

Asahi

Asahi Group

RESEARCH AND DEVELOPMENT



- Asahi Breweries, Ltd.
- Asahi Soft Drinks Co., Ltd.
- Asahi Group Foods, Ltd.
- Asahi Biocycle Co., Ltd.
- Asahi Quality & Innovations, Ltd.

Message

Continuing to create “glocal”[※] value unique to Asahi Group” as a business that develops sustainably alongside society.

The Asahi Group operates alcoholic beverage, soft drink, and food businesses around the world, primarily in Japan, Europe, Oceania, and Southeast Asia. In January 2019, we enacted a new Asahi Group corporate philosophy called the “Asahi Group Philosophy (AGP)” with the aims of sharing our philosophy among Asahi Group employees throughout the world and increasing our sustainable corporate value. Under the AGP, the mission of the Asahi Group is to “Deliver on our great taste promise and bring more fun to life”. As we seek to accomplish this mission, the Research & Development Division will continue to seek out better technology and new knowledge.

In addition to product development in the areas of alcohol beverages, soft drinks, and food, our R&D programs seek out analytical and quality assurance technologies that support our search for outstanding health-promoting ingredients and food safety, as well as promote the development of environmentally-friendly containers, the utilization of by-products, and the development of green technologies to realize a more affluent and sustainable society.

Supporting these R&D programs is a vast store of technical know-how cultivated over many years, and developed by the individual researchers who inherit and build on that know-how. Furthermore, a research approach of seeking to incorporate the latest science at an early stage, in addition to a corporate culture of working together across departmental boundaries, has provided us with a platform to support these activities. The Asahi Group will continue to contribute to the development of a sustainable society, and to take on the challenge of creating unique glocal value.



Asahi Group Philosophy

Our Mission

**Deliver on our great taste promise
and bring more fun to life**

Our Vision

**Be a value creator globally and locally,
growing with high-value-added brands**

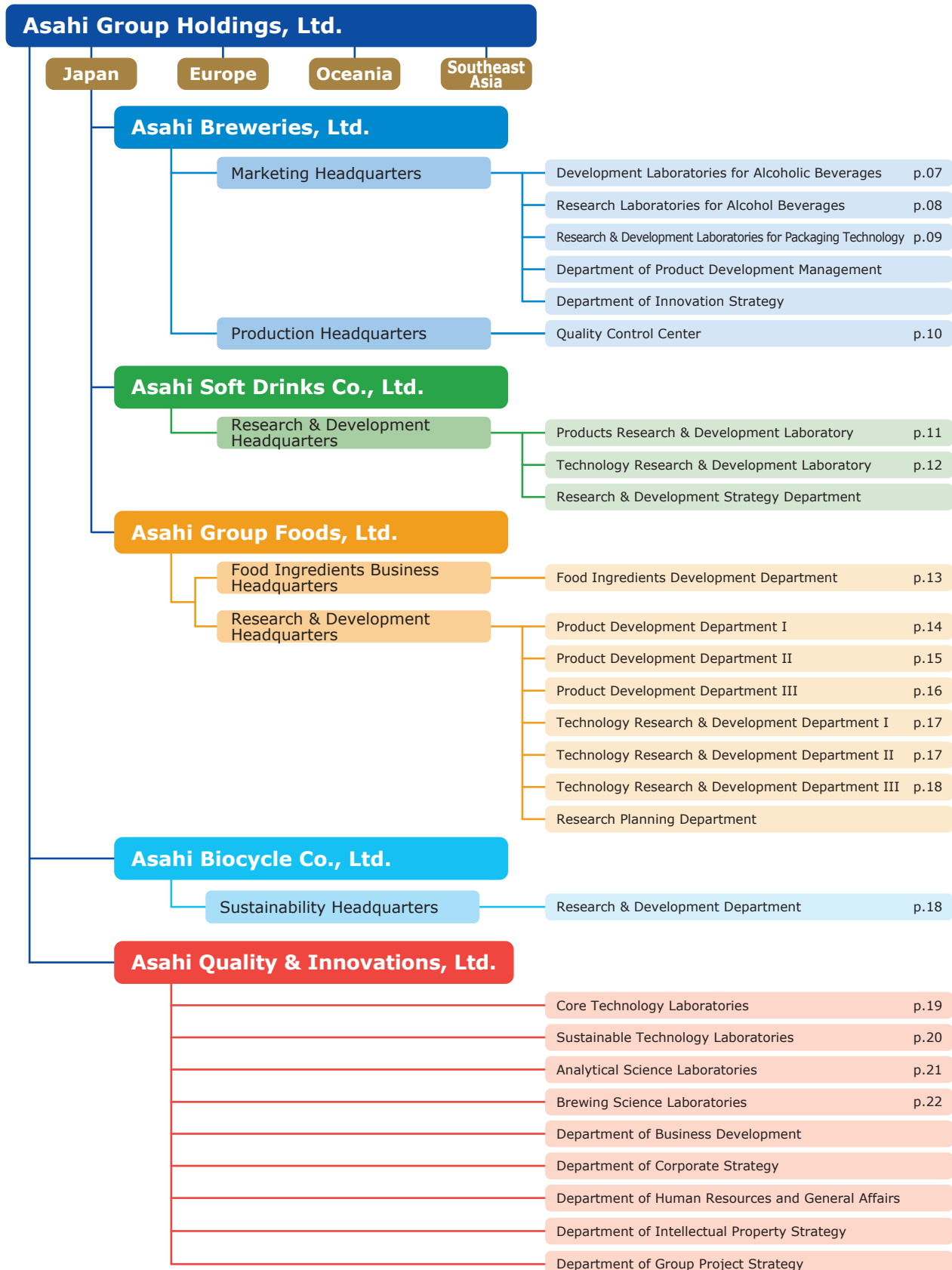
Our Values

**Challenge and innovation
Excellence in quality
Shared inspiration**

[※] Glocal
“Glocal” is a phrase coined from the words global and local. It refers to the approach “Think globally, act locally”.

Organizational Structure of Research & Development

At the Asahi Group, the R&D divisions of Group Companies carry out relevant R&D that directly links to business operations such as product development and quality assurance, while laboratories run by Asahi Quality & Innovations, Ltd. engage in research themes that may lead to mid- to long-term business development through Group Companies in Japan and abroad. These R&D organizations collaborate with each other in the pursuit of their respective research goals.



Research & Development areas

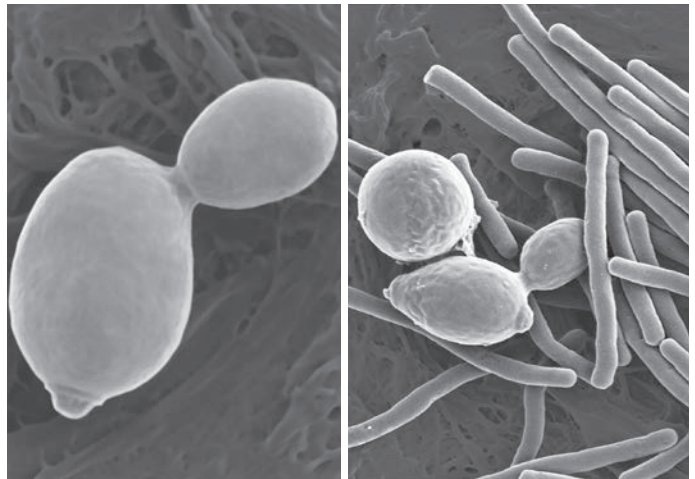
Asahi Group focuses its efforts on R&D activities that will create new value, with the aim of delivering the best impression to our customers. We take on challenges in a wide range of research and development fields, based on the following pillars: “product development”, through which we employ our unique technologies; “fundamental technologies”, including quality assurance and the development of production technologies for delivering higher quality and safer products; and “search for new ingredients”, through which we maximize the potential of functional microorganisms and expand their uses.

