You can then cut off the leg below the knot.
3 Cut off the end of the remaining leg around the 'toe' area.
4 Place the clip so it's pinching shut the top of the remaining leg.
5 Place the balloon in the bowl and pour the olive oil over it. Use your hands to make sure that the balloon is really slippery and slimy. Now place the slippery balloon in the waist of the tights and tie the string.
6 Imagine the top of the tights is your stomach and the balloon is your breakfast. Your stomach squishes your cornflakes for about three hours but you only need do this for a few seconds.
7 Release the clip and squeeze the balloon along the leg of the tights.
8 (Optional Horrible Step) Carry on squeezing until the balloon emerges from the leg of the tights and plops into the bowl of water!

What happens:
You will find the easiest way to squeeze the balloon along the leg of the tights is to stretch the leg of the tights and pinch the fabric just BEHIND the balloon.

Why?
The squeeze pushes the balloon forward. Balls of food are squeezed forward by the sides of your intestines in the same way. This is called peristalsis (per-ry-stal-sis).

Horrible Mess Warning:
Wash and dry your hands afterwards!

HORRIBLE SCIENCE

Record Sheet for Horrible Scientists.

Names of scientists in your group.

_____

_____

How are you going to record your results?_____

_____

_____

What do you predict will happen?

_____

_____

_____

How many times should you do your experiment? _____What, if any, are the reasons you may want to repeat your experiment?

_____

_____

_____

How will you measure your results accurately?

_____

_____

_____

_____

WHAT HAPPENED DURING YOUR EXPERIMENT? Try to use some scientific language to describe what happened.

_____

_____

_____

_____

_____

_____

Was it what you expected? .....If not what was different?

Give as many reasons as you can for this.

How do your results compare with other groups who have completed this experiment?

Is there anything you could add to this experiment?

When you have finished you can draw yourself and your group doing your experiment (look at the pictures in Horrible Science).