

our food
our health
our planet



Training Handbook: Families Programme

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Introduction



Welcome to The Crunch



**our food
our health
our planet**

Welcome to The Crunch; an exciting year of activities, experiences and discussions about our food, our health and our planet. Everyone's invited to get involved and help create the recipe for a happier, healthier future.

The future of food is one of the biggest challenges on our plate. Food and drink are fundamental to our lives, connecting everything from our health to the world around us.

It's time for us to take a fresh look at our relationship with food. At the moment it's unsustainable, and this needs to change so that we can live healthier, happier lives.



The Crunch: for families

Across the summer of 2016, nine UK science centres will be providing opportunities for families to get hands-on, with fun activities and a great new online game, exploring our food, where it comes from, and how it affects our health and the world around us.

The families programme will reach 130,000 people across the UK, and will engage families at local festivals and community events, and within the science centres.

The families programme will focus on:

1. Where food comes from and how it is produced
2. What is in our food and drink
3. The impact food and drink have on our health, and the health of our planet

The Crunch: in schools and colleges

The Crunch kits will be given free of charge to all primary and secondary schools and colleges across the UK in spring 2016. The kits contain science equipment to help schools and colleges deliver The Crunch along with additional resources online, including drama resources and supporting films, with topics that span science, geography, food technology and more. Science centres will also be sent the kits, and are encouraged to highlight these at events and potentially to use the kits as part of their programmes.

thecrunch.wellcome.ac.uk/schools

The Crunch Ambassadors

From across the UK, this passionate squad of ambassadors are here to help science centres, schools and others to facilitate activities and to kick-start conversations on the links between our food, our health and our planet.

Ambassadors come from a wide range of backgrounds including youth work, community engagement, science, health and food technology. They can share real-world experiences with families at your events, out in the community and in your science centre, making learning relevant and increasing engagement.

To find out more about the ambassadors, who they are, where they are based, or even to become one yourself, visit

thecrunch.wellcome.ac.uk/ambassadors



Chew it over: dramatised dialogue

If you want to chew the ideas over, you can get really stuck into debating these topics at one of our theatrical dialogue sessions. Aimed at adults, these in-depth sessions combine dialogue with theatre, to really think about food issues and feed into research and policymaking.

Together, these different areas of The Crunch, along with the vibrant website and social media programme, will engage families, school children and adults across the UK in a wide variety of activities, experiences and discussions about our food, our health and our planet. Everyone's invited to take part and help create the recipe for a happier, healthier future. Get involved in The Crunch and be part of the conversation.



Be part of The Crunch Week: 16 – 22 May 2016

Activities will be taking place throughout 2016, but we'll be focussing lots of activity on The Crunch Week: 16 – 22 May 2016. So get involved and use The Crunch Week to kick-start your activities.

The Crunch is brought to you by the Wellcome Trust, an independent charitable foundation dedicated to improving health around the world. ASDC has been commissioned to create the families programme, in partnership with expert staff at Eden Project, At-Bristol Science Centre and The University of the West of England, including a new and exciting digital game created by Aardman Animations.

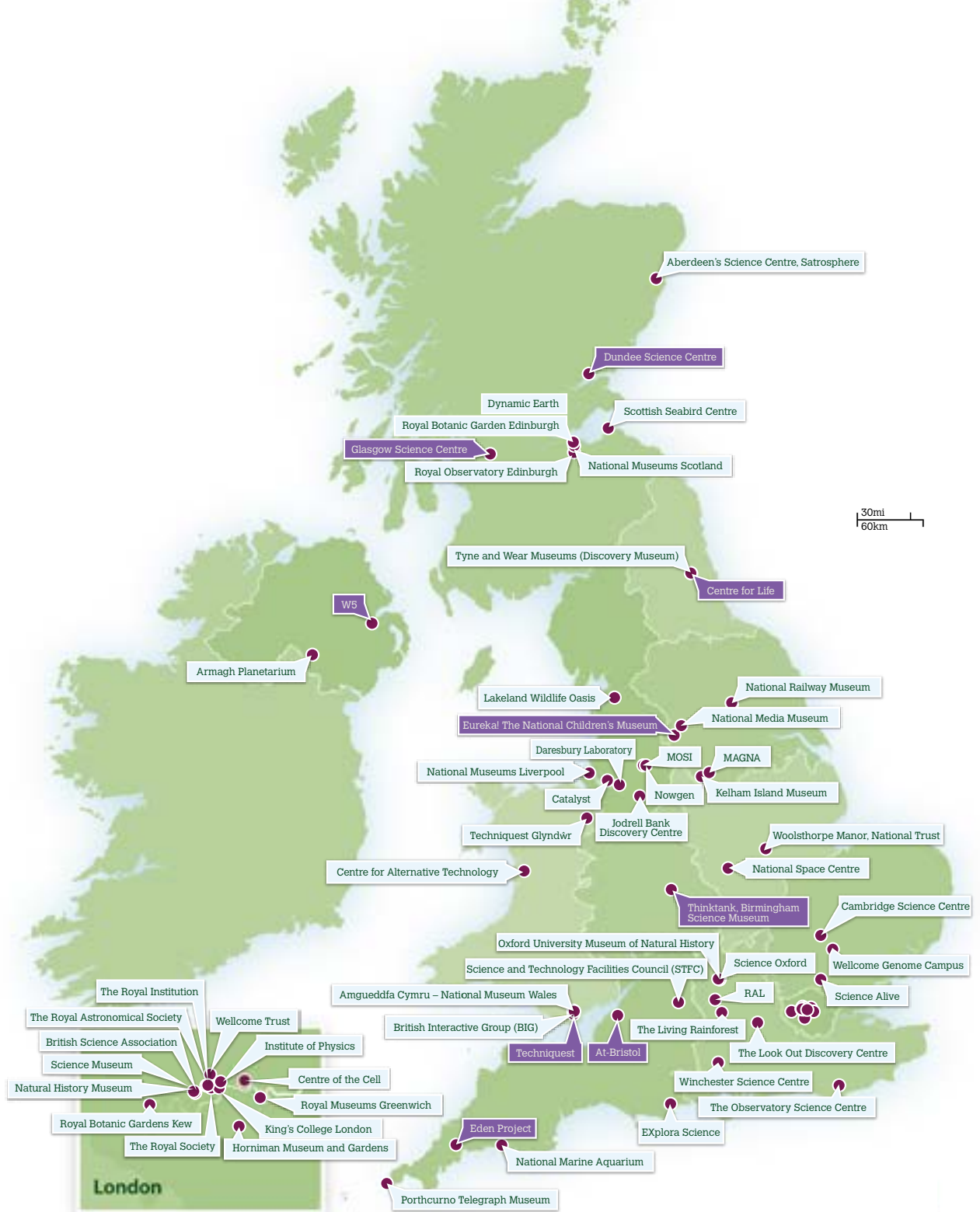


To find out more go to:

-  thecrunch.wellcome.ac.uk
-  facebook.com/thecrunch2016
-  [#TheCrunch2016](https://twitter.com/TheCrunch2016)

The Association for Science and Discovery Centres Network

The Crunch Delivery Centres



www.sciencecentres.org.uk

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Introducing the team



our food
our health
our planet



The Science Centre Delivery Partners

- 1. At-Bristol Science Centre**
Bristol
- 2. Eden Project**
Cornwall
- 3. Eureka! The National Children's Museum**
Halifax
- 4. Centre for Life**
Newcastle
- 5. Thinktank, Birmingham's Science Museum**
Birmingham
- 6. Techniquest**
Cardiff
- 7. Glasgow Science Centre**
Glasgow
- 8. Dundee Science Centre**
Dundee
- 9. W5**
Belfast

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The Project Team

The resources, equipment and activities within The Crunch: families programme, have been created and developed by the project team, made up of the following people, led by ASDC.

Dr Penny Fidler

The UK Association for Science and Discovery Centres

Andy McLeod

The UK Association for Science and Discovery Centres

Maddy Foard

The UK Association for Science and Discovery Centres

Gabi Gilkes

Eden Project

Katy Nehammer

At-Bristol Science Centre

Jo Bryant

At-Bristol Science Centre

Dr Enda Hayes

University of the West of England

Lorna Probert

Aardman Animations

Neil Pymer

Aardman Animations

Rohini Denton

Aardman Animations

George Rowe

Aardman Animations

Chloe Barraclough

Aardman Animations

If you have any questions about the project, please feel free to contact the ASDC Project Manager Andy McLeod on 0117 925 9753 or by email Andy.McLeod@sciencecentres.org.uk.

Alternatively please call the ASDC office in Bristol on 0117 915 0181.

The Crunch family experience



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The activities provide opportunities for families to investigate and discuss the following key questions through demos, investigations and stories from the UK and around the world:

- Where does our food and drink come from?
- How is our food and drink produced and processed?
- What nutrients are in our food and drink?
- How does the food and drink we consume affect our health and the health of our planet?

The activities have been designed with a variety of events in mind and the following section of the handbook includes key messages and top tips on how to deliver the family experience. You may wish to adapt and enrich the activities depending on your plans – we would love you to share your brainwaves with us and the other centres and will be setting up an online group to facilitate this process.

Although the programme is flexible, we recommend including as many as possible of the below core activities at the events you deliver. This is to ensure that families are provided with enough opportunities to explore the above questions in diverse ways. You may wish to present these activities in a performance format, getting volunteers up to assist with grinding the corn, pedalling the bike, using the handle to press seeds or roll the oats. The activities have been designed to support this style of delivery as well as a more drop in approach.



Image credit: Lee Pullen, At-Bristol Science Centre.

The core experience:

1. Grinding corn*
2. Making corn tortillas
3. Recycling fruit and veg*
4. Pressing seeds*
5. Iron fish*
6. Eating insects
7. Soil textures
8. Rolling oats*
9. Digital game Hungry City (working title) – to be featured at every event

*These core activities can be delivered from The Crunch Bike, which we recommend featuring at as many of your events as possible.

Links between the activities

The main links are highlighted at the top of the activity descriptions.

In particular, we recommend linking Grinding corn and Making corn tortillas as these two activities work very well together - participants can use the corn they have ground in Grinding corn to make corn tortillas.

The Iron fish activity also connects strongly to Iron breakfast. Fill the usherette tray with cereal and hide the Lucky Iron Fish inside the tray. Ask participants to find the fish and then say there is still iron present in the tray even though the fish has been removed.

The juice produced in Recycling fruit and veg can be tested for vitamin C using DC Pip solution and the freshly blended juice can be compared with shop-bought alternatives.

The Crunch family experience



You could use Insect eating as an introduction to running Insect ingredients or Future foods workshops. Fruit and veg smoothies could also be enriched with insect protein!

The Magnetic map can be used to link many of the activities, including Grinding corn, Iron fish, Eating insects, Future foods, Chicken and Chocolate.

There are of course many other potential combinations of activities and we would be delighted to hear your suggestions.

Linking the live activities to the digital game

It's important that families are encouraged to engage with the digital experience 'Hungry City' (working title) a game that can be played on a tablet (provided by us) or on participants' mobile devices during or after your events. A mission 'card' is being designed to connect the live experience with the digital game. Copies of this card will be included in the kit sent out to your centre in late April or early May. We would like you to provide these to all of the families at your events to inspire them to try out the activities and play the game. The card will feature characters from Hungry City and a URL to play the game online. It may take the form of a collectors' ticket, with space(s) for an achievement stamp. We would like you to instruct families to collect a stamp at your live events and they will be rewarded with a secret code on the card to access bonus content in the game.

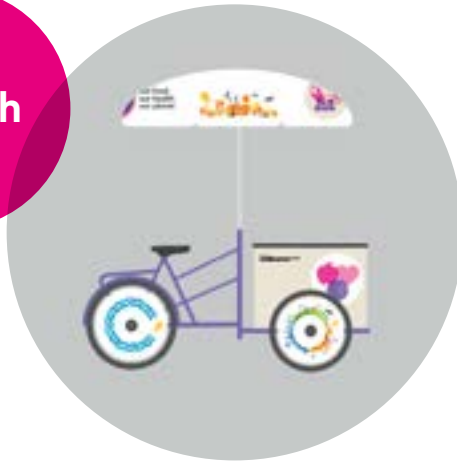


Image credit: Lee Pullen, At-Bristol Science Centre.

Activities



The Crunch Bike



Environment



Health



Nutrition



Demo



Hands-on

A portable performance platform for The Crunch family programme

The Crunch Bike is a custom built piece of equipment developed for The Crunch families programme. It can be used as a focal point for events and activities that are part of The Crunch, as well as a delivery platform and focal point for some demos and hands-on activities. The bike has the following incorporated pieces of equipment:

- Pedal-powered juicer
- Magnetic map
- Storage shelf for Usherette tray

The bike box also has a mounting point for other pieces of equipment to be attached during operation:

- seed press
- corn grinder
- oat roller

The main surface provided by the top of the box acts as a table top for presenting other activities, and demos.

The Crunch bike is a symbol for sustainability and healthy living, and will be a popular attraction at events. Audiences may assume it is there to serve food, but we can use this to our advantage, and engage with people about our food, our health and our planet using any of our food-based activities.

Equipment



- Crunch bike (branded)
- Support frame for using pedal-powered juicer
- Parasol (branded)
- Magnetic map
- Pedal-powered juicer
- Ramp for loading and unloading bike

Top tips



1. Bikes can be pedalled and steered short distances (e.g. around a festival site, from a car park to a venue) but are not recommended for busy streets.
2. As there are two front wheels, either side of a large box, the steering mechanism will take a bit of getting used to!
3. The bike will fit in a van, but will need a minimum of two people to load and unload, weighing around 25kg.
4. The bike box has a suspended shelf, which will fit the usherette tray, and a lower shelf which can be used to store other pieces of kit and consumables.

Additional information



The Crunch Bikes have been designed and built by Business on Bikes, based in Bolton. **The bike dimensions are as follows:**

Floor – handlebar height:	1.02m
Parasol height:	2m
Box width:	56cm
Bike and box width combined:	89cm
Bike total length:	2.1m





Grinding corn



Environment



Health



Nutrition



Demo



Hands-on

Using a corn grinder to turn raw corn kernels into fresh corn flour

Corn has travelled from the Americas across our planet to become one of the most widely grown food crops. Today corn (also known as maize) is grown throughout the world and is used to make thousands of food and non-food products. Familiar to us as sweetcorn, popcorn or cornflakes, it can also be ground, becoming one of the world's most popular food ingredients, corn flour.

Links to other activities

Making corn tortillas: use the freshly ground corn to make tortillas.

Rolling oats: compare the whole and ground version of oats and corn.

Magnetic map: explores cereals and crops grown around the world.

Key take-home messages

- Corn is a crop with many uses and we eat it in a wide variety of products.
- Corn flour is made by grinding up the whole grain (kernel) of the corn.
- Corn flour contains more fibre than other corn-based products, which is good for human health.
- We rely on a huge amount of corn being produced every year all around the globe.

Additional messages

- Among many other products, corn can be used to make corn flour (what this activity is about) as well as the thickening agent corn starch, frequently known as cornflour in the UK.
- Overall we use 38,232 million bushels of corn annually (971,144 tonnes), but only 200 million

(5,080 tonnes) of this is consumed directly as food.

- Corn is also used in thousands of non-food products, from wallpaper paste to toothpaste and as a binding agent in medication and vitamins.

Background information

What is corn?

Corn can mean different things in different parts of the world. The term can refer to many grass-like crops, and frequently refers to wheat in England and oats in Scotland and Ireland. This activity uses maize (from the genus *Z.m.mays*) which originated in the Americas, and was first cultivated in Europe late in the 15th Century. It now grows across the world, and is produced in six of the seven continents.

To make corn flour, the whole grain (kernel) of the corn is ground up into a flour. To make corn starch, only the endosperm is ground, resulting in a finer, more tasteless flour.

Is corn good for you?

Corn (when eaten as a vegetable) is a good source of insoluble fibre, which aids digestion and helps balance bacteria in your gut. In terms of vitamins and minerals, it's a good source of B vitamins, vitamin C, magnesium and potassium. Although it contains some natural sugars in its vegetable form, it contains less than half the amount of a banana, while containing a similar amount of calories.

Many products that would usually contain wheat flour can be made with corn flour instead to make popular foods such as pasta and bread gluten-free. Gluten refers to the proteins found in wheat endosperm, which is a type of tissue produced in seeds that is commonly ground to make flour. It is when corn is used to make products such as High-Fructose Corn Syrup (HFCS) that it is far less good for you.



Demo



Hands-on

The activity

1. Using the corn plant, or images provided, introduce corn as a plant, growing in the ground, then explore the participants' awareness of it as a food, or in food products. Discuss that popcorn, sweetcorn and corn flakes are all made of corn from the same plant, which is called maize, and has been used to feed people for thousands of years.
2. Pass popping corn kernels round the participants, explaining that these are simply dried kernels of corn that come directly from the ear or cob, as it is also known.
3. To turn the kernels into flour, it's best to use the corn grinder on the table. Load the hopper with corn kernels and get volunteers (not very small children, as they will struggle) to turn the handle to produce a flour made from corn, corn flour.

Equipment and consumables



Corn grinder – 'Wondermill Junior Deluxe'

Popping corn kernels – approx. 500g per day

Bowl or tray for catching ground corn

Corn sack props

Corn plant or corn on the cob

Corn products



Top tips



1. The handle can be tough to turn, the setting can be adjusted on the grinder, but the looser the plates are set, the coarser the flour produced will be. Parents can assist children to turn the handle.
2. If you are not linking to Making corn tortillas, you can hand out samples of corn flour in paper bags (stickered or branded) with suggestions for what you can do with the corn flour.
3. The corn grinder is supplied with both stone and stainless steel grinding plates. The stone plates produce a better standard of corn flour.

