Matters of food and the gut

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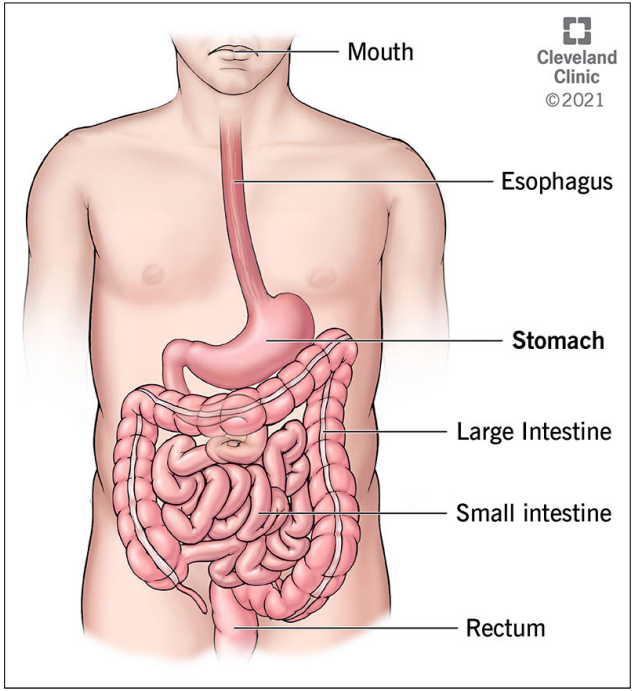
What in food that can impact the ‘gut microbiome’?

- **Diversity** of food
- **Nutrient content** in food (particularly, fibre and sugar)
- **Chemicals** in food (used in production, processing, storage)
  - Pesticides, fungicides, herbicides, fertilizers
  - Antibiotics
  - Preservatives and additives (e.g., emulsifiers, colours)
  - Contaminants like heavy metals
- **Pathogens** in food and water

‘Gut’ – the digestive or gastrointestinal (GI) tract

- **Tube** (about 30 m); series of **hollow organs**
  - Upper GI tract: mouth, esophagus, upper part of small intestine
  - Lower GI tract: lower part of small intestine, large intestine, rectum, anus
  - Part of digestive system along with liver, gall bladder, pancreas
- Role in digestion, absorption, waste elimination; **host to the microbial community**

