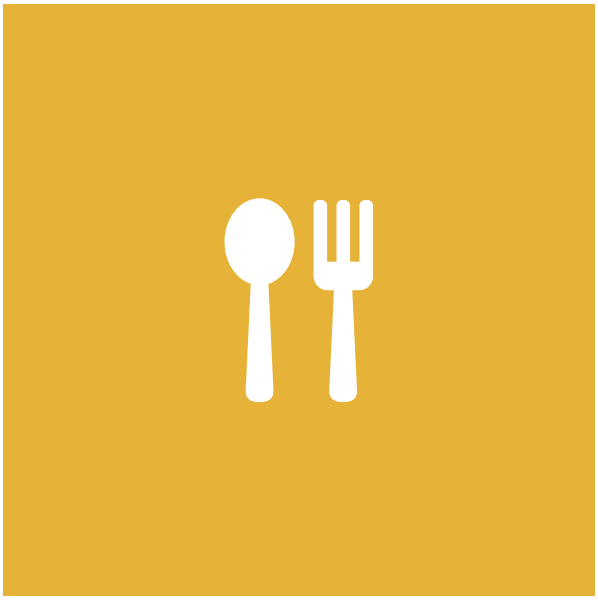
“AminoScience” in action

“AminoScience” is one of the sources of our Group’s unique competitive advantage. In the four growth areas of Healthcare, Food & Wellness, ICT, and Green, we can co-create greater social value and economic value.

Healthcare

Contributing to advance treatment and prevention and to help extend healthy life expectancy

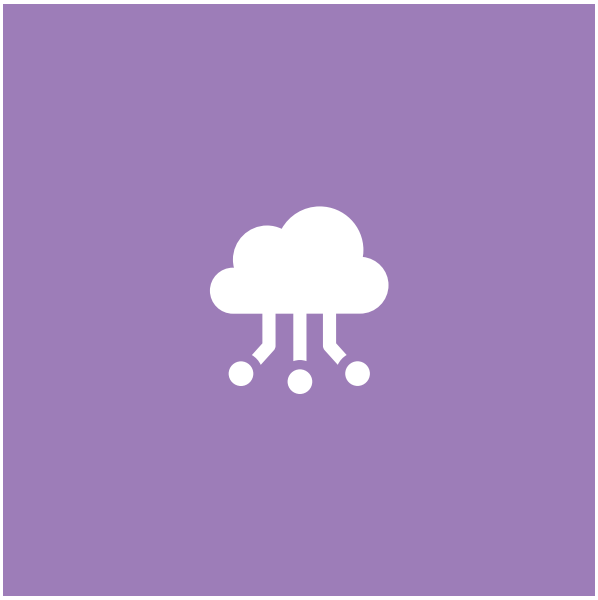
We are using “AminoScience” to deeply understand the human body and create therapeutic modalities that will advance medical treatment and prevention and contribute to longer, healthier lives.



Food & Wellness

Contributing to well-being and self-fulfillment through food

With a new business model utilizing “AminoScience,” we can connect with all consumers to offer delicious foods and services. Our aim is to provide products and services that promote health, nutritional value, and well-being.



ICT

Contributing to advance semiconductors for a smart society

We are applying “AminoScience” to innovate faster semiconductors with lower environmental impact, and to improve the well-being of consumers in a smart society.

Green

Creating new food standards and transitioning to recycling-based biocycles

We are creating new food standards for future generations and reducing our environmental impact. We are applying “AminoScience” to realize a sustainable society and planet through the transition to recycling-based biocycles with less environmental impact.

CIO Dialogue

The strength of the Ajinomoto Group based on “AminoScience” and establishing sustainable growth through innovation in the four growth areas

CIO Shiragami on advancing “AminoScience” to pursue innovation—“We will dramatically increase the Ajinomoto Group’s corporate value with our human resources’ passion toward our Purpose and the power of ‘AminoScience’.”

Hiroshi Shiragami

Director, Representative Executive Officer & Executive Vice President Chief Innovation Officer (CIO), Supervision of Research and Development

Interviewer: ASV Report Editorial Team

Q1

What is the Ajinomoto Group’s “AminoScience”?

As stated in the Ajinomoto Group's Purpose “Contributing to the well-being of all human beings, our society and our planet with ‘AminoScience’,” I believe that “AminoScience” is the starting point where all employees play their part in creating value.

“AminoScience” is the source for the Ajinomoto Group's unique strengths and competitiveness of the businesses we have developed from our pursuit of the function of amino acids and from our dedication to co-creating social value and economic value since our founding over a century ago. “AminoScience” is a collective term for the various materials, functions, technologies, and services derived from research and implementation processes with a rigorous focus on the functions of amino acids. It also refers to the Group’s unique scientific approach to connect these findings and services to help resolve social issues and contribute to well-being.

Everyone in the Ajinomoto Group is actively working to

refine and apply “AminoScience” to help resolve social issues and provide social value, as we are passionate about creating ASV. Our various business operations around the world are working to create substantial social value by offering products matched to local food cultures and co-creating innovation with diverse partners.

Through pursuing innovation with “AminoScience” in the four growth areas of Healthcare, Food & Wellness, ICT, and Green based on future social value, we can co-create even greater social value and economic value for the future.

The bodies of all living beings are made of protein, and protein are made of amino acids. Amino acids play an essential role in maintaining the biological functions of living things. By exploring the functions of amino acids, “AminoScience” can contribute to the well-being of all human beings, our society and our planet. I believe that the value “AminoScience” can provide is virtually unlimited.

Q2

What has been the role of “AminoScience” in the growth of the Ajinomoto Group?

“AminoScience” has been our source for the innovation that has enabled us to diversify our operations and expand our businesses worldwide for over 100 years. The two main drivers for the global expansion of the B2B and B2C operations of the food products business have been our Deliciousness Technologies and our local approach to marketing in each country. In all of our activities from the worldwide fermentation production of the AJI-NO-MOTO® umami seasoning and nucleotide seasonings to the development and sale of unique services and products, the Ajinomoto Group’s employees work closely with communities in each country to provide deliciousness adapted to local food cultures and customs. Consumers in each country love the seasonings, processed foods, and beverages we have created using “AminoScience.”

The food products business is the Group’s core operation, and it will continue using “AminoScience” to drive the development of its operations and achieve steady growth.

The AminoScience business has expanded their amino acids and specialty chemicals businesses by engaging in all types of amino acid production and developing applications by utilizing physiological, nutrition, and reactivity functions of amino acids. We are using our existing businesses as a base for recognizing innovation ahead of time and co-creating new value with our ecosystem partners in the medical and semiconductor markets. Through this, we will continue to develop “AminoScience” and our business models to set the foundation for the Ajinomoto Group to undergo an unmatched business model transformation. In the 10 years since 2011, the business fields that have implemented this business model generated an average CAGR of roughly 18% in business profits.

Q3

How were the four growth areas decided upon?

The goal for our “purpose-driven management by medium-term ASV initiatives” is to dramatically expand our business. To achieve this goal, we set four growth areas where we will follow a basic policy of applying “AminoScience” and focus on high-growth markets

where we can create high social value. We formed a roadmap for the Group by backcasting to ensure we would make tangible progress toward our vison for 2030. The first step was to talk with next-generation employees and key managers to create a Picture of the Future of human beings, society, and the planet. The next step is to identify social issues in the four growth areas where we can apply “AminoScience” to create social value.

The four growth areas are areas where the Ajinomoto Group can use the unique value creation of its businesses to help resolve social issues and contribute to well-being and apply the Ajinomoto Group Creating Shared Value (ASV) to enhance its corporate value and fulfill our Purpose.

Q4

What are the basic growth strategies in the four growth areas?

“AminoScience” is the primary source of our market competitiveness, and it will be important to reconsider it from the perspective of the whole Group. Put simply, we need to integrate food products business and AminoScience business. Our management strategy is currently especially focused on advancing initiatives to bring together our four intangible assets – human, technology, customer, and organizations. These initiatives include interchanging personnel and organizational structures across the food products business and AminoScience business, integrating our technologies of both businesses, connecting customer data to product and service value, and interlinking the B2B and B2C businesses. We are also developing business models of BMX in four growth areas, that transform business models based on our existing businesses.

Q5

What are the specific strategies for the four growth areas?

We have specific growth strategies for each of the four growth areas.

In the Healthcare area, we are applying “AminoScience” to gain a deeper understanding of the human body that will enable us to further advance health-related treatment and prevention and contribute to extending healthy life expectancy. We are looking ahead to advances in medical modalities and are developing “AminoScience” and business models to make them a reality. In the current pharmaceutical amino acid business, we will transform the business model to support expansion into nucleic acid drugs and other biopharma services as well as biopharmaceutical and regenerative medicine media, and to further expand the medical food business. We are also laying the groundwork for gene and cell therapy as future fields where “AminoScience” will drive next-generation businesses.