Additional information



Jonathan Foley, 2013 piece in Scientific American about the discrepancy between corn 'the crop' and corn 'the system': www.scientificamerican.com/article/time-to-rethink-corn/

The Eden Project has a great exhibition about the human microbiome: www.edenproject.com/visit/whats-here/invisible-you-the-human-microbiome-exhibition

Families may mention coeliac disease in relation to gluten. For more information visit: www.nhs.uk/conditions/Coeliac-disease



Making corn tortillas



Environment



Health



Nutrition



Demo



Hands-on

Using ground corn (maize) to make and cook soft tortillas

Corn is a crop grown around the world that is used in thousands of food, and non-food products. The way that corn is produced and used changes how healthy it is for us and our planet. Corn is used in animal feed in some parts of the world, and these animals then enter our food chain as protein. The efficiency with which animals convert feed to protein is called the Feed Conversion Ratio (FCR).

Links to other activities

Grinding corn is a great introduction to this activity, taking families from raw grain to cooked and finished foodstuff.

The magnetic map is a really useful tool for families to investigate where and how much corn is grown and to put it into context with other cereals and crops around the world.

The 'How much water do you eat?' activity offers a link to the embedded water of corn.

Key take-home messages

- Corn is a cereal crop grown around the world that we use a lot in our lives.
- We eat corn in a wide variety of products. Tortillas are an example of a food which can easily be made from dry seeds of corn.
- The way the food we eat is produced changes how healthy it is for us and our planet.

Additional messages

- Corn is sometimes eaten as a vegetable (sweetcorn) and sometimes as a grain (tortilla)
- A grain is the harvested dry seeds or fruit of a cereal grass such as corn (maize)
- A huge amount of our planet's natural resources such as water, land and energy are needed to produce our food.

– Processed food containing a lot of different ingredients uses more of our planet's resources than basic food products such as the tortilla you have made today.

– Corn kernels are made up of four major components which are starch, fibre, protein and oil.

Background information

What is corn used for?

Corn can be processed in different ways to tap into any of its four major components and use them in all kinds of products. A typical supermarket can contain around 4,000 products that use corn in their production from cornflakes to paper goods and adhesives to meat, milk, eggs, and other products that come from corn fed animals.

Corn is also used to produce high fructose corn syrup HFCS, a sweetener used by the food industry in countries where corn is cheaper than sugar. HFCS has been linked to increase in obesity and diabetes, especially in the US where it is most widely used.

Corn as animal feed

In the UK, animals are fed on grass and pasture as well as a variety of cereal grains including corn. In other countries, especially the US, corn makes up a far larger proportion. The efficiency with which various animals convert feed into protein varies widely and a number used to compare these is the Feed Conversion Ratio (FCR). If an animal has a FCR of 3, it means that it takes 3 kg of feed to produce 1 kg of animal.

As animals have a varied diet and are reared in numerous different ways calculations for these numbers vary. For example beef cattle can have FCR's ranging from 5 to 20.



Demo



Hands-on

Is corn good for you?

An ear of corn (i.e. corn on the cob) has about the same number of calories (average 52) as an apple and less than one quarter of the sugar. When eaten as a vegetable it also has a high proportion of insoluble fibre, the kind that goes through the body intact and helps with bowel movements. This is why you might see sweetcorn in your poo, especially if you don't chew the sweetcorn. Corn tortillas are a simple food, requiring only ground corn and water, making them a healthier food for us and the planet when compared with some processed foods.

The activity

1. Introduce corn. Explore audience's experience of corn products and what it looks like as a plant and in its raw form. Discuss how and where it is grown. Consider how much grain is needed to make a tortilla compared to how much grain is required for animal products.
2. Introduce corn tortilla making. To make 8 tortillas. Mix 50g Masa Harina* flour (or 25g masa harina and 25g freshly ground corn) and 30-40ml water. Add the water a little at a time to make a soft dough that comes away cleanly from the sides of the mixing bowl. **Food safety note: if no immediate hand washing facilities are available, facilitators should wear gloves to handle and mix dough.**
3. Divide the dough into 8 equal portions. Hand portions out a few at a time (i.e. just before pressing and cooking) to participants. **Food safety note: as participants will be handling the dough, only they/their family should eat the tortilla they make. If there are no immediate hand washing facilities consider having gloves available for participants.**
4. Flatten dough in tortilla press using a laminating pouch, greaseproof paper or plastic bag to avoid the dough sticking. Fry in a dry pan on medium-high heat. Approximately 2 minutes each side until starting to brown.
5. Transfer to serving plate/napkin/kitchen roll and allow participants to sample their tortilla (allowing it to cool slightly before eating).

Equipment and consumables



- Mixing bowl and serving plate/napkin/kitchen roll
- Tortilla press
- Plastic bag/greaseproof paper/laminating pouch to prevent tortilla dough from sticking to press.
- Induction hotplate
- Induction frying pan
- Spatula
- Masa Harina flour* and freshly ground corn from corn grinding activity (optional)
- Water
- Corn plant or corn on the cob or dried corn (i.e. popcorn)
- Corn products (e.g. cornflakes, popcorn, sweetcorn, corn syrup, corn oil) Corn sacks (showing how much grain is needed to feed animals)

*What Is Masa Harina?

This ingredient looks a lot like finely-ground cornmeal. However, Masa Harina is ground from corn kernels that have been soaked in limewater, an alkaline solution that changes the physical structure of the corn, making it physically softer and also freeing up more of its nutritional content. If you substitute cornmeal for Masa Harina your tortillas will just end up a bit more brittle.

Making corn tortillas



Demo



Hands-on



Top tips



1. Mix 50/50 masa harina and ground corn flour if combining with corn grinding activity.
2. Place the dough near the hinge of the press to get the best spread tortilla.



Additional information



Statistics for FCR for Poultry Source: DEFRA report July 2013; Agricultural Statistics and Climate change: www.gov.uk/government/uploads/system/uploads/attachment_data/file/225181/agriclimate-4edition-30jul13.pdf

The prop corn sacks provided use data from DEFRA (chicken) and Meat Production Wales (beef). They are designed to show that it takes at least 7 kg of grain to produce 1 kg of beef and 3kg of grain for 1 kg of chicken. For pork, the figure is close to 4 kg of grain per kg, and for insects it is less than 2.

Food Standards Agency (FSA): What farm animals eat? www.food.gov.uk/business-industry/farmingfood/animalfeed/what-farm-animals-eat





Rolling oats



Image credit: James Halfhide, Imbhams Farm Granary

Using an oat roller to turn raw oats into porridge-ready flakes

Oats are a nutritionally valuable food, which can be processed to make many common food products. When oats are processed their nutritional value is reduced. Demonstrating how the whole grains are 'rolled' can show us how to turn a whole oat groat into a porridge-ready flake.

Links to other activities

Grinding corn: compare the whole and ground version of oats and corn.

Iron breakfast: rolled oats are used to make muesli and porridge, popular choices of breakfast cereals in the UK.

Key take-home messages

- Oats are a cereal crop found in muesli, porridge, flapjacks and many other foods.
- Oat rolling is a simple process that uses the whole grains of the oats, called oat groats.
- Oats are high in fibre which has been shown to have various health benefits.
- Dietary fibre is only found in foods that come from plants - foods such as meat, fish and dairy products don't contain any.
- Many people don't get enough fibre in their diet.

Additional messages

- Rolling whole oat grains (groats) ensures that the fibre-rich bran and cereal germ parts of the oat are used in addition to the endosperm.
- Whole grains contain more fibre than grains without the outer bran cover. Increased fibre in our diets can assist in lowering cholesterol.
- Oats are used widely in feeding livestock, including horses, cattle and sheep, which are eaten as animal products across the world.



Environment



Health



Nutrition



Demo



Hands-on

Background information

What is dietary fibre?

The basic composition of the oat grain is similar to that of other cereals, with the outer layer containing the majority of the fibre. Compared to other cereals oats generally contain a little more protein and fat, and especially high amounts of the soluble fibre beta-glucan. Beta-glucan is known to lower cholesterol and glycemic response, so may help to reduce the risk of heart disease and type 2 diabetes.

What is cholesterol?

Cholesterol is made in our liver from saturated fats and can be absorbed from cholesterol containing food. We need cholesterol to make bile, which we need for digesting our food, and for making some hormones. We reabsorb it in our intestines ready to be used again.

However, too much cholesterol can cause it to clump together. It is a waxy substance, not soluble in water, sticks to the walls of our blood vessels and can cause high blood pressure, heart attack and stroke. This usually occurs later on in life, but we can start building up these plaques from early age. Soluble fibre forms a gel that can bind to cholesterol in the small intestine preventing it from being reabsorbed into the blood.





Demo



Hands-on

The activity

1. Introduce oats and find out when people have eaten oats (breakfast, cereal bars etc).
2. Look at the oat plant or ears of oats, and groats and rolled oats – notice the different parts that do and don't get eaten.
3. Introduce the concept of fibre, the different types of fibre (soluble and insoluble) and which parts of the plant are high in fibre. Use the soluble and insoluble fibre supplements mixed with water to compare the difference between them and what roles fibre plays in the body.
4. Participants use the oat roller to roll some oats. Pour groats in the top of the roller and collect rolled oats out the bottom. Collect them in paper bags for them to take home with a suggested recipe. The oat roller can be attached to either the bike or a suitable table top.

Equipment and consumables



Oat roller and clamp to attach it to table
Oat groats – approx. 500g per day
Oat products (cereal bars or breakfast cereal)
Bowl to collect rolled oats
Bags for visitors to take rolled oats away
Recipe stickers for muesli and/or porridge
Oat plant or ear of oats
Soluble fibre powder (e.g. Psyllium husk powder sold as a food supplement) and Insoluble fibre powder (e.g. flax bran)
Containers for fibre
Water to mix with fibre

Top tips



1. When cleaning at the end of the day, don't submerge the oat roller in water.
2. After using, turn the handle a few times to dislodge any leftover oats and wipe with tissue and sanitizer, especially the handle.
3. The oat roller can be attached to either the bike or a suitable table top.

Additional information



Food and Agriculture Organisation (FAO) - background information on oats:
www.fao.org/docrep/008/y5765e/y5765e05.htm

British Nutrition Foundation: www.nutrition.org.uk/healthyliving/basics/fibre.html

British Heart Foundation page on cholesterol: www.bhf.org.uk/heart-health/risk-factors/high-cholesterol

World Health Organisation media centre page on healthy diets: www.who.int/mediacentre/factsheets/fs394/en/

NHS page on the importance of dietary fibre: <http://www.nhs.uk/chq/pages/1141.aspx?categoryid=51>

Michael Mosely on changing diet to lower cholesterol: www.bbc.co.uk/news/magazine-33601171



Pressing seeds



Environment



Health



Nutrition



Story



Demo



Hands-on

Pressing sunflower seeds to expel (release) oil

Pressing seeds to release oil is a simple process that can be applied to a variety of different seeds and nuts. Our bodies require fats and oils, but not in excess as that can be harmful to health. Omega-3 oils can be grown in plants and harvested to provide a more sustainable source of these oils that may be beneficial to our health.

Links to other activities

Corn grinding and Oat rolling: compare the processes of grinding corn, rolling oats and pressing seeds. All begin with a whole grain or seed, all use mechanical action to break the grain or seed down into their different components.

Key take-home messages

- Edible oils come from parts of plants high in fat (i.e. seeds and nuts).
- Some fats are essential for a healthy diet but too much fat is not good for us.
- Omega-3 fish oils have several documented health benefits.
- Fish, like humans, accumulate nutritionally beneficial omega-3 oils from what they eat.

Additional messages

- Fat is used in the body to insulate us and our vital organs, as well as storing energy.
- Oils and fats are both organic materials composed of carbon, hydrogen and oxygen.
- These elements combine to form chains known as fatty acids, which can be either saturated or unsaturated.
- Cooking oils such as sunflower and olive oils are high in unsaturated fat
- Saturated fats such as those found in butter or lard are frequently solid at room temperature

Background information

How do we get oil?

Broadly speaking, there are two methods used to produce oil, extraction and expulsion.

Extraction is often used on a mass production scale, using solvents to extract the oil from the seeds.

Expelling oil (i.e. using a press like the one we are demonstrating) uses pressure to squeeze the oil out of the seed. This can be done by a hot or cold method. Cold pressing is seen as better quality as you are not changing the oil's properties with heat, but it takes longer and you yield less oil.

What do our bodies need fat for?

A small amount of fat (approx. 10% of what you eat) is an essential part of a healthy, balanced diet. Fat is a source of essential fatty acids such as omega-3 – “essential” because our bodies can't make them itself.

Fat helps the body absorb vitamins A, D and E as these vitamins are fat-soluble.

The fat you eat is broken down during digestion into smaller units of fat called fatty acids. Any fat not used by your body's cells or to create energy is converted into body fat. Likewise, unused carbohydrate and protein are also converted into body fat.





Story



Demo



Hands-on

What are saturated and unsaturated fats?

All fats contain 9kcal g⁻¹ (carbohydrates and proteins both contain 4 cal g⁻¹). However, there are different types of fat, unsaturated and saturated. Saturated fats such as lard or butter are usually solid at room temperature. Their name comes from their chemical structure - all the available bonds are literally 'saturated' with hydrogen and can't bond any more. This chemical structure also means that saturated fats are able to form straight, long sheets that can be absorbed onto our artery walls, causing narrowing and more rigid arteries – sometimes even forming a type of 'plaque'. We're often advised to replace saturated fats with unsaturated fats in our diets.

Unsaturated fats are more likely to be liquid at room temperature (sunflower oil is largely unsaturated fat). Unsaturated fats have double bonds within them. Fats with one free double bond are called monounsaturated, and if they have more than one double bond free polyunsaturated.

Unsaturated fats have 'bends' where the double bonds exist. The more double bonds (polyunsaturated) a fat has, the more bendy or globular the fat is and the less it is likely to form sheets and line our arteries.

Fish oils in seeds

A research team led by Professor Jonathan Napier at Rothamsted Research published findings from a field-scale trial of Camelina Oilseed plants, engineered to produce omega-3 fish oils in their seeds. Omega-3 fish oils have been historically linked to health benefits such as lowering of blood pressure and triglyceride levels, but our main dietary source of these beneficial long-chain polyunsaturated fatty acids (LC PUFAs) is oily fish that are not able to produce these oils and have to get them from their diet. The main producers of omega-3 LC PUFA are marine microalgae. In 2013, 51% of all fish directly consumed by humans worldwide was produced by fish farming (known as aquaculture), with this figure set to rise in the next few years (www.seafish.org/industry-

support/aquaculture) and there is an urgent need to find new and sustainable sources of healthy omega-3 fish oils for the fish feed industry to reduce the pressure on marine fish oil stocks. Growing perennial crops engineered to produce omega-3 oils is one approach that is being investigated to meet the increasing demand for these beneficial oils.

The activity

1. Introduce the subject of oil and fat. Ask participants to share their ideas and experience of fat and oil. Ask participants what types of naturally occurring foods are high in fat and discuss which ones you could make oil from (i.e. Seeds, nuts, olives). Fat from animal products used to produce solid fats rather than oils (i.e. butter, lard).
2. Introduce different types of fat – saturated and unsaturated. Discuss that some fat is essential for a healthy diet but too much and the wrong types of fat can be bad for us.
3. Introduce seeds. Press some between sheets of kitchen paper with a rolling pin and see the oil that comes out onto the paper.
4. Introduce the oil press. Heat up the press using the kerosene lamp supplied, then pour seeds into funnel/hopper and turn the handle. Catch the oil in the bowl. Taste the oil and examine the leftover pulp. Get the participants to feel the pulp, and see how dry it is. Compare the oil's appearance and flavour to that of commercially produced oils.
5. Ask what other types of oils there are – has anyone heard of fish oil? Fish oils are high in omega-3, and are better for us than other types of oil. Fish oils contain omega-3 oils because of what those fish eat in the wild, for example plankton. Farmed fish is less likely to contain high levels of natural omega-3, so alternative ways are being investigated of getting omega-3 oils into sustainable and perennial crops, such as sunflowers.

Equipment and consumables



- Oil press (including clamp to attach it to tabletop).
- Kerosene for heating lamp.
- Sunflower seeds.
- Funnel/hopper (to load seeds in top of press).
- Oil collection bowl.
- Bread/breadsticks for dipping and tasting the oil.
- Examples of different types of fats and oils.
- Paper towel.
- Rolling pin (to demo crushing seeds to get oil out).
- Muslin Cloth for squeezing/wringing out oil.
- Examples of oils; shop bought sunflower oil, olive oil and cod liver oil

Top tips and safety note



1. The kerosene lamp has a naked flame, and care must be exercised at all times with this piece of kit. It must also be attended and supervised at all times.
2. The kerosene/lamp oil must be stored separately from any edible food and ingredients in the kit. Store it in a closable, airtight box.
3. There will be a fire blanket supplied with the kit.
4. Paper towels should be on hand for wiping up any spilt oil or oily fingers.
5. The oil press can take a little while to warm up so the first seeds through the press might not yield much oil to start with.



Additional information



Big Picture on Fat:
www.bigpictureeducation.com/fat

Professor Jonathan Napier Research paper on Fish Oils in Seeds: www.rothamsted.ac.uk/news-views/first-gm-oilseed-crop-produce-omega-3-fish-oils-field

NHS pages on fats in diet: www.nhs.uk/Livewell/Goodfood/Pages/Fat.aspx

British Nutrition Foundation page on fats: www.nutrition.org.uk/healthyliving/basics/fats.html

Why does fat make food taste good?

