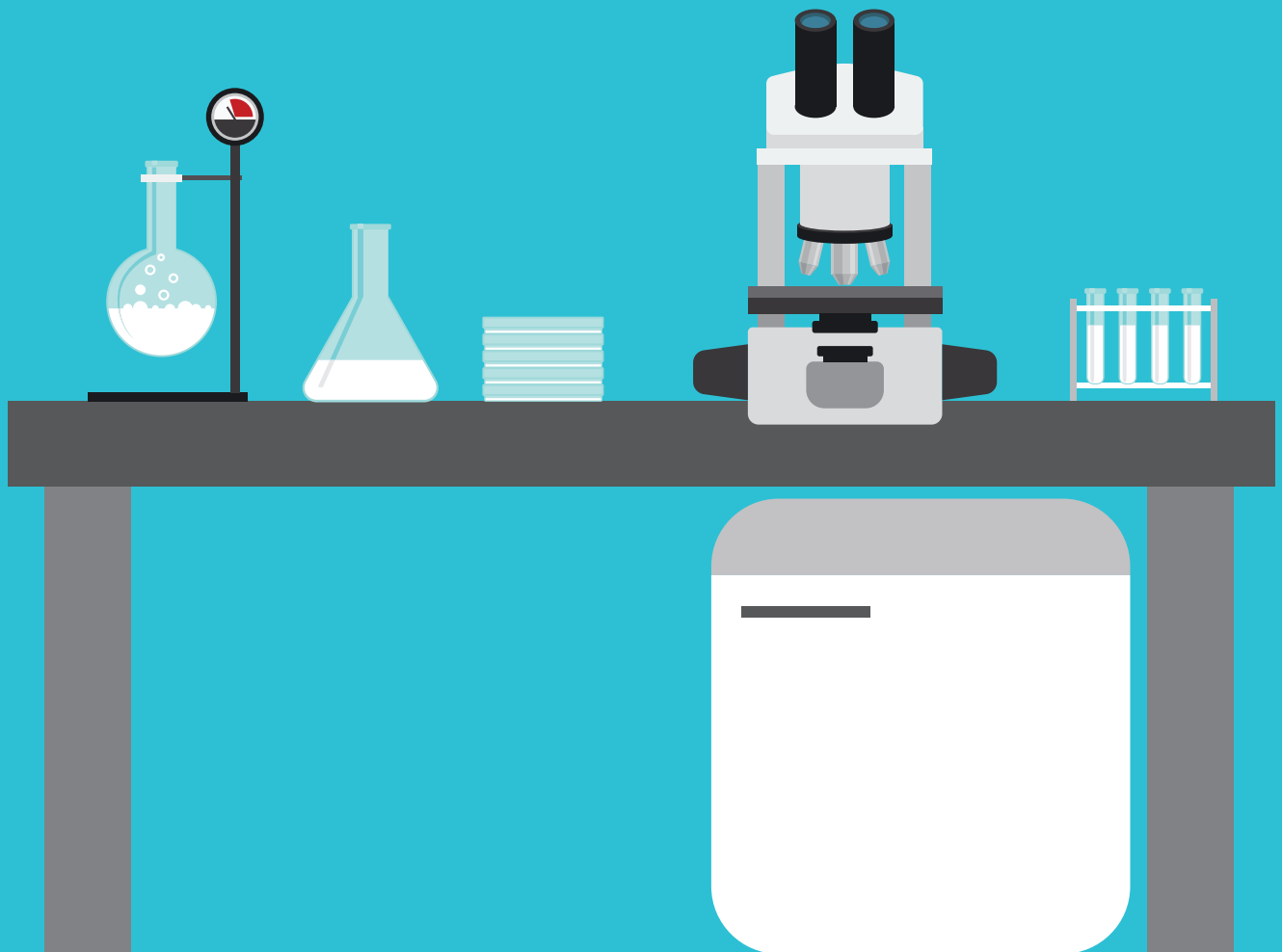


Under the Microscope

Microorganisms and Quality Control



What is Yakult?

Yakult is a fermented milk drink containing our unique probiotic bacteria, the *Lacticaseibacillus paracasei* Shirota (LcS) strain.