In the Food & Wellness area, the foundation for sustainable growth is the food products business, which maintains strong brand trust worldwide and is steadily growing from its close contacts with local communities. To add to our growth potential, we will expand our business frontiers by continuing to provide deliciousness catered to local food cultures. We established the Marketing Design Center in Japan to develop new market fields, revitalize business by developing appealing new products and resolving challenges, and create locally successful products for global markets. By improving the sophistication of our marketing and continuing to develop AJINOMOTO Park, which connects to 10 million unique users per month, we will develop products attuned better to consumer preferences, provide direct-to-consumer solutions, and build new Food as a Service (FaaS) businesses. We will use digital technology to connect with consumers and gain a deeper understanding of their

expectations and issues, and apply “AminoScience” to provide delicious food products and services that enhance personal health, nutritional value, and well-being based on each consumer’s own personality.

The ICT area will contribute to advances in semiconductors and the creation of a smart society. We created Ajinomoto Build-up Film® (ABF) with “AminoScience” as a support business for the sustainable production of commercial AJI-NO-MOTO® and nucleotide seasonings, and then built it into a business of its own. ABF has become an essential material for semiconductor substrates, and our ongoing development is generating growing demand for ABF with advances in semiconductors for PCs, servers, data centers, generative AI and graphics processing units (GPUs). We will continue actively co-creating with our ecosystem partners in the semiconductor field to form businesses in new areas and seize opportunities to pursue new business opportunities in next-generation semiconductor systems, such as optoelectronic co-packaging. Our ICT activities connect to our other growth areas by helping to improve consumer well-being with food products and services, and to extend healthy life expectancy in a smart society.

In the Green area, we will build the next pillar of our food products business by creating a new food standard named “with Earth” food which focuses on sustainable, delicious, and healthy food products with low environmental impact for future generations. We are approaching the challenge to establish sustainability as an opportunity to use “AminoScience” for innovation. Our objective is to construct a complete social ecosystem that is sustainable and planet friendly by converting our fermentation production biocycle into a zero environmental burden process. We are also developing solutions for improving the quality of plant-based food products, and advancing development of precision fermentation, regenerative agriculture, and other areas.

Q6

Lastly, what will be the key to achieving the growth that the 2030 Roadmap aims for?

To achieve the growth we are aiming for, we must pursue current opportunities and issues facing our businesses and turn them into business growth, and we must continue developing business models by taking an overall view of our Group’s core strengths anticipating changes in consumers, society, and the market. Our fundamental strength arises from the tangible and intangible assets in our current food products and AminoScience businesses. One of the most important keys to fulfilling the 2030 Roadmap will be to further develop our business models by integrating and fully using our human, technology, customer, and other intangible assets. The 2030 Roadmap interlinks our business departments and provides a framework for examining and promoting strategies in the four growth areas.

We are also strengthening our strategy for discontinuous growth. We have innovation strategy teams around the world that are gathering information on global innovations and potential partner candidates among startups, leading-edge companies, and collaborative partners. In addition, we are constantly updating our comprehensive growth strategies, including discontinuous corporate venture capital, joint ventures, and M&A strategies, in each business and domain.

And, human resources are vital as the most important element. From strategy conception to execution, a highly dedicated Ajinomoto Group workforce that approaches our targets as one’s own initiative is essential to fulfilling the 2030 Roadmap. We have and will continue to engage in management and employee dialogue to share our Purpose, stoke passion, and enhance our ability to execute.

Connecting the core businesses to the four growth areas

Our current core businesses will be the foundations for growth in the four areas to bring us to our vision for 2030.
We will further hone and activate our strength in “AminoScience” to achieve dramatic growth.

Current business of the Ajinomoto Group

The Ajinomoto Group operates a wide range of businesses around the world centered on our food products business and AminoScience business. The food products business encompasses Sauce & Seasonings, Quick Nourishment, Frozen Foods, and Solution & Ingredients. The AminoScience business includes Bio-Pharma Services & Ingredients and Functional Materials. Each of these businesses are built around the Group's product and service strengths. While emphasizing these strengths, we are shifting our focus to four specific growth areas to take us to our vision for 2030.

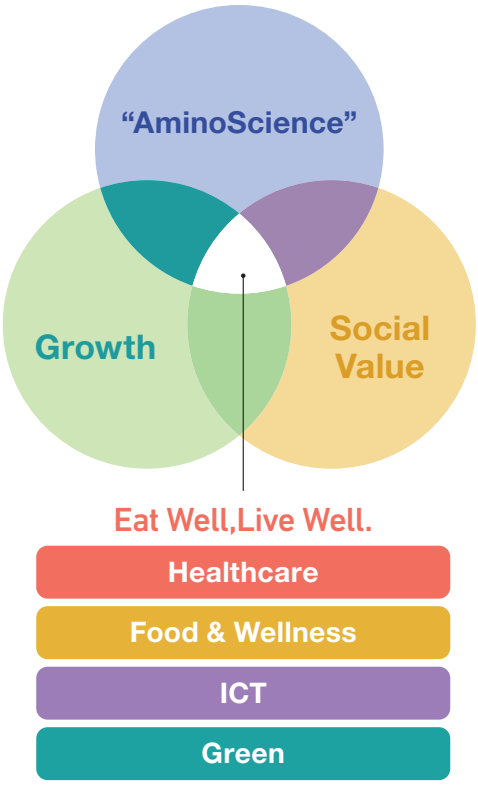
Ajinomoto Group’s Business Activities

Food products business

Businesses that apply “AminoScience” to Seasonings & Foods, and Frozen Foods

AminoScience business

Businesses that apply “AminoScience” to Healthcare and Others



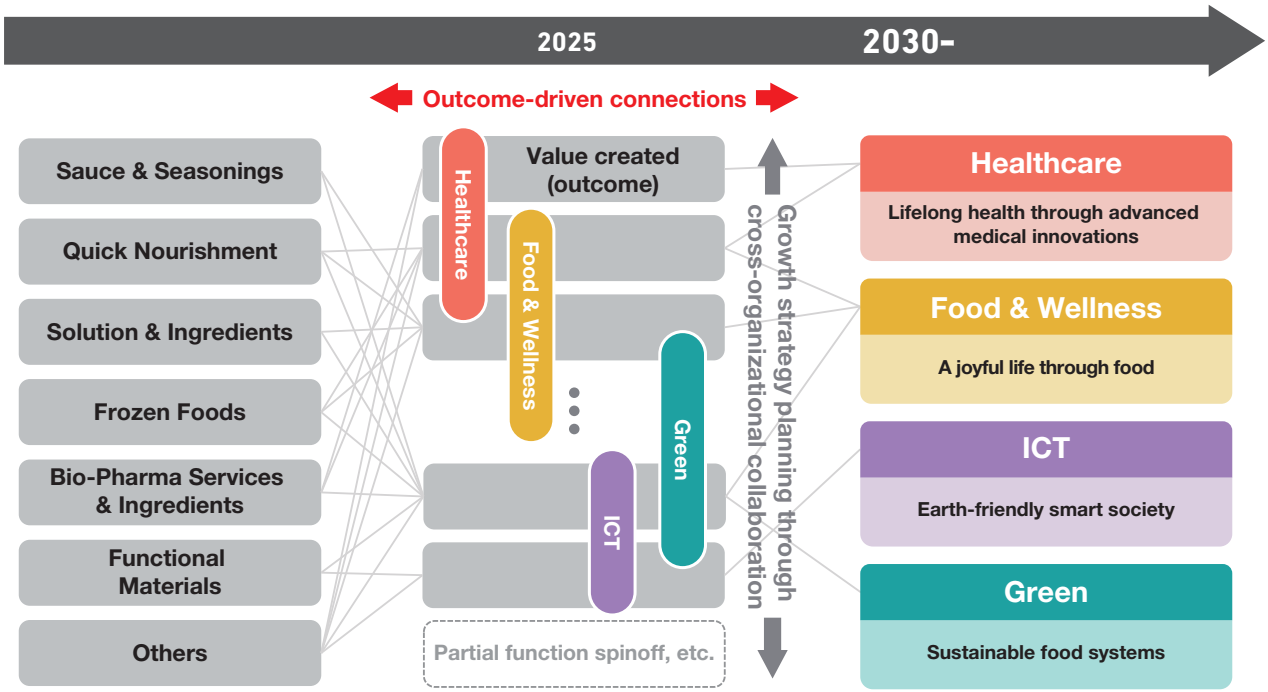
The four growth areas

The Ajinomoto Group is aiming to fulfill its vision for 2030 and beyond by directing its current food products and AminoScience businesses toward four growth areas where we expect ongoing long-term market growth, where we can create attractive social value, and where we can fully leverage our “AminoScience.” We are refocusing our business target areas and concentrating the investment of the Ajinomoto Group management resources into the four growth areas of Healthcare, Food & Wellness, ICT, and Green.

Leveraging “AminoScience” to drive dramatic growth in four growth areas

We will progress toward our vision for 2030 by following the growth strategies to deliver value in the four growth areas and by interconnecting the tangible and intangible assets across the conventional businesses and organizational lines of the food products and AminoScience businesses.

Many of our businesses are already leveraging the strength of “AminoScience,” but we will further refine and apply it to develop businesses that further that enhance the value we provide in the four growth areas and drive dramatic growth for the Ajinomoto Group.