Fats help you enjoy the taste of food because they're able to dissolve and concentrate flavour and odour chemicals. These chemicals are released into the air by the heat of cooking. You can taste sizzling bacon even before you eat it because some of the flavour molecules are already in your nose and mouth.

Fats also help distribute salts and other seasonings throughout foods, such as salad dressings. This means that they make more contact with your tongue and give a deeper flavour. And fatty foods have a special mouth feel. Chocolate, custard, and peanut butter all melt at body temperature. When chocolate melts in your mouth, it creates a smooth, full, coating sensation that most of us find very pleasant.

Our bodies absorb fatty foods at a slower pace than proteins or carbohydrates, so fat makes us feel full. And when we feel full, our brains trigger the release of hormones that also make us feel relaxed and content. The close tie between fat, flavour, fullness, and happiness is thought to be an evolutionary adaptation. As fat provides more calories by weight than either sugars or proteins, in the past when food was harder to come by a liking for fats would have been an evolutionary advantage as eating fat would have helped protect the body against starvation and exhaustion.





Recycling fruit and veg



Environment



Health



Nutrition



Demo



Hands-on

Using pedal power to whip up tasty smoothies and juices

Fruit and vegetables are a valuable source of nutrients and are necessary for a balanced diet. Making them into delicious smoothies and juices can allow this food to be consumed easily, and the fruit and vegetables we use don't even have to look that good to taste great. Vast quantities of fruit and vegetables go to waste needlessly every day because of the way they look!

Links to other activities

Iron fish: also explores different nutrient levels found in vegetables.

Key take-home messages

- Fruit and vegetables contain a wide variety of nutrients and, for a healthy balanced diet, we should eat a range of different produce.
- Fruit and vegetables often go to waste needlessly especially those that don't 'look pretty'.
- Waste happens all along the food supply chain, from harvest to market to our own plates.

Background information

Are smoothies good for you?

Smoothies and juices are a great way of getting some of the fruit and vegetables we need, but, when made with just fruit, they may contain lots of sugar. Using vegetables like spinach, carrots and kale can reduce the sugar content, without compromising on taste. In juicing, the pulp of the fruit or vegetables is removed during the process, meaning you get an intense hit of nutrients, without the fibre contained in the pulp. The equipment in this activity is more likely to produce smoothies, where the whole of the produce is used and you get a thicker, fuller drink that has all the nutrients and fibre still included. Both smoothies and juices made with fruit and vegetables are good for you in moderation, as part of a active lifestyle.

Food waste

The UN Food and Agricultural Organisation (FAO) estimates that one-third of food produced for human consumption is wasted globally (about 1.3 billion tons per year). According to WRAP, the sustainability agency, each year 90,000 tonnes of produce in the UK goes to landfill. Much of this is fruit and vegetables which have been rejected purely for aesthetic reasons. The Soil Association estimates that in the UK 20-40% of produce is rejected simply based on its looks.

The activity

1. Introduce fruit and vegetables. Discuss how attractive or unattractive they look, where they come from and what fruit and vegetables people eat on a regular basis.
2. Plan the recipe for that batch of smoothie with the participants around. What fruit and vegetables do they want to put in the blender? Ask if anyone has any allergies to any of the fruit or vegetables you have with you.
3. Ask for volunteers to pedal the bike to blend the fruit and vegetables into a juice or smoothie. Serve the resulting smoothie to the participants.
4. Gather the participants' thoughts on the taste of what they produced.





Demo



Hands-on

Equipment and consumables



- Pedal-powered blender (attached to the Crunch Bike).
- A selection of fruit and vegetables (washed) Suppliers will be suggested.
- Chopping board and safety knife.
- Disposable and sustainable cups.
- Paper towels or cleaning wipes to clear up any spills as you go.
- Funnel and sieve to assist with serving.

Top tips



1. Get volunteer participants to pedal hard for 30 seconds each.
2. The seat is height-adjustable, but it is recommended that children smaller than the height of the top of the box do not use the pedal-powered smoothie.
3. When using the pedal-powered smoothie maker, ensure the rear wheel is lifted off the ground using the frame provided, and the front wheels are placed on their provided mounts.
4. Enjoy making up smoothie recipes, but suggest no more than 4 different produce items per batch.
5. Take care to avoid the participants coming into contact with the knives, and where possible, pre-chop and prepare fruit and vegetables in advance.
6. All fruit and vegetables should be washed before use to remove pesticide and fungicide residues.
7. Use supplied attachment to assist with pressing produce down into blender jug.

Additional information



Suggested Fruit and Veg suppliers:

Food and Agriculture Organisation (FAO):
www.fao.org/food-loss-and-food-waste/en/

WRAP: www.wrap.org.uk/content/household-food-drink-waste-%E2%80%93-product-focus

Love Food, Hate Waste:
www.lovefoodhatewaste.com/content/story-food-2

Tristram Stuart: www.ted.com/talks/tristram_stuart_the_global_food_waste_scandal?language=en

Feedback (linked to Tristram Stuart):
<http://feedbackglobal.org/>

French supermarkets campaigned to sell ugly fruit and vegetables in 2014. Their website is here: <http://itm.marcelww.com/inglorious/> and a video of the campaign can be found here: <https://vimeo.com/98441820>

Jamie Oliver worked with Asda in January 2015 to try bringing ugly fruit and vegetables to a few of their stores:
<http://goo.gl/Wnq2k9>

In November 2015 Hugh Fearnley-Whittingstall started a campaign on the subject with a BBC television show called 'War on waste':
www.rivercottage.net/war-on-waste

Stop the Rot: a campaign aimed at reducing waste throughout the supply chain:
www.stoptherot.org.uk/#lifting-the-lid



Soil textures



Environment



Health



Nutrition

Exploring and testing the moisture content of healthy soil

Soil is full of life – much of which we cannot see. Like all living things it can become unhealthy and even die if it isn't looked after properly. Without soil there wouldn't be food to eat, or freshwater to drink. Soil is an important part of healthy plant and crop development. Healthy soil requires the right balance of moisture and nutrients to produce crops that are important for our health.

Links to other activities

Fertilisers in soil activity: both these activities explore what is needed for healthy soil

As all crops require healthy soil to survive, you can link to any of the activities that use crops such as 'Rolling oats', 'Making corn tortillas', 'Grinding corn'.

Key take-home messages

- Different soils feel different as they are made of different sized particles. The three main types are sand (largest particles), silt (medium particles) and clay (smallest particles).
- Soils with lots of small, clay size particles will retain more water than soils with larger, sand size particles.
- Different textures suit different crops, most crops grow more efficiently in lower clay and higher sand content, preventing the crop getting waterlogged. Rice is an exception, as it prefers high clay content soil.

Additional messages

- The best conditions for growing healthy crops are generally loamy soil, which is a mixture of sand and silt, with less than 20% clay. This suits maize, wheat, barley and potatoes among others.

- As soon as the soil has more than 30% clay content, this strongly controls the moisture content of the soil. The soil can become waterlogged and it is difficult for roots to remove this water. Rice prefers clayey soil as it likes to grow in standing water and clayey soils can hold lots of water.

Background information

Why is soil important?

Healthy soil is incredibly important in the production of healthy crops. The texture of the soil is important for controlling how much water the soil can hold, and sustainable agriculture needs water to sustain healthy plant growth. Without healthy and sustainable agriculture, human health can suffer. Everything alive on land needs healthy soil to function properly as surmised nicely in this quote from the James Hutton Institute publication 'What on Earth?'

"Every single life form on land depends on a healthy soil to survive. The plants, the animals which feed on the plants, and the animals that eat the animals which feed on the plants – none of them would exist if it wasn't for a living soil".

James Hutton Institute





The activity

1. Start the activity by collecting a tray of local soil and asking the audience to feel the soil by passing it over their fingers. Does the soil feel “gritty” or smooth? Can the audience roll the soil into a ball?
2. Explain that the soil is made up of different sized particles: the “gritty” texture (like granulated sugar) is the larger particles called sand, the smooth texture (like butter) is provided by the smaller particles called clay and if the soil feels more like an intermediate texture, this is caused by middle sized particles called silt (more icing sugar than granulated sugar).
3. Get the participants to touch the examples of the clay and sand soils and compare to the local soil. What type of soil is the local soil most like?
4. Place two spoonfuls of each different soil type (two, three or four depending on what is available) into the small mixing pots, add 10ml of water and stir the pots.
5. Put the wet soil into separate muslin cloth squares, and squeeze the water in each into separate pots. After squeezing, the pots should contain different amounts of water, showing that different textures of soil have retained different amounts of water.
6. The audience can then touch the sample within the muslin and see that the clay is still wet, showing that clay retains more water than the other soil types and that the sandy soil can be broken back down to its original texture.



Equipment and consumables



Tray and trowel.

3 x small mixing pots and spoons.

Pipette and water.

Muslin squares and 3 x larger containers.

At least two samples of soil; sandy, silty, clayey and (wherever possible) local.

Top tips



1. The local soil sample will probably have larger bits of organic matter (like twigs and leaves) within it and these should be removed beforehand so the sample is the actual soil which will probably have a combination of all the particle sizes.
2. Be careful to use the same amount of soil for the experiment otherwise this will not provide a good representation of the water holding capacity of the soils. If they all have similar amounts of water in the final collection vessel, don't worry the clay soil will still look very different from the sandy soil inside the muslin.

Additional information



2015 International Year of Soils:
www.fao.org/soils-2015/en/ Estimating soil texture: www.ext.colostate.edu/mg/gardennotes/214.html

James Hutton Institute booklet:
www.hutton.ac.uk/sites/default/files/files/Soils-A5-booklet.pdf

Fertilisers in soil



Environment



Health



Nutrition



Story



Demo



Hands-on

Exploring and testing the moisture content of healthy soil

Links to other activities

Soil textures also explores the components of healthy soil.

Magnetic map and cards showing where different food crops are grown around the world.

Iron fish investigates the nutrient iron and shows why it's important for our health.

Key take-home messages

- Most of our food (95%) comes from plants which are grown in different types of soil around the world.
 - Animals that many humans eat also get most of their food from plants grown in soil.
 - Living things such as humans, other animals and plants need nutrients to grow and stay healthy.
 - If soil doesn't contain enough nutrients we can't produce enough nutritious food for us and other animals to eat.
 - Soils around the world are becoming increasingly unhealthy and often don't naturally contain all of the nutrients that are essential to grow nutritious food crops.
 - There are different ways of adding nutrients to soil, some are artificial and unsustainable but others are natural, such as planting beans to help provide soil with nitrogen (N₂). This is called nitrogen fixing, where bacteria present in the roots of a plant such as beans converts atmospheric N₂ into ammonia (NH₃), allowing the soil to make use of the excess Nitrogen produced in this process.
- The most important nutrients for the majority of crops are nitrogen (N), potassium (K) and phosphorus (P). Other nutrients such as iron, zinc and calcium are also needed for healthy soil, and can also be added as fertilisers to increase crop yield as well as human nutrition.
 - Minerals such as iron and calcium are needed in small amounts to help our bodies function properly and stay strong.
 - In the UK, the minerals iron and calcium are often added to all wheat flour, iodine is supplied as iodinated salt, and many processed foods and drinks are fortified with a variety of mineral elements, particularly iron and zinc.
 - Soil is one of the most diverse habitats on our planet – a teaspoon of soil contains more inhabitants than there are humans on earth! These are mainly bacteria, fungi, yeasts and other micro-organisms but also worms, beetles and woodlice.

Background information

What are fertilisers?

Fertilisers contain concentrated sources of plant nutrients in chemical or natural form. Most contain major plant nutrients, which plants need in relatively large amounts. Some also contain trace elements, which plants only need in tiny amounts.





Image credit: Lee Pullen, At-Bristol Science Centre.



Story



Demo



Hands-on

Types of Fertilisers

Most fertilisers are based on the three major plant nutrients:

Nitrogen (N): For green leafy growth. Decaying fish, animal manure and alfalfa meal are all good natural sources of nitrogen. Often farmers use a nitrogen fixing plant, like beans, to help increase the concentration of nitrogen in a soil (see the Three Sisters Gardening section).

Phosphorus (P): For healthy root and shoot growth. Bone meal is a good natural source

Potassium (K): For flowering, fruiting and general hardiness. Good natural sources are citrus rind, banana peels, wood ash and seaweed. Potash, which is a natural mineral mined from old stone deposits can also be added as well as granite dust, as this also has high levels of potassium.

Compost is generally a good natural source of all nutrients, in particular potassium and phosphorus. Artificial chemical fertilisers include an NPK ratio, which is the ratio of Nitrogen:Phosphate:Potassium; this tells you the amounts of each nutrient that the fertiliser has. These types of fertilisers will often give a large boost to the nutrients but then get used up quickly.

Companion planting

When certain types of plants are grown together they can help each other by providing nutrients in the soil, offering protection from wind or sun, and by attracting beneficial pests or keeping harmful ones at bay.

Three Sisters Gardening

Ancient Native American farmers understood that soil fertility was important for crops. In order to maintain the soils fertility they often used the Three Sisters Gardening method planting corn, beans and squash together. Corn acted as a natural pole for beans. The beans fixed nitrogen in their roots, increasing the concentration of nitrogen in the soil, as well as stabilising the corn in the wind.

Squashes, which grew along the ground, provided organic matter and prevent the soil from drying out. These crops also provide complementary nutrition with the corn providing carbohydrates, the beans are rich in protein and the squash is high in vitamins. Different crops have different needs, for example corn needs plenty of nitrogen whereas wheat can survive in environments with lower levels of all nutrients. Potatoes need lots of potassium to grow.

Other examples of companion planting

BBC guide: www.bbc.co.uk/gardening/basics/techniques/organic_companionplanting1.shtml

The Poached Egg Plant: a companion plant that's helpful in vegetable gardens as it attracts hover flies that feed on aphids and pollinate plants: www.bbc.co.uk/gardening/plants/plant_finder/plant_pages/488.shtml

Equipment and consumables



Rapitest soil testing kits, testing soil for N, P and K levels.

Pipette.

Soil samples, including local soil.

Water (deionised if possible).

Jam jar container.

Corn, beans and squash plants as props if possible.

One tablespoon of soil will need to be placed in the jam jar at least 30 minutes before the activity with 5 tablespoons water (ratio of 1:5), stirred and then left to settle until the soil is at the bottom and there is relatively clear water above. This is the water that is then used in the Rapitest kits, as the nutrients will have been transferred to the water from the soil.



Story



Demo



Hands-on

The activity

1. Begin by asking participants what humans need to grow. Then ask them what they think plants that we (and other animals some of us eat) rely on for food need to grow. Just like humans and other animals, they require nutrients. Ask participants if they know the names of any nutrients they get from eating plants. Get participants to uncover through discussion where plants and crops get their nutrients from, mostly from the soil through roots.
2. Introduce a sample of local soil, which will have been sitting in jam jar full of water. The water should be clear, and the soil should be sitting at the bottom of the jar. The nutrients that were in the soil will now also be in the water.
3. Pipette out enough water to fill the testing kit chamber, then add the corresponding powder capsule to the water in the kit.
4. Secure the lid and shake the kit. You can get participants to help with this. The water will begin to change colour depending how much of the nutrient it is testing for is in the sample.
5. Use the scale on the side of the kit to help determine how much of that nutrient is in the soil. What does this mean? What crop could grow well in this soil? Use the FAO link below to get some values of nutrients required for different crops around the world. As an example, corn needs 200kg/ha Nitrogen, 50-80kg/ha Phosphorus and 60-100kg/ha Potassium. Potatoes need 120kg/ha* Nitrogen, 50-80kg/ha Phosphorus and 125-160kg/ha Potassium.
6. The audience can then touch the sample within the muslin and see that the clay is still wet, showing that clay retains more water than the other soil types and that the sandy soil can be broken back down to its original texture.

*kg/ha = kilogram of fertiliser per hectare of land.
1 hectare = 100 acres, or 10,000 square metres.

Top tips



1. Allow the jam jar of soil and water to sit as long as possible, but at least 30 minutes as this will make identifying the colour change easier. Do not worry if the water is not completely clear as clay particles take some time to settle.
2. Do not allow the participants to use the powder capsules and try and keep away from them as they contain chemicals.

Additional information



The nutrients different crops need:
www.fao.org/nr/water/cropinfo.html

Natural sources of NPK as well as the other micronutrients: www.plantstogrow.com/Botany/Workshop_notes/Notes/Organic%20sources%20of%20NPK.pdf

Resources developed by the FAO for the International Year of Soils in 2015:
www.fao.org/soils-2015/en/

James Hutton Institute learning resources about soils: www.hutton.ac.uk/learning

Soil and earthworm quiz from Open Air Laboratories (OPAL):
www.opalexplornature.org/soilquiz





Chocolate



Environment



Health



Nutrition



Demo



Hands-on

A closer look at chocolate

Links to other activities

Magnetic map: shows where in the world cocoa is grown (West Africa, South East Asia and South and Central America).