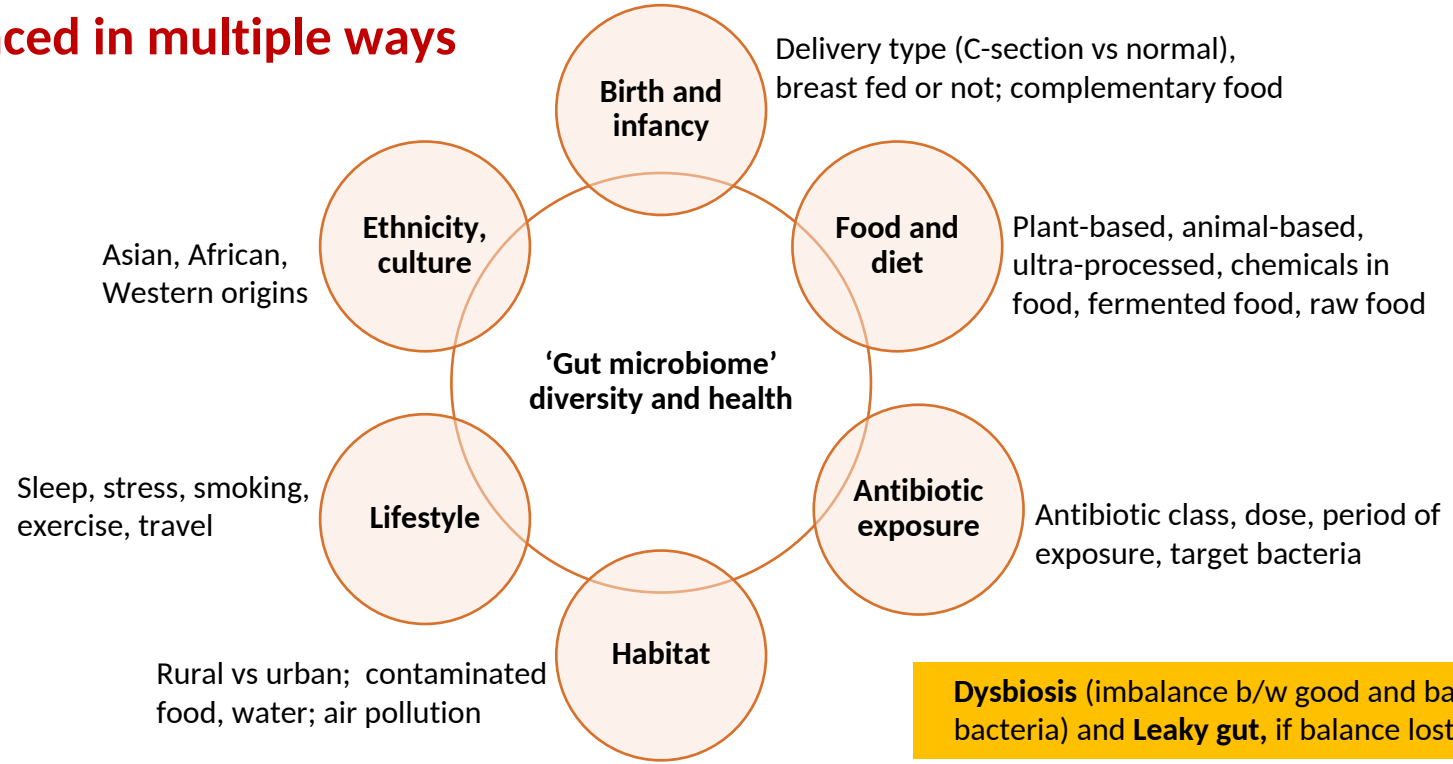


Source: Cleveland Clinic

Bacteria dominates the ‘gut microbiome’; bacterial genes much higher than human genes

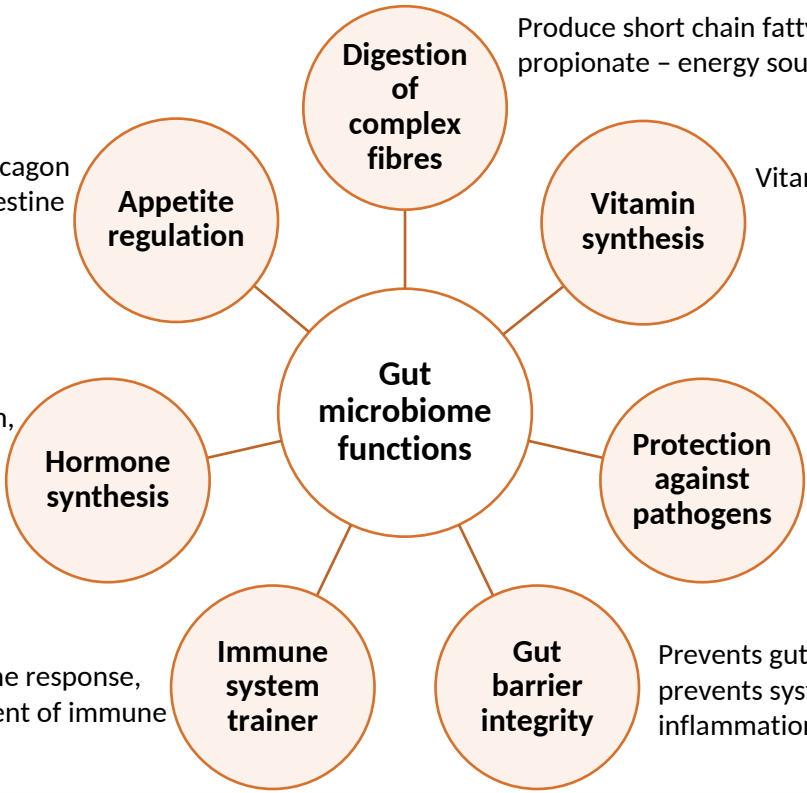
- **Gut microbiome**: Live microorganisms (**microbiota**) + genetic elements + metabolites etc.
- Microbiota: **bacteria** (most abundant), fungi, virus, archaea
- **Trillions** of bacteria (~38) compared to about 30 trillion cells in human body (~1:1)
  - Most (90+ per cent) in large intestine (colon)
  - About 1-2 kg (similar to the weight of brain)
  - One spoon of stool contains more bacteria than there are people on the earth
  - About 2,000 species (core vs rare; abuout 90 per cent of core is ***Bacteroidetes***, ***Firmicutes***); others include *Actinobacteria*, *Proteobacteria*
- **2-20 million bacterial genes**, compared to 20,000 genes in human genome; help bacteria perform functions human body cannot (e.g., vitamin synthesis, complex fibre digestion)