Healthcare

Strengths in Healthcare area and the development of "AminoScience" and business

The Ajinomoto Group has been developing businesses in the healthcare field, which utilizes the functions of amino acids, since around the time of its founding.
The accumulation of scientific knowledge also bears fruit in the healthcare field.

History of the Ajinomoto Group Healthcare Area

1910s B2B materials business begins with the Company's founding

1956 Pharmaceutical amino acid business started, supplying essential amino acids for infusion solution

1981 Pharmaceautical enteral nutrition business using amino acids launched

1987 Japan's first serum-free culture medium introduced

1989 S.A. OmniChem N.V., a contract manufacturer of small molecule drugs in Belgium, acquired (currently S.A. Ajinomoto OmniChem N.V.)

2012 Joint venture Ajinomoto Genexin Co., Ltd. established in South Korea to develop and manufacture biopharmaceutical culture media

2013 Althea Technologies, Inc., a biopharmaceutical contract developer and manufacturer in the United States, acquired (currently Ajinomoto Althea, Inc.)

2016 GeneDesign, Inc., a CDMO for nucleic acid drugs in Japan, acquired

2018 Cambrooke Therapeutics, Inc. acquired, entry into the medical food business supplying products for people with PKU

Ajinomoto Kohjin Bio Co., Ltd. established to manufacture culture media for regenerative medicine

2020 Nualtra Limited, a medical food provider in Ireland, acquired

Taking on the challenge of innovation is one of our strengths in the healthcare field.

The Ajinomoto Group also uses the function of amino acids to develop business in the healthcare field, and launched its first B2B materials business in 1909, the year of the Group's founding. In 1956, we began selling amino acids for medicinal use, and our amino acids were also used in the world's first amino acid infusion solution.

In the 1980s, we developed and launched our own pharmaceutical enteral nutrition and used amino acids as a protein source with excellent digestion and absorption. In addition, we supply amino acids for various pharmaceutical products such as glutamine for gastric ulcer drugs and valine, leucine, isoleucine, and arginine for liver desease treatments. We also introduced animal cell culture medium and Japan's first serum-free culture medium.

We have been especially active in biopharmaceutical and regenerative medicine research in recent years where we are developing applications for "AminoScience." We made a full-scale entry into the production and sales of biopharmaceutical manufacturing media in 2012 with the establishment of a joint venture with Genexine Inc., of South Korea (acquired sole proprietorship in 2023). In 2014, we developed culture media for iPS and ES cells, which are attracting attention in regenerative medicine, and in 2017 we established a joint venture with Kohjin Bio, of Japan, to strengthen our capabilities in regenerative medicine culture media. As with our abilities to develop food and other products, we intend to use our growing knowledge and expertise in scientific research in amino acids to produce products for the healthcare field.

In the bio-pharma service field, we expanded our pharmaceutical contract manufacturing business in 1989 by acquiring the Belgian company S.A. OmniChem N.V., which facilitated joint development and co-creation with customer global pharmaceutical manufacturers.

We strengthened our ability to produce protein drugs and other products for the biopharmaceuticals market by acquiring Althea Technologies, Inc. of the United States, in 2013, and established a contract manufacturing service to cover all volumes from small-lot to mass production of oligonucleotide products by acquiring GeneDesign, Inc. of Japan, in 2016. We have enhanced the structure to provide solutions and services meeting all of our client's needs by effectively utilizing these tangible assets and expanding our unique technologies and services, including AJIPHASE®, an intangible asset of the Ajinomoto Group.

In addition to pharmaceuticals, we will also expand our customer base to the medical food field. We entered the medical food market in 2018 by acquiring U.S. medical food company Cambrooke Therapeutics, Inc. to provide products to patients with the amino acid metabolism disorder phenylketonuria (PKU). Although the number of PKU patients is relatively small, our products address their deepest concerns. In 2020, we added the Irish supplement company Nualtra Limited into the Group. Nualtra offers products to improve the quality of life of people with dietary restrictions due to illness and seniors with nutritional deficiencies due to aging by offering medical foods that efficiently deliver nutrients with minimal burden on the body. By deepening our relationships and engaging in close dialogue with pharmaceutical firms and other companies, research institutions in related fields, and customers using our products, we are continuing to develop and hone the strengths of "AminoScience." We are building out our portfolio of companies and our range of expertise to pursue innovation and prime our ability to address future issues in the healthcare field.

Healthcare

Contract oligonucleotide therapeutics business The AJIPHASE® breakthrough

The Medium-Term ASV Initiatives 2030 Roadmap aims for the AminoScience business to be generating business profits at the same level as the food products business by 2030. The Bio-Pharma Services business will play a key role in our growth strategy for the AminoScience business.

Why the Ajinomoto Group is positioned to contribute to a new era of medical care

The Bio-Pharma Services business has been attracting attention in recent years as a rapidly growing business utilizing “AminoScience,” which is being led by our AJIPHASE®. Our Bio-Pharma Services manufacture oligonucleotide compounds that pharmaceutical manufacturers use to produce oligonucleotide therapeutics.

Broadly speaking, there are three types of drugs: small, medium, and large molecule drugs. Most conventional medicinal therapeutics are small molecule drugs with low molecular weight. Large molecule drugs, or biologics, are composed of proteins with large molecular weight. Antibody therapeutics, such as the Opdivo cancer therapy, are a type of large molecule drug. Currently, medium molecule drugs are receiving attention. The oligonucleotide compounds that the Ajinomoto Group manufactures are gaining recognition as a promising third type of medical modality. The oligonucleotide compounds that are the main component of oligonucleotide therapeutics can be produced through chemical synthesis, which reduces manufacturing cost, and offer high target specificity, therefore causing minimal side effects. Oligonucleotide therapeutics are being used to treat hereditary and cardiovascular diseases, which have been particularly difficult to treat, and offer new avenues for treating cancer and viral infections.

Features of oligonucleotide therapeutics

	Small molecule drugs	Nucleic acid drugs	Large molecule drugs
Manufacturing method (cost)	○ Chemical synthesis (low)	○ Chemical synthesis (low)	Biofabrication (high)
Intracellular targeting	○ Yes	○ Yes	No
Intracellular RNA targeting	No	○ Yes	No
Target molecule specificity	Low	◎ Even higher	○ High
Side effects	Many	○ Few	○ Few
Medicinal efficacy	Low	○ High	○ High

Partially processed by our company based on “The World Middle Molecule Drug Market” (TPS)

Market environment change from 2016 to 2022

Number of approved nucleic acid drugs: 5 ▸ 16 (3 times)

Number of clinical trials of nucleic acid drugs: Approx. 300 ▸ Approx. 700 (2 times)

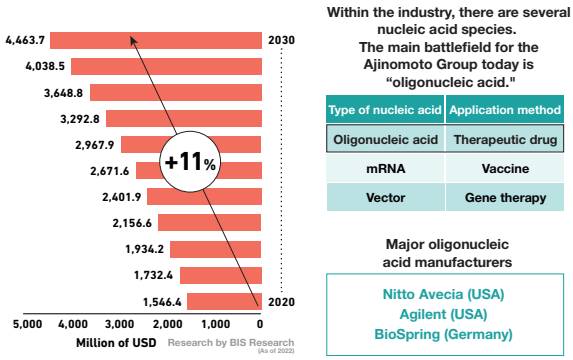
A comparison of the features of small, medium, and large molecule drugs for oligonucleotide therapeutics. Oligonucleotide therapeutics are characterized by higher specificity for target molecules and fewer side effects compared to conventional small molecule drugs.

AJIPHASE®—the world’s only combined solid- and liquid-phase synthesis technology

The oligonucleotide therapeutic market is currently growing at an annual pace of around 11% and is expected to reach a market size of ¥450 billion by 2030 (see Oligonucleotide compounds CDMO market). Markets with such growth promise usually lead to intense pricing competition that reduces profit margins. However, our AJIPHASE® contract manufacturing service for olionucleotide compounds uses a unique liquid-phase synthesis method which will allow us to offer price competitive services while maintaining a high profit margin.

The most common method used to produce olionucleotide compounds is solid-phase synthesis. Although used

Nucleic acid drug CDMO market



Within the industry, there are several nucleic acid species. The main battlefield for the Ajinomoto Group today is "oligonucleic acid."

Type of nucleic acid	Application method
Oligonucleic acid	Therapeutic drug
mRNA	Vaccine
Vector	Gene therapy

Major oligonucleic acid manufacturers

Nitto Avecia (USA)
Agilent (USA)
BioSpring (Germany)

The nucleic acid drug industry is in an overall growth stage, and the CDMO market for nucleic acid drugs is expected to grow to ¥450 billion in 2030. / Manufacturing contracts tend to go to the small number of leading CDMOs. Key to competitiveness will be unique strengths and differentiation.

worldwide, the method requires an expensive dedicated synthesizer and uses a large volume of organic solvents and raw materials to produce only a relatively small amount of deliverables. Although the process is relatively short, it can only synthesize small amounts at one time. This makes solid-phase synthesis adequate for small-lot synthesis for reagent products but not suitable for mass production of final products.