Search for new ingredients

Microorganisms play an important role in the manufacture of alcoholic beverages and fermented milk. Various technologies, such as fermentation control and analytic technologies, are required to make full use of microorganisms. Leveraging these microbial utilization technologies together with functional evaluation technologies accumulated through the development of various health foods, Asahi Group searches for novel ingredients with beneficial effects on human health.

Microbial ingredients

We conduct research in the search for useful components of yeast and lactic acid bacteria that are beneficial to human health, and we carry out other studies on beneficial microorganisms including *Bacillus subtilis*.



Brewing yeast

Lactic acid bacteria and yeast

Fermented milk ingredients

We search for components that have health benefits from the wide range of components produced in the process of fermentation by lactic acid bacteria.



Product development

We develop a wide range of food and drinks to offer customers products that will contribute to realizing a rich dietary culture. We also develop various health foods and drinks including “food for specified health use” (FOSHU) and “food with function claims” utilizing various functional ingredients identified through new ingredient research.

Alcoholic beverages

Asahi Beer scientifically elucidates the art of brewing beer from diverse perspectives: technologies for manufacturing “good” tasting beer; technologies to maintain the just-made fresh flavor; analysis of brewing yeast genes that impact fermentation, etc. to further improve product quality and develop innovative products. The products we develop range from beer and related products to ready-to-drink (RTD) alcoholic beverages, wine and non-alcohol beverages.



Testing of beer head retention

Beverages

We are also active in the field of non-alcoholic beverages including carbonated drinks, lactic drinks, lactic acid drinks, coffee, tea, fruit and vegetable juice. We seek new raw materials and examine manufacturing technologies to develop new products that meet customer tastes and trends. We also actively promote the development of “food for specified health use” (FOSHU) and “food with function claims” to accommodate health needs.



Coffee Cupping

Food, dietary supplements and skincare

We develop products to meet a variety of taste, health and beauty needs. This includes snacks, food designed for infants or the elderly, and freeze-dried food and seasonings for professional use, as well as dietary supplements and skincare products. We have developed a rich line-up of products catering to people from all generations, and honed our technologies in these fields with the aim of improving quality.



Products for livestock and agricultural use

We are engaged in the development of materials that support livestock health and environmental conservation leveraging our microbial expertise and utilizing beer brewing by-products processed with our proprietary technologies.



Structural analysis of yeast cell components

Fundamental technologies

We are continuously refining our fundamental technologies to ensure our innovative research findings can be applied to business and to deliver high quality and safe products to customers. Further, in addition to deriving benefits from products, as a company operating its business by receiving the gifts of nature, the Asahi Group is committed to passing such gifts on to the next generation by promoting proactive initiatives to address various environmental issues.

Analytic technologies

To ensure Asahi Group to continuously deliver the highest quality and safety, we are constantly advancing our analysis and evaluation technologies that play an important role in quality and safety assurance by analyzing trace components contained in ingredients and substances that are generated during manufacture and storage.



Structural analysis of unknown volatile components

Process development

Our process development technologies facilitate the development of food and beverage products by verifying the various technical problems that arise when moving from laboratory-scale tests to commercial production at manufacturing plants.



Culture test of lactic acid bacteria

Packaging

Asahi Group develops user friendly and environmentally conscious cans and plastic bottles and cardboard carton packages. Using our unique technologies, we devise packages with novel designs that are pleasing to both the eyes and the touch, to help make the customers' daily lives more enjoyable.



Plastic bottle design Improving the usability of carton packages

Sensory evaluation

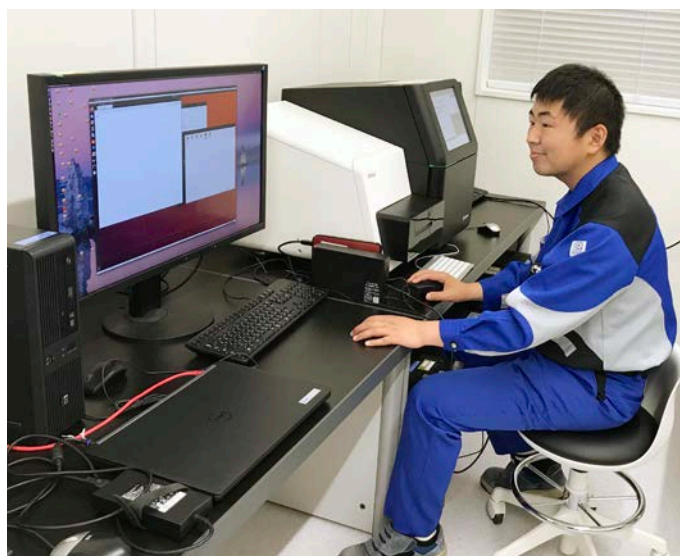
Human senses of taste and smell are indispensable for evaluating subtle differences in flavor when manufacturing food and beverage products. We are working to achieve higher quality by evaluating the flavor of our products from various perspectives, not only by improving the accuracy of the sensory evaluation performed by a selected panel of evaluators, but also by incorporating new technologies including instrumental analysis and brain science approaches.



Measurement technology of brain waves

Microbiota research

It has become clear through recent research that intestinal microflora has a diverse impact on our physical and mental health. We aim to deliver new health values leveraging our technologies for analyzing intestinal flora, which we have accumulated over years of research since the 1970s. We are also working to increase agricultural productivity through the research of plants and soil microorganisms using these technologies.



Microbiota analysis technology

Environmental Technology

To achieve the Asahi Carbon Zero medium- to long-term targets to reduce greenhouse gas emissions from the Asahi Group's business activities, we have been implementing demonstration tests of fuel cell power generation using biogas derived from beer brewery wastewater, as well as the installation and demonstration tests of autonomous hydrogen energy supply systems, CO₂ separation and recovery testing equipment, etc.



Demonstration testing equipment for biogas power generation

Development Laboratories for Alcoholic Beverages



Striving to create products that are sure to delight customers

We are engaged in the development of new products across product lines including beer and related products (beer, *hap-poshu* [low-malt beer], new genre, etc.), ready-to-drink (RTD) alcoholic beverages (*chuhai*, cocktails, etc.), wine and non-alcohol beverages (beer-taste and cocktail-taste beverages, etc.). From small-scale production of prototypes to follow-up for mass production at breweries and distilleries, we are always striving to create products that are sure to delight customers.

Development of brewed alcoholic beverages

When developing beer, wine and other brewed alcoholic beverages, we produce small batches of prototypes in a small-scale plant to determine the flavor profile for the new product. Through this process, various factors and conditions will be determined including the type and quantity of ingredients (malt, hop, fruits, etc.) to use, selection of fermenting yeast, fermentation temperature and time, and so on. Trial batches are repeatedly produced and evaluated to determine the optimal set of conditions from countless combinations of these conditions.

Development of RTD alcoholic beverages

For the development of canned *chuhai* and cocktails, hard seltzer, referred to as RTD alcoholic beverages, we study techniques for preparing and blending ingredients such as fruit juice, liquors and other flavoring agents to propose new flavors and meet the ever diversifying tastes of consumers. We also explore and evaluate new ingredients to create innovative flavors.

Development of non-alcohol beverages

We develop non-alcohol beverages that can delight customers based on the concept of "smart drinking" by combining techniques for brewed alcoholic beverages for beer and wine, techniques for preparing and blending ingredients such as fruit juice, liquors, and flavoring agents for ready-to-drink (RTD) alcoholic beverages, and techniques for controlling the alcohol content and removing the alcohol component.