Yakult

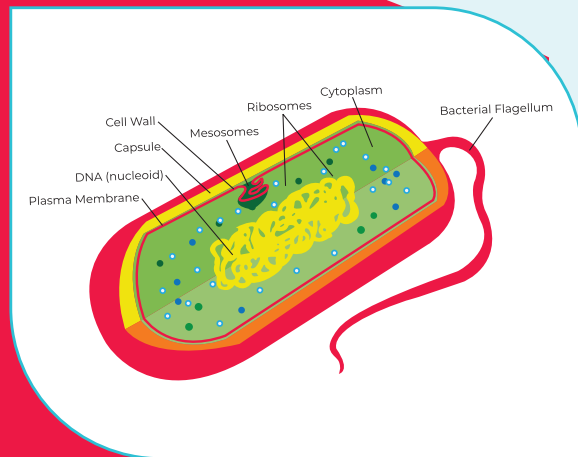
www.yakult.com.au

Bacteria

Bacteria are one of the most common types of living **microorganisms**. Bacteria species are classified according to distinguishing features and each species requires unique environmental conditions to survive, grow and multiply. Without optimal conditions, bacteria will become dormant or die.

Beneficial or Harmful?

Bacteria play important roles in many aspects of our daily lives. Some are beneficial and can improve or maintain health, create medicines, and produce foods and drinks, such as Yakult. Other types of bacteria can be harmful to humans, as they are pathogenic and produce toxins that may lead to illness or decay. Whether or not bacteria are harmful or beneficial to humans, they all play an important role in breaking down molecules.



General Structure of Bacteria

What are Microorganisms?

- The earliest form of life found on Earth
- Prokaryotic cells/Unicellular (single-celled)
- Microscopic (can only be observed under a microscope)
- Bacteria, yeast, fungi, virus, protozoa, etc.
- Can utilise energy sources such as sugars, sunlight, sulphur and iron
- Can survive in extreme conditions, such as Antarctic ice or volcanic lava
- Are sensitive to their environment (e.g. the presence of nutrients, oxygen, light, temperature, pressure, exposure to toxins, and influences of co-existing species)
- Responsible for breaking down molecules (decomposition and fermentation)
- Beneficial or pathogenic (causes harm to other organisms)

Bacteria in Yakult

Yakult utilises a unique beneficial bacterium called *Lactocaseibacillus paracasei* Shirota (LcS) strain. The LcS strain is a type of lactic acid bacteria (LAB) that utilises sugars such as glucose and lactose to generate energy used for survival, growth, and replication. LAB were discovered by Louis Pasteur in 1857 and are recognised as beneficial bacteria closely associated with digestive balance. When LAB ferment (replicate in the absence of oxygen), lactic acid and lactate are produced as byproducts.

The Story Behind the LcS Strain

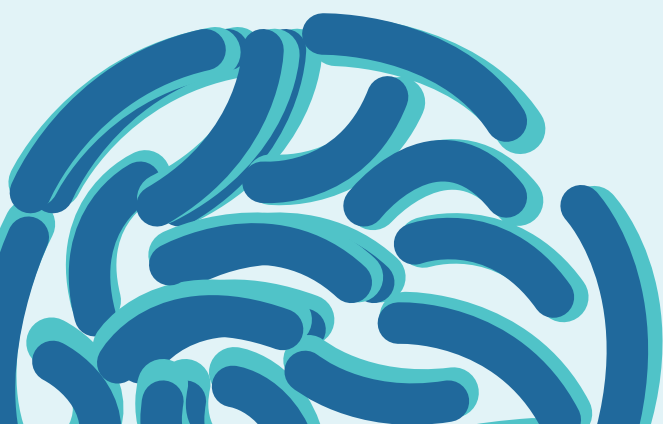
Yakult, the fermented milk drink, was born in Japan in 1935. Loved for over 90 years, its continued success stems from two key elements: the unique *Lactocaseibacillus paracasei* Shirota (LcS) strain and the spirit of our founder.

In the early 20th century, many people lost their lives to infectious diseases. Seeking to change this, Yakult's founder, Minoru Shirota, M.D., Ph.D., began researching microorganisms with a focus on preventive medicine. In 1930, he succeeded in strengthening and culturing a strain of lactic acid bacteria that reaches the intestines alive and improves intestinal health.

To deliver the benefits of this strain to as many people as possible, he developed the fermented milk drink Yakult in 1935. Today, Yakult is enjoyed worldwide, carrying forward Dr. Shirota's mission to contribute to the health and happiness of people everywhere.