The liquid-phase synthesis method developed by the Ajinomoto Group has essentially the opposite characteristics. Liquid-phase synthesis uses less organic solvents and raw materials and the process speed is slower but industrial-scale mass production is possible with a single synthesis. In addition, the process allows for quality analysis to be performed during synthesis, which enables the formulation of high-quality processes. The most efficient manufacturing process would therefore be a combination that takes advantage of both processes—solid-phase synthesis to produce small volumes at the reagent step followed by liquid-state synthesis for mass production of the finalized product. The Ajinomoto Group provides the world's only oligonucleic compound contract manufacturing service that combines solid- and liquid-phase synthesis, and our manufacturing structure enables us to handle any level of volume from micrograms to tons.

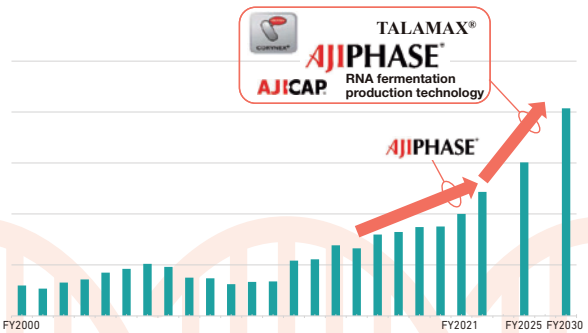
In addition to reducing manufacturing costs, AJIPHASE® also allows companies to use its standard small molecule synthesis facilities with minimal capital investment. The Tokai Plant has converted from manufacturing small molecule active pharmaceutical ingredients (APIs) to liquid-phase manufacturing of medium molecule APIs. Another advantage of liquid-phase synthesis is that it allows for collaboration among companies, and we have already started working with new partner companies. We are also tightening our collaboration with YMC Co., Ltd. for purification.

We are strengthening our production structure using the liquid-phase synthesis method to develop it into a CDMO business.

Our primary method for fortifying our infrastructure has been through capital investment, such as with the acquisition of GeneDesign or by improving our business sites. As we work toward our objectives for 2030, we will now be focusing on enhancing the high-value-added services unique to the Ajinomoto Group to fortify the advantages we have over rival firms. One major aspect of this will be transforming from a contract manufacturing organization (CMO) to a contract development and manufacturing organization (CDMO).

We are continuing to develop the AJIPHASE® technology for the new era of nucleic acid medicine and steadily growing market demand by expanding our manufacturing capacity, introducing new technologies such as hybrid manufacturing methods using enzymes, and creating a unified global marketing team to strengthen our marketing structure.

Image of sales expansion of the Bio-Pharma Services business

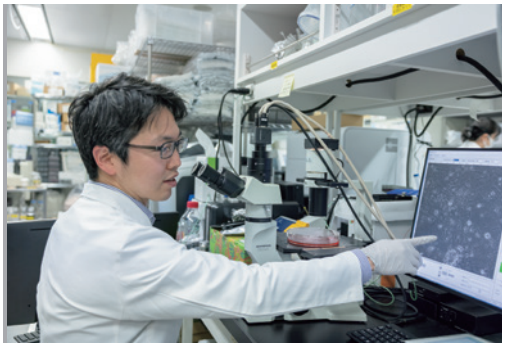


The progress made in the expansion of the Bio-Pharma Services business is remarkable. We will strengthen our AJIPHASE® and other unique manufacturing technologies and solution capabilities to boost sales and accelerate our profit growth.

Healthcare

Strength of the Ajinomoto Group in culture media for regenerative medicine

Regenerative medicine is anticipated to become a groundbreaking area of medical treatment in the 21st century, with research and development of culture media being one of the most important issues in this field. The Ajinomoto Group contributes to this research and development.



Two leading medical experts in cutting-edge cardiac regenerative medicine talk about contribution of the Ajinomoto Group and their expectations for the future

Dr. Keiichi Fukuda is CEO and Representative Director of Heartseed, Inc., a company whose mission is to open the door to the treatment of heart disease through regenerative medicine. He began research into myocardial regeneration in 1995 while working at Keio University Hospital. During his research, Dr. Fukuda successfully differentiated cardiac muscle cells from bone marrow, going on to achieve further success by creating cardiomyocytes from iPS cells, and focusing on the potential of medical culture media (cell culturing media), he presented his findings at an academic conference. “Mr. Okamoto, a researcher from the Ajinomoto Group, attended that conference, and was interested in my work. Cell culture medium contains a great many amino acids, and the Ajinomoto Group had a wealth of knowledge gained from research in this area. Discussions with Mr. Okamoto convinced me that it would be possible to promote growth at every stage of cultivation of cardiomyocytes from iPS cells by putting careful thought into the culture medium, and I decided to move ahead with my research in concert with the Ajinomoto Group.” (Fukuda)

At the time, almost all of the cell culture media used in research and development in regenerative medicine was general material, and no attention was paid to its composition. Dr. Fukuda and the Ajinomoto Group began research and development on cell culture media. “The great thing about the Ajinomoto Group is its ability to analyze the composition of cell culture media. For example, analyzing compositional changes in the culture medium before and after cell culture was an extremely effective way of finding an optimal solution. I was also impressed by the Ajinomoto Group’s deep understanding of research in areas that require a high level of safety, such as myocardial regeneration, and by the generosity they showed by not being willing to settle for overly quick results.

Dr. Fukuda established Heartseed, Inc., in 2015, and is dedicated to research and development intended to improve efficiency and lower the cost of cardiomyocytes derived from iPS cells.

The current status of cardiac regenerative medicine, and our contribution to the development of culture media

Dr. Shugo Tohyama led the research and development of culture media for many years under Dr. Fukuda and has now taken up the mantle of research into cardiac regenerative medicine. “We have been working with the Ajinomoto Group since 2011 to develop culture media, in order to use this media in clinical applications. Thanks to the Company’s huge library of amino acids, we were able to develop a deeper understanding of cellular metabolic characteristics and greatly accelerate our efforts. I’m certain that had we been working on our own, we would have been lagging far behind the stage we have now reached.

Here is an example of joint development of a purification process, which had proved to be a difficult task when creating cardiomyocytes from iPS cells. To create cardiomyocytes from iPS cells, we proliferate large numbers of undifferentiated iPS cells, which are then differentiated to create cardiomyocytes. These cardiomyocytes are then purified and matured to create cardiomyocytes for transplantation. The difficult part of this process was purification. This requires elimination of any iPS cells that do not become cardiac myocytes after differentiation. After searching for difference in amino acids that these two types of cells like to eat, we identified glutamine. We then found that although iPS cells die in a short time if glutamine and glucose are removed from the culture medium, the cardiomyocytes would survive and produce energy if lactic acid was added. “When we were developing this method of purification, the Ajinomoto Group contributed a great deal by providing a variety of culture media with certain types of amino acids removed and by analyzing the culture media itself. “In the course of developing multiple different types of culture media, we had discussions with the researchers at the Company almost every month on which elements could be adjusted to create even better media. We would sometimes make requests, or the Company might offer suggestions; it was a two-way dialogue that was extremely useful in research and development.” (Tohyama)

Research and development in culture media development is still in its infancy. There must be culture media that are perfect for other organ cells than cardiomyocytes, so this is a field with great hidden potential.

Phases of cardiomyocytes

Proliferation
Proliferation of iPS cells in an undifferentiated state. Adding the amino acid tryptophan to the culture improves efficiency.

↓

Induction of differentiation
iPS cells differentiate to form cardiomyocytes. This is difficult because even slight environmental changes may induce errors in reproducibility. Content not released.

↓

Purification
Elimination of iPS cells that were unable to differentiate. Work to bring cardiomyocyte purity as close to 100% as possible.

↓

Maturation
The cardiomyocytes created are in the same state as that of a newborn infant. Culture medium to promote maturation in development.

The people we talked to

Keiichi Fukuda

CEO and Representative Director of Heartseed, Inc.

M.D., PhD. Engaged in research in cardiac regeneration from the 1990s, and in 1999 was the first person in the world to create cardiomyocytes from adult stem cells. In 2015, established Heartseed, Inc., a leading company in regenerative medicine.

Shugo Tohyama

Assistant Professor, Department of Cardiology, Keio University School of Medicine / Principal Investigator, Kanagawa Institute of Industrial Science and Technology (KISTEC)

M.D., PhD. Began research into cardiac regenerative medicine under Dr. Fukuda. Developed the world’s first myocardinal sorting method using culture medium and has published many articles on technical development in regenerative medicine.

Food & Wellness

Current strengths in Food & Wellness

The Ajinomoto Group has grown by applying its Deliciousness Technologies to scientifically analyze food cultures and offer products matched to local cultures worldwide. Driving our growth is our high-level approach to the pursuit of deliciousness around the world.

