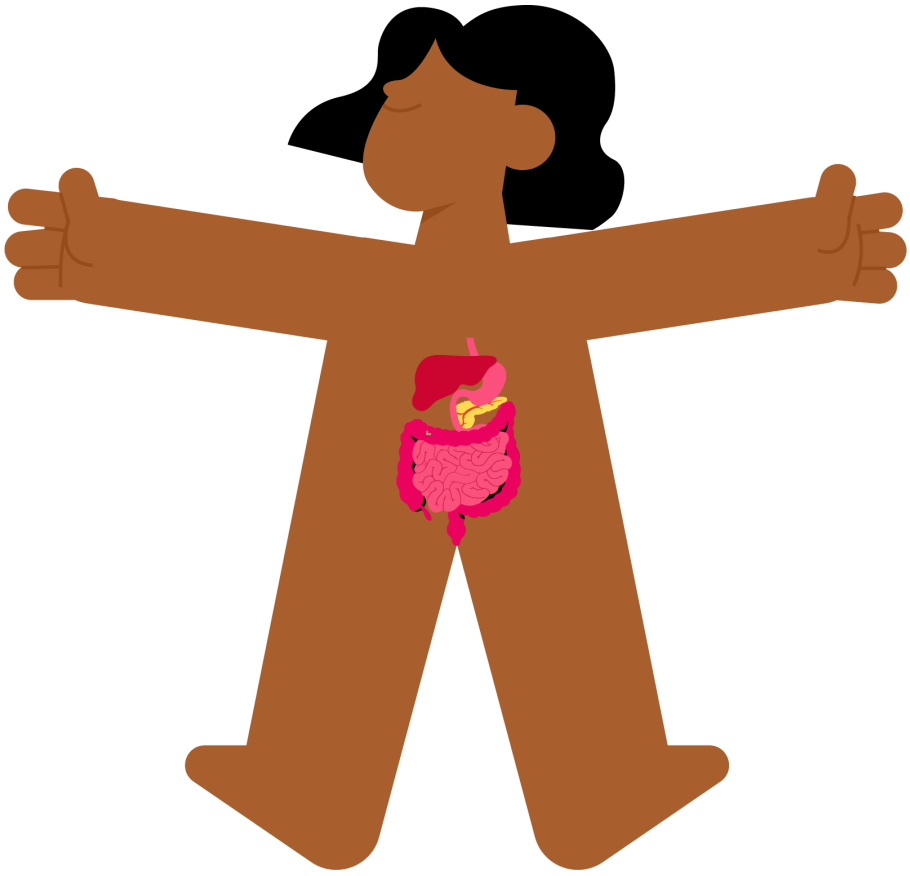
Life in the Gut

Year 8 Science
Year 9 Science
Years 7 & 8 Health and PE



(Science, Year 8, ACSHE136)
People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity

(Science, Year 9, ACSSU176)
Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems

(Science, Year 9, ACSSU179)
Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer

(Science, Year 9, ACSHE157)
Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community

(Health and PE, Years 7 & 8, ACPPS073)
Investigate and select strategies to promote health, safety and wellbeing

(Health and PE, Years 7 & 8, ACPPS077)
Plan and use health practices, behaviours and resources to enhance health, safety and wellbeing of their communities

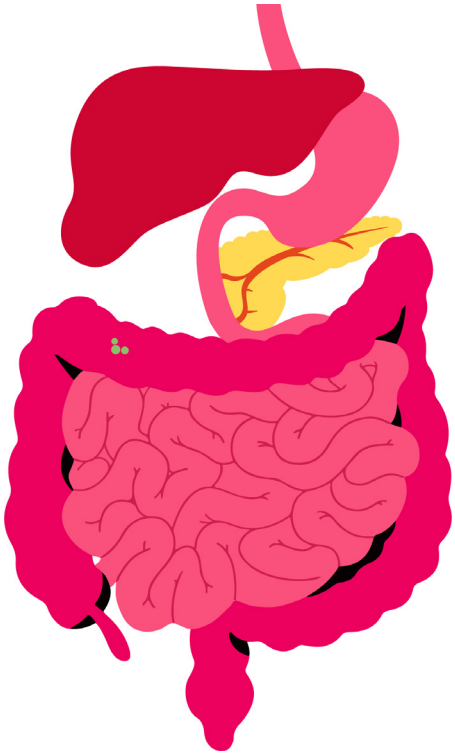
Hort Innovation Strategic levy investment | ONION FUND

This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Life in the Gut

The ecosystem inside you!