Research

Combining our technological expertise to create the *Mirai no Lemon Sour*

The Laboratory holds Seeds Proposal Meetings, during which development staff have the opportunity to propose their original ideas to management with the objective of commercializing promising ideas. This exciting new product development, which began in 2021 with the idea of putting real lemon slices in a wide-mouth can, posed many brain-wracking challenges before it became a reality.

Incorporating real lemon slices, which by their nature have individual differences, broke the conventional wisdom that products should be completely uniform, and a great deal of drive and energy was required to break through the many hurdles involved in development. The Development Laboratories for Alcoholic Beverages, the Research Laboratories for Alcoholic Beverages, the Research & Development Laboratories for Packaging Technology, and the production and marketing divisions joined forces as a united team, and in April 2023, two years after the initial idea was proposed, we were finally able to deliver the "world's first canned lemon sour with real lemon slices" to customers as a test product.

Through repeated testing in cooperation with lemon slice suppliers, the Development Laboratories for

Alcoholic Beverages developed the lemon slice processing method and the flavor balance of the product. Consumers of the new beverage are greeted by the surprising sight of lemon slices gently emerging from the foam when the can is opened, as well as an authentic fruit taste made possible by using real lemons, and a flavor that matures over time from production to opening. The team's hard work resulted in a flavor that is both surprising and exhilarating and truly worthy of the name *Mirai no Lemon Sour*. Going forward, our team will continue working together to overcome the remaining hurdles on the path to mass production, with a view to a future in which even more customers will be able to enjoy the great taste of the *Mirai no Lemon Sour*.





Applying state-of-the-art technologies to make our products taste even better

We are conducting state of the art research and development to make beverages taste better and create new attractive drinks. Scientists specializing in such fields as brewing technology, exploration of novel ingredients, and microbiological control bring together their research findings and cooperate with the manufacturing site as well as the headquarters' departments to create a product that will always exceed the expectations of customers.

Development of brewing technologies

We perform research on the ingredients and manufacturing processes of beer and related products, to find a way to produce high-quality and tasty beverages in a stable and efficient manner by combining new ingredients and new brewing technologies. We also contribute to our quest for "deliver on our great taste" by realizing new flavors through different combinations of ingredients and technologies.

Development of technologies for microbiological control

Amongst the countless microorganisms that live in the environment, there are ones that deteriorate beer quality. We investigate the characteristics and genes of such microorganisms to develop new test methods and improve sterilization techniques, which will be used to protect the delicious flavor of our products. We examine the possibility of unknown microbiological risks before launching a new product and also develop new technologies for microbiological control to deal with such risks. We are progressing our research to ensure we provide consumers with safe and secure products.

Research

Improving quality of draught beer and non-alcohol beer keg utilizing technologies for microbiological control

Beer has been recognized as a more microbiologically stable beverage compared with non-alcohol beverages. This is due to the presence of ethanol, hop bitter compounds and low pH. However, some microorganisms, so-called beer spoilage microorganisms, can grow in and spoil beer, causing turbidity and off-flavor. To overcome this issue, we have long been working on developing microbiological control technologies necessary for the stable production of draught beer. There is no end to the fight against beer spoilage microorganisms. We have recently isolated and reported a novel beer spoilage microorganism called *Liquorilactobacillus nagelii* (former *Lactobacillus nagelii*).

In addition, we strive to utilize the knowledge obtained so far to offer high quality draught beer in the on-premise market. Even if beer is sterile at the time of shipment from the brewery, flavor deterioration could sometimes occur after several days have passed since the beer keg was opened and connected to a dispense systems. Our research has found that only a few types of beer spoilage microorganisms cause sensory deterioration.

We are currently discussing measures to prevent such flavor deterioration. Further, toward the realization of "smart drinking" advocated by Asahi Group, we aim to create an environment where everybody can toast with a beverage served from a tap, rather than where people who can drink choose draught beer while people who cannot drink choose bottled non-alcohol beer. There is a significant hurdle in microbiological control to offer non-alcohol beer keg due to no or a very small amount of alcohol. Nevertheless, we have undertaken the development of technologies to achieve this goal.



*These initiatives were reported in the *Journal of the American Society of Brewing Chemists* and at the ASBC Meeting, an international beer brewing science conference.



The external appearance is also an important part of the product

Most people may think that new product development is all about developing new content or new taste, but the external “look” of the product is also an important part of the product. We can improve both the functionality and design of the package by making use of various technologies, and even add value to the product concept through package design. We perform evaluation tests on the cans, bottles, paper boxes and other packaging materials used by Asahi Group (AG) companies to ensure safety and security to our customers and also pursue research to improve recyclability and reduce waste.

Development of new containers and packages

We develop cans, bottles, paper boxes and other packaging materials for use by our AG companies. Our mission is not only to developing user-friendly and aesthetically pleasant packages but also promoting light weight and environmentally conscious packages to reduce the burden on the environment.

Research on new technologies and trends

We conduct surveys and analysis of new technologies and trends related to packaging in Japan and overseas to support the development of new packages that are more attractive to customers. Based on the information collected and technologies identified, we develop packages with new added values responding to changes in society's needs.

Evaluation tests on new packages

We perform evaluation tests on packaging materials for new products developed by the AG companies to ensure safety and security to our customers. We also make improvements to packages of existing products. If any problems are found with our packages, we investigate the cause and take corrective measures to solve the problem.

Development of new equipment for serving draught beer

We are working to develop draught beer equipment that creates new value and is more attractive for both customers and restaurant/bar operators who use them. In other words, equipment useful for serving delicious beer to customers, easy to handle for restaurant/bar operators, and is friendly to the environment.

Research

Japan's first experience-based package innovation "Super Dry Nama Jokki Can"

"We wanted consumers to enjoy at home the fine foam and luxuriously large sips you would expect when drinking from a mug of freshly poured draft beer at a pub". We made it come true with an innovative package design, which helped invigorate our *Super Dry* brand. If you find creamy foam developing a nice head, you will see it as additional value. To produce fine foam and make this happen, we developed a material with a special surface structure. However, fine bubbles alone are not enough to constitute consumer value. We developed a design where the entire top of the can pulls off to create a wide opening to make it look more like a mug and allow for generous gulps. Double safety structure veils sharp edges anywhere near the opening so as to protect consumers from getting hurt. With mounting expectations even before the launch, *Super Dry Nama Jokki Can* was launched in April 2021 to achieve record-breaking sales that set new standards for beer sales. *Nama Jokki Can* will continue to evolve to exceed expectations.



Cumulative number of members enrolled in THE DRAFTERS service using Full-fledged Foaming Rich Server exceeds 20,000

Full-fledged Foaming Rich Server is dedicated for use in *THE DRAFTERS*, a new draught beer subscription service offered by Asahi Breweries. Aiming to ensure that everyone can easily enjoy delicious draught beer, Asahi Breweries fully leveraged the expertise accumulated in the development of professional-use draught beer equipment to create this home-use beer server, which provides users with an experience of high-density creamy foam and the great taste of sub-zero beer. As one of its features, this server is designed to be easy to use at home, while equipped with professional specs that deliver authentic draught beer. Since its launch in May 2021, the server has been used by more than 20,000 members in cumulative total and widely acclaimed. *Full-fledged Foaming Rich Server* will continue to evolve for our great taste promise.





Assuring the highest quality

The Quality Control Center supports quality assurance processes by conducting component, microbial and food safety analysis of raw materials and finished products, to deliver products of the highest level of quality to customers. We also conduct quality risk assessments and address identified risks. We employ a wide array of advanced technologies for detection/identification of hazardous microorganisms, analysis of foreign substances, abnormal odor and taste, DNA analysis, analysis of residual agricultural chemicals and mycotoxin, radiation measurement and more, to ensure the quality of the products of Asahi Breweries, Ltd.