Key take-home messages

- Chocolate, in its raw form as cacao (cocoa), grows on trees! Specifically the Theobroma cacao tree which originated in the Ecuadorian Amazon region of South America.
- 5-6 million farmers across the world rely on growing cacao to feed their families. Around 50 million more base their livelihoods on the production process of chocolate, from transportation of beans to the creation of the end product on store shelves.
- 4.4 million metric tons of cocoa are currently produced around the world each year. Due to a rising and increasingly affluent population, by 2020 demand is expected to outstrip supply by one million metric tons.
- Chocolate undergoes a long production process from the fresh raw pod and bean, to the finished product that we recognise. Many cacao farmers have never tasted chocolate as we know it.
- A survey by the British Heart Foundation reported the average Briton eats almost three chocolate bars a week, that's more than 150 per year.
- Cocoa beans contain naturally occurring polyphenols – micronutrients which may help to reduce blood pressure and have antioxidant properties. However, many chocolate products are high in sugars and saturated fat. These foods are often energy-dense (high calorie) and too much of this energy can lead to weight gain which is a risk factor of cardiovascular disease. Healthier sources of polyphenols include beans, pulses, fruit and vegetables.

Background information

Threats to cacao

- Cacao is a delicate and sensitive crop that grows in a narrow tropical belt around the planet. Cacao trees need very specific conditions to grow and only produce yields after 5 years. Yields are threatened by wind, sun, pests, and disease.
- Due to its hyper sensitivity and the tropical environment in which it grows, the global Cacao crop is threatened by pests, fungal infections, climate change and farmers' lack of access to yield-enhancing fertilizers. It is estimated that current production is only about a third of its potential rate.
- Social problems are also rife in the world of cacao production. Child labour is a huge problem in Cote D'Ivoire and cacao production sits alongside coca (or cocaine) production in areas of South America which leaves it vulnerable to control by cartels (see stories below.)

Possible solutions

- Researchers are working on multiple approaches to boost and protect the fragile crop. These include selective breeding and genetic recording, as well as efforts to educate farmers on novel planting, improved irrigation and pest-management techniques.





Demo



Hands-on

- Mixed agroforestry systems. For example planting a mixture of cacao trees, food crops, and timber trees for shade. These mixes improve water-holding capacity throughout the entire system by varying the root structures. Another strategy takes the opposite approach, creating large plantations of cacao trees at higher altitude—out of the traditional pest and disease ranges—in the full sun and irrigating them with fertilizer-enriched water for maximum productivity.
- Molecular research labs around the world are working with cacao farmers on the ground to identify and then sequence trees in areas found to display signs of disease resistance. They are then able to use the genome map to identify the gene variant in the cultivar that gives resistance to the dread fungus. In subsequent breeding efforts, the breeders can quickly determine if new cultivars carry that trait or other useful traits for the next generation of cacao trees. Already farmers in Latin America are grafting parts of branches from these new plants to their trees.

A future without chocolate?

The delicate “chocolate tree,” *Theobroma cacao*, is in peril. The tree is extremely susceptible to pests and fungal infections. In 1988, just six years after the Center for Cocoa Science was established in the thriving cacao-growing region of Bahia, Brazil, the fungal disease ‘witches’ broom’ was found in the area. It reduced production by 80%, driving people whose families had grown cacao for generations to abandon their farms and move to city shantytowns—effectively destroying in a few short years a vast archive of cacao-farming knowledge built over centuries. Another fungal disease, ‘frosty pod rot’, has spread throughout Latin America where it could be even more devastating than witches’ broom.

The Ivory Coast produces 40% of the world’s cocoa (making up 15% of their GDP and 5% national employment.) But within the 1.2 million workers in the cocoa industry there are child labourers aged 5-17, working over 100 hours per week in dangerous conditions, with little or no access to formal education.

Since 2009 the World Cocoa Foundation (WCF) has been running a \$40-million programme, to improve the livelihoods of young cacao farmers in five West and Central African countries. The program oversees a series of successful field schools. Local farmer ‘leaders’ do much of the teaching, from obvious topics such as disease management, pruning and harvesting to topics such as malaria, HIV/AIDS, farm safety and the avoidance of child labour. According to WCF president Bill Guyton, graduates increased their incomes by 23 to 55%. By 2014 the Cocoa Livelihoods Program had trained nearly 200,000 farmers, helping them to enhance productivity and quality, promote crop diversification and boost supply-chain efficiency.

In Columbia coca (cocaine) and cacao production areas often overlap. Children and young people are used on the farms as extra labour and to fund their education but many get co-opted into street gangs and rival cartels controlling the production of cocaine. Top cacao producers such as Granja Luker (who supply all of the Eden Project’s chocolate), also run training academies, working hard to promote and sustain the best methods of cultivation for cacao crops, so that young people are equipped with the best knowledge to grow cacao and have a future outside of the cartels and drug and industries.

To the ancient Aztecs and Mayans, chocolate was the magical food of the gods. In 19th century Cuba it was considered a powerful aphrodisiac drug. In twentieth century America, it was used as a digestive aid. Nowadays, many consider it as the ultimate comfort food. For connoisseurs, cacao beans, rather like coffee or wine, can be detected area by area. For example, if a Cacao plantation is near to a banana plantation then the taste of bananas can be picked up in the beans.



Demo



Hands-on

Equipment and consumables



- Chocolate infographic sheet.
- Cocoa pod prop.
- Handful of pre-roasted cocoa beans.
- Cocoa nibs (half a cup of cocoa beans roughly crushed to smaller pieces).
- Centres have the option to buy some raw chocolate for selected participants to taste.

The activity

1. Using the props and the infosheet, participants are able to examine chocolate as a crop from its raw origin (the pod), through to the roasted beans and nibs and potentially to the finished chocolate product (*optional.)
2. The sheet can be used to stimulate discussion around where in the world it is produced and how it is processed, who imports (and eats) chocolate the most; and some of the historic and social context of chocolate production. Watch the 2014 video in which a lifelong cocoa farmer tastes chocolate for the first time. <https://www.youtube.com/watch?v=zEN4hcZutO0> Why do some people in some parts of the world spend their lives producing food crops that they never taste? What implications might it have for the global food system?
3. Participants should be encouraged to touch, smell and taste the props to get a sense of chocolate as a crop.
4. Is it a Future Food? How do participants feel about the threats to chocolate? Or the cost of chocolate rising massively or demand outstripping supply by 2020? What are the best methods they think might be to meet future demand.

Top tips



1. Start the activity by asking participants who knows where chocolate comes from and how it looks before it is processed. Ask again after the activity in case some people are surprised by what they have learnt!
2. In understanding that the food system changes, it helps to ask different age groups about their memories of chocolate. Did they eat it as a kid, what did it look like back then, how has it changed?

Additional information



The Future of Chocolate on Earth. Video by Distinctive Voices: www.youtube.com/watch?v=2BvTw5LtCis

Cacao Genome Database. A public and private collaboration: www.cacaogenomedb.org

Sustainable Cocoa Initiative: Securing Cocoa's Future: www.mars.com/cocoasustainability/home.aspx

Genome-sequencing of cacao <http://www.research.ibm.com/articles/genome-sequencing.shtml>

www.cacaogenomedb.org/

Chocolate and Health lowdown from the NHS <http://www.nhs.uk/Livewell/superfoods/Pages/is-chocolate-a-superfood.aspx>

Cocoa contains many chemicals and compounds such as caffeine and serotonin that bind to neuro-receptors in the brain, releasing hormones and causing temporary feelings of alertness or wellbeing. Dopamine- 'the love hormone'- is one such product. This is why in ancient-times and still today, chocolate is considered an aphrodisiac or a comforting treat.

Chocolate



Demo



Hands-on



Latest funded research on flavanols and health benefits in chocolate



www.marscocoascience.com/

Chocolate: History, Culture, and Heritage. Edited by Louis Evan Grivetti and Howard-Yana Shapiro. Wiley, 2009.

A brief history of chocolate
www.smithsonianmag.com/arts-culture/a-brief-history-of-chocolate-21860917/?no-ist

British Heart Foundation chocolate survey of 3,000 adults in the UK (2015):
www.bhf.org.uk/news-from-the-bhf/news-archive/2015/february/bhf-reveals-cravings-for-sweet-treats

Myths about chocolate: http://dechox.bhf.org.uk/survival_kit/myths-about-chocolate/

How much sugar is in chocolate treats?
http://dechox.bhf.org.uk/survival_kit/how-much-sugar/

The changing size of chocolate bars:
www.appliancecity.co.uk/news/news/is-our-chocolate-getting-smaller;
www.bbc.co.uk/newsround/25401945



How much water do you eat?



Environment



Health



Nutrition



Demo



Hands-on

Embedded water is the water required to produce food and non-food items. The decisions we have and make as consumers can have substantial implications for the environment and the broader health of our society and planet.

Vast quantities of water are required to produce the food and drink we use every day. From the growing of raw materials to the processing, manufacturing, distribution, consumption and waste of products, water is required every step of the way. This activity includes cards containing information on the embedded water levels of several common food types in litres per kg.

Links to other activities

Cup of tea: this activity tells the story of the amount of embedded water in a cup of tea.

Key take-home messages

- Embedded or virtual water is the amount of water used during the lifecycle of a food/drink process - from how it is produced to where it goes to/ ends up.
- Food and drink labels contain little or no information about embedded water. The food and drink we consume has an impact on the amount of clean water that's available to use and this affects our health and the health of our planet.

The activity

Participants can explore the embedded or virtual water in foods they will recognise. There are a number of different ways in which the activity can be delivered. It can be told as a story, or delivered as a hands-on game putting items of food and drink in order, as the results may be surprising.

1. Participants can attempt to rank the foods in order from most to least in terms of virtual water, before knowing the actual amounts.
2. The cards can be used in a 'Higher or Lower' style generation game, led by the facilitator.
3. As a suggested extension, participants can design their own food labels for common food and drink items. What information would they include aside embedded water?

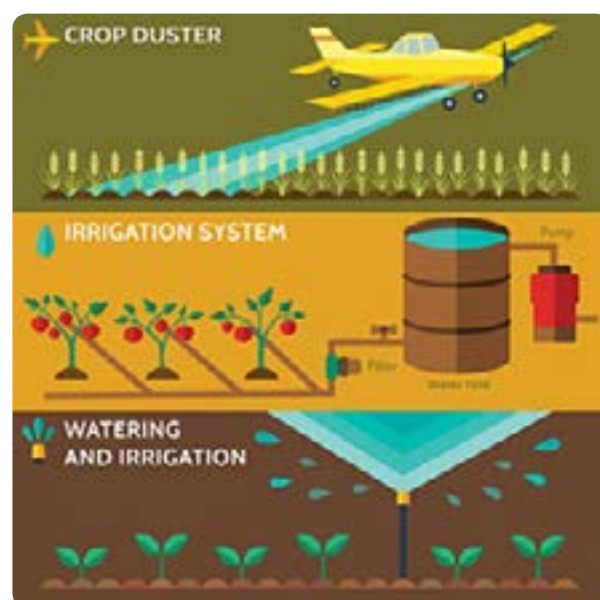


Table of Virtual Water for common food types.

Food Type	Litres of embedded water / kg of food
Apple	700
Banana	860
Beef	15500
Beer	300
Bread	1300
Cabbage	200
Cheese	5000
Chicken	3900
Chocolate	24000
Coffee	560
Cucumber	240
Dates	3000
Groundnuts	3100
Lettuce	130
Maize	900
Mango	1600
Milk	1000
Olives	4400
Orange	460
Peach	1200
Pork	4800
Potato	2560
Rice	3400
Sugar (from cane)	1500
Tea	120
Tomato	180
Wine	960

Source

<http://waterfootprint.org/media/downloads/Hoekstra-2008-WaterfootprintFood.pdf>

Equipment and consumables

Set of information cards for 25 common foods in the UK.

Set of food and drink items to line up in order.



Story



Hands-on

Additional information

How Much Water do you eat? XA Research Fund, Esther Delbourg

<https://vimeo.com/132733488>

Hoekstra, A, The Water Footprint of Food. <http://waterfootprint.org/media/downloads/Hoekstra-2008-WaterfootprintFood.pdf>

Water footprint Product Gallery

<http://waterfootprint.org/en/resources/interactive-tools/product-gallery/>

Water Footprint Assessment Manual – Global Water Footprint Standard

http://waterfootprint.org/media/downloads/TheWaterFootprintAssessmentManual_2.pdf

World Bank Group – Water and Food Security

<http://water.worldbank.org/WPP-Food-Security>

Key terms explained

- Virtual water or embedded water is the volume of freshwater used to produce a product (a commodity, good or service), measured at the place where the product was actually produced.
- Key principles of accounting and reporting embedded water:
 - **Relevance:** data and methods appropriate to the assessment of the water arising from specific products have been selected.
 - **Completeness:** all product life cycle water arising within the system and temporal boundaries for a specified product which provide a material contribution to the assessment of water arising from that product have been included.
 - **Consistency:** assumptions, methods and data have been applied in the same way throughout the quantification and support reproducible, comparable outcomes.
 - **Accuracy:** bias and uncertainty have been reduced as far as practical.
 - **Transparency:** where the results of life cycle water assessment carried out are to be disclosed to a third party, data and information is made available that is sufficient to support disclosure and allow such a third party to make associated decisions with confidence.

Magnetic map



Environment



Health



Nutrition



Story



Demo



Hands-on

An interactive map looking at what the world eats

Links to other activities

We recommend using the magnetic map and sets of cards described below during the delivery of the following activities to help engage families with global stories:

Iron fish, Grinding corn, Making corn tortillas, Future foods, Eating insects, Chocolate and Chicken.

Key take-home messages

- The global population is predicted to increase from 7.4 to 9.6 billion people by 2050 with the majority of people living in urban areas. These changes are already affecting our health and the health of our planet.
- We currently produce enough food to feed everyone in the world but many people are not getting enough nutrients from their diet and about a third of the food produced is lost or wasted.
- Around the world traditional diets are being replaced by diets high in processed foods that contain refined sugars, fats, oils and meats.
- Our diets are becoming less diverse - there are 22,500 food plants that exist in the world but only 15 crop plants provide 90% of the world's food energy intake.
- Rice, maize and wheat comprise the main part of the diet of over 4 billion people (66% of the global population.)
- People around the world are investigating ways of increasing the amount of nutrients we get from our diet without further damaging the health of our planet.

The activity

- 1. The Magnetic map** is a storytelling prop that can be used in outreach settings, or in your centre. You can use the map and the below card sets to explore a number of key areas for e.g. diets in different parts of the world; connections between our changing diet and our changing environment, how we rely on a relatively small number of crops for food and how the nutritional value of these crops is decreasing, and stories about how people around the world are trying to address these issues.
- 2. Card set one:** Top 10 foods can be used as a crop fact or guessing game. Participants pick a card and read out what they think is the most exciting fact about each crop e.g. I am the most produced grain the world...I need 2000 litres of water to produce one kilo of food etc. They then offer a series of clues about their crop until someone guesses what it is. The corresponding magnetic image is then placed on the map in one of the main areas where it is consumed.
- 3. Card set two:** Global Ingredients As above for some of the most interesting food plants from around the world; participants share facts with the group, guess where they come from (both originally and today) and place on the map accordingly.
- 4. Card set three:** Whose food? Participants/facilitators present a card, share facts about that diet: the group guesses where in the world the family lives and places the corresponding magnetic image on the map. Can be used to stimulate discussion about why the diets are so different and how they compare to our own, how our diets vary amongst the participants in the group, what each families' favourite food/dinner is?
- 5. Quick version:** facilitator can introduce each crop, plant or diet and participants can be invited to put them on the map.



Story



Demo



Hands-on

Equipment



Map shows: Where the major crops are eaten (wheat, maize, rice, roots =yams/cassava/ potato/ taro, sorghum/millet and plantain.)

Card Set 1 + set of magnets: Shows top 10 food crops in the world with top production facts (corn, wheat, rice, potatoes, cassava, soybeans, sweet potatoes, sorghum, yams, and plantain.)

Card Set 2 + set of magnets: Global Ingredients with top facts (Chocolate, pineapple, coffee, tea, tomatoes, and sugar cane.)

Card set 3 + set of magnets: What the World Eats: different diets from around the world.

Top tips



1. The activities should be used to help participants understand that the global picture continually changes, what and why some of these changes occur (e.g. population growth and climate change) and what future changes may look like. The aim is to stimulate thought and discussion, with no 'right' or 'wrong' answers.
2. **Card Set 2 Tip:** Can also be used as a competitive 'crop top trumps' with participants comparing annual yields figures, or choosing their most significant fact e.g. I produce twice as much protein per acre than any other vegetable crop.
3. The Whose food card set can be used to further stimulate debate about different diets around the world and in the UK what's recognisable, what isn't? Has our own diet changed since childhood? Are there any new foods? What foods have been forgotten? What food in the pictures would you be willing/ not willing to try?

Additional information



National Geographic photo story: Feeding 9 billion: www.nationalgeographic.com/foodfeatures/feeding-9-billion/

Information is Beautiful infographic: 'What is the World's Biggest Cash Crop' www.informationisbeautiful.net/visualizations/what-is-the-worlds-biggest-cash-crop/

Food Climate Research Network: www.fcn.org.uk

Nature Food Special including podcast www.nature.com/news/specials/food/index.html

WHO nutrition links: www.who.int/nutrition/topics/en/

World Food Programme resources on malnutrition – includes a helpful short video: www.wfp.org/hunger/malnutrition

Access to Nutrition Index: www.accesstonutrition.org

Oxfam: The Food Index - www.oxfam.org.uk/what-we-do/good-enough-to-eat

FutureFood 2050 – Nutrition innovation: <http://futurefood2050.com/interviews/nutrition-innovation/>

Sustainable Food Trust: <http://sustainablefoodtrust.org/>

Smithsonian Institute: Game changing crops that could help feed the hungry. www.smithsonianmag.com/40th-anniversary/five-game-changing-crops-that-could-help-feed-the-hungry-806108/?no-ist

Ted Talk: the case for engineering our food https://www.ted.com/talks/pamela_ronald_the_case_for_engineering_our_food



Iron fish



Environment



Health



Nutrition



Story



Demo



Hands-on

Many people around the world, including in the UK, don't get enough iron from their diet. Iron deficiency is the most common and widespread nutritional deficiency affecting nearly 3.5 billion people around the world. In Cambodia, a fish made from iron has been used in cooking pots as one way of addressing this challenge. The fish is a lucky symbol in Cambodia and this has helped to build trust in this health intervention within local communities.