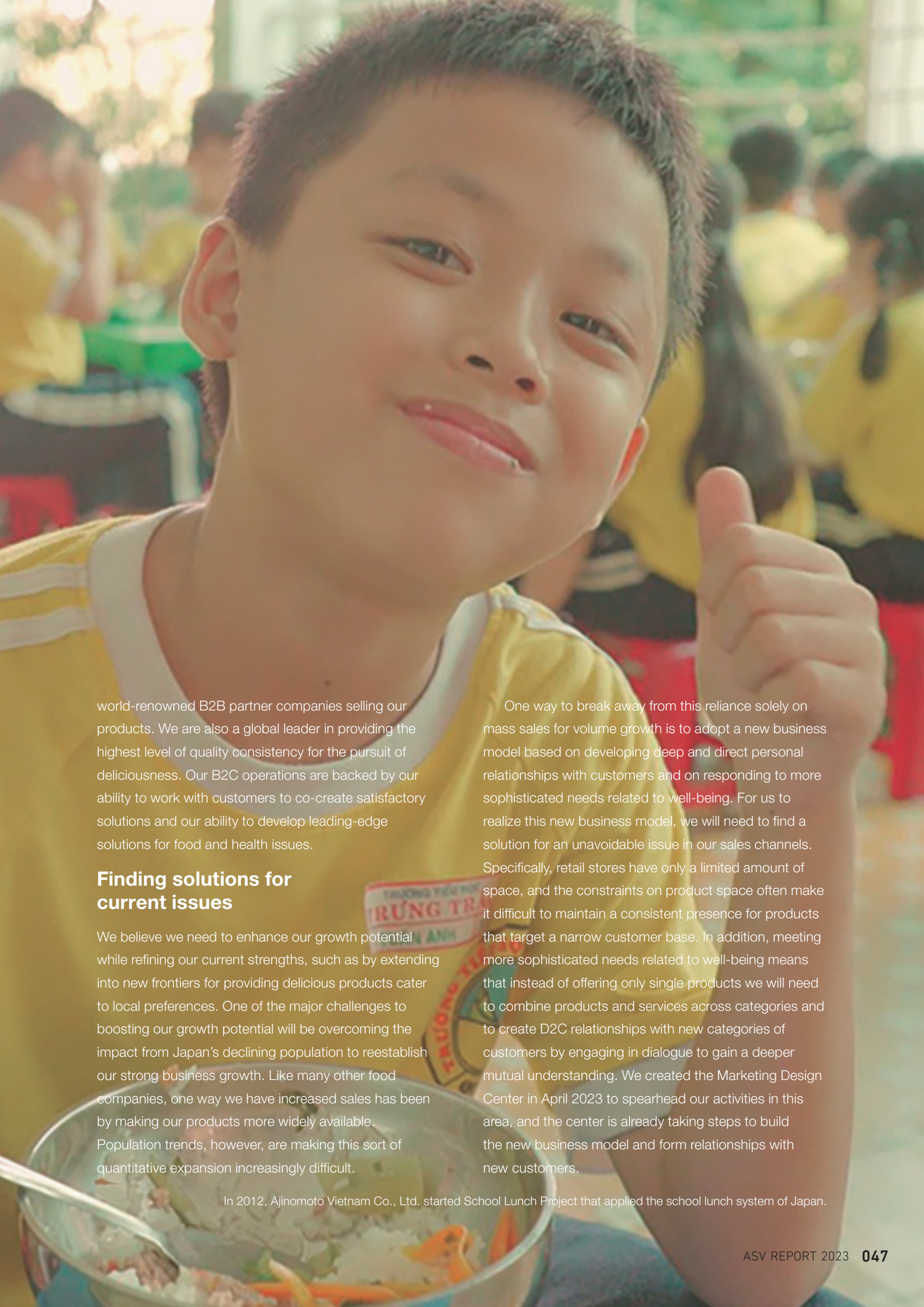
The Ajinomoto Group has grown its business by taking a scientific approach to examining local food cultures and using Deliciousness Technologies supported by “AminoScience.” Our Deliciousness Technologies are at their best with seasonings products and are a key element to our strength in the markets of Southeast Asia, Latin America, and West Africa. By closely tracking the changes in food preferences as these markets have developed economically, our main product offerings have evolved from umami seasonings to flavor seasonings and menu-specific seasonings. Every product was created from a deep understanding of local dietary habits and taste preferences and applying our Deliciousness Technologies. This business model has the potential to further expand its frontiers, and we see much promise in Cambodia, Laos, and Bangladesh.

Some regions have different growth models. In North America and Europe, for example, where the food cultures and eating habits are already very mature, we are developing the market for frozen foods led by Asian frozen foods, such as Gyoza, where we are applying “AminoScience” to scientifically analyze food ingredients and preparation methods. We then use our taste, ingredient, and preparation technologies to find solutions to reproduce the delicious flavors and identify issues in the preparation methods. Access to worldwide information via the internet and tourism from Asia are helping drive market penetration of both Japanese and Asian frozen foods, which even have growth potential in various Asian countries.

Strength the double pillars of B2C and B2B businesses

One of our strengths is that we are one of only a small number of companies with sales surpassing ¥1 trillion whose B2B operations (including the AminoScience business) generate more than 30% of our overall sales. This strength reflects the many advances in the elements of deliciousness—taste, aroma, and texture—we have made with “AminoScience” to create unique and superior ingredients.

Another of our strengths is our global network of



world-renowned B2B partner companies selling our products. We are also a global leader in providing the highest level of quality consistency for the pursuit of deliciousness. Our B2C operations are backed by our ability to work with customers to co-create satisfactory solutions and our ability to develop leading-edge solutions for food and health issues.

Finding solutions for current issues

We believe we need to enhance our growth potential while refining our current strengths, such as by extending into new frontiers for providing delicious products cater to local preferences. One of the major challenges to boosting our growth potential will be overcoming the impact from Japan's declining population to reestablish our strong business growth. Like many other food companies, one way we have increased sales has been by making our products more widely available. Population trends, however, are making this sort of quantitative expansion increasingly difficult.

One way to break away from this reliance solely on mass sales for volume growth is to adopt a new business model based on developing deep and direct personal relationships with customers and on responding to more sophisticated needs related to well-being. For us to realize this new business model, we will need to find a solution for an unavoidable issue in our sales channels. Specifically, retail stores have only a limited amount of space, and the constraints on product space often make it difficult to maintain a consistent presence for products that target a narrow customer base. In addition, meeting more sophisticated needs related to well-being means that instead of offering only single products we will need to combine products and services across categories and to create D2C relationships with new categories of customers by engaging in dialogue to gain a deeper mutual understanding. We created the Marketing Design Center in April 2023 to spearhead our activities in this area, and the center is already taking steps to build the new business model and form relationships with new customers.

In 2012, Ajinomoto Vietnam Co., Ltd. started School Lunch Project that applied the school lunch system of Japan.

Food & Wellness

We will contribute to the well-being of each and every person through digitalization and the development of products and services with high nutritional and health values based on “AminoScience.”

D2C platform innovations that deliver the joy of personalized cuisine

In the changing society of today, we must promote food and wellness digitally. We will resolve health issues by forming deep connections with consumers, contributing to their well-being through comfortable food experiences.

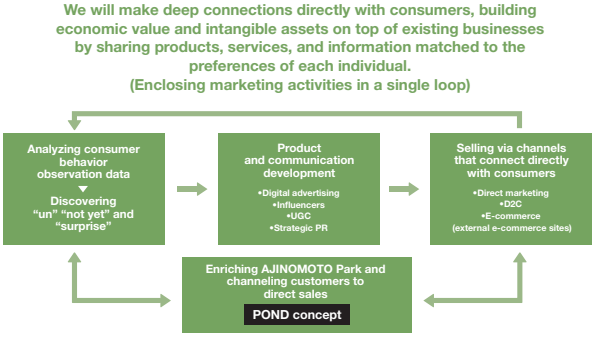
POND concept for the Marketing Design Center and AJINOMOTO PARK

Organizational concept for the Marketing Design Center

How can we connect with our customers, how do we gain an in-depth understanding of them, and how can we create products? To offer the joy of personalized meals, we must have a deep understanding of consumers. We connect directly with our customers, communicating in a manner suited to each to address their health issues, and providing them with satisfying experiences with food. This is the “Food and Wellness” concept that the Ajinomoto Group wants to achieve through digital technology. We therefore established the Marketing Design Center in April 2023, and will work to achieve this transformation.

Specifically, we will focus on upgrading our existing owned media, AJINOMOTO PARK. Currently boasting 10 million unique users per month, this site mainly provides recipe information, with many users simply browsing for recipes and then leaving. We hope to make this site an attractive “POND,” enhancing it with fun, useful content that will make it enjoyable for users coming in from the outside to navigate around. We also hope to learn about the values and lifestyles of each of our customers as users navigate the site, forming deep connections through two-way communications with each user.

The activity cycle of the D2C platform we are aiming to create



Developing appealing content and collecting customer data

We analyze the wealth of customer data gained by making deep connections with each user and combine the results with the Ajinomoto Group’s prized Deliciousness Technologies, allowing us to develop products and services suited to each person’s biometric information, preferences, and lifestyle patterns. We also work to co-create value with our customers by asking members to try out prototypes before we commercialize them, asking for their opinions on these items. Sharing these opinions universally throughout the Company makes it more likely that existing business departments will develop hit products.

We also guide users to sites where they can purchase products, which leads to the D2C business. Although our D2C products are currently centered on supplements, we plan to expand this to include other food products immediately.