Component analysis

Providing accurate and timely analysis data on a daily basis

We perform analysis to confirm the conformance to quality standards of raw materials and finished products, to conduct risk control, develop new analytical methods to support product development, research products distributed in the market, provide advice for improving inspection ability in manufacturing process, and coordinate confirmation of analytical accuracy at all breweries.

Microbial analysis

World's highest level of detection sensitivity for risk factors in food

We have systems in place to test various substances that pose potential risks to product quality. We are also working to achieve high sensitivity and efficiency of analysis by using the latest analytical instruments to enable detection of substances present in trace amounts.

Food safety analysis

Stringent tests on quality risks performed on materials and products from within Japan and overseas

An accurate and robust microbial testing system has been built within Japan to implement speedy inspection of finished products before shipment and microbial inspection of imported wines, spirits, etc. to support the delivery of safe and secure products.

Research

Establishment of a new beer turbidity analysis method and elucidation of composition changes in turbid materials

Currently, most beers are filtered before shipment and thus have a transparent appearance. However, inappropriate handling of beer after shipment may cause turbidity. We sometimes receive inquiries from our customers on the causes of turbidity. Turbidity in beer is categorized by cause into two types: freeze turbidity, which occurs when beer is frozen mistakenly, and oxidative turbidity, which occurs when beer is exposed to high temperatures and other improper conditions. Identifying the cause of turbidity is essential to explain the proper handling of beer to customers. Asahi Breweries has its own method of determining freeze turbidity or oxidative turbidity. However, recently, there have been cases where the conventional method fails to correctly determine the cause of turbidity. To address this issue, we elucidated the composition of turbid materials that form in commercially available beers by combining a new sophisticated analysis method and the conventional method, and found that the composition of turbid materials has changed in many beers from that reported pre-

viously. One of the possible causes of the composition changes in turbid materials in many beers is changes in the manufacturing process. The newly established analysis method has enabled the determination of freeze turbidity or oxidative turbidity, which was difficult with the conventional method. This new analysis method and findings on the composition changes in turbid materials were presented at an international conference, Brewing Summit 2022.





Enhancing brand value through differentiation

We are working to enhance the brand value of our products, especially flagship brands, by developing robust technology that will differentiate us from competitors and enhance the value of individual products. As a pioneer of the Japanese soft drink business with a range of core brands including *MITSUYA CIDER*, first launched in 1884 as *Mitsuya* Hirano-Sui and long embraced by Japanese consumers, *WILKINSON* launched in 1890 which was the first beverage to use the term “tansan” (meaning carbonic acid) as a product name, “*WILKINSON TANSAN*”; *CALPIS*, first launched in 1919, Bireley’s distributed in Japan since 1951, *Juroku-Cha* launched in 1993 as the pioneer of the blended tea market, and *WONDA* launched in 1997 as the next generation of canned coffee, we are constantly pursuing innovation to develop delicious, lively, fun and healthy products and to further enhance our brand value.

Product development

We develop new products to accommodate customer needs. We are also constantly renewing and improving our legacy brands to keep with the changing needs. Moreover, we proactively address the research noting not only physical health but also mental health to help our customers have wellness life.

Commitment to deliciousness

We conduct research and evaluation on the sensory aspects (such as taste, aroma and color) of preproduction samples and finished products and apply the results in new product development by utilizing our unique system for sensory evaluation data management.

Supporting Asahi Group businesses worldwide

We promote exchanges of information and technology among Group companies and affiliated companies to serve growth of the Asahi Group’s beverage business.

Research

R&D aimed at further enhancing the brand value of carbonated drinks

MITSUYA CIDER and *WILKINSON*, both with a history spanning over a century, are our two core brands in the carbonated beverage category which has a strong customer base around the world. We are strengthening R&D for these brands to invigorate the soft drink market.

In *MITSUYA CIDER*, we have been developing underlying technologies to enhance its “refreshingness” which is an essential value of the brand. Also, its lineup has been diversified with favor variations and difference in carbonation level to suit the different tastes and needs of all generations. On the other hand, *WILKINSON* enhanced its brand value of “intense and refreshing stimulation” as the top soda brand to capture changing consumer needs and create a new beverage scene.

To help identify potential added values, we are also focusing on a research of various effects that sparkling water may have on people’s mind and body. To date, we have discovered that drinking sparkling water when in mentally demanding tasks, such as an office time, can help prevent drowsiness and maintain motivation.

We have also identified some other intriguing results that show promise for improving productivity,

such as an immediate increase in typing speed after drinking sparkling water.

In addition, we have also discovered new benefits of carbonated drinks, including that drinking sparkling water in hot environment such as summer weather helps improve mood and that drinking sparkling water while playing e-sports—which has recently gained in popularity as a barrier-free sport—may help to maintain judgment capability and enhance enjoyment of the game. The potential benefits of sparkling water are outlined in the “Asahi Carbonated Drinks Lab” (<https://www.asahi-inryo.co.jp/rd/tansan/>). We have high hopes for many benefits that sparkling water can provide for the body and mind in the future.





Maintaining technological strength to continue creating safe, secure, and environmentally friendly products

The Technology Research & Development Laboratory continues to pursue research aiming to improve our manufacturing technology to ensure efficient production, product quality and safety, so that we can deliver safe and delicious products to as many customers as possible. We engage in production tests at laboratory scale, development of new plastic bottles and packaging technology, as well as development of technologies to ensure the safety and security of the product contents, such as microbial analysis and physical and chemical analysis.

Product safety and security, enhancing brand value

We are working to develop technologies for the control, rapid detection, and identification of microorganisms in beverage products. We are also developing trace component analysis technologies that will lead to advancement and systematization of product design technologies.

Development of packages

We are working to develop product packages with improved usability, or packages that are more lightweight and attractive. We produce plastic bottles and cardboard cartons in a comprehensive process from design to mass production.

Technological development

We use our test plant to develop manufacturing technologies that add new value to our products. We are also developing upcycling technologies to reduce manufacturing residues and recycle resources.

Research

■ Development of packages friendly to both humans and the environment

With the rise of online shopping and disaster prevention awareness, an increasing number of consumers are purchasing whole cartons of large-volume PET bottled mineral water. We are also upgrading our cardboard packaging to more "human-friendly" designs, such as making opening the package more intuitive and incorporating strategically-placed slots in the cardboard for easy opening.

In addition, we have led the industry in developing "simple eco-label products"—environmentally-friendly products whose label wrappers can be removed easily—and "unlabeled products," which eliminate label wrappers entirely.

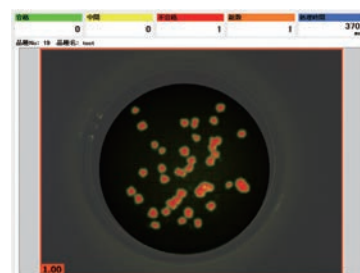
■ Developing technologies to maintain freshness and reduce manufacturing residues and manufacturing product samples for business discussions

We have upgraded our 1/10 scale test plant, with operation of the facility commencing in March 2023. This test plant is used to develop technologies to help maintain freshness and manufacturing residues. In collaboration with the Technology Research & Development Laboratory, we also install fermentation equipment and conduct technological development and verifications. The test plant is also used to produce plain samples for business discussions and serves as an important first step in bringing new products to a wider consumer base.