Links to other activities

This activity can be run with the Iron breakfast activity. Fill the usherette tray with cereal, and have the iron fish "swimming" inside the tray. Get the participants to hunt for a clue as to what the activity might be about – the iron fish.

Use the Magnetic map to point out areas where the iron fish is used currently (Cambodia as of Feb 2016).

Key take-home messages

- Iron is an essential nutrient for growth and development that plays a key role in transporting oxygen around the body.
- We get most of the iron we need from food, but many people don't get enough from their diet.
- Iron deficiency is the most common and widespread nutritional deficiency in the world and, if untreated, can lead to health conditions such as iron deficiency anaemia.
- A range of solutions tailored to local environments is needed to tackle iron deficiency.
- The Lucky Iron Fish is one example of a health intervention that is being trialled to reduce iron deficiency in countries where people are not getting enough iron from their diet for e.g. Cambodia in Southeast Asia.

Background Information

What are the causes of iron deficiency?

May be due to one or a combination of the following factors:

- **Blood loss:** This is the most common cause of iron deficiency in women of childbearing age.
- **Increased iron requirement:** Periods of growth during childhood and adolescence sharply increase the need for iron. There is also an increased need during pregnancy.
- **Inadequate dietary intake and diminished iron absorption:** Plant-based sources of iron are a little harder for the body to absorb - vitamin C will aid in absorption of all forms of iron. Inhibiting factors include tea and coffee (e.g. polyphenols, phytates), and calcium.

What does iron deficiency do to the body?

- Iron deficiency anaemia is a condition where a lack of iron in the body leads to a reduction in the number of red blood cells and a subsequent lack of oxygen delivered to organs and tissues.
- This means you can suffer from tiredness, shortness of breath, heart palpitations and a pale complexion. If left untreated it can make people more susceptible to illness and infection.
- Pregnant women and children are particularly vulnerable. Anaemia is thought to contribute to 20% of all deaths during pregnancy.
- The Recommended Daily Allowance (RDA) for iron is 9mg/day for men and postmenopausal women. For younger women it is 15mg per day, with an additional requirement recommended during pregnancy.
- Our body carefully monitors its levels of iron; absorbing more when demand is high and less when stores are adequate. Iron is stored primarily in the bone marrow and liver.



Story



Demo



Hands-on

How can iron deficiency be addressed?

The World Health Organisation (WHO) recommend a multi-pronged approach to tackling iron deficiency. Here are the main ways that iron deficiency is addressed.

- **Increase iron intake:** Dietary diversification including iron-rich foods and enhancement of iron absorption, food fortification and iron supplementation. There are many foods that are naturally good sources of iron, such as green vegetables and red meat;
- **Control infection:** Immunization and control programmes for malaria, hookworm and schistosomiasis. Infection from these parasites can have a negative impact on health, and can be a predictor for a high prevalence of anaemia;
- **Improve nutritional status:** Prevention and control of other nutritional deficiencies, such as vitamin B12, folate and vitamin A.

The Lucky Iron Fish

The Lucky Iron Fish social enterprise is trying to address this global health challenge in parts of the world where people are not getting enough iron from their diet, for example, Cambodia.

The activity

1. Begin by asking participants about nutrients. Can anyone name any foods that are rich in iron? Why is iron important for health? Bear in mind that some people may have personal experience of iron-deficiency anaemia as it is quite common in the UK.
2. Lack of access to nutritious food is a major global health issue. The Iron Fish can be introduced as an example of a product that has been designed to help address iron deficiency, and its' efficiency is being researched in trials right now. It's important that facilitators also mention the measures the WHO recommends to address iron deficiency and anaemia for e.g. having a diet that includes iron-rich foods or food fortified with iron.

Equipment and consumables



The Lucky Iron Fish, a small handheld piece of iron shaped like a fish.

If delivering with Iron breakfast, tray, cereal, magnet, cup and magnifying glass also required.

Top tips



1. The Iron Fish is heavier than some participants may expect, so take care when handing it to young children.
2. Don't leave the Iron Fish out in the rain as it will rust. If it does start to rust, clean it with a little lemon juice.

Please read these FAQs relating to the fish:
www.luckyironfish.com/facts

Additional information



WHO factsheet on iron deficiency:
www.who.int/nutrition/topics/ida/en/

NHS guide to anaemia and iron deficiency:
www.nhs.uk/conditions/Anaemia-iron-deficiency-/Pages/Introduction.aspx

WHO global targets relating to maternal, infant and young child nutrition:
www.who.int/nutrition/global-target-2025/en/

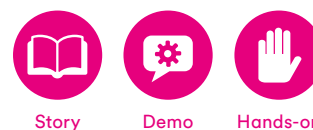
Lucky Iron Fish BBC report:
www.bbc.co.uk/news/health-32749629

Find out more: www.luckyironfish.com

Ongoing clinical trial: <https://clinicaltrials.gov/ct2/show/NCT02341586>



Iron breakfast



See the iron in breakfast cereal

Iron is a micronutrient that keeps us healthy and it's found in some food and drink. But not everyone gets enough iron from their diet. Iron is lost when food is processed and is sometimes added back in. We can see added iron as a dark powder in some types of breakfast cereals, if we use a powerful magnet.

Links to other activities

Link this activity to the Lucky Iron Fish to tell a more global story of iron in our diets.

Key take-home messages

- Breakfast cereals are made from grains of crops. For example, rice, oats, wheat and corn (maize).
- Iron is a (micro/ tiny) nutrient found in some food and drink including breakfast cereals and it plays a role in keeping us healthy.
- Many people don't get enough iron in their diet.
- Iron is lost from crops (grains) when they are processed/ refined to make some breakfast cereals such as Rice Krispies (other cereals are available).

Additional messages

- Iron plays a key role in transporting oxygen around the body.
- Iron deficiency is the most common nutritional deficiency in the world and if untreated can lead to iron deficiency anaemia.
- Iron deficiency is surprisingly common in the UK – particularly among infants under two, teenage girls, pregnant women and the elderly.
- When a micronutrient is lost and then added back in, it is called enrichment. When it is added in but does not occur naturally, it is called fortification.

Background Information

Why is iron important for health?

- Iron is used to produce red blood cells, which help store and carry oxygen in the blood. If you have fewer red blood cells than is normal, your organs and tissues won't get as much oxygen as they usually would.
- Iron deficiency is the most common and widespread nutritional disorder in the world.
- Too little iron in our diets can lead to anaemia. 2 billion people – over 30% of the world's population – are anaemic, many due to iron deficiency
- Symptoms of iron deficient anaemia include tiredness and lack of energy (lethargy), shortness of breath, a pale complexion, heart palpitations. Be aware, it is also possible to have too much iron in our diets, which is called hemochromatosis and can be damaging to vital organs. This is most common in people that take an excess of iron supplements.

Food that's naturally rich in iron

- Wholegrain oats
- Dark green leafy vegetables, such as spinach.
- Beans
- Dried fruit, such as raisins and apricots
- Meat





Story



Demo



Hands-on

How much iron should we eat?

- The recommended daily intake of iron according to the NHS, is 9mg for men, 15mg for women and between 7 to 10mg for young children.
- Teenage girls need more iron than boys, especially around menstruation.
- Our body carefully monitors its levels of iron; absorbing more when demand is high and less when stores are adequate.
- Iron is stored primarily in the bone marrow and liver.

Understanding food labels: enriched vs. fortified

- **Enriched foods:** have lost nutrients during their processing but the nutrients have been added back in. For example B vitamins lost when wheat is refined are added back to white flour. That's why many breads are "enriched with vitamins."
- **Fortified foods:** have had extra nutrients added (rather than replacing the lost nutrients). For example, milk is often fortified with vitamin D, which improves the body's ability to absorb calcium and phosphorus already present in milk. Breakfast cereals are commonly enriched with vitamins and minerals. Check out the label the next time you reach for a cereal box.

The activity

1. Ask participants what they know about iron – what is it? A metal? Does anyone know anything special about this metal? Etc. Discuss natural sources of iron in our diets and iron deficiency both in the UK and globally.
2. Ask participants to help you finely crush some Rice Krispies into a paper cup. You will need around a third to a half of a cup of Rice Krispie dust.

3. Introduce the magnet. Hold the magnet (attached to spoon if using) against the side of the cup, near the bottom where the crushed cereal is and shake the cup a little. When you then draw the magnet up the side of the cup, there should be some very tiny dark specks of dust, following the pull of the magnet. This dark dust is iron.
4. Encourage participants to look at their own breakfast cereals at home and notice how much iron is in them.

Equipment and consumables



Rice Krispies, or other easily crushable, pale cereal high in iron (>10mg/100g).

Strong magnet (neodymium).

White paper cup.

Magnifying glasses.

Spoon (optional, to help with crushing and to attach the magnet to).





Image credit: Lee Pullen, At-Bristol Science Centre.



Story



Demo



Hands-on

Top tips and safety note



1. Safety note: Ensure you only have one magnet in use at a time. Strong magnets (e.g. neodymium) can cause pinches to fingers when attracted to each other. It is recommended that only facilitators use the magnets, and warn participants of their strength.
2. This activity works with lots of breakfast cereals. However, Rice Krispies are pale in colour and a good contrast to the dark iron particles, allowing them to be more easily visible. Rice Krispies are also easy to crush so even little fingers can have a go.
3. Having a large mound of Rice-Krispies can be a real crowd puller. Try pouring several boxes of Rice Krispies into a large, open-topped box or into the usherette tray. This also then forms the ideal place to bury the Iron Fish for little fingers to find.
4. You may wish to pre-crush some Rice Krispies for participants to add to in order to speed up the activity. You can whiz them in a food processor or try using a rolling pin with the Rice Krispies in a bag.
5. Ask participants to use their fingers to crush a few grains at a time instead of handfuls.
6. It can take a bit of practice to draw the magnet up the side of the cup in such a way that the clump of iron filings remains together and therefore visible. Magnifying glasses will help.

Additional information



Statistics vary, but the World Health Organisation estimates that a staggering 2 billion people around the world are anaemic and that the vast proportion of these is associated with iron deficiency.

www.who.int/nutrition/topics/ida/en/

NHS info on iron deficiency:

www.nhs.uk/conditions/Anaemia-iron-deficiency-/Pages/Introduction.aspx





Our future food?



Environment



Health



Nutrition



Hands-on

Participants learn to cook potential foods of the future

Our diet and environment are changing rapidly and many people worldwide don't have access to enough nutritious food. This situation is predicted to worsen in the future. What types of food could be better for us and our planet in the future?

Links to other activities

Magnetic map: use the 'diets around the world' set of cards and magnets.

Story of chicken: use this activity to tell the story of how diets have changed over time.

Key take-home messages

- The way we cook and eat food has changed over time, and will continue to do so in the future.

Background Information

Context

By 2050 there are likely to be another 2.5 billion mouths to feed. Environmental changes will affect food availability, consumption and health. The food system and our own eating habits need to change to meet this challenge and we can start with gaining a better understanding of the links between food production, environment and health.

Potential edible solutions that are being explored:

Seaweed

Algae, including seaweeds might be at the bottom of the food chain but could provide a solution to issues around food production. They can feed humans and animals and can be grown in the ocean, a big bonus with land and fresh water in increasingly short supply.

There is currently research (funded by Wellcome Trust) going on to analyse how safe and nutritious duckweed would be as a human food. Duckweed is an easy-to-cultivate plant with a very high

protein content that grows incredibly quickly (it can increase its biomass by up to 50% a day).

Quinoa

Quinoa is a complete protein, meaning it contains all your essential amino acids, which are the building blocks of proteins. For thousands of years it has been the staple crop of the Andean region, either roasted and ground into flour, or eaten as a grain. Quinoa can grow at wildly varied altitudes, survive drought and grow in temperatures ranging from -4 to 35 degrees Celsius. Its versatility and hardiness combined with its nutritional value make it an attractive crop to grow as our climate becomes more unpredictable. Western demand for this 'super crop' has driven market prices upwards (tripling since 2006) meaning that poorer communities in the Andes are now struggling to afford this diet staple and turning to cheaper junk food, instead.

Insects

At least 1,400 species of insect are eaten across Africa, Latin America and Asia. With rising food prices and worldwide land shortages they will soon be making more of an appearance on European menus. Not only are many bugs rich in protein and low in fat and cholesterol but they are also small and cheap to produce. Environmentally they outstrip more conventional livestock. Insects are better at converting plant biomass into edible meat, emit fewer greenhouse gases and can thrive on waste that would normally be thrown away.



Image credit: Lee Pullen, At-Bristol Science Centre.



Image credit: Lee Pullen, At-Bristol Science Centre.

The activity

1. This activity can be delivered in several different ways. The equipment list and method described below is for making nori rolls using a quinoa-rice mix and with an edible insect in the middle. It takes around 15 minutes and produces quite a lot of sushi rolls, so it is good to encourage participants to work in small groups. This requires an indoor or kitchen-based set up, due to the amount of equipment and fresh and perishable ingredients.
 2. Prepare quinoa and rice in advance. Cook in the rice cooker at the start of the day. Season with sushi vinegar, portion up into smaller quantities (enough for each session) and refrigerate as soon as it has cooled sufficiently to be put in the fridge. Food safety note: cooked rice and quinoa should be kept in the fridge until ready to be used and eaten and should not be stored beyond 24 hours.
 3. Discuss what participants like to eat, find out if it is different to what they ate in the past (good for getting adults involved) and ask what they think we might be eating in the future.
 4. Start the cooking activity. Introduce and discuss the ingredients one by one as you add them.
- Start with the algae (nori sheet) - hand one out to each participant/group for them to lay it on their sushi roll mat (on top of chopping board)
 - Introduce the quinoa-rice mix and add a line of the mix along one edge of the nori sheet.
 - Finally the ingredient you have been waiting for – the insects! Discuss and add a few down the middle of the line of rice-quinoa.
 - Wet the edge of the nori sheet opposite the rice and using the sushi mat (this is to help it stick together) roll the sheet tightly into a log shape.



Hands-on

- Slice the log into bite sized pieces.
- Dip into soy sauce and enjoy!

Equipment and consumables



- Rice cooker.
- Sushi roll mats (one per participant/group).
- Chopping boards (one per participant/group).
- Spoon for serving the quinoa or rice mix.
- Knife for slicing the sushi once rolled.
- Small bowl of water and pastry brush to make the nori stick to itself at the end of the roll.
- Small dipping bowls for soy sauce (optional).
- Chopsticks for eating (optional).
- Quinoa
- Sushi rice
- Seasoned sushi vinegar
- Nori sheets (sushi seaweed)
- Insects
- Soy sauce (optional for dipping).

Top tips



1. This is a great activity for intergenerational discussion. Encourage grandparents and parents to share stories of what they ate as a child compared to what is available in supermarkets today.
2. As this activity requires handling multiple food items, due care and attention should be exercised, and it is not recommended for children under the age of 7 (especially not unattended).

Our future food?



Hands-on



Additional information

For more info on the current research into Duckweed cultivation have a look here: www.wellcome.ac.uk/Funding/Strategic-funding/Our-planet-our-health/Funded-projects/Global-food-systems-and-health/WTP059780.htm

A BBC TV series 'Back in time for dinner'. A six-episode series following a family experiencing diets from the 1940s to the 1990s. The final episode looks at future food. A clip can be found here: www.bbc.co.uk/programmes/p02p2tgx

A TED talk by Michael Silverstein from 2013 about global farming and resources in the future: www.ted.com/watch/ted-institute/ted-bcg/michael-silverstein-the-future-of-food

A TED talk about biodiversity of crops and preserving them for the future: www.ted.com/talks/cary_fowler_one_seed_at_a_time_protecting_the_future_of_food#t-27141

American Museum of Natural history had an exhibition and online resources on future foods: www.amnh.org/exhibitions/our-global-kitchen-food-nature-culture/future-of-food

There is a 'meal-replacement beverage' called Soylent that claims to contain all the nutrition an average adults needs. For more information have a look here: https://en.wikipedia.org/wiki/Soylent_%28drink%29

And if you still want to know more on edible insects there is a UN Food and Agriculture Organization paper from 2013. It is a pretty accessible read but rather long (201pages): www.fao.org/docrep/018/i3253e/i3253e.pdf

This report from the Food Foundation provides an overview of the current diet of the average UK family. <http://foodfoundation.org.uk/food-foundation-launches-its-first-report-force-fed/>

Professor Alan Dangour, project funded through 'Our Planet, Our Health' (Wellcome Trust) www.wellcome.ac.uk/Funding/Strategic-funding/Our-planet-our-health/Funded-projects/Global-food-systems-and-health/WTP059781.htm





My global cup of tea



Image credit:
Vanderdecken.



Environment



Health



Nutrition



Story

A cup of tea is used to highlight interdependencies between food, water and energy.

A simple cup of tea is produced using a surprisingly large number of resources and many people from around the world are involved in this process. All of the different parts of this system are connected, often in unexpected ways, which means changes have global effects on our health and the health of our planet.