Lactocaseibacillus paracasei Shirota (LcS) strain



Bacteria Identification

Classification



Bacteria classification is the way in which bacteria are named and usually consists of 3 parts: the genus, species, and strain. The *Lactocaseibacillus paracasei* Shirota (LcS) strain used in Yakult has been named in honour of Dr. Minoru Shirota, who discovered the LcS bacteria and instigated its use in Yakult products. Some other key identifying factors of the LcS strain nomenclature include:

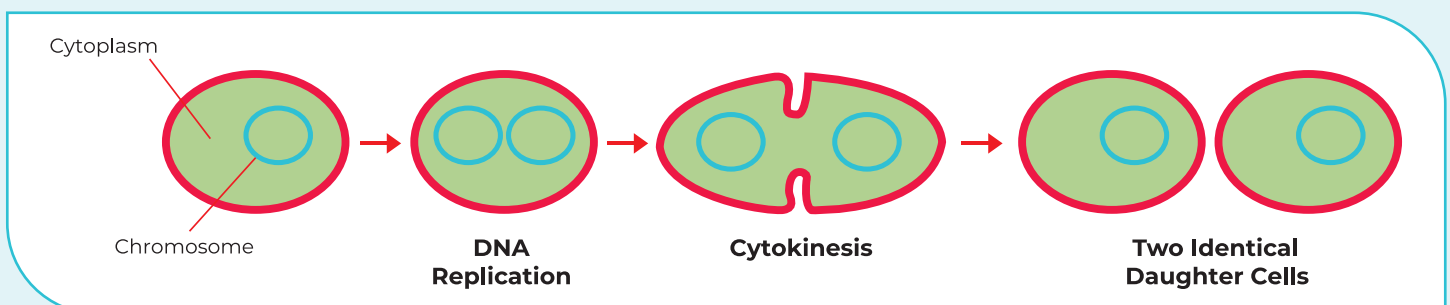
- **Lacti** – relating to milk or lactic acid (by-products of the bacteria)
- **Bacillus** – describing the shape of the bacteria (rod-shaped), and
- **Casei** – taken from ‘casein’, a protein found in dairy products (indicating that the bacteria are found in dairy products).

The name of a newly discovered strain is determined by its characteristics, as well as its similarities to other strains that have already been discovered. Occasionally, bacteria are also named after the scientist who discovered them. When naming bacteria, scientists use a structured, hierarchical system of classification called taxonomy to classify bacteria accurately against other pre-existing species. The system uses 7 classifications that group organisms based on their similarities from broad to specific, considering both genetics and physical attributes.

The classification of a bacteria strain considers all defining characteristics including size, shape, physical structure and organelle composition, genetic make-up, growth patterns and the locations in which it is found. These factors also affect the name of bacteria for identification.

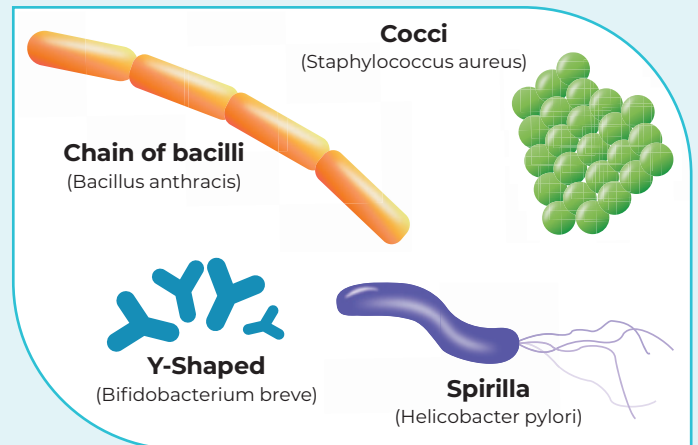
Growth Patterns

Most bacteria reproduce through a process known as binary fission. A single-celled bacterium will replicate the contents within the cell and then divide into two. Genetic material, either DNA or RNA is duplicated so all new cells are identical to the original. The time that it takes for a single bacterium to multiply is known as a generation and as bacteria multiply, older generations are more likely to be genetically removed from the original strain.



Shape

- **Bacilli** – rod-shaped
- **Cocci** – spherical-shaped
- **V-shaped** – or Y-shaped
- **Spirilla** – spiral-shaped

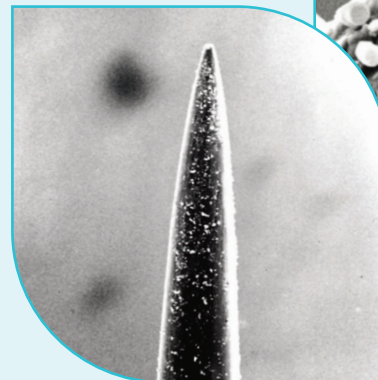


Shapes of Bacteria

Size

Bacteria are microscopic and require a highly powered microscope to be seen. The size of an individual bacterium can vary in length between 0.1-10µm. Even at 30 times magnification bacteria cannot be identified on the tip of a needle, as individual bacteria need to be viewed using an electron micrograph at 3,000 times normal vision.