What's inside us is intricately affected by the foods we eat and even by the soil those fruit and veg were grown in.



Equipment:

- a diagram of the human digestive system to show to the whole class
- ingredients and equipment for the fermentation experiment on page 5
- microscopes and sampling equipment for observations on page 6

Duration:

30 minutes in session 1

30 minutes 2-3 days later

Location:

The classroom / science lab

Notes:

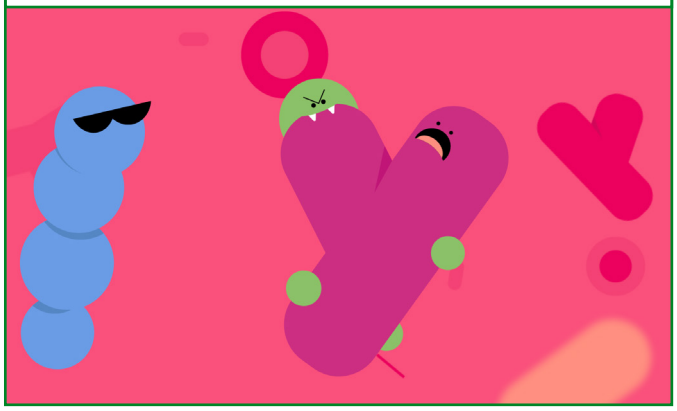
Getting Started

- Measure the width or length of the classroom.
- Compare that distance to 10 metres.
- What's 10 metres long? Your GUT. All squiggled up inside you.

Gut microbiome

- Show an image of the human digestive system and have it available for reference after viewing the Nomcast.

Students watch and listen to **Nomcast Series 4, #2 Gut Health**.



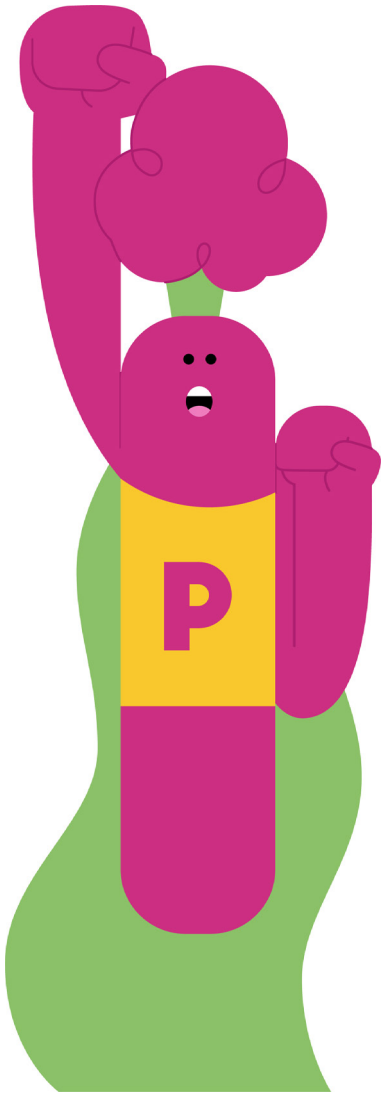
The Bigger Picture

Discuss:

- Ask students to list some of the many things that affect the human digestive system. The most obvious being, the food you eat! But also, your moods, how much exercise you have had, if you have been ill, how much sleep you have had.
- Remind students about the good bacteria, prebiotics and probiotics from the Nomcast, and focus on the term **gut microbiome**.
- A biome is a naturally occurring community of living organisms that share one ecosystem – and a microbiome is a very small ecosystem that is INSIDE you.
- Just like in nature, **biodiversity** is important here.
- What you eat and the nutrients, minerals, good bacteria and microbes that are on what you eat make up a rich diet that is great for your gut microbiome.
- Many of the nutrients, minerals and beneficial bacteria in and on your food come from the soil the food was grown in. Put simply, richer and more biodiverse soil leads to richer and more diverse goodies you eat along with your veg.
- The key here is that good soil health adds to human health through what we eat.