Links to other activities

How much water do you eat? Explores how much water is used to produce different types of food we eat every day.

Key take-home messages

- Understanding that food, water and energy are connected and part of a global system.
- By 2050 the global population is expected to have grown to 9.6 billion which will require an increased food demand of 60%, increased water demand of 55% and an increased energy demand of 80%.
- Producing simple food items, such as a cup of tea, have consequences that impact our health, and the health of our planet.

Background Information

Tea

1. We drink approximately 216 millions of cups of tea every day in the UK, but where does it come from? Tea is grown across the globe, but China, India and Kenya are the top three tea producers. Kenya is a leading producer of the tea leaves that go into teabags used in the UK – around 5 million Kenyan people are employed in the tea industry. Growing tea requires a lot of space and results in land-use changes.

2. Tea production has direct and indirect greenhouse gas (GHG) emissions from fertiliser, transportation, packaging, consumer preparation of tea, and waste.
3. Other concerns include employee welfare and habitat loss through tea production systems.

Milk

1. Our milk can come from anywhere in the UK and more recently due to changes in Common Agricultural Policy, can actually come from across the EU.
2. Our milk predominantly comes from dairy systems that can either be grass-fed or grain-fed. Grain-fed systems can have a higher environmental impact (e.g. GHG emissions) but a low land-use impact (e.g. use less space). However, recent evidence suggests grass-fed is a better sources of heart-healthy fats and certain antioxidants.
3. Getting milk from the dairy farm to the consumer requires inputs (feed for the animals), production on farm, processing, packaging, storage and refrigeration and transportation. All of which can have an impact on emissions to soil (e.g. nitrogen fertilisers), water (changes to nitrogen levels) and air (carbon dioxide, ammonia, methane and other such gases).

Water and energy

1. Availability of water. In the UK, we often take water for granted. Clean water that's suitable for drinking comes from our taps and is locally sourced. But many people in the developing world struggle to access enough clean water every day.
2. Energy for water. We need energy to treat (purify) and distribute (pump) our water to get it from the catchment to our house, and to treat or pump waste water before returning it to the environment.



Story



3. Water for energy. We need electricity to heat our water for our cup of tea. Our energy systems are heavily dependent on our water systems. UK electricity is produced by natural gas (47%), coal (28%), nuclear (16%), renewable energy (7%) and others (2%). We need water for current production systems such as thermal electric cooling and hydropower, but also for future possible sources e.g. shale gas.
4. Competing demands for water. We also need water for food through the irrigation of crops and animal consumption. About 70% of our planet's freshwater supply is used in agriculture.
5. Water and energy systems have substantial impacts on the health of our environment and ecosystems with a subsequent impact on our health. For example, approximately 38% of the UK's carbon dioxide emission in 2013, came from energy supply.

The activity

1. Ask families to deconstruct the cup of tea into the three most common components. What's in a cup of tea? Tea, water and sometimes milk. Families may like to share different types of tea they drink. Discuss where all the components that make up tea come from. Begin to explore parts of the world where tea is produced e.g. Kenya. The magnetic map can be used to engage families with where countries are. You can then move on to asking families how much water they think is needed to make a cup of tea and introduce the concept of embedded water.
2. The Cup. This activity can be extended to include thinking about the cup in which the tea is served. What's it made of? How much water and energy was required for that?

Equipment and consumables



We recommend using simple props such as a cup and the key elements contained within it (i.e. tea, water and sometimes milk).

Human stories and images linked to tea production and consumption would also help to bring the story to life.

Top tips



1. You are welcome to make a cup of tea to demonstrate this story! You can also bring a flask of tea to outreach events if electricity and equipment access is limited.
2. Introduce the concept of the food, water and energy nexus to the audience, but then let the audience lead the deconstruction of the various elements that make a cup of tea.
3. Use prompts and questions so that the audience become the story tellers and systems thinkers.
4. Information and key data can be taken from the How much water do you eat? activity.
4. Section 8 of the handbook contains more information and background on how food, water and energy are connected.



Image credit: Haneburger.



Story

Additional information i

How much water do you eat? <https://thecrunch.wellcome.ac.uk/the-crunch/how-much-water-do-you-eat>

Your food is global: www.foodsecurity.ac.uk/food/food-global.html

Water footprint network:
<http://waterfootprint.org/en/>
Water, Energy & Food Security Resource Platform - www.water-energy-food.org/

The water footprint of food: <http://waterfootprint.org/media/downloads/Hoekstra-2008-WaterfootprintFood.pdf>

Top 10 tea producers in the world:
www.worldatlas.com/articles/the-worlds-top-10-tea-producing-nations.html

Where does Britain's tea come from? BBC video clip:
www.bbc.co.uk/news/uk-25658267

Energy supply figures based on 2010 data - www.energy-uk.org.uk/energy-industry/electricity-generation.html

UK's carbon emission figures² based on 2013 data - www.gov.uk/government/uploads/system/uploads/attachment_data/file/295968/20140327_2013_UK_Greenhouse_Gas_Emissions_Provisional_Figures.pdf

High Tea – an online game about the opium and tea trade between Britain and China and the events directly preceding the historic 'Opium Wars' in the mid-19th century:
<http://hightea.wellcomeapps.com/>

Hayes, E. T. and Crilly, D. (2014) The water—energy—food nexus—balancing our (in) securities. *Environmental Scientist - Water Security*, 23 (3). pp. 30-33. Available from: <http://eprints.uwe.ac.uk/25124> Food and Agriculture Organization of the United Nations Rome, 2014, The Water-Energy-Food

Nexus - A new approach in support of food security and sustainable agriculture.
www.fao.org/nr/water/docs/FAO_nexus_concept.pdf

Foster, C., Green, K., Bleda, M., Dewick, P., Evans, B., Flynn, A., Mylan, J. (2006). Environmental impacts of food production and consumption: A report to the Department for Environment, Food and Rural Affairs. Manchester Business School. DEFRA, London

www.ifr.ac.uk/waste/Reports/DEFRA-Environmental%20Impacts%20of%20Food%20Production%20%20Consumption.pdf

Economic and Social Research Council (ESRC), Global food systems and UK food imports: Resilience, Safety and Security. Discussions from the ESRC Public Policy Seminar, 30th March 2012.

www.foodsecurity.ac.uk/assets/pdfs/gfs-and-uk-food-imports.pdf





Eating insects



Environment



Health



Nutrition



Demo



Hands-on

What our food might look like in the future

Two billion people around the world eat insects, mainly in developing countries. As the global population grows and the overall demand for food, particularly meat, increases there is an urgent need for alternative sources of protein that don't require huge amounts of our planet's resources to be produced. Insects have the potential to help meet this demand. There are more than 1,900 edible insect species with some 'farmed' especially for human consumption, and others for animal feed.

Links to other activities

Future foods - insects are used as a protein source in sushi.

Magnetic map - includes insect eating cards and tasting notes.

Key take-home messages

- Insects are a protein-rich, nutritious, inexpensive and environmentally sensitive food source.
- Insect protein is a good source of healthy fats. Some species (such as crickets and larvae) even have similar levels of omega-3 fats as fish.
- Livestock farming currently contributes to around 18% of global greenhouse gas emissions. Farmed insects release much less ammonia and methane than pigs and cattle.
- Insect farming uses a fraction of the energy, water and land needed to raise livestock.
- Because they are cold-blooded, insects require less energy to stay warm and are therefore more efficient at converting feed into protein (crickets, for example, need 12 times less feed than cattle, four times less than sheep, and half as much as pigs and chickens to produce the same amount of protein.

Background information

Chapulines are a popular street food snack from the Oaxaca region of Mexico. Made from the *Sphenarium* species of grasshopper, which is harvested from early May through the late summer/early autumn). After being thoroughly cleaned and washed, they are toasted on a comal (clay cooking surface) with garlic, lime juice and salt containing extract of agave worms, lending a sour-spicy-salty taste to the finished product.

Deep-fried scorpions (fried in a vegetable oil) are a usual snack in the street food markets of Bangkok, Thailand, where vendors can make better profits from selling insects than noodles or fresh fruit. Like other insect-munching parts of the world, Chapulines and street-food scorpions are eaten for their taste rather than out of necessity.





Demo



Hands-on

The activity

1. How do you eat yours? This activity can be performed in or out of science centres; as a stand-alone busking activity, to pull a crowd or as part of a more in-depth activity linking to 'Insect ingredients' and 'Future Foods'
2. Participants can think about the area needed to produce livestock versus insect protein, to stimulate debate about why eating insects could be better for the planet. Alternatively, participants can be shown insect-rich diets from 'Hungry Planet- What the World Eats' and asked what's the weirdest thing you've ever eaten? Would you eat insects?
3. Family groups can then be asked to take the 'insect-eating challenge!' Choose from a mealworm or cricket (for the more adventurous) and take a bite.
4. This is used to stimulate discussion of some of the pros and cons of eating insects and where in the world insects are eaten for their flavour already. An extension of the activity could be to draw up a table of the advantages and disadvantages of eating insects.

Top tips



1. Crowds can be pulled by the facilitator asking for brave participants.
2. To conserve supplies, volunteers can be chosen to represent different family groups and challenged against each other for a competitive element to the activity.
3. This busking activity can be used to get families to sign up for an 'Insect ingredients' workshop.

Equipment and consumables



Edible insect 1: Edible insects such as mealworms and crickets will be sent to science centres and a supply list provided
www.thailandunique.com/edible-insects-bugs

Edible insect 2: Crickets
www.thailandunique.com/edible-insects-bugs

Additional information



Wageningen University and Research Center- (includes links to key insect TED Talks.)

www.wageningenur.nl/en/Expertise-Services/Chair-groups/Plant-Sciences/Laboratory-of-Entomology/Edible-insects.htm

Includes: Marcel Dicke TED Talk 'Why not Eat Insects?' www.ted.com/talks/marcel_dicke_why_not_eat_insects?language=en Professor Arnold van Huis at TEDxEde talk

Laboratory of Entomology
www.wageningenur.nl/en/Expertise-Services/Chair-groups/Plant-Sciences/Laboratory-of-Entomology/Research.htm

Grub Kitchen, an innovative restaurant in South Wales promoting sustainable eating including entomophagy: www.grubkitchen.co.uk/why-insects/

BBC article 'Time to put Bugs on the Menu, featuring latest research from Wageningen University and Research Centre and the United Nations' Food and Agriculture Organisation (FAO) 2014 'Insects to Feed the World' Conference. www.bbc.com/future/story/20141014-time-to-put-bugs-on-the-menu



Insect ingredients



Environment



Health



Nutrition



Story



Demo



Hands-on

Using insects to make tasty snacks

As the global population grows and the overall demand for food that's rich in protein, particularly meat, increases there is an urgent need to change the food supply chain and rethink what we eat. Alternative sources of protein such as insects may have the potential to help address some of these issues. This activity provides participants with the opportunity to encounter edible insects in food and explore why they may become a more common part of our diet.

Links to other activities

Magnetic map: show areas of the world where insects are eaten as a normal part of daily life. Use the 'insect tasting notes' and 'diets around the world' sets of cards to help with this.

Eating insects: you could use some insects as a busking activity to drum up support for the next 'Insect ingredients' workshop.

Future foods: as above, use insects to drum up support for the next 'Future foods' workshop.

Recycling fruit and veg: use insects as a protein source in a 'future smoothie' recipe. To make an insect-protein shake.

Key take-home messages

- Eating insects is far more common in other cultures than in the UK – about two billion people around the world eat insects as part of their regular diet.
- Insects are rich in nutrients for e.g. protein, fibre, minerals (iron), vitamins and fatty acids such as Omega-3s.
- The number of people around the world eating protein-rich food such as meat is increasing rapidly.
- There is an urgent need for change as we are

running out of resources such as land and water that are needed to produce the food we eat. Large amounts of gases that are not healthy for us or our planet are released into the earth's atmosphere by the food supply chain/ system.

- People around the world including the UK are not getting enough nutrients from their diet.
- Edible insects may be one way of helping to address these issues.

Additional messages

- Entomophagy is the human consumption of insects as food. The eggs, larvae, pupae, and adults of certain insect species have been eaten by humans since prehistoric times
- As insect-eating is not a major part of our food culture in the west, food labs are investigating the use of insect flour, or insect-protein, as a nutritional addition or ingredient in other recipes.
- In 2014, around 315 million tonnes of meat were produced worldwide. For 2015, the Food and Agriculture Organisation forecasts an increase to 318.8 million tonnes. If a global average is taken, meat consumption amounted to 43.4 kilograms of meat per person in 2014.



Image credit: Bernard Dupont.



Story



Demo



Hands-on

- Increasing the production of edible insects/ products for humans and livestock to eat is one potential solution that is being investigated to see what impact this would have on our health and the health of our planet. A combination of changes is needed including how our food is produced, what we and livestock eat, and a reduction in food waste.
- Greenhouse gases such as carbon dioxide and methane (cow belches) trap heat and make the planet warmer. Human activities, for example, the production of the food we eat, are responsible for almost all the increases in these greenhouse gas emissions during the last 150 years.
- The European Commission requires edible insect vendors to prove that the products they're selling have been eaten by humans since or before 1997 or else have to undergo rigorous testing for classification as a "novel food." Some insects such as the cochineal are also already used in the production of carmine dye, which appears in a wide variety of red coloured food and non-food items.
- Nutritional value of cricket flour: 100g contains: 121 calories, of this only 49.5 calories come from fat. 12.9g protein. 75.8 milligrams of iron. Whole crickets contain 9.6g protein per 100g and 5.6g fat.

The activity

Conversation starters/ key questions:

1. Has anyone ever eaten an insect before? Would you be brave enough to try them? Are they a food you would consider for the future? In fact, people all around the world are eating insects right now, and they form a normal part of a normal diet for about 2 billion people every day. In the UK, we don't eat insects as often, which is why today we thought you would like to cook up and taste some insect recipes.
2. Are you happy to eat them whole or would you prefer to eat them if they were hidden in other types of food? You actually already eat them without even realising! It is estimated that the average person consumes 500g-1 kg of insects or insect parts each year and many of these can legally be present in your food – There are guidelines governing how many insect parts like wings, thoraxes and heads can be contained in different food types such as cereals or juices.

Equipment and props



This activity can be run as a cooking workshop, if the appropriate space is available. Alternatively, batches of these recipes can be prepared in advance by science centre staff, and the products can be handed out at events. **If baking in a science centre, the following kitchen equipment will be required:** oven, mixing bowls, utensils, baking tray and scales.



Story



Demo



Hands-on

Insect recipes

Chocolate chirp cookies (cooking with whole insects)

Prep: 20 minutes

Cooking time: 8-10 minutes

Makes: 20 cookies

Ingredients:

2 ¼ cups of plain flour

1tsp. baking soda

1tsp. salt

1cup unsalted butter, softened

¾ cup caster sugar

¾ cup brown sugar

1tsp. vanilla

2 eggs

340 grams chocolate chips

½ cup dry- roasted crickets (from Eating insects activity kit)

Method:

Pre-heat the oven to 190C. Mix together butter, all the sugar, the vanilla and beat until the mixture is smooth and creamy.

Beat in the eggs and then slowly add flour, salt and baking soda.

Stir in the insects and chocolate chips.

Place rounded teaspoonfuls of the mixture onto a greased baking tray and put in the oven for 8-10 minutes.



Image credit: ComQuat.

Nutty mealworms

Prep and cooking time: approx 5 mins

1 cup (40g) freeze-dried mealworms

16 oz (450g) spicy nut mixture, or any seed, nut or trail mix

Method:

In a dry pan or skillet, fry the mealworms over medium heat for no longer than a couple of minutes, stirring frequently and watching carefully, as they scorch easily.

Allow to cool, and then mix the mealworms with the spicy nut mixture. Serve as a snack.

Cricket flour brownies

Prep: approx. 20 mins

Cooking: 24 mins

1/2 cup butter

1 tbsp butter

6 tbsp cocoa

Pinch salt

2 eggs

1 cup sugar

¾ cup All-Purpose Baking Cricket Flour (1 pack supplied)

1 tsp vanilla

Method:

Preheat oven to 180°C. On a low heat, melt the butter in a medium sauce pan and mix in the cocoa and salt. Once the butter is fully melted, mix in the sugar, cricket flour, eggs, and vanilla.

In a greased 20cm x 20cm baking tray, pour out your Cricket Flour Brownie Mix.

Cook in a heated oven for 24-minutes- you can check with a toothpick to make sure it comes out clean.

The mix may look like it is not quite ready, but you don't want to overcook your Cricket Flour Brownies.



Story



Demo



Hands-on



Top tips



1. Good to work in small groups to produce one batch of dough each. Or as a demo for a larger group, who can then take a section and make their own cookie/brownie.
2. Baked goods can be prepared in advance and used in busking activities at events.
3. Crowds can be pulled by the facilitator asking for brave participants
2. Baked goods can be prepared in advance and used in busking activities at events.
3. Gather thoughts from participants on what they thought of the taste, nutritional value and if they think insects will/ should be more commonly eaten in the UK in the future.