Individual bacteria are more distinct, magnified x3000.
Image sourced from Yakult Honsha.



Unknown bacteria on tip of needle, magnified x30.
Image sourced from Yakult Honsha.

Bacteria in the Digestive System

Bacteria play a vital role in the digestive system, helping to break down organic matter to be utilised by the body. Our intestines contain over 100 trillion bacteria and include both beneficial bacteria and potentially harmful bacteria. While harmful bacteria cannot be altogether eradicated from the digestive tract, optimal digestive function occurs when the balance of microorganisms is skewed in favour of beneficial bacteria. Beneficial bacteria can help digestion by:

- Synthesis of key vitamins (e.g. K and B vitamins)
- Aiding absorption of nutrients
- Fermenting dietary fibres
- Suppressing harmful bacteria growth

Digestive Balance

Digestive balance can be disrupted by several factors. These can include illnesses and health conditions, as well as lifestyle factors that deplete the number of beneficial bacteria in the digestive system. These include:

- Stress
- An unbalanced diet
- Alcohol consumption
- Smoking
- The natural ageing process
- Some medications

For optimal digestion, the diversity and balance of bacteria should be higher for beneficial bacteria and lower for potentially harmful bacteria.

Yakult and Digestion

The LcS strain utilised in Yakult is a beneficial bacterium, also referred to as a probiotic.

Probiotics are defined as “Live microorganisms that, when taken in adequate amounts, confer a health benefit on the host” – World Health Organisation (WHO).

With over 90 years of research, the LcS strain is well known for its survival in the gut, its positive impact on the gut microbiota, and its ability to improve stool consistency. In every bottle of Yakult, there are at least **6.5 billion** LcS strain to ensure that Yakult’s fermented milk drink is making a positive difference to those who consume it.



Beneficial Bacteria



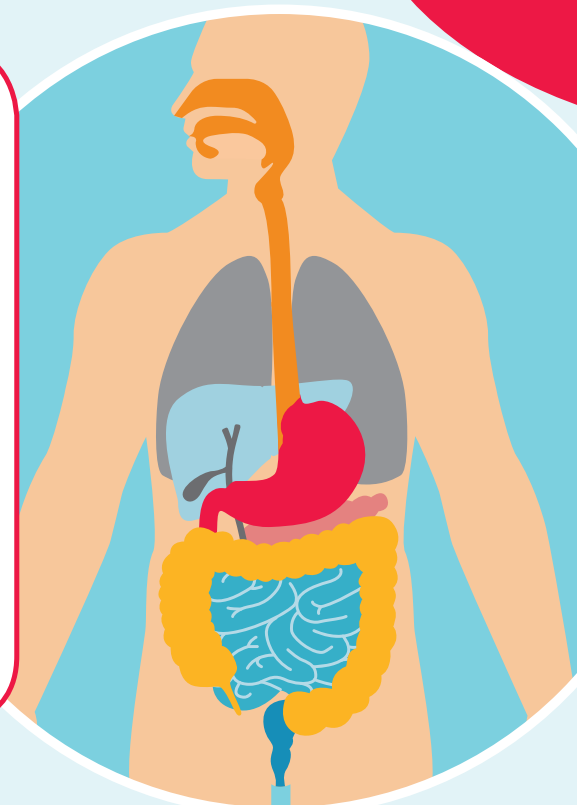
Lactobacillus



Bifidobacteria



Lactococcus



Potentially Harmful Bacteria



E.coli



Staphylococcus



Clostridium Perfringens

Yakult in the Laboratory

Quality Control (QC) at Yakult Australia

Yakult follows stringent quality control protocols to ensure that only the best quality reaches consumers. Over 100 tests are conducted on every batch of Yakult; this includes microbiological quality, composition, and taste. Tests occur before, during, and after the drink's production.

The high quality of Yakult is ensured through an extensive variety of tests. Raw ingredients are sampled and inspected for quality before purchase, and all mixtures are tested before progressing to further stages of production. Additionally, the LcS strain is cultured under precise laboratory conditions and rigorously tested to ensure high numbers of Colony Forming Units (CFUs) are present through all stages of manufacturing.

Filled and packaged Yakult bottles are randomly selected for further testing, and final inspections assess for any incorrect printing, undesirable markings, improper lid sealing or packaging faults. After approval, Yakult will be ready for dispatch. Samples from every batch are retained and tested throughout the product's shelf life.



