# Microbes are everywhere in the food system



# Single celled algae

Phytoplankton communities contain single-celled algae that are a food source for us (like Chlorella and Spirulina).



Diverse microbial communities consisting of fungi, bacteria, protozoa and other micro-organisms occur in all parts of our food system and are essential in its functioning and health, for food security and climate change mitigation.

## Soil environment

Soil microbial communities differ depending on the type of soil and the type of plants that grow in them. Fungi form a large web underneath the soil connecting plants with each other, whereas bacteria are often more localised around plant roots.



### **Plant enviroment**

Microbes exist even on and within plants supporting plant health.

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# **Plants and disease**

Individual microbial species that naturally occur in the environment can cause plant disease and food losses, if environmental conditions are right.





Individual microbes can be harmful to plant, animal and human health if environmental conditions are in their favour. These microbes are often a natural part of microbial communities in low numbers.



## Animals and disease

Pathogenic microbes like the bacterium that causes tuberculosis often exist within the microbial community which support host health and only become harmful when the host immune system is weakened. Anti-microbial resistances can be transferred from animal to human bacteria through the food we eat.









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# Microbes in foods

When food is stored too long and under the wrong conditions (too hot or wet), food starts to go rotten. Decomposing microbial organisms like mould take over the naturally occurring microbial community. The microbes that decompose foods are often harmful to humans and cause food poisoning.

# Animal environment

Animals have their own gut, rumen, skin and mucosal microbial community which has a similar role than the one in humans: nutrient absorption, defense against pathogens and supporting immune functioning.

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### Microbes on food

Fermented foods such as yoghurt are rich in bacteria that are beneficial to human health, such as Lactobacillus or Bifidobacterium bacteria. Food fermentation relies on beneficia yeasts and bacteria that occur naturally on food to multiply so that microbes that cause food to go rotten are outnumbered: this way, we can store food for longer.

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#### Human environment

Humans have their own skin, mucus and gut microbial communities which support physical and mental health, nutrient absorption in the gut and defense against diseases. The human gut microbiota is strongly influenced by the food we eat.

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#### Humans and disease

Microbes that are part of the natural microbial community can become harmful when the human immune system is weakened.

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#### Food waste

Rotting of food is considered beneficial in the process of recycling our food waste: microbes decompose food leftovers so that nutrients can be released back into the soil or water for plants, animals and soil microorganisms to benefit.

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