■ FLOX-AI, the soft drink industry's first AI-based rapid microbial testing system

Pre-shipment microbiological inspections for quality assurance typically require three to five days using conventional methods, and the final assessment is made through visual inspection—which is both time-consuming and labor-intensive. In order to address this hurdle, we have developed a technology that uses AI (deep learning image processing) to analyze fluorescent images of microorganisms and learn the differences in shape, color tone, and other characteristics and quantities between acceptable and unaccept-

able samples. This technology enables the inspection to be completed in around one day and to automatically detect the presence of microorganisms.





Development of food ingredients with unique values to support the wider market

We develop proprietary food ingredients and materials such as yeast materials, daily ingredients and freeze-dried ingredients. To give some examples, yeast-related ingredients extracted and processed from yeast (e.g. yeast extract), professional-use creaming powder born from the expertise of the developer of the first infant formula in Japan, and powder premix drinks and powder foods developed with the ingredients and technologies mentioned earlier are some of the various food ingredients and materials that we have developed. We support product development in the wider market by tailoring each ingredient to the specific needs of our clients and by engaging in basic research.

Development of dairy ingredients, freeze-dried ingredients, and powdered foods

We are working to develop dairy ingredients for a range of commercial applications, such as addition of flavor to dairy products and improvement of texture and color. We are also developing food ingredients such as fruit, plum, and miso as well as easy-to-use processed freeze-dried products that can be used as ingredients in food or health supplements without sacrificing nutritional value or other properties. Other development areas include powdered beverages for cup-type vending machines and OEM products that utilize these ingredients and raw materials. We aim to constantly provide optimal products by focusing on and meeting the diverse needs of our customers.

Development of yeast extract seasoning and their applications

We develop, change the design, and support the sales of yeast extract seasonings and other products making use of the nutrients and umami components included in yeast. We also develop applications for such seasonings according to client needs. We are also stepping up efforts on interdisciplinary product development by combining our expertise in dairy ingredient and powdered food development as well.

Development of high value-added yeast-based ingredients

We are focusing our efforts on developing yeast-based ingredients with higher added value, for example by establishing screening and cultivation methods for novel yeasts, and by carrying out multifaceted research on yeast utilization such as methods for producing yeast extract and processing yeast cell walls. In addition, we work on joint developments with various organizations, both within the Asahi Group and beyond, to propose new values to the markets of the world.

Research

■ Development of yeast cultivation technology

In order to obtain yeast with new functions, we carry out screening among the vast yeast strain library held by Asahi Group and investigations to identify the optimum cultivation conditions for each strain. We have succeeded thus far in commercializing of yeast products, by screening for yeast strains containing large amounts of glutamic acid and establishing special culture techniques. We have also developed yeast products rich in glutathione and nucleic acid.

■ Expansion of applications for yeast-based materials and ingredients

There are various materials and ingredients made by processing yeast including yeast extract and yeast cell walls. We are also developing suitable applications to make the most of the features of each ingredient. Not to mention applications in food products, we propose wide-ranging applications for yeast-based materials to our clients, for instance, using yeast extract as a culture medium component, or using dried yeast and yeast cell walls in pet food and animal feed

■ Technology development for expanding the applications of dairy ingredients for business use

We are also working to develop dairy ingredients that not only deliver distinctive dairy flavor, but are stable under a range of environments, including high temperatures, high salt content, and acidic conditions. We are striving to develop dairy ingredients and technologies that are suitable for a wide range of applications in terms of both flavor and function.



■ Development of ingredients and processing technologies for adding new flavor

As alternative protein sources such as plant-based meat are increasingly attracting attention worldwide, we are considering the use of yeast extracts as a seasoning to add meaty flavor. In addition, we are also developing new techniques to add flavor more effectively, such as those to process ingredients to add a smoke flavor.



Development of freeze-dried food products that offer freshly made taste and inspiration

Since the development of Japan's first freeze-dried miso soup with the ingredients and miso freeze-dried together into a block, we have continued to recreate a variety of foods and meals under the Amano Foods brand, such as miso soup, rice porridge, dishes to top a bowl of rice, curry, and pasta, using the freeze-drying technology. Our aim is to offer savory meals ready to eat just by adding hot water by further advancing existing technologies and identifying the optimum freeze-drying conditions for individual products. We also work on developing instant soup powder and other food products.

Development of freeze-dried food products

Before moving onto commercial production, we make prototypes of food products, including miso soup, other types of soup, and various side dishes, using our small-scale testing facility until we can realize the flavor we wanted to achieve. We identify the most delicious composition from countless combinations of ingredients and seasonings by repeating test production and evaluation.

Development of instant soup powder

The instant soup powder category needs to be responsive to changing needs, especially the rapidly changing convenience store trends. We are therefore constantly looking for new dried ingredients and seasonings that could be incorporated into instant soup and collecting information on powder blending and packaging technologies with an aim to create innovative products.

Competitive technology development and fundamental research

We strive to increase production efficiency and competitive edge by reviewing product processing methods. In addition, we study eco-friendly product design technologies, including through exploring new ways to reduce food waste and plastic use.

Research

Revamp of *Uchi no Omisoshiru* instant miso soup series

In autumn 2023, we launched our revamped lineup of *Uchi no Omisoshiru* instant miso soup products. In the development of the new product, we made improvements to further enhance the taste while maintaining the current taste and flavor. For the "Nameko mushroom and Wakame seaweed", one of the *Uchi no Omisoshiru* products, which was most susceptible to browning in color, we formulated a new substance that inhibits browning of the miso. This improvement allows our customers to enjoy the "freshly made taste" for longer.

Furthermore, the entire series was designed with the environment in mind. During the freeze-drying process, seasoned miso is frozen and dried in a vacuum machine. By concentrating the seasoned miso as much as possible, our process design reduces the amount of electricity used for drying, thus reducing environmental impact. Although we encountered challenges when con-



centrating the seasoned miso, such as freezing difficulties and reduced drying efficiency due to higher salt and solid content, we were able to overcome these hurdles through trial and error combined with the technologies we have developed over the years. Going forward, we will continue to pursue new developments from both an "offense" and "defence" perspective to achieve further innovation in manufacturing while delivering the high quality demanded by our customers.



For Achieving “deliciousness with added value”

We develop new products in a wide variety of categories, from tablet candies, candies, baked confectionery, chocolates, beverages, to dietary supplement, beauty food and skincare products. We not only make prototypes in our laboratories but also conduct test production at a larger scale using actual-size factory equipment to identify and solve problems encountered during the transition from laboratory scale to commercial scale. Our goal is, above all, customer satisfaction. We are working, both independently and as a team, to realize additional value for the customer, quality improvement from an early stage of development, and an environment that encourages new challenges and proposals.

Product development

To achieve a flavor, texture, appearance, and functionality that will satisfy a wide range of generations, we are constantly searching for new ingredients of high quality and innovative added value while considering the cost effectiveness as well.

Achieving deliciousness

We try to maintain our sharp senses of taste and smell by regularly conducting sensory evaluation tests. Objective evaluation is also employed by quantifying food texture in numerical terms. We also have our staff try tasting products and foodstuff that are attracting attention to enrich the food experience of our R&D staff to develop delicious products.

Offering additional value

We strive to create products that are not only delicious but offering added value and additional benefits, for instance, by developing foods with functional claims (dietary supplements and functional snacks) containing Asahi Group's proprietary functional ingredients such as lactic acid bacteria and milk-derived peptide.

Research

■ MINTIA

In developing the *Mintia* product line, we aimed to enhance the brand's essential value proposition of refreshment by focusing on all aspects of the product, including its taste and texture as a tablet confectionery, and to stimulate ongoing demand by delivering a product experience that contributes to health and wellbeing through refreshment.

We are also working to develop and launch environmentally-friendly products, including releasing the first *Mintia* product to employ a thinner plastic container in 2023.