Testing

The extensive tests conducted during the manufacturing of Yakult ultimately assess the **safety, consistency,** and **high bacteria count** of Yakult. Some of these tests include:

Test Type	What it measures	Purpose in Yakult Production
Specific Gravity	Density of samples	Ensures that the ingredients are mixed in the appropriate ratio
Brix	Total soluble content (i.e. sugars in Yakult) using a refractometer	Ensures the palatability of Yakult
pH Meter	pH (acid/alkaline scale)	Ensure that the acidity remains within a safe and optimal range for fermentation, taste, and product stability
Titrateable Acidity	Level of acid concentration	Monitors LcS growth
LcS Enumeration	Number of live LcS bacteria	Ensures that at least 6.5 billion CFU of LcS bacteria are present in each Yakult bottle at the end of the fermentation and throughout its shelf life
Standard Plate Count (SPC)	Presence and level of contaminating bacteria	Ensure that Yakult has not been contaminated
Yeast and Mould	Presence of yeast and/or mould	Ensures that Yakult has not been contaminated, by using selective agar
Coliforms	Presence of coliforms	Ensures a high hygiene standard

The presence of coliforms generally indicates poor hygiene practices during food production. Yakult has a zero tolerance of coliforms in all samples.

Hygiene and Food Safety

Hygiene is a key element in the successful operation of the Yakult factory. Our drinks must be free from contaminants, both physical and microbiological, to protect the health and safety of consumers. Yakult Australia follows the *Food Standards Australia and New Zealand (FSANZ)*, to maintain high hygiene and food safety practices which are designed to prevent accidents, maintain staff safety, and accurately monitor and maintain hygiene standards.

Two ways that Yakult maintains hygiene and food safety:

Uniform

- Clean, visible, protective uniform with no buttons, zippers or pockets
- No jewellery or loose hair
- Surgical mask
- Hair net and/or beard net
- Thick-soled and high-tread gumboots

Procedures

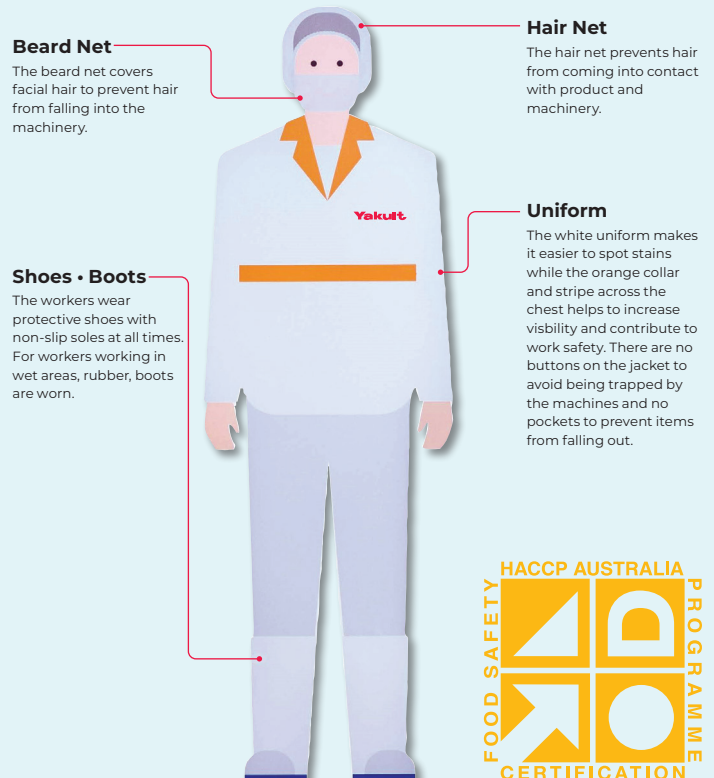
- Wear staff uniforms properly in production areas
- Wash hands thoroughly before entering manufacturing and laboratory areas
- Use sanitising footbaths at all manufactory entrances and exits
- No consumption of food, drink or smoking in manufacturing areas
- Thoroughly clean and sanitise all processing equipment before and after use

Quality Assurance (QA) in Food Safety

In addition to internal Quality Control (QC) standards, Yakult Australia is also registered with *Hazard Analysis and Critical Control Point (HACCP)* Australia as an external Quality Assurance (QA) measure.

HACCP Australia is a nationally accredited organisation that reviews the quality of Yakult's food safety and hygiene practices. As an external assessor, HACCP provides unbiased audits on Yakult's monitoring to ensure the implementation of food-safe equipment, materials and services.

What our staff wear



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