Moving away from our previous business model of directing communications to the needs of the mass target with the largest common denominator, we will work to ensure that we offer the joy of personalized meals to a narrower band of core customers by connecting directly with them and engaging in dialogue. The Ajinomoto Group possesses data on 1.5 million customers, which sets us apart from other companies in the food industry and is a significant advantage in moving ahead with this D2C innovation.

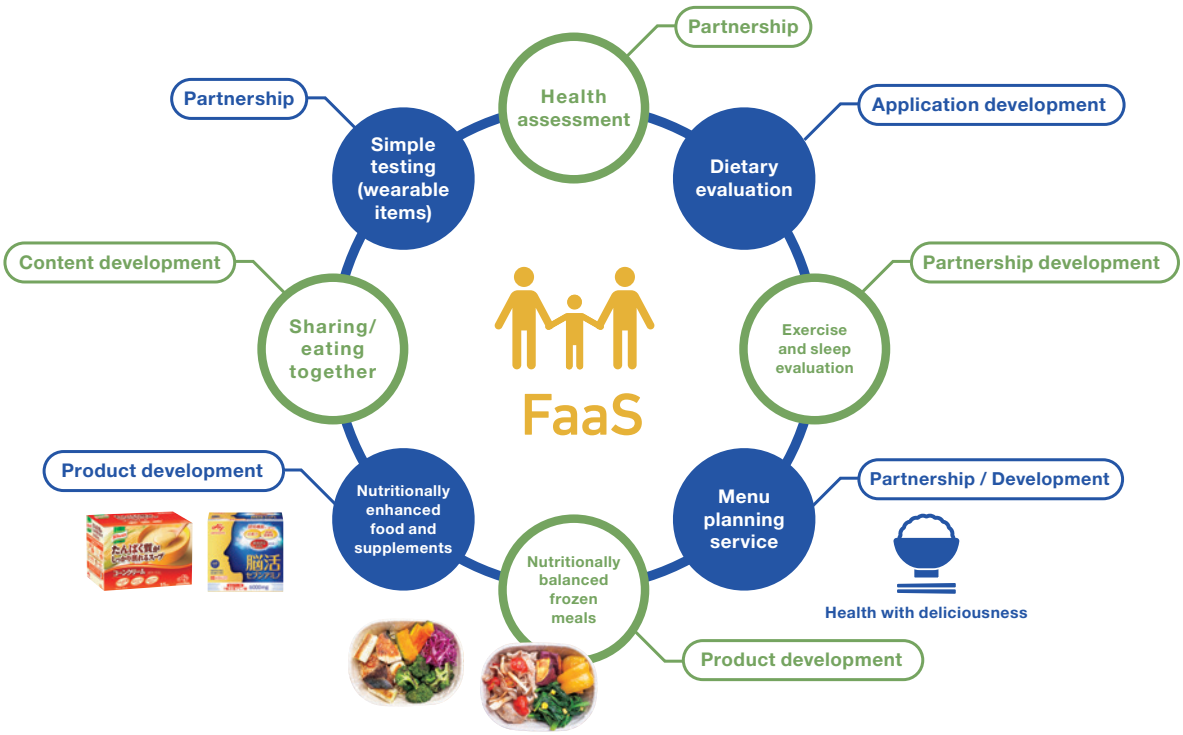
What is “Future Menu” that allows people to live an enjoyable life with delicious food?

Unlike conventional recipe sites, "Future Menu" provides a delicious and enjoyable food experience while maintaining a nutritional balance for daily meals and extraordinary meals such as eating out and home parties with close friends and family. We conducted test marketing for members only from April to May in 2023.

Food & Wellness

From “Food” to “Meals” A new business model based on the FaaS concept

Transitioning from a business model that provides goods to large numbers of people to one that provides personal value to small and medium-sized groups. What is the FaaS concept of services with a greater focus on food and health?

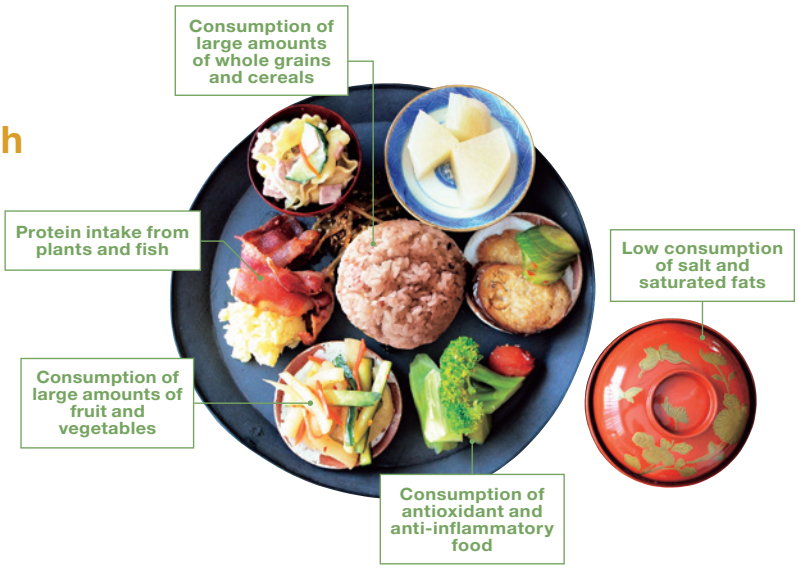


What is the FaaS concept?

There is a growing trend toward the number of patients with so-called lifestyle-related disease such as hypertension and diabetes to increase every year. It is said that while these may not impede everyday life immediately, they can lead to serious ailments such as heart disease and kidney failure. There is a range of data showing that diet is particularly important, and since many of those with lifestyle-related disease are in their forties and fifties, behavioral changes must be made by those in their twenties and thirties to prevent this. However, people with lifestyle-related disease or pre-morbidities are engaged in work and child-rearing at a busy time of their lives, which makes it difficult for them to pay attention to nutritional balance in what they eat. That has inspired the Ajinomoto Group to create the FaaS concept.

“FaaS” stands for “Food as a Service.” Although Ajinomoto has only offered products such as low-salt seasonings, low-calorie sweetener, and protein-enriched foods to date, our goal is to take things a step further, making a commitment to helping people achieve nutritional balance throughout their diets, and offering a comprehensive service that takes data from health checks into consideration. In addition to our existing food business model aimed at addressing the broad-ranging needs of more people (large groups), we will partner with external organizations to create new business models targeting specific health-related needs (medium to small groups).

Issues with food and health



Including those with pre-morbidities, approximately 20 to 30 million people are frail or suffer from lifestyle-related disease. The primary causative factors in terms of food are excessive salt, sugar, and fat, and protein deficiency. To address these, we must do more than offer suggestions for products that turn specific nutrients on and off; looking to the future, we must propose and provide meals tailored to each individual.

Specifically, the Ajinomoto Group will develop and provide a meal assessment application that checks whether everyday meals are nutritionally balanced, and work with Oishi Kenko Inc., to develop and offer frozen meals that meet health needs and are both healthy and delicious. We will offer meal programs that combine products and services that address lifestyle-related disease to hospitals, clinics, health management businesses, municipalities, and insurance companies.

In addition, we will provide a complete lineup of nutritionally enriched processed foods and supplements that offer a variety of choices that address the health needs of the individual, and which supplement diets that are deficient in protein or amino acids. Looking to the future, we will cater to a broader range of health needs. For example, we hope to offer the nutrition children need during development through daycare centers and after-school study facilities, and provide nutrition tailored to those who want to maintain or increase muscle strength through fitness gyms and sports-related businesses, as well as to provide nutrition for older people who want to address issues such as frailty and dementia though local governments and care facilities.

Approach to pre-morbidities—Providing menus based on the logic of finding the factors common to areas where people live long lives

People become concerned about their health, even though they may not be unwell. They want to stay young and healthy forever. The Ajinomoto Group is also creating an approach to such pre-morbidities. To date our nutritional theory has only taken account of aspects such as salt, sugar, and protein volume, but we are evolving this to create a unique logic that sheds light on the quality of protein, carbohydrates, and fats, based on the latest “AminoScience” research. This is an approach to nutrients that only the Ajinomoto Group can offer, thanks to our many years of “AminoScience” research.

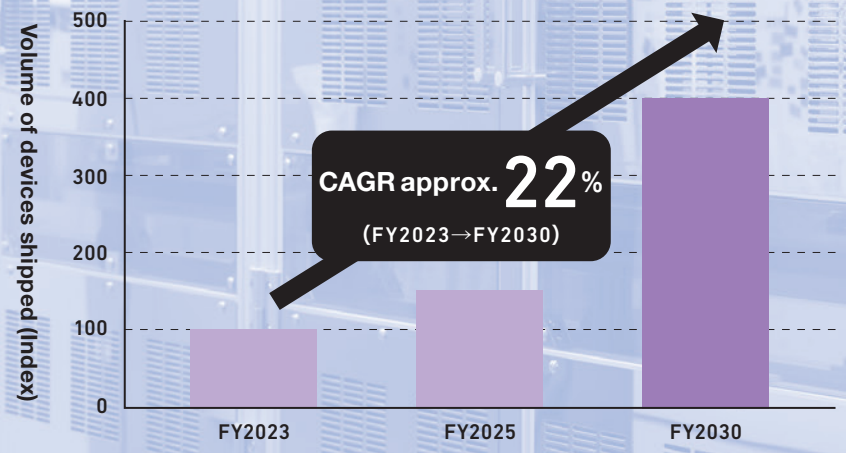
Using the Deliciousness Technologies of which the Ajinomoto Group is so proud, we are working to make it possible to offer meal programs that do not sacrifice satisfaction or flavor.

