GutBugs@School

Microbes and the Human Microbiome
This slide set is a tool to stimulate discussion and support knowledge development for further inquiry.

The slides are divided into three sections: The human microbiome, Gut Bugs (or the gut microbiome) and the Gut Bugs trial. Most slides are image-heavy to enhance usability by allowing teachers to adapt the narrative and facilitate discussions to suit a range of learner needs.

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Slide 5: Wellcome Library, London. Wellcome Images
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Slide 15: Mice drawn by Alistair Kwan for the Liggins Institute

Slide 18: Images 1-3 used with permission from Justin O’Sullivan, Thilini Jayasinghe and Karen Leong. Image 4 used with permission from Greenstone TV Ltd and Razor Films Ltd.
What is a microbe?
Where do we find microbes?

Wellcome Library, London. Wellcome Images images@wellcome.ac.uk http://images.wellcome.ac.uk Thames at Brentford and Thames at Hungerford. A microscopic examination of the water supplied to the inhabitants of London and the suburban districts Arthur Hill Hassall Published: 1850
What do we know about the microbes that live on us, around us, and inside our bodies?
What is a microbiome?

A **microbiome** is a community of microbes living in one place.

Where do we find microbes in the human body?

- skin
- saliva
- belly button
- tears
- nose
- mouth
- gut
What is the human gut microbiome?
Knowledge technologies
Key concepts: Gut microbiome

- Mostly bacteria
- Tens of trillions
- 300–1000 species
- 99% from 30–40 species

- Mostly in the colon
- Around 100 times more genes than the human host...so they can do a lot to us!

- 60% of dry weight is bacteria
Key concepts: Gut microbiome

• The bacteria in our gut help us to digest food

• It eats what we eat: changing our diet changes our microbiome
Key concepts: Gut microbiome

• We can add/remove microbes
• We can support the ‘good’ microbes by feeding them

  Prebiotics, probiotics or microbe-rich food, eating in new places, taking antibiotics, taking laxatives, having diarrhoea...
Manipulating the gut microbiome
Manipulating the gut microbiome

1. Drawn by Alistair Kwan for the Liggins Institute

2.
The gut microbiome and good health
The Gut Bugs clinical trial
Gut microbiome transfer (GMT)

1. Stool from a healthy donor
   - Good bacteria

2. Processing

3. Pills, Liquid

4. Delivery type:
   - Through nose or mouth
   - Stomach
   - Large intestine
   - Colonoscopy
Gut Bugs
Research question:
Will Gut Microbiome Transfer (GMT) help teenagers who are impacted by obesity?
Hypotheses:

What might happen?

• Shift in recipient’s gut microbiota towards donor
• No change in recipient’s gut microbiota
• The recipients could lose weight and keep it off for a long time
• The recipients may lose weight, but this weight loss may not last
• There is no weight loss effect
If the treatment works, what are possible benefits of GMT for people who are impacted by obesity?

• Low cost
• Relatively simple treatment
• Relatively non-invasive
Research Methods
Problem solving

Trial Participants

Ideal donor?
Risk of infection?
Side effects?
Will anyone volunteer?

Treatment

How to deliver the treatment?
How to make and store capsules?
How long will bacteria live?
Ideal treatment amount and frequency?
Capsules frozen until needed
“The capsules are just like hand-made chocolates”

- Professor Wayne Cutfield
Participants

Donors

18-28 years
Lean
Healthy
Low BMI
Drug free
Physically active
Participants

Recipients

14-18 years
High BMI
Healthy
No antibiotics within previous 3 months
The Gut Bugs trial

Gut Bugs is a ‘gold standard’ randomised, controlled trial (RCT).

The Gut Bugs research design:

• double-blinded
• placebo-controlled
• randomised
A randomised controlled trial (RCT) is the ‘gold standard’ for clinical trials in medical research.

It is the most reliable method for testing new drugs or treatments.
Double blinding

Double blinding means that neither the participants nor the researchers know who is getting the treatment. Researchers and participants stay blinded until the trial is finished and the results are analysed.

Double blinding reduces *bias*. 
The Gut Bugs trial

Participants and researchers are ‘blinded’ – no one knows who is getting the ‘poo’ capsules and who is getting the ‘dummy’ or placebo capsules.

If a change is noticed, no one knows if it is due to the ‘poo capsules’ (the gut microbiome transfer). Participants and researchers will be ‘unblinded at the end at 2019 once results are analysed.
A placebo-controlled trial

One group is given a ‘dummy’ or placebo. They are the control group.

One group is given the treatment.

Researchers can then compare effects of the treatment with the control.

The placebo effect is when an improvement happens because the participant believes the treatment has worked, even though they have only been given the placebo.
The Gut Bugs trial

Gut Bugs participants are randomly assigned to two groups.

Participants receive ‘poo capsules’ (treatment group),

OR placebo capsules filled with saline (salt) solution (control group).
Randomisation

Randomisation means that researchers can’t predict whether participants will be assigned to the control group or the treatment group.

There are many methods of randomisation. Randomisation is often by computerised selection.

Randomisation reduces bias.
Research findings so far...

**Pilot trial**

It was difficult to tell if significant weight loss was achieved, BUT there was evidence of:

- the treatment groups microbiome shifting to resemble the donors’
- no shift in the control group
- engraftment
- augmentation

This was enough evidence to proceed to the main trial.
Next steps...

If the treatment was effective, researchers would identify which combinations of bacteria were most effective, and then try to culture (grow) them in the laboratory.

Then the treatment could be scaled up and guaranteed to be disease-free.

But this is easier said than done...