Additional information



Food and Agricultural Organisation report on insects as contributing to food security: www.fao.org/forestry/edibleinsects/en/

Edible insect infographics, including nutritional info for 13 species of insect: www.hellawella.com/grab-some-grub-nutrition-values-for-edible-bugs-infographic/23017

FAO Food Outlook (global food markets): www.fao.org/3/a-i4136e.pdf

Insects the Future of Food? Guardian article 2011. www.theguardian.com/lifeandstyle/wordofmouth/2011/sep/16/insects-arachnids-future-food

Britain's first insect-only restaurant www.independent.co.uk/life-style/food-and-drink/news/grub-kitchen-paying-a-visit-to-britains-first-insect-only-restaurant-a6734116.html

The Grub Kitchen website: www.grubkitchen.co.uk

Nordic Food Lab: www.independent.co.uk/life-style/food-and-drink/features/waiter-theres-a-fly-in-my-soup-insects-as-food-are-more-than-just-a-gastronomic-gimmick-8113939.html

Nordic Food Lab: <http://nordicfoodlab.org/>

Jonny Bingham and David Jones, two critically acclaimed chefs are working at the Innovation Centre of University of Nottingham's Food Processing Facility develop edible insect products www.binghamandjones.co.uk

Stefan Gates mealworm burger www.bbc.co.uk/food/0/21260185



The story of chicken



Environment



Health



Nutrition



Story

The way we farm and eat chickens has changed enormously over the past 100 years. This has not only affected our diet and the farming landscape but also had an impact on the chicken breeds themselves.

Links to other activities

Grinding corn: Poultry (chickens, turkeys, quails, ducks and geese) are fed on cereal grains such as corn. Free range poultry, geese and ducks in particular, also graze on grass

Pressing seeds: Explores omega-3 fat - the amount of this healthy fat found in chicken meat has declined due to changes to poultry diets.

Key take-home messages

- Selective breeding has been with us for millennia.
- Livestock on today's farms look quite different from their wild ancestors.
- The foods we eat have changed over time and will continue to change in the future.

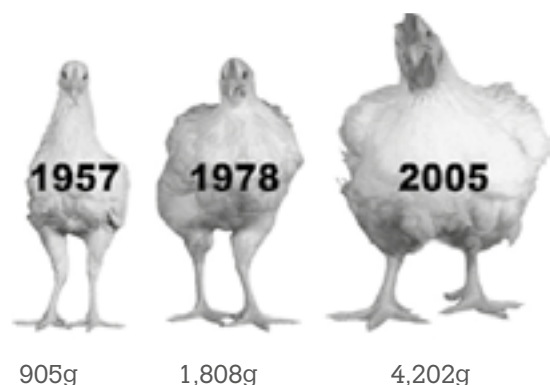
Background information

- There are two types of chickens and two production systems, broilers (meat) and layers (eggs).
- There are over 20 billion chickens on the planet at any one time, producing 1.2 trillion eggs.
- Over the past 50 years, this has increased by 450%, compared to 150% for cattle, sheep, and goats, and 250% for pigs.
- This is largely due to the increased wealth of consumers and demand from developing countries such as China and India (Science 327: 816, 2010) but also due to reduction in cost of chicken as production became more efficient.

- Chicken is cheaper to produce and less energy intensive than lamb, beef or pork.
- The average UK consumer eats 7 portions of chicken a week!
- Campylobacter is the most common cause of food poisoning in the UK and about four in five cases of campylobacter poisoning come from contaminated chicken and other poultry that are not cooked or handled properly.

How have chickens changed?

- The ancestor of today's chicken is the Jungle Fowl first domesticated in Asia as early as 8000 years ago.
- Intensive production and genetic selection have increased broiler growth rates by 300% over the last 50 years, from 25 g per day to 100 g per day. This means that chickens can be harvested at a younger age and so increases farming yield. This has also led to health problems in birds including skeletal abnormalities, ruptured tendons and degenerative bone disease.
- According to a statistic from Poultry Science, if humans grew as quickly as the 'Chicken of Today', "a three-kilogram newborn baby would weigh 300 kilograms after two months."



M. J. Zuidhof et al. Growth, efficiency, and yield of commercial broilers from 1957, 1978, and 2005. Poultry Science (December 2014) 93 (12): 2970-2982. By permission of Oxford University Press.



The activity

The story of the domestic chicken is not an activity by itself but information from the story can be woven into other activities or as a prompt for discussion.

Relevant science experiments and craft activities could also be run alongside the storytelling for inspiration see: www.studentguide.org/all-things-eggs-activities-experiments-art-more/; <https://www.food.gov.uk/sites/default/files/happy-chicken-finger-puppet.pdf>

Equipment and props



This is mainly a story-telling opportunity so there are no major equipment needs. However, the story teller may wish to use images of chickens from different decades to illustrate the story.

Additional information



For more information on welfare issues in commercial broiler production have a look here:

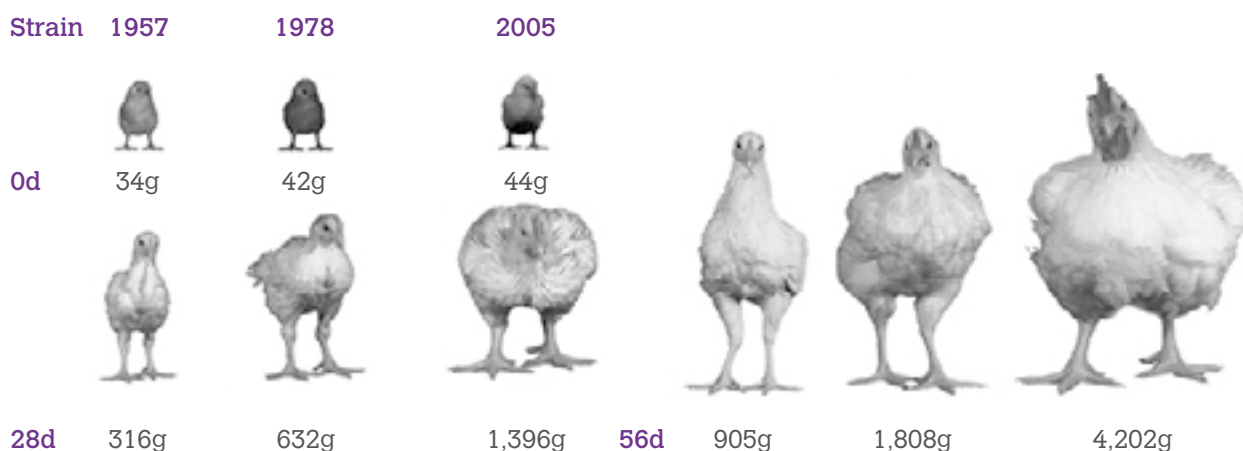
www.fao.org/docrep/013/al723e/al723e00.pdf

Health in my backyard: a community engagement project funded by the Wellcome Trust that explores the perceptions, attitudes and perceived health risks to animal farmers in Dong Thap province, in the central Mekong Delta in Southern Vietnam.

www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_grants/documents/web_document/wtp058183.pdf;
<http://factandfictionfilms.com/engage/health-in-the-backyard/>

When chickens go wild on the island of Kauai, Hawaii: www.nature.com/news/when-chickens-go-wild-1.19195

Changes in chickens from 1957–2005



M. J. Zuidhof et al. Growth, efficiency, and yield of commercial broilers from 1957, 1978, and 2005. *Poultry Science* (December 2014) 93 (12): 2970-2982. By permission of Oxford University Press.

The story of chicken



Hands-on



Rewinding the clock on chicken domestication: www.sciencemag.org/news/2015/09/here-s-what-happens-when-you-rewind-clock-chicken-domestication. The amount of fat in chicken meat has increased over time and now exceeds the protein content due to changes in poultry diets. The omega-3 content (healthier fat also found in oily fish) has decreased relative to omega-6 fat.

www.fcm.org.uk/research-library/modern-organic-and-broiler-chickens-sold-human-consumption-provide-more-energy-fat

A UK research project on cultural and scientific perceptions of human and chicken interactions: <http://scicultchickens.org/>

The rise of the takeaway - a study published by the Centre for Diet and Activity Research at the University of Cambridge in England showed people living near a higher number of takeaway outlets tended to eat more takeaway food and were more likely to be obese than those who were less exposed: www.cedar.iph.cam.ac.uk/blog/the-rise-of-the-takeaway/

The Challenge of Feeding 9 Billion People: www.agro.uba.ar/users/semmarti/Poblacion/Godfray-2010ScienceFoodSecurityFeeding9billion.pdf

The history of chicken in our diets: <http://bigpictureeducation.com/chicken>

British Poultry Council: www.britishpoultry.org.uk

Chicken breed gallery: www.poultryclub.org/breed-gallery/chickens/

To find out more about the difference between broilers and layer chicken: <https://youtu.be/uXR0Pbqanx8> Food Standards Agency information on campylobacter and a relevant infographic: www.food.gov.uk/news-updates/campaigns/chicken-challenge-2015; <https://uk.pinterest.com/pin/432978951648477756/>

How long can you survive in a chicken? Campy command – a game about campylobacter and how it spreads: <https://thecrunch.wellcome.ac.uk/the-crunch/campy-command>

Comparative anatomy of the domestic chicken: interactive resource from the Howard Hughes Medical Institute: <http://www.hhmi.org/biointeractive/comparative-anatomy-domestic-chicken>

Sustainable Food Trust feature on Chicken in the UK: <http://sustainablefoodtrust.org/articles/chicken-in-the-uk-a-snapshot/>





The digital experience



Introduction

The Crunch family experience

Activities

The digital experience

Community engagement

Marketing and PR

Evaluation of The Crunch

Additional resources

The digital experience - get involved with the great new online game



We are delighted to be working with Aardman Animations, creators of Shaun the Sheep and Wallace and Grommit, to create a fabulous new online game for The Crunch.

The game brings alive the key messages of The Crunch families programme, of where our food comes from, what is in our food and drink and the impact our food and drink have on our health, and the health of our planet.

The game is a key part of the families programme, to enhance and continue the experience in the digital realm for those families who have engaged with the hands-on experience. It is targeted at children aged 7-11 and their families.

The game is a central part of the whole user experience and a big part of what we would love you to promote in your science centre. A key focus of the digital experience is that it is played and enjoyed by a large proportion of the 130,000 people who take part in The Crunch families programme across the UK.

We are hoping that you will:

- Promote the game to families who come to all of your events for The Crunch.
- Have the game visible on the special tablet stand when running your activities. We will provide the necessary equipment.
- Have it on display on screens within your science centre if possible.
- Queue walk with the game on the tablet on busy days to show people what they can do online.
- Share the game through your social media channels to tie in with your events.
- Share the game on your members newsletters.
- Link it from your website.

The game will launch in May for the first science centre events and we give you a preview here:

The characters and the design

The characters, created by Aardman and tested and shaped by the target age group, look like this:



Image credit: Aardman Animations

The initial screen designs for Hungry City look like this:



Image credit: Aardman Animations

The digital experience - get involved with the great new online game



How to use the Game and the secret code at your events:

- We are delighted to include in your equipment a tablet pre-loaded with the game. This will come with a special casing so you can secure it when required.
- We are also supplying an offline version of the game so you can use it where there is no internet.
- Usage of the game by the families who engage with your live activities is important, and seen as a key measure of success. Therefore, we really need you to make the game as prominent and interesting as possible to families to make sure there is a very high conversion rate. To achieve this we are giving you special cards to give to children, with a secret code.
- The secret code will unlock part of the Aardman game - areas that are not accessible to everyone, just those who have been to an event and have the secret code.

An overview of the game

Aardman Animations have a strong pedigree of creating fantastic well-loved games, and we hope this will add to the list.

The game narrative: 'Hungry City' has a serious food problem. The only food that's available in the city is unhealthy, imported in from thousands of miles away, or bad for the planet in some way and just plain horrible! Help some forward-thinking kids as they fight to bring back yummy, good, fun food to Hungry City, that is good for them and the planet.

Hungry City is an innovative variation of the much loved Tower Defence game genre. The player takes charge over an array of food dispensaries, strategically placing them around fixed pathways through Hungry City in order to feed the residents of the city. The player will need to consider the health of the population, the environmental impact of the methods they use and the types of food they distribute to their hungry city.

The grown-ups have made a mess of it... now the kids are in charge.

Additional information

Website address:
Thecrunch.wellcome.ac.uk/hungrycity



Community engagement

Introduction

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Community engagement



The Crunch families programme has a strong focus on engaging families from areas of the community within the top 25% on the Indices of Multiple Deprivation. To ensure these families can take part, science centres will also run a host of community programmes, such as golden ticket schemes, family bursaries and community open days to attract families who may not otherwise come to the science centre or take part in The Crunch.

The ASDC report 'UK Science and Discovery Centres: Effectively engaging under-represented groups' www.sciencecentres.org.uk/reports/underserved provides inspirational case studies from science centres across the UK detailing programmes that successfully engage under-represented groups in science centres.

This section shares best practice in Community engagement, with recommendations and top tips to make it successful.

General top-tips to increase engagement with under-represented groups

These are reminders and we acknowledge that most science centres, are already doing many of the items below:

- 1. Collaborate with local groups:** There are plenty of local charities, city youth groups and community organisations with strong relationships with the groups you want to target and who will share your goals, and fully understand what will, and will not, work. Speak to them, take their advice. Meet them before you do anything else.
- 2. Understand the reasons:** If certain families or sectors of society are choosing not to engage with your science centre, there is a reason. Understanding and addressing this is paramount. Sometimes it is cost, travel or they simply haven't heard of the opportunity, but usually it is a feeling of 'this is not for me'. This is often deep-seated and you need advocates within their community whose recommendations they value and trust. This is

key. The advocates can also be children who have participated with their school and want to bring their families to explore.

- 3. Work with community engagement specialists** who already have trusted relationships with community groups. This could be done in a number of ways such as collaborating with other community organisations, working with volunteer umbrella groups, or recruiting a volunteer with these skills.
- 4. Adapt everything:** What works with one group may not engage another.
- 5. Remove cost barriers:** However, never assume that because an event is free, it will attract people from under-represented groups. This is unlikely.
- 6. Build relationships** rather than just a one-off experience, and use this to nurture people's confidence to explore and try out new learning opportunities through follow-on experiences. You don't know where this first step could lead.
- 7. Meet with your Local Council** (ask for the Community or Regeneration sections) to discuss which areas in your region are best targeted to inspire families who are high on the indices of multiple deprivation. Ask which areas are already well-served with activities and learn where to access the local data.



Image credit: Lee Pullen, At-Bristol Science Centre.

Community engagement



8. Collaborate with schools: Engage with schools in disadvantaged areas (through bursaries and special programmes) to begin to build relationships with those families who don't otherwise engage with science. Every school will receive a free kit for The Crunch, so you can link to the kits in discussions.

Specific top-tips when developing and co-developing community events

Here are some questions to ask when developing a community event.

The most important top-tip is know your audience and know your event

1. Speak to the community event organiser and ask:
 - What is the audience profile?
 - What is the event like?
 - What do they feel the reaction to The Crunch activities will be, and to the science centre being there?
 - Is there anything you might need to be aware of?
 - Where will you be situated, is it in the best place for families?

Take their advice. Community organisers are the experts on their communities.

2. Can you find out more? For example, comments and photos from last year, the event or community group website and social media, local council information on the profile of that area?
3. How are your activities described in the event literature and website and how might that affect expectations and perceptions of who you are and what you will be doing?
4. General logistics, including, what is the timetable for the day showing what are you competing with and when?



Image credit: Lee Pullen, At-Bristol Science Centre.

At outreach events

1. How can you build on participant's knowledge and experiences, for example, by linking The Crunch activities to parts of the world they have links with?
2. Consider if you need to translate anything and consider the language you use, for example, what names are used for certain foods locally and what do people call the venue?
3. Use family friendly language, for example use 'grown up' rather than 'parents'.
4. Is any specific, additional staff training or information needed, for example with content that could be controversial or sensitive, or comfort levels of participants with male or female staff?
5. Will there be challenges in the specific outreach environment, for example, others drinking alcohol at a festival?
6. What other information do you want to take about The Crunch, for example, taking The Crunch schools kit?
7. What information do you want to take about your science centre which could create an ongoing relationship beyond the event, for example information on volunteering, discount vouchers, community membership, and community open weekends?

Community engagement



Events in your science centre

1. Are any additional resources or facilities needed, for example a prayer room, translation of signage or other logistics?
2. Do you need to run any staff training or give information, for example, with halal food provision or content in exhibitions that could be controversial or sensitive?
3. What information might you want to provide to ensure participants can feel comfortable and make the most of their visit in what may be an unfamiliar area of the city and building.



Image credit: Lee Pullen, At-Bristol Science Centre.

Additional information i

Accessing the Indices of Multiple Deprivation to decide who to engage:

These are available online for each Country.

In Scotland: <http://statistics.gov.scot/data/scottish-index-multiple-deprivation>

In Wales: <http://wales.gov.uk/statistics-and-research/welsh-index-multiple-deprivation/?lang=en>

In England: www.gov.uk/government/collections/english-indices-of-deprivation

In N. Ireland: www.nisra.gov.uk/deprivation/nimdm_2010.htm

With thanks to Jo Bryant, Community expert in At-Bristol Science Centre for the contributing part of the above section.





Marketing and PR

Marketing and PR



The Crunch brand identity stretches across all the activities that are happening throughout the UK, so it's important to use the brand when promoting your activities for The Crunch families programme to tie everything together.

The guidelines and assets have been made to be as flexible as possible for you to use. Please read and follow the full brand guidelines which can be found on the website: thecrunch.wellcome.ac.uk/sciencecentres. Below is a summary and introduction to get you started.

The project name and strapline

The Crunch: Our food, our health, our planet.

You should always refer to the project as **The Crunch**.