ICT

ABF: The semiconductor insulator film that has become a global standard

Ajinomoto Build-up Film® (ABF) continues to achieve high levels of growth as the de facto standard in the semiconductor market, which is anticipated to reach ¥100 trillion in 2030. What is the secret behind its overwhelming dominance?

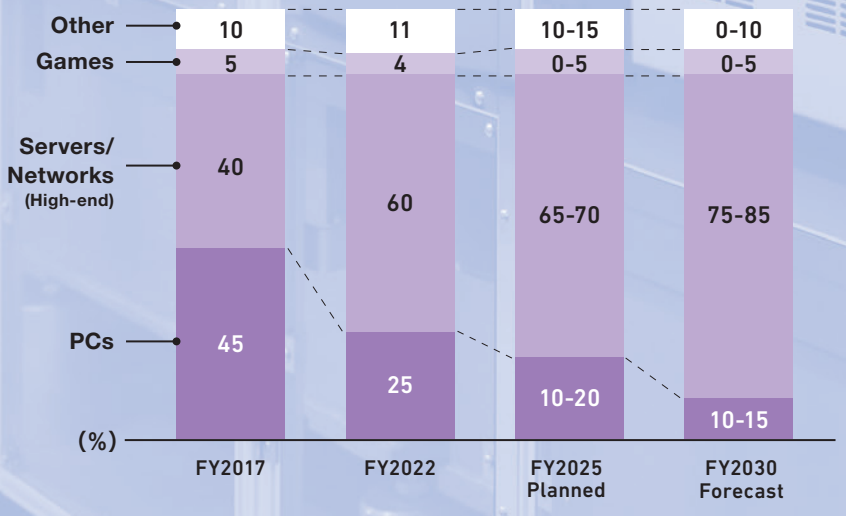
[Growth of the HPC* market (devices)]



Source: Fuji Chimera Research Institute, Semiconductor packages/Module substrates In-depth analysis of related markets 2022 Edition

* High-performance computing

[Trends in volume by ABF application]



* Ajinomoto Group estimates

What strengths have led to the continued use of ABF in the semiconductor industry for so many years?

The semiconductor market is expected to reach ¥100 trillion in 2030, with digital technologies centering around semiconductors forming a foundation for our everyday lives, as well as being essential to achieving progress and building a technologically advanced future. Against this backdrop, Ajinomoto Build-up Film® (ABF) continues to achieve high levels of growth as the de facto standard in the semiconductor market. ABF from Ajinomoto Fine-Techno Co., Inc., has won acclaim as an essential insulation material for the high-performance CPU packages that are the heart of today's PCs.

While it may seem somewhat incongruous that the Ajinomoto Group makes materials that form part of a semiconductor package, these materials were created based on "AminoScience," which is the result of our research on amino acids. The Group first turned its attention to curing agents for epoxy resins and associated functionality in the 1970s, using our knowledge of amino acid technology, and has continued with research at the fundamental level. The need for new types of insulating materials grew in the 1990s as CPUs became increasingly highly integrated, and major semiconductor manufacturers adopted ABF as the Group took on the difficult task of switching from ink-based insulation material to film. That switch saw ABF gain instant access to the market.

The strength of ABF lies in its ability to handle the constant increase in CPU capabilities, and in the Group's ability to rapidly develop products that meet the needs of our customers. Another strength of the Group lies in our ability to enter the development and manufacturing sites of our customers, allowing us to maintain our position as a partner in the creation of new value.

Going forward, the IoT[*1] is expected to facilitate the high-speed exchange of large volumes of information between both people and things, helping the formation of a highly advanced information-based society, and creating new value. Accordingly, the markets for both semiconductors and semiconductor packaging are expected to grow even further, and the manufacturing processes and materials supporting them are also expected to grow more sophisticated.

The Ajinomoto Group has based its development of ABF on a strongly held vision of contributing to the growth of a smart society. Looking to the future, we will continue to work as a member of an ecosystem that is essential to the industry, helping create the technologies our customers need. The Group is actively engaged in working in other new domains in addition to ABF. We hope that you will continue to watch us as a leading innovator in this industry.

Cross-sectional image of a package substrate

*1 Performing automatic recognition, control, and remote measurement, etc. by connecting various objects to the Internet or communicating with each other by using communication functions

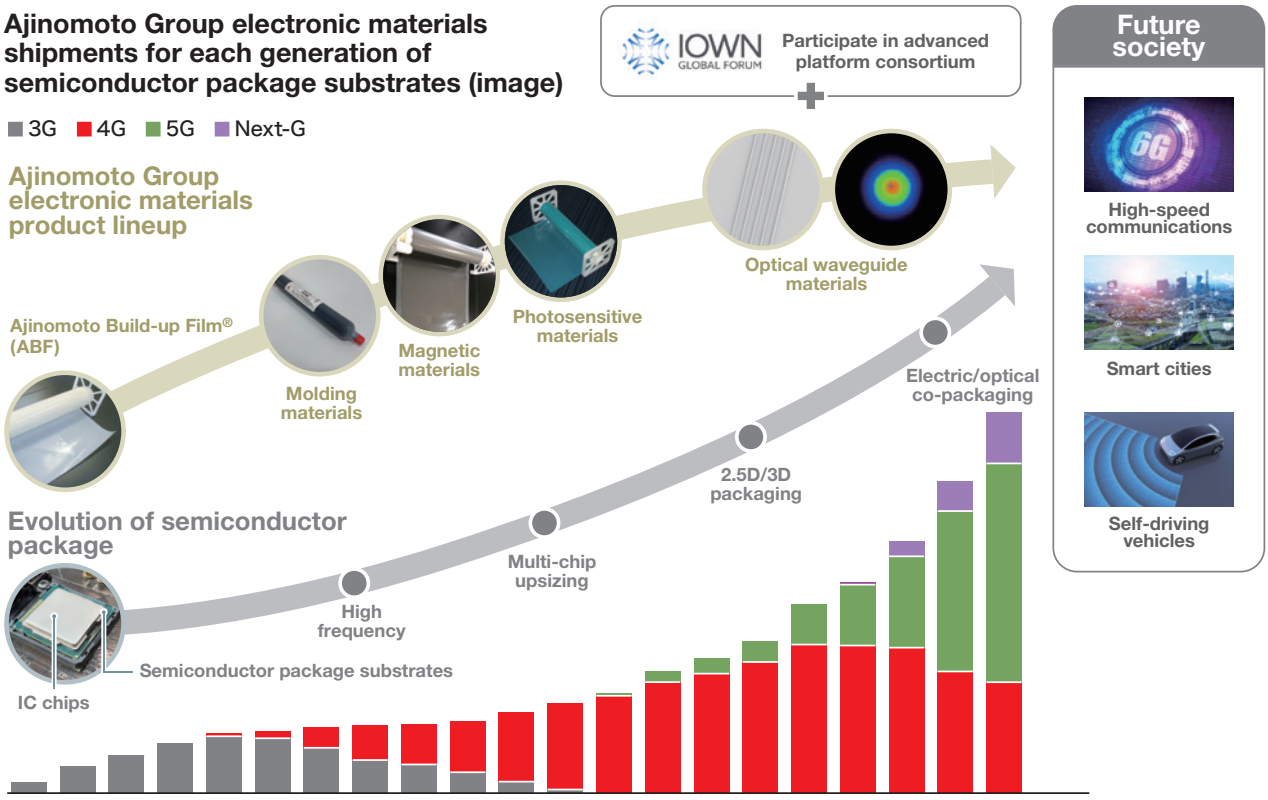
ICT

An image of the future in the ICT area

Future society will be supported by highly developed ICT. We will contribute to the realization of a future society using the wealth of knowledge that the Ajinomoto Group has cultivated through ABF development, etc., based on “AminoScience.”

It is predicted that the society of 2030 and beyond will be a smart society, in which people and things are interconnected, supported by highly developed ICT, a society in which people are freed from physical handicaps and limitations. In order to acquire the technologies needed to bring that future to reality, such as the optical waveguide technologies that enable low power consumption and high-speed communications, advanced technologies such as bioelectronics that link living organisms to devices, and advanced semiconduction packaging materials that make low transmission loss possible, the Ajinomoto Group will work in close cooperation with leading companies and participate in academia and consortiums, leveraging its unique network to create customer value quickly.

In the future, we will continue to use our development co-creation ecosystem to provide key materials based on “AminoScience,” helping to bring to reality a future with a decarbonized society, and 6G next-generation communications networks along with smart cities and self-driving vehicles that make use of them.



Why is the technology of the Ajinomoto Group needed in an era of intense competition for semiconductors?

Tadashi Kamewada

U.S.-based semiconductor consultant
AZ Supply Chain Solutions

After joining the Japanese subsidiary of a major U.S. semiconductor manufacturer, moved to the company's U.S. headquarters in 1997, where he managed supply chains for package substrates, back-end materials, and other equipment. He is currently active as a business consultant in the semiconductor industry.