‘Gut microbiome’ – unique like a finger print, shaped up and influenced in multiple ways



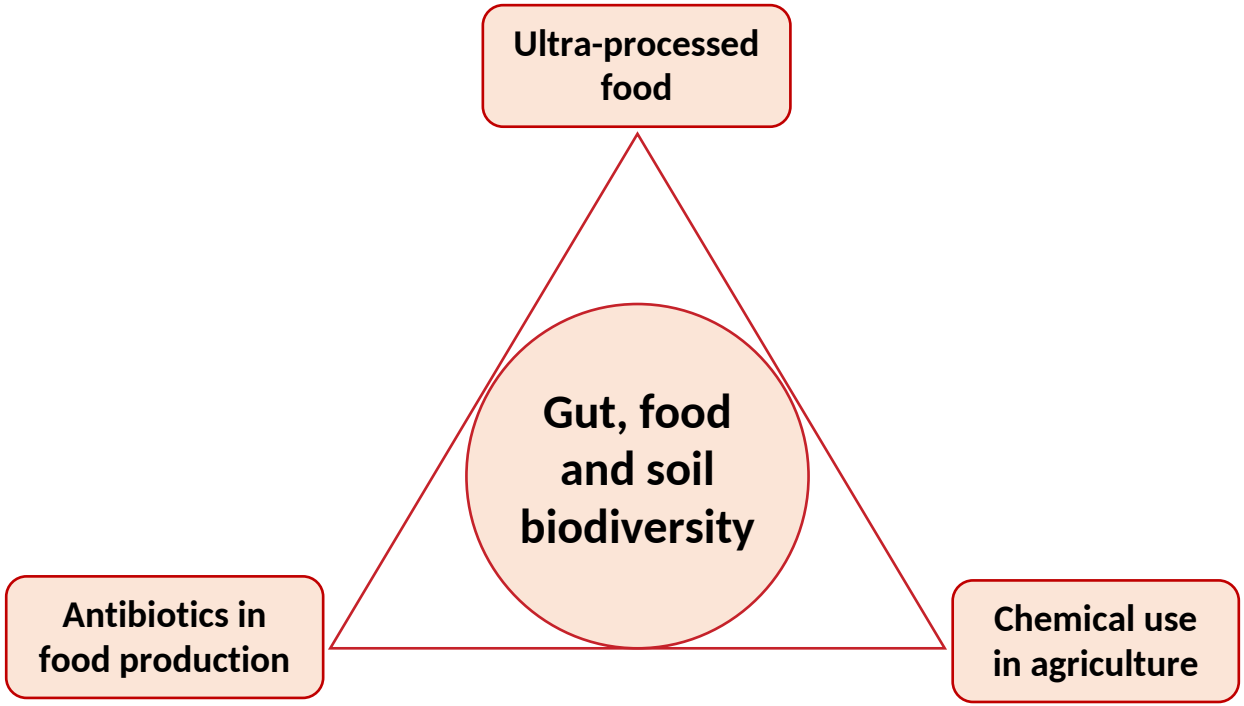
Dysbiosis (imbalance b/w good and bad bacteria) and **Leaky gut,** if balance lost

The ‘second brain’; the emerging ‘multi-organ’



Bidirectional communication pathways:
Gut-brain axis
Gut-lung axis
Gut-thyroid axis
Gut-HPA axis