The project strapline is: **Our food, our health, our planet.**

When talking about the families programme, you can use The Crunch: for families

All the brand assets and brand guidelines can be found on a hidden area of the website here: thecrunch.wellcome.ac.uk/sciencecentres

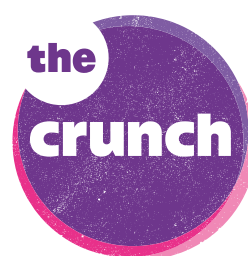
The Crunch Logo

There are two main versions for you to use. Other options are in the brand guidelines and brand assets documents online. The Crunch logo should appear top left on all publications and materials related to your activities, and these are the preferred versions.

Master logo with strapline:



Master logo without strapline



The Crunch website and social media

The Crunch website is: thecrunch.wellcome.ac.uk

Social media

The Crunch is on the following accounts:

- **Facebook:** TheCrunch2016
- **Instagram:** TheCrunchWellcome
- **Twitter:** #thecrunch2016

Please like, comment and share posts on these accounts, and tag us in your posts about The Crunch.

Text for PR and marketing

The Wellcome Trust team will be looking after national and broader PR and marketing for The Crunch, but we hope your teams will be able to use your local and regional networks to promote your activities for The Crunch.

Please do put your comms and marketing team in touch with us or the Wellcome Trust directly for guidance or to share your PR and marketing planning.

Lynn Huynh, Communications Project Manager
l.huynh@wellcome.ac.uk

Priya Barde, Communications Executive
p.barde@wellcome.ac.uk

Marketing and PR



How to refer to the project on your website and in print

Welcome to The Crunch, an exciting year of activities, experiences and discussions about our food, our health and our planet. Everyone's invited to get involved and help create the recipe for a happier, healthier future. **(35 words)**

The future of food is one of the biggest challenges on our plate. Food and drink are fundamental to our lives, connecting everything from our health to the world around us.

It's time for us to take a fresh look at our relationship with food. At the moment it's unsustainable, and this needs to change so that we can live healthier, happier lives. **(35 + 65 = 100 words)**

Our food, our health, our planet.

How to refer to events on smaller flyers

Come and take part in The Crunch, an exciting season of activities, experiences and discussions about our food, our health and our planet. Everyone's invited to get involved and help create the recipe for a happier, healthier future. **(35 words)**

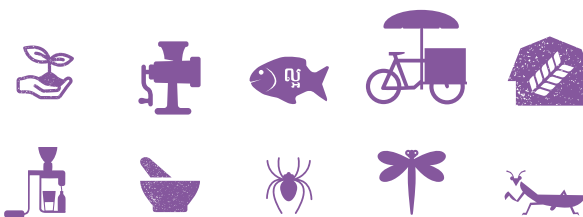
Illustrations you can use

You can use this illustration (the landscape composition), for example at the bottom of your flyers or web pages. You can also use pieces of it as shown in the brand guidelines. This illustration can also be used as a circular device (see overleaf) with the title of your event in the middle.



Icons

There are a host of lovely icons that convey the content of The Crunch. You will find these on the bike, the tablecloth and other places across the project. A sample is below, and the rest are in the brand assets and guidelines. There are also a series of circular devices you can use for flyers. The ASDC and Wellcome Trust teams are happy to advise on any branded assets you are creating.



Typeface

Please use **Circular** and **Calvert MT** when creating any flyers or The Crunch materials. These will be provided for your organisation. All details are in the brand guidelines.

The acknowledgment

The Crunch is brought to you by the Wellcome Trust, an independent charitable foundation dedicated to improving health around the world. The UK Association for Science and Discovery Centres has been commissioned to create the families programme, in partnership with expert staff at Eden Project, At-Bristol Science Centre and The University of the West of England, including a new and exciting digital game created by Aardman Animations.

The Crunch aims to inspire everyone to consider the connections between our food, our health and our planet, so that we can all help create the recipe for a happier, healthier future.

Marketing and PR



How to refer to The Wellcome Trust

Please use only the Wellcome Trust logo below: Created by The Wellcome Trust. Generally this will be placed bottom right and positioned directly below The Crunch logo and at the same width - please read the brand guidelines carefully.

Created by
wellcometrust

Created by
wellcometrust

The Crunch is brought to you by the Wellcome Trust, an independent charitable foundation dedicated to improving health around the world. The Crunch aims to inspire everyone to consider the connections between our food, our health and our planet, so that we can all help create the recipe for a happier, healthier future.

How to refer to ASDC

The UK Association for Science and Discovery Centres (ASDC) is the UK's vibrant national membership organisation that brings together the leading informal science engagement organisations in the UK, including the major science and discovery centres and science museums. Every year in the UK, 20 million people of all ages and backgrounds choose to engage with science at one of the UK's science and discovery centres or science museums. This equates to 385,000 people every week of the year who come to our centres to explore and delve into science in a hands-on, involving and personal way.



Which logos to use when?

The logo hierarchy is as follows:

1. The Crunch
2. Created by Wellcome Trust
3. Your Science Centre Logo
4. ASDC logo
5. The Crunch: Family Programme Logo rack

Adding your logo

This should be placed in line, on a baseline, with the other partners. All logos should be in greyscale so as not to distract from the main purpose of the flyer or page.

Partner logos to use, and where to use these



Marketing and PR



How to refer to The Crunch: for families

Across the spring and summer of 2016, nine UK science centres will be providing opportunities for families to get hands-on, with fun activities and a great new online game, exploring our food, where it comes from, and how it affects our health and the world around us.

The families programme will reach 130,000 people across the UK, and will engage families at local festivals and community events, and within the science centres.

The families programme will focus on:

1. Where food comes from and how it is produced
2. What is in our food and drink
3. The impact food and drink have on our health, and the health of our planet

Linking with schools, colleges and ambassadors

Feel free to tell the media about the other parts of The Crunch using the following words:

The Crunch: for schools and colleges

The Crunch kits will be given free of charge to all primary and secondary schools and colleges across the UK in spring 2016. The kits contain science equipment to help schools and colleges deliver The Crunch along with additional resources online, including drama resources and supporting films, with topics that span science, geography, food technology and more.

thecrunch.wellcome.ac.uk/schools

The Crunch Ambassadors

From across the UK, this passionate squad of ambassadors will help science centres, schools and others to facilitate activities and to kick-start conversations on the links between our food, our health and our planet.

Ambassadors come from a wide range of backgrounds including youth work, community engagement, science, health and food technology. They can share real-world experiences with families at your events out in the community and in your science centre, making learning relevant and increasing engagement.

To find out more about the ambassadors, who they are, where they are based, or even to become one yourself, visit thecrunch.wellcome.ac.uk/ambassadors

Usage of resources

We expect that all The Crunch resources will be licenced under Creative Commons (Attribution-Non Commercial shareAlike 4.0 International), except where specified.



Evaluation of The Crunch



Evaluation of The Crunch



As with all ASDC National Strategic Programmes, we will be asking all our partner science centres to evaluate their activities and events in a unified manner, using a methodology and set of questions given as part of the programme materials. Through this centralised collaborative method, ASDC has successfully previously undertaken the largest national impact evaluations in informal science learning, and we know many of you have been part of these.

For The Crunch, ASDC will be working with Dr Ben Gammon, who will create the methodology and analyse the data, alongside Opinion Leader (www.opinionleader.co.uk) who are working with the Wellcome Trust to independently evaluate all areas of The Crunch including a more in-depth look at the impact of the family events.

There are three parts to the evaluation of the families programme:

- Metrics of who came to all of the events so we can measure against our targets
- Interviews by science centre staff at a representative number of the events
- More in-depth interviews by Opinion Leader at a small number of the events

An overview of the evaluation process

1. A questionnaire for families will be developed by ASDC and Dr Ben Gammon, in consultation with Opinion Leader and the Wellcome Trust.
2. These will be supplied to you before you begin delivering activities.
3. We will provide guidance at the training academy, on how to select events and families.
4. We will give you an Excel spreadsheet to input your evaluation data electronically, which you will submit to Dr Ben Gammon for analysis.



Image credit: Lee Pullen, At-Bristol Science Centre.

Details of the evaluation

1. We expect to ask each science centre to conduct 10 interviews at 10 events (100 interviews in total) to build a representative cross-section of the audience engaged by the programme both on-site and through outreach.
2. Interviews will be brief, a few minutes, as we know families are keen to move on.
3. Your staff would ask the questions.
4. We are interested in the responses from the whole family group, children as well as adults.
5. Questions will cover the activities, takeaway messages and emotional aspects of the experience.
6. The questionnaire will mainly include closed questions, with two or three open-ended questions.
7. As this is a UK-wide project we would like to know where participants are from, and will ask you to (gently and sensitively) ask adults within the groups for their postcode, with reassurances that this data will not be used for anything other than plotting where people are from across the UK.

Evaluation of The Crunch



Recording and reporting your metrics

We also wish to know overall, the total number of people you engage with The Crunch, as well as what your event entailed, where you ran your activities and who came. ASDC will therefore supply you with a spreadsheet to record the below metrics, and we ask you to fill this in as you go along. We will ask you to submit data to us at an interim point to check progress, and to submit the full metrics at the end of the project with your final report.

The metrics sheet will include the following:

1. A brief description of your event.
2. How many people you engaged with The Crunch.
3. A general description of those attending (see metrics sheet).
4. The male/female split.
5. The estimated ages (a general overview or adult/child ratio).
6. Percentage of participants from disadvantaged backgrounds and how you know this.
7. Event location (including postcode).
8. The date.
9. Activities included in the event.

Additional Postcode data

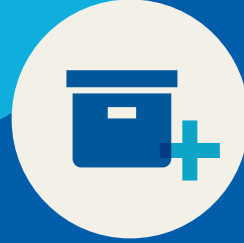
Please also submit any additional postcode data that you collect related to The Crunch, for example through community bursary schemes, community open days and golden ticket schemes.

As with all ASDC programmes, the final project payment to science centres will only be released when we have received all your evaluation data



Image credit: Lee Pullen, At-Bristol Science Centre.

Additional resources



Health and safety



The Crunch activities have been developed to be used with a family audience at your science centre and in outreach settings.

ASDC will supply sample risk assessments. However the responsibility for ensuring all The Crunch activities are delivered in a safe manner, and that all members of the public are safe throughout, lies entirely with your science centre or organisation.

In your risk assessment, the activities and equipment cannot be assessed in isolation. You will need to consider a host of other factors to assess the safety of running your activities. For example (and not limited to): the nature of the venue, the type of event, is it indoors or outdoors, how many trained staff do you have, how much experience do any volunteers or ambassadors have, are there any specific local emergency procedures and what is happening nearby.

We are expecting each organisation to create risk assessments for each outreach and science-centre-based event in a manner consistent with your normal risk assessment process.

We draw your attention to the following areas as you write your risk assessments:

- 1. The Crunch Bike** is the focal point of the families programme. When making a smoothie, the back wheel is raised up on a stand. As someone pedals, the back wheel will spin quickly. We have fitted wheel guards, however in addition we recommend the following:
 - You ensure all members of the public are a safe distance from the spinning wheel.
 - You check the wheel guards at the start of each event to ensure they are in place and undamaged.
 - You and your team are extremely vigilant, especially when toddlers are near the bike, where the spinning wheels are at hand height.
 - You risk assess these specific factors at every event, review it more than once a day, and take any necessary mitigating actions.

Riding the Bike: We advise that you don't ride The Crunch Bike on any roads. Steering is too difficult, as the box and two wheels are at the front. Riding on any roads is entirely at your own risk.

- 2. Pressing seeds:** this activity uses a small kerosene lamp to heat the seeds which allows the oil to be released more easily.
 - Kerosene needs to be stored under specific conditions. It is flammable and has to be stored in a sealed container, out of sunlight, away from heat and away from food.
 - Please ensure the kerosene lamp, and any hot oil, can never be touched by curious small children and other members of the public.
- 3. Making corn tortillas:** The hotplate and frying pan are used to cook the tortillas. Both children and adults get very engaged with this activity and it has been successfully run in other science centres. Do ensure that the frying pan is out of reach from small curious hands, and that you, or others, cannot knock the hot pan off the hotplate (or knock the table it sits on) in a manner that could cause harm. Do not leave the hotplate unattended when in operation or still hot.
- 4. The Corn grinder and oat-roller:** Remember not to ever leave these unsupervised, in case little fingers try to get in to the mechanism.



Health and safety



5. Iron breakfast: Magnets: Neodymium magnets are used to pull the iron out of the cereal. These magnets are strong. There are several key risks with them, which need to be mitigated, and include but are not limited to, the following:

- Children love to put their fingers, noses, lips etc between magnets. Never have more than one magnet available as the pinch is severe and the risk is high, and painful.
- These are strong magnets, store away from The Crunch tablet, other computers, phones, credit cards and other electronics.
- Cardiac pacemakers can be affected by neodymium magnets. Behaviour of pacemakers can be influenced by neodymium magnets, especially at close range (Technol Health Care. 2008;16(1):13-8)). The size of magnets used in The Crunch (up to 2.5 cm x 3cm thick) could have an effect on a pacemaker up to approximately 16 cm. We therefore recommend that you keep the magnets always 30 cm or more from every participants' chest. To achieve this you must set up the equipment as advised. Further information on this will be provided.

6. Lifting: There are some items of equipment that are heavy and care must be taken when moving and setting these up. Please be sensitive to the fact that you may be unaware of your colleagues health issues that mean it is difficult for them to lift items. Take care, for example, with:

- The Crunch Bike, take care when loading this on and off a van.
- The event shelter, table and other kit. This can be heavy, take care.

7. Falling: Please set up the equipment so that it is safe, robust and will not fall in any way. If in any doubt don't use that item of equipment. In particular, ensure:

- The banners cannot topple on anyone.
- The event shelter is securely anchored, and reassesses if the weather changes, especially if it becomes windy. The same applies to the flags and all other items outside.
- Take care when loading and unloading the van.

Acknowledgements



With grateful thanks to everyone on the project team whose hard work, creativity and dedication have created the content, activities and resources for the families programme.

Dr Penny Fidler

The UK Association for Science and Discovery Centres

Andy McLeod

The UK Association for Science and Discovery Centres

Maddy Foard

The UK Association for Science and Discovery Centres

Gabi Gilkes

Eden Project

Emma Fowle

Eden Project

Katy Nehammer

At-Bristol Science Centre

Jo Bryant

At-Bristol Science Centre

Dr Enda Hayes

University of the West of England

Also with many thanks to the team at Aardman Animations for all their great work creating and producing the digital piece for The Crunch: Lorna Probert, George Rowe, Neil Pymmer, Chloe Barraclough, Rohini Denton, Dan Binns, Corin Wilkins, Sarah Matthews and Jamie Lewis.

The Charette

At the start of this project, ASDC held a one-day Charette in Bristol. This day brought together experts from a range of fields, including research, local and global food and water systems, international development, community engagement, food programmes, science centres and public engagement. We are hugely grateful to the following people for participating in this ideas and knowledge-sharing day, and for so generously giving both their time and their expertise, which has been hugely valuable to the project team in shaping the content of the programme.

ASDC

Dr Penny Fidler – Project Director

Maddy Foard and **Alan Sweetman**

Wellcome Trust

Nora Maddock – Project Manager
- Food and Drink

Stephanie Sinclair – Senior Project Manager
- Food and Drink

Wellcome Library

Helen Wakely – Archive Project Manager

Aardman

Neil Pymmer – Creative Director

Rohini Denton – Digital Producer

At-Bristol Science Centre

Emma Cook – Exhibition Manager

Jo Bryant – Community Engagement Manager

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Ben Gammon – Evaluation consultant

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Damien Crilly – Environmental Business Manager

F3

Katrin Hochberg – Sustainable food advisor

Fifteen Cornwall

Matthew Thomson – Chief Executive

London School of Hygiene & Tropical Medicine

Dr Rosie Green – Lecturer in Nutrition and Sustainability

Oxfam

Vicky Goodban – Programme Manager UK Poverty Programme, Wales

Richard King – Research Advisor

Suzanne Saunter – Head of Supporter Mobilisation

Pearson Education

Anne-Marie Shand – Senior Project Manager

Rothamsted Research

Prof Johnathan Napier – Associate Director

Matina Tsalavouta – Head of Communications and Public Engagement

Sanger Institute

Dr Julia Willingale-Theune – Public Engagement Manager

School Food Plan

Myles Bremner – Director

Soil Association

Libby Grundy – Senior Policy Advisor, Food for Life

Rupert Aker – Head of Engagement, Food for Life

Theatre of debate

Nigel Townsend – Artistic Director

University of Bristol

Dr Katherine Baldock – NERC Knowledge Exchange Fellow - Urban Pollinators

Dr Patricia Lucas – Senior Lecturer - Food Poverty and Obesogenic Environments

University of Exeter

Professor Juliet Osborne – Chair in Applied Ecology

Dr Jenny Lloyd – Senior Research Fellow in Child Health/Healthy Lifestyles Programme (HeLP) Trial Manager

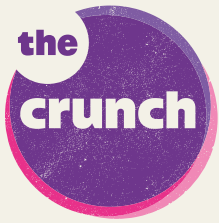
Dr Sarah Goldingay – Lecturer, Department of Drama

University of Leeds


Professor Victoria Burley – Associate Professor in Nutritional Epidemiology

University of the West of England

Dr Enda Hayes – Senior Research Fellow



To find out more go to:

 thecrunch.wellcome.ac.uk/families

 facebook.com/thecrunch2016

 [#TheCrunch2016](https://twitter.com/TheCrunch2016)

 instagram.com/thecrunchwellcome

Created by

wellcometrust



The Crunch Families Programme is delivered in partnership with