■ Kotsukotsu Care

Kotsukotsu Care is a mail-order supplement containing live *Bacillus subtilis* C-3102. *Bacillus subtilis* C-3102 is a proprietary bacterial strain with probiotic health benefits that was discovered through research conducted by CALPIS Co., Ltd. As many customers who purchase mail-order food products take these supplements over a long time frame, we optimized the size and the number of capsules required per day in order to make it as easy as possible to continue taking this supplement on an ongoing basis.

■ Ippon Manzoku Bar PROTEIN

Ippon Manzoku Bar PROTEIN is a convenient, great-tasting nutrition bar that provides a protein boost.

To deliver products of the highest quality that fully satisfy our customers, we start from the selection of raw materials and conduct exhaustive research, such as studying the combination of different types and properties of proteins, to fulfill the product concept, including not only the high quality standards demanded by customers but also the perfect texture and taste.





Ensuring food safety for infants and the elderly

Building on the technologies heritage of Wakodo brand, which made the first infant formula in Japan, we develop infant formulas, baby foods, toddler foods and food products designed for the elderly. Making prototypes and providing follow-up for commercial production are not our only tasks. We also focus our efforts on thoroughly ensuring food safety and quality through careful selection of ingredients and collecting the latest information from academic conferences and councils. We engage in product development with an attitude as if to make something for our family members so that even infants and elderly people can consume our products with confidence and peace of mind.

Development of formulas for infants and young children

We seek ways to differentiate our products by examining various ingredients and content levels that will contribute to infant growth, while keeping in compliance with the specifications and standards for infant formula as specified by Japan's Ministerial Ordinance on Milk and Milk products Concerning Compositional Standards, etc. We also actively collect information from literature and academic conferences to design our formula based on the latest nutritional science and to ensure that babies will be able to take in sufficient nutrition from the infant formula alone.

Development of baby foods

Ingredients are selected and chunk size and firmness are adjusted by month of age according to the immature masticatory and digestive functions of infants. We have set our own standards on the content of nutritional components which is more rigorous than other standards to ensure that we can provide safer and securer products. While adhering to such rigorous standards, we try to achieve good taste by bringing out the best of the natural flavors of the ingredients and using good broth.

Development of care-related foods

We develop products designed to enhance the intake of such nutrients as protein, dietary fiber, and energy, which tend to be deficient in the elderly and people whose ability to eat has diminished. We offer authentic meals that would take a lot of work to cook by oneself, with reduced salt content and fine-tuned firmness and viscosity to enable these people to eat with confidence and peace of mind so that they can enjoy the experience of having a hearty meal.

Research

■ Development of "Goo Goo Kitchen with Plenty of Ingredients" aimed at revitalizing the baby food market

In developing "Goo Goo Kitchen with Plenty of Ingredients," we selected a wide variety of ingredients, including protein ingredients which are difficult to provide with homemade baby meals.

Additionally, in response to the needs of users, we were committed to increasing the volume of ingredients and completed a filling and satisfying food product. Further, this product is designed to enable easy nutrition intake by increasing the content of iron and calcium which tend to be deficient during the weaning period.



will be able to take in just the right amount of nutrition without excess or deficiency. Beta-lactoglobulin is an indigestible protein included in bovine milk but not in human breast milk. This protein contained in *Haihai* has been pre-digested to reduce the digestion burden for babies.

■ Development of satisfying nursing-care food

We believe that boosting the motivation to eat is an important factor for preventing malnutrition in the elderly. Based on this idea, we developed nursing-care food focusing on not only the deliciousness but also on more satisfaction than conventional care food. While giving consideration to soft texture and ease of consumption appropriate as universal design food, we succeeded in preparing food products that are delicious, satisfying and visually appealing at the same time by including larger cuts, selecting colorful vegetables and bringing out the deep taste of respective ingredients by adjusting the proportion of extracts and broth used.

■ Improvement of infant formula "Wakodo Lebens Haihai"

The best nutrition source for babies is breast milk. "Wakodo Lebens Haihai" has been repeatedly improved to approach breast milk and with consideration for infants' digestion and absorption abilities so that babies

Technology Research & Development Department I



Technological development supporting the development of “food with function claims”

Our department carries out technological development and materials research to support the healthcare, food and confectionery and freeze-dried food businesses. In recent years, we have focused our technological development efforts on the development of “food with function claims”, which has attracted a high level of attention in the health market. We have developed advanced component analysis technology and new functional evaluation technology. We contribute to the maintenance and promotion of our customers’ health by supplying them with products developed using these new technologies.

Research into functional ingredients

We research food ingredients with expected health benefits, including functional ingredients (such as lactic acid bacteria and milk-derived peptide and yeast) that have been developed independently by Asahi Group. We use advanced evaluation technology to verify the safety of each food ingredient, as well as a variety of functions.

Development support for “food with function claims”

“Food with function claims” requires scientific evidence to be submitted to the Consumer Affairs Agency. We support the development of “food with function claims”, including the selection of functional components to meet customers’ needs. We also help to put together and submit reports containing data proving the safety and functionality.

Development of evaluation technology and analytical technology in relation to functional components

We carry out the functional evaluation of materials using mainly human-derived cultured cells. The constituent components and functions differ from material to material, and for this reason we also develop the optimum analytical and evaluation methods. When human efficacy testing is required, we carry out functional evaluation to provide new health value from numerous perspectives, including coordinating testing based on the latest evaluation methods.

Technology Research & Development Department II



Technological development and analysis supporting product safety

Technology Research & Development Department II conducts food safety analysis to ensure and assure the safety and reliability of raw materials and finished products. We support the baby food business by analyzing various risk factors, including through the measurement of residual agricultural chemicals, heavy metal minerals, mycotoxins, and radioactive materials in food and the identification of foreign substances, and developing new analytical technologies.

Analyses for ensuring product safety

We ensure product safety by conducting analysis of radioactive materials in infant formula and residual agricultural chemicals in baby food products, microanalysis of heavy metal minerals and arsenic, analysis of mycotoxins in milk ingredients, analysis of foreign substances found in products and manufacturing processes, and microbial identification using a DNA sequencer and other equipment.

Improvement of analysis technologies and their accuracy

We explore new analysis methods to promptly respond to various risks. We also verify rapid microbial testing methods to save effort and time for testing at manufacturing plants.

Technological exchange with other departments

We hold exchange meetings with the quality assurance departments of our company plants to spread of our analytical technologies. We also provide consultation on foreign substance detection, microbial analysis, etc.



To introduce Asahi Group's proprietary functional ingredients to the world

We are contributing to the growth of the Asahi Group's functional food business through the development of new ingredients such as new lactic acid bacteria, as well as low-cost manufacturing processes of our ingredients already used in the business, and analytical technologies for their functional components.

Development of manufacturing technologies for Asahi group's proprietary ingredients

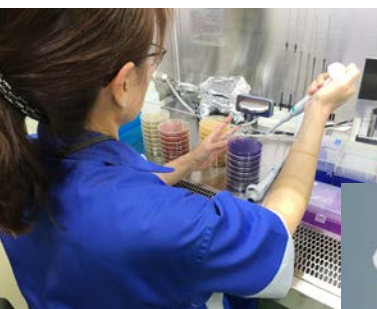
We develop manufacturing technologies to start industrial production or to reduce manufacturing costs of our proprietary ingredients including milk-derived peptides (e.g. Lactotripeptide) and lactic acid bacteria (e.g. *Lactobacillus* L-92 and *L. gasseri* CP2305).

Development of technologies for analyzing functional components

We work to standardize the composition of key functional components included in our proprietary ingredients, develop quantitative tests necessary for quality assurance of ingredients, and verify analytical precision. We handle a wide range of analytical methods, ranging from HPLC and LC-MS to fluorescent staining for bacterial count and enzyme activity evaluation.