Boasting a market share of close to 100% worldwide, Ajinomoto Build-up Film® (ABF) continues to achieve high levels of growth as the de facto standard in the semiconductor market. How did ABF achieve this dominance so quickly? We asked semiconductor consultant Tadashi Kamewada about the strengths and future potential of this material.

Q What were your initial impressions on the potential of the switch to film from ink-based insulation material?

"With the intensifying competition in the mid-1990s, insulating films were groundbreaking because of the reliability of the products using them, as well as the cost reductions, manufacturing process efficiencies, and miniaturization they offered. I first encountered the Ajinomoto Group in 1998, when I was working for a major U.S. semiconductor manufacturer. When I was introduced to them, I was surprised that the Group was making semiconductor materials. We evaluated the material thoroughly over three years before deciding to adopt it, and all of the employees involved in its development were outstandingly patient and responsive."

Q What points allowed ABF to revolutionize the market so quickly?

"In the semiconductor world things are only on or off. Once the decision has been made to adopt ABF, it is used in all CPUs of that generation. Even major competitors are wary of entering this niche market. Although it was a late starter, there was no substitute for ABF, and it immediately captured the market."

Q What are the merits of the rapid development capabilities of the Ajinomoto Group?

"Although it's the norm today for semiconductor manufacturers to team up with materials suppliers and substrate makers, ABF pioneered this approach, offering greater ability to address issues during manufacturing development, and ultimately allowing rapid development of CPUs. Once good team relationships have been established it is difficult to gain entry later. There is also the benefit of being able to keep pace with clients over the long term."

Q How do you feel about innovative technology at the Ajinomoto Group?

"In the semiconductor industry we are constantly holding technology meetings with our business partners based on a roadmap for the future. In my view, when making next-generation products, the Ajinomoto Group offers timely provision of parts and materials that meet the needs of our customers, and also adds high performance and flexible processing."

Q What was your impression of the Ajinomoto Group as a business partner?

"The Ajinomoto Group, including its engineers and sales personnel, is very good at building relationships for co-creation. What's more, they appear to have accumulated a great deal of knowledge related to materials development. Semiconductors feature a range of materials, and thus complex adjustment is needed to ensure that the component materials are compatible with each other and provide acceptable performance. To that end, the Ajinomoto Group possesses a library of accumulated knowledge that allows prompt handling of complex adjustment. The extensive expertise they have acquired through ABF development is truly amazing."

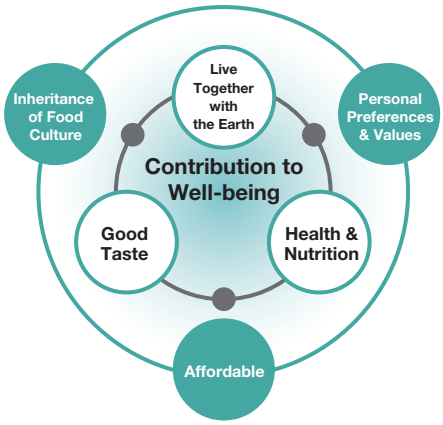
Q Looking to the future, what role do you think the Ajinomoto Group will shoulder in the semiconductor industry?

"The current focus of the industry on back-end packaging should make ABF even more important as a core substrate material. The increasing sophistication of semiconductors brings with it a growing need for ABF, which will make it even more influential in the future."

Green

“AminoScience” that leads the “with Earth” Era

Under the circumstances of food shortages due to climate change and population growth, we aim to contribute to the spread of “with Earth” food and the promotion of carbon recycling by leveraging the strengths of “AminoScience,” and to update the standard for a new type of food that will allow us to “Live together with the Earth” into the future.



Great Taste, Green Future.
"with Earth" Food Initiative

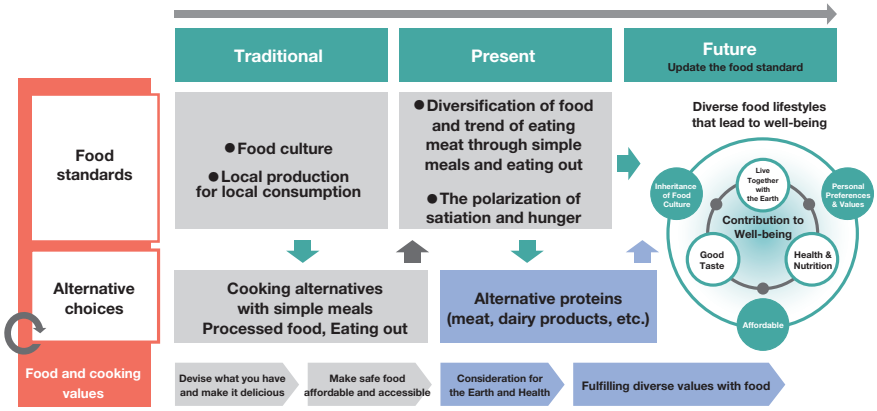
A new type for food, "with Earth" food Great Taste, Green Future.

The Ajinomoto Group does not want people to endure the pleasure of eating, while taking proper care of the environment and their bodies. That is why "with Earth" food, the new type of food we are aiming for, is sustainable, good-tasting, and healthy. While respecting local food culture, we will respond to the diversifying tastes, values, and lifestyles of consumers, and propose a new type of food that people can use in their daily lives by designing not only substitutes, but also the taste, nutrition, and texture of the ingredients themselves.

1. What is the new food standard?

The world is home to diverse food cultures rooted in rich climates, people's spirituality, and history. In recent years, economic growth has led to the development of various food-related industries, which, combined with the advancement of women in society, has led to the expansion of convenient options that support shorter cooking times and alternatives. People have updated their food standard (daily food) by wisely incorporating them into their daily lives. Today, the issue of global sustainability is becoming more serious. As the world's population grows, the amount of food and energy required is also increasing, and environmental considerations are becoming essential for the sustainability of human society. The plant-based food market has expanded to a scale approaching ¥500 billion, mainly in Europe and the United States, but is currently stagnant or shrinking due to issues related to taste and nutrition in spite of high prices. The Ajinomoto Group is leveraging "AminoScience" to solve these issues and provide "with Earth" foods that are tastier and healthier, updating the food standard for the future.

We will create a new food standard that balances good-taste, health & nutrition, and live together with the earth.



2. The spread of "with Earth" food

In order to achieve carbon neutrality (or negativity) in the future and meet the need for protein brought about by the increasing human population, it is important to wisely incorporate plant-based foods and other environmentally friendly ingredients and foods into our daily diet.

The Ajinomoto Group has "AminoScience" as its strength to efficiently produce large quantities of environmentally friendly food ingredients and deliver them to consumers as more delicious and healthier foods. There are three areas where "AminoScience" can be utilized. The first is plant-based foods or plant-derived proteins. To address the lack of taste, texture, and nutritional value that has been an issue with conventional plant-based foods, we will promote the provision of "Plant-Based with Nutrition," which designs optimal nutritional balance including protein for each application by utilizing our Deliciousness Technologies and Nutrition Design Technology. As part of that, we are strengthening our "Plant Answer®" model, which provides optimal solutions for each customer in our B2B business. As an example, we have invested in DAIZ Inc., a startup company that develops and manufactures "Miracle Meat" derived from sprouted soybeans, offering a solution using our Deliciousness Technologies. As a new challenge, "2Protein" (powder type and tablet), a plant-based protein for which we supported product development, was launched in July 2023 as a new product by Japanese startup company TWO Inc. Leveraging "AminoScience," this product contains the ideal balance of essential amino acids needed to support body building through training. The regrowth of the market for plant-based foods is vital to the spread of "with Earth" food, and the Ajinomoto Group will promote active investment and cooperation through B2B and B2C businesses. The second area is cultured meat. In this area we make extensive use of the cutting-edge research that the

Ajinomoto Group has pursued in the medical field at its Research Institute for Bioscience & Fine Chemicals. We are engaged in joint research into meat culturing technologies with Super Meat, an Israeli company in which we have invested. In addition, we will contribute to sustainability and protein crisis countermeasures in cooperation with related ministries and agencies by sponsoring the Cellular Agriculture Research Institute for the purpose of acquiring a license and commercialization in Japan. The third area is the use of microbial protein "Solein®," which uses CO_2 as a source of nutrients. Ajinomoto has entered into a strategic alliance with Solar Foods, a Finnish food tech company, to develop products using Solein® developed by Solar Foods, and will begin marketability testing in Singapore in 2024.

The Ajinomoto Group's "AminoScience" has garnered attention from startups around the world, and we have received offers of cooperation from many businesses.

What are alternative proteins?

Plant-based food

A generic term for foods made using plant-derived ingredients as substitutes for animal protein. Such as soy meat instead of meat or oats milk instead of cow's milk.

Cultured meat

Meat made by placing cells extracted from animals into a culturing medium containing amino acids and other nutrients for culturing. Cultured meat also has low GHG emissions.

"Solein®", microbial protein

Developed by Solar Foods. Protein with a similar amino acid makeup to meat, created in a