Going 'PRO'

- Review the section of the Nomcast from 04:17, when the prebiotics are introduced.
- Share the additional information in the box below. This will provide background to the fermentation demonstration that completes the lesson (on the next page).



What are prebiotics and probiotics?

Although pro sounds fancy, these guys are both great.

Prebiotics

Prebiotics are mostly made up of fibre or complex carbohydrates that are hard for human cells to digest, so *we* don't absorb them, but the good bacteria can break them down and use them for fuel Lots of different vegetables have prebiotics, some more than others. For example, onions contain plenty of two kinds of prebiotics, inulin and FOS (Fructooligosaccharides). Both of these prebiotics really help get the good bacteria fighting fit.

Probiotics

Probiotics are living bacteria that add to the team of good bacteria already in your guts. They're rich in *lactobacilli*, a common type of bacteria that can reduce inflammation, better absorb proteins and even help our poo find its way out more efficiently. Probiotics also occur naturally in vegetables but over the millennia, humans have pro-boosted the probiotics potential of food through simple fermentation that encourages lactobacilli to grow.

Fermentation Demonstration

You will need:

- 400g cucumbers, washed
- 1 white or brown onion, peeled
- non-iodised salt
- water
- a glass jar such as a 1L flip-top jar

Method:

- Slice the cucumbers if large, or leave whole if small enough to fit in the jar.
- Slice the onion in half, then cut into thin crescent moons.
- Make up a brine solution of 5% salt in water. (Easiest to do this by weight: 10g salt in 90g water.)
- Tumble the onions and cucumbers together in the jar, then tip over the brine.
- Cover with a piece of cotton cloth such as a teatowel held on with a rubber band, or the lid without its rubber air seal (if using a flip-top jar with a removable rubber seal). You want to allow a little bit of airflow between the pickles and the environment but not to let dust or insects in.
- Let this sit somewhere cool and out of sunlight for 2-3 days.
- Do not let it get above comfortable room temperature (26°C).

Teacher Notes:

- Save a small slice of onion and cucumber in a tightly sealed plastic container in a fridge – this provides the comparison sample 2-3 days later.
- Please make sure the jar is sterilised before use
- As you are only making one jar, all chopping can be done by the teacher
- Please observe health and safety guidelines
- No-one needs to eat the fermented pickles that result (but they might want to!)

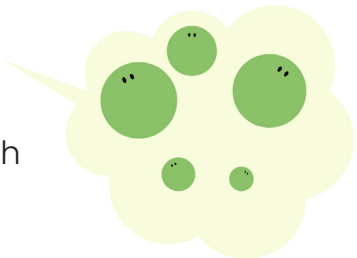
Three Days Later

Comparing samples

- Take samples from the fermentation jar and prepare slides.
- Try samples of the fermented cucumber, onions and the pickling liquid.
- Take similar samples of the fresh onion and cucumber that you saved in the fridge (hopefully no-one ate them!)
- Make a tiny bit of fresh 5% salt solution (brine) and sample that, too.
- Students compare the two sets of samples (fermented and fresh liquids and solids) under a microscope and record observations between the fermented ingredients and the unfermented ingredients.

What should you see?

- The liquid in the fermented samples should show the beginnings of an active live culture of lactobacillus. It may be cloudy and have clumps of bacteria in it that are not in the unfermented / fresh samples.



What's happening?

- By adding salt to the water, we have adjusted the pH of the solution to favour the development of lactobacillus.
- The solution becomes more acidic over time (this is generally lactic acid), which prevents the growth of mould and other undesirable bacteria.
- Bacteria and yeasts naturally occurring in the onions and cucumbers will have provided the base of this community.
- Over time, at the right pH and a stable temperature, the community of bacteria that we have favoured (lactobacillus and other bacteria) will dominate the mixture.
- Naturally fermented pickles of this sort generally are fermented for a few weeks to ensure that the dominant culture in the mix is these beneficial bacteria – in the short time frame of this experiment, they may not have dominated yet but should be visible.
- The links below will be useful if students further research the science of fermentation.

More information:

- Serious Eats: The Science of Lactic Acid Fermentation: Pickles, Kraut, Kimchi, and More: https://www.seriouseats.com/science-of-lactic-acid-fermentation-preservation
- Fine Cooking: The science of pickles: https://www.finecooking.com/article/the-science-of-pickles