CSE campaigns; gut-food-soil connect



Ultra-processed/Junk/HFSS foods: ‘products’ made in factories, not in kitchens

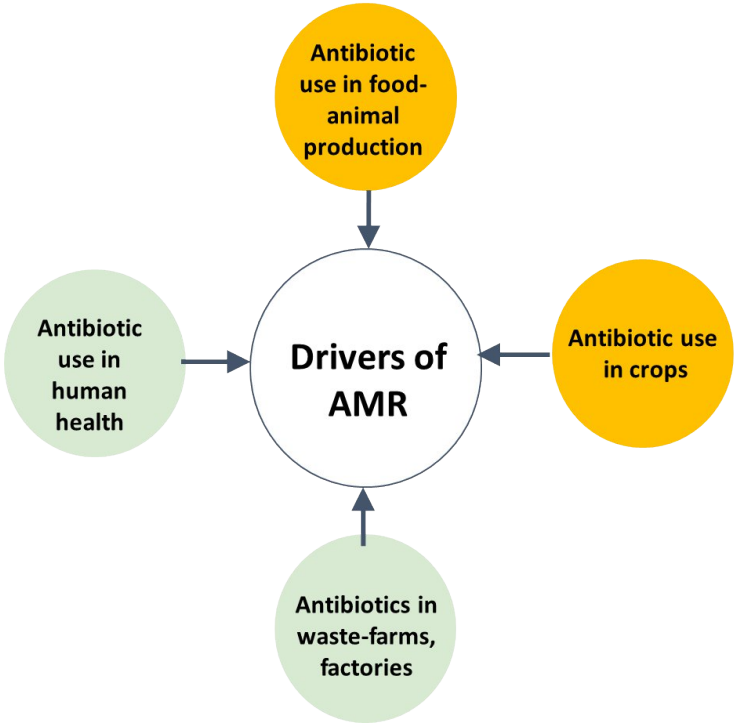
- **Low fibre connection**
  - Often no real food matrix; pre-digested
  - Good gut bacteria that thrives on fibre **starves**, **dies off**, or **eats protective mucus lining**
  - Results in **dysbiosis**, **leaky gut, low production of SCFAs**– reduced satiety, more hunger
- **High chemical connection**
  - Emulsifiers due to detergent effect can **wash off the gut lining**
  - Artificial sweeteners can trick bacteria; promote **glucose intolerance**
  - Preservatives to prevent microbial growth can also **kill good gut bacteria**
  - Food colours can **trigger immune system** and **allergic responses**

Ultra-processed/Junk/HFSS food: made addictive; aggressively marketed; misleading labels

- **High sugar connection**
  - High sugar in UPFs often **overflows into large intestine**
  - **Opportunistic bacteria** (e.g., certain *E.coli*, *Proteobacteria* sp.) and **fungi** (e.g., *Candida* sp.) can use this sugar as 'fast fuel' to **outgrow** good bacteria (e.g. *Bifidobacteria* sp., *Lactobacilli* sp.) which ferment fibre
  - Can result in:
    - **Dysbiosis** and **leaky gut**
    - **Drop in SCFA** (e.g., butyrate that repairs gut; prevents colon cancer)
    - **Rise in ethanol** and **acetaldehyde** (due to sugar breakdown); irritation of gut lining and **non-alcoholic fatty liver disease**
  - Opportunistic bacteria through the gut-brain axis can also **'hack'** the brain to **crave for more sugar;** making UPFs addictive

Antibiotic use in food production can lead to dysbiosis and antimicrobial resistance

- Antibiotics indiscriminately used in **poultry, dairy, aquaculture, bee-keeping, crops**
- Meat, eggs, milk, fish meat, honey, crops can have **antibiotic residues**
- Antibiotic exposure kills good bacteria in gut
  - **Dysbiosis**; reduced bacterial diversity
  - Potential impact on gut microbiome functions
- In addition, low concentration, long term exposure makes bacteria **resistant** (selection pressure); spread of **antimicrobial resistance (AMR) – the silent pandemic**



Pesticide residues in food

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- Ongoing studies indicate disbalance in gut microbiome due to certain pesticides; linked with **endocrine disruption**
  - High **estrogen** levels in body due to dysfunctional **estrobolome** (collection of gut bacteria that regulates estrogen metabolism)
  - Increased **cortisol** secretion, decreased T3 (**thyroid hormone** levels), increased **insulin** resistance through multiple pathways (e.g., low-grade inflammation and leaky gut)

Part of the answer lies in making our food systems sustainable

- **Who grows** – local food growers
- **How we grow** – less intensive and less toxic
- **What we grow** – biodiversity rich and nature-friendly
- **What we eat** – less processed and more bio-diverse and local

Thank you

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