Technical support for commercial utilization of Asahi Group's proprietary ingredients

We provide both internal and external collaborators with technical supports for their full utilization of our proprietary ingredients, such as preparing technical information documents necessary for Asahi's own consumer product application and/or overseas B2B food ingredient business.



Bacillus subtilis
C-3102



Contributing to the livestock industry through microbial research

We research and develop nature-based products to help farmers produce safe and high-quality meat and eggs. Numerous microorganisms reside in the digestive tract of humans and other animals. Inside our body, they form a microbiota whose balance has a large influence on our health. Asahi Biocycle Co., Ltd. engages in research to apply our microbial expertise accumulated over many years to supporting the healthy growth of livestock.

In addition, we manufacture and sell the agricultural materials derived from beer yeast cell walls and contribute to a stable agricultural production and turf management. We also provide technical supports to growers and sales channels.

Applying our technology to enable livestock production with minimal use of antibiotics

As demands for safe and reliable animal products increase around the world, the livestock industry needs to respond to calls for eliminating the use of antibiotics as growth promoters. Our research is making a great contribution to the healthy growth of livestock without depending on antibiotics and the efficient use of feed, which is receiving remarkable attention from livestock stakeholders worldwide.

Probiotic feed additive **CALSPORIN**

CALSPORIN is a probiotic containing *Bacillus subtilis* C-3102 for livestock animals including cattle, swine, and poultry. Research and farm trials around the world have demonstrated the positive effect of **CALSPORIN** on animal performance with consistent improvements in growth and feed conversion.

CALITER Mix livestock feed

Microorganisms are the key to effective composting, particularly the *Bacillus* species. By combining two *Bacillus* species (*Bacillus subtilis* C3102, *Bacillus coagulans* CP3425), which are active in different temperature zones, **CALITER Mix** livestock feed supports a smooth increase in fermentation temperature, helping to eliminate harmful bacteria and shorten fermentation time.



Realizing a well-being society with the power of microorganisms and science

We are engaged in research and development at a wide range of stages from fundamental research to prototype development and production technology development, centering on the area of microorganisms including lactic acid bacteria, yeast, and intestinal microflora,* where the Asahi Group's core technologies lie. We are committed to developing and commercializing ingredients and services that are sure to be effective by leveraging cutting-edge science to contribute to promoting our customers' health and happiness and in turn realizing a well-being society.

*Aggregates of various intestinal bacteria

Creating new values through fermentation

Aiming at creating food products and drinks with unprecedented value, we are engaged in search for and breeding of yeast, lactic acid bacteria, and other beneficial microorganisms and development of fermentation technologies utilizing them.

Pursuing the value of flavor

To propose new food values, we pursue research and development on the contributions of food components to the overall flavor of a food product as well as the various effects that delicious foods and drinks have on us.

R&D of functional ingredients

Targeting a wide range of food-derived substances such as yeast and lactic acid bacteria, we explore new functional ingredients, re-search their functional mechanisms and effectiveness on humans, and propose the commercial utilization of these ingredients.

Commercialization of ingredients using beneficial microorganisms

To realize the commercial production of ingredients using beneficial microorganisms, we work on implementing high value-added ingredients, including through development of new processes for mass production and research on starters.

Research

World-first finding that a specific species of intestinal bacteria contributes to improved performance in endurance sports

The human intestinal tract is populated with a wide variety of intestinal bacteria, known as gut microbiota, totaling some 40 trillion organisms, and it has become clear in recent years that this microbiota has a significant impact on health and disease. The Asahi Group has long studied the positive health effects of gut microbiota and the foods that help gut microbiota. As part of this research, we demonstrated—in a world first—that *Bacteroides uniformis* (*B. uniformis*), a species of human intestinal bacteria, contributes to exercise function and that ingesting the cyclic oligosaccharide α -cyclodextrin, which serves as a source of nutrition for this bacteria, can improve performance during endurance sports*.

We first studied the gut microbiota of 48 long-distance runners belonging to the track and field club (long-distance team) of Aoyama Gakuin University, our joint research partner. Our initial study found that their gut microbiota was rich in *B. uniformis* and that the

runners with higher numbers of this bacteria had faster 3,000 m times than

those with lower numbers. Next, ten ordinary male subjects were given supplements of α -cyclodextrin, a source of nutrients for *B. uniformis*, for eight weeks. The study found that not only did the number of *B. uniformis* bacteria in their gut microbiota increase, their 10 kilometer cycling time on an exercise bike improved by approximately 10%, and that their post-exercise fatigue was also lower. The mechanism behind this efficacy is believed to involve the acetic and propionic acids produced by *B. uniformis* in the intestinal system, and we hope these findings will have applications in the field of sports and athletic function in the future.



*SCIENCE ADVANCES · 25 Jan 2023 · Vol 9, Issue 4 · DOI: 10.1126/sciadv.add2120



R&D aimed at ensuring the sustainability of the environment and resources

To contribute to the sustainable future of the Asahi Group, we promote sustainability R&D. We work on five initiatives: development of technologies to reduce CO₂ emissions from plants and other impacts on the environment and create environmental value; sustainable securing of major ingredients such as barley and utilization of by-products; development of new applications of yeast resources; and research to promote responsible drinking.

Reduction of greenhouse gas emissions associated with the Group's activities

We are developing technologies to reduce greenhouse gas emitted in the manufacturing process (Scopes 1 and 2), eco-friendly containers and packages, energy-saving drink serving equipment, etc. (Scope 3).

Securing of resources and development of upcycling technologies

Climate change is expected to affect major ingredients for Asahi. We develop technologies that achieve stable procurement of these ingredients and upcycling by-products generated in the manufacturing process.

Development of new applications of yeast resources and their commercial production

With the aim of contributing to a sustainable society through our business, we are engaged in research and development to expand new applications and utilization of yeast resources held by the Group and create new businesses.

Research on alcohol and health

To actively promote "responsible drinking," which is one of the Asahi Group's material issues, we work on research projects to prevent alcohol-related issues in collaboration with outside research institutes, etc.

Research

Recovery and effective use of CO₂ emitted from plants

The Asahi Group has set out "contribute to a sustainable society through our business" as one of the guiding principles of the Asahi Group Philosophy. The Group is working on developing various technologies to achieve the Asahi Carbon Zero, the Asahi Group's medium- to long-term goal of reducing greenhouse gas emissions from the Group to zero by 2050. As part of this effort, with a view to separating and recovering CO₂ from the gas emitted every day from boilers and other facilities at plants, a testing equipment was installed at the Asahi Group Research and Development Center in 2020 to conduct demonstration tests. Meanwhile, to realize this technology, it is necessary at the same time to solve the issue of how to do with recovered CO₂. As part of these efforts, we are developing a recovery and purification process for use in the Group's products, such as beverages. We are also working to demonstrate methanation technology as a carbon recycling technology that uses carbon dioxide as a raw material for the production of other substances. Making effective use of the synthet-

ic methane as fuel for boilers and fuel cells would enable the reduction of greenhouse gas emissions from plants. The Group is also conducting development of world-leading technologies, including long-term test operation of a fuel cell power generation system using biomethane gas derived from wastewater.

The Group is also conducting development of world-leading technologies, including long-term test operation of a fuel cell power generation system using biomethane gas derived from wastewater.

The entire Asahi Group is working to actively utilize renewable energy at production bases across the world and promote energy conservation through such measures as revising manufacturing processes and improving logistics efficiency.





Safeguarding food safety throughout the Asahi Group

We use the latest technologies to address various risks such as chemical substances, microorganisms and contamination by foreign materials, to ensure the safety of raw materials and products of the Asahi Group (AG). We also provide technical support to both domestic and overseas AG companies to improve the safety level.

Developing analysis technology to address a wide range of risk factors

We develop analysis techniques to address various risk factors including trace amounts of residual agricultural chemicals, heavy metals and microorganisms. We also engage in the development of comprehensive analysis methods capable of detecting and identifying even unexpected substances so that we can respond to contingency situations.

Development of life science analysis technology

By using advanced analytical technologies and data science, we develop fundamental research technologies applicable for food safety and the creation of unique global value.

Supporting AG companies through analysis technology

We provide technical support to AG companies using the latest inspection technologies such as DNA analysis and highly reliable spectrophotometric assays that have been applied to forensic investigations. We have contributed to both the AG and our customers by handling cases that are difficult to analyze at external institutes and ensure safety and security of AG products.

Research

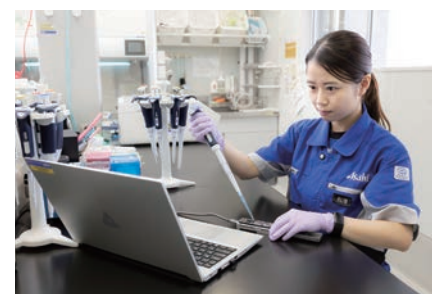
Developing and deploying techniques using MinION sequencers for the identification of beer spoilage bacteria in overseas breweries

As Asahi Group accelerates global expansion through the acquisition of overseas beer breweries in recent years, we are increasingly committed to assuring the quality of its products whether manufactured both in and outside of Japan. We have been engaged in technical collaboration with European beer brewers since 2018 and have supported the local engineers to enhance techniques to detect and identify beer spoilage bacteria.

As our latest project, we are developing a technique to analyze beer spoilage bacteria at the genetic level for more accurate identification of the bacterial species. We introduced a low-cost, palm-sized genetic sequencer named MinION that can be easily operated by on-site engineers. We have succeeded in significantly reducing the overall processing time by simplifying the process for extracting DNA from the bacteria, and additionally improving the process so that multiple samples can be analyzed at a time. Furthermore, we established a technique that can be applied to identify not only beer spoilage bacteria but a broad variety of bacterial spe-

cies that may be present in the manufacturing environment posing potential risk to beer quality. (The technique has been filed for patent protection).

We conducted a verification test using this technique in a plant in Rome. After the technique was optimized to the local circumstances, even inexperienced staff without any knowledge of molecular biology techniques can operate the technique by participating a short training program. Thanks to their efforts, we were able to obtain reliable results. The technique has been successfully implemented in the plant. We are planning to further deploy the technique to other overseas plants in the future.





Applying state-of-art technologies to realize new possibilities for alcohol beverages

We are conducting state of the art research to develop new and attractive alcohol beverages and make the world more enjoyable with alcohol beverages. Scientists specializing in various fields including fermentation, sensory evaluation and aroma analysis bring together their research findings to develop products that will open up new possibilities of alcohol beverages.

Development of brewing techniques

We explore ways to more efficiently produce for higher-quality alcohol beverages through detailed analysis of the relation between each manufacturing process and the flavor of the beverages. We are also working to develop brewing techniques to realize beverages with new, attractive flavors.

Analysis of taste and aroma components

The flavor components are very important for alcoholic beverages. We perform research and development of the components that contribute to forming the flavor of beverages. We try to increase pleasant flavor and decrease unpleasant flavor and taste.

Sensory evaluation

In order to ensure that high quality delicious products are delivered to customers, it is important to evaluate whether the product actually carries the intended flavor. Sensory evaluation is performed by trained evaluators on a daily basis and used to inform the development of new technologies and products.

Development of fermentation technologies

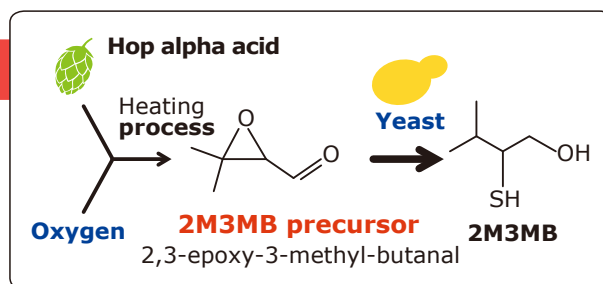
We research the genes function of microorganisms and its appropriate management methods, in order to promote the healthy fermentation of microorganisms such as yeast and make delicious alcohol beverages.

Research

First in the world to identify an off-flavor precursor

While it is almost impossible to find a unified definition for a "good" beer, we think that "having sophisticated flavor and aroma free of unpleasant odors and tastes (i.e. off flavor)" is one important definition of a good beer.

One type of off flavors found in beer is called sulfury flavor caused by sulfur-containing compounds which may occur depending on the ingredients used, abnormality in the brewing process and storage conditions. One of the sulfury flavor, often described to have an onion-like odor or sweaty smell, is known to be caused by 2-mercapto-3-methyl-1-butanol (2M3MB). This substance has been known for long to affect the flavor of beer, but had not been fully examined, because it was difficult to analyze due to its extremely low flavor threshold and content (in terms of ppt). Encouraged by the recent advancement of analytical instruments, a research project was launched to develop technology for controlling off-flavor and ensuring consistent good flavor.



2M3MB is not present in wort, which beer is made from, but produced later in the process of fermentation by yeast. Therefore it was believed that a precursor to 2M3MB must be present in the wort. For decades, however, no one succeeded in identifying this precursor. We purified constituents of hop and performed fermentation tests repeatedly in search for the precursor, and finally identified 2,3-epoxy-3-methyl-butanol as the precursor of 2M3MB through structural analysis using GC/Q-TOF and other latest analytical instruments. We will continue our research to find out how the yeast metabolizes the precursor and convert it to 2M3MB.

*This research was presented at the World Brewing Congress 2016, one of the largest international academic conferences in the world.

Our facilities

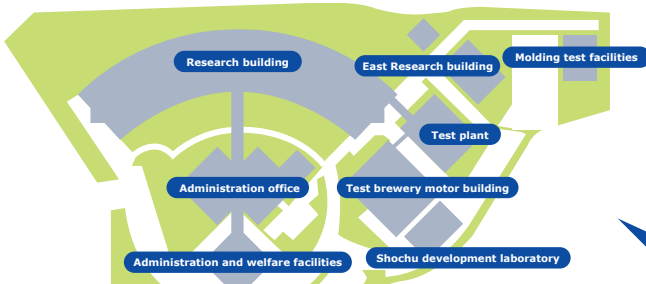
Asahi Group Research and Development Center (Moriya)

1-1-21 Midori, Moriya, Ibaraki
302-0106, Japan

Asahi Group Research and Development Center (Moriya) has a Group-wide operating model to create technology synergy and new value through R&D activities crossing organizational borders.



Area Map



About the Facilities

Active information exchange is taking place across organizational barriers in our office area, where we have introduced a free address system in our office area to allow workers to freely choose their seat and move around according to their mood or work. In addition, we offer Wi-Fi and a comprehensive search system covering a wide range of information from the world so that researchers can access necessary information anywhere and any-time. Combined with welfare facilities including the cafeteria and the refresh room, we provide a work environment to stimulate flexible thinking.

We are also committed to environmental conservation and have been certified for ISO 14001:2015 (environmental management systems).

- Research building
- Administration office
- Administration and welfare facilities
- Office
- Laboratory
- Library



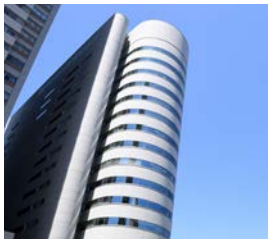
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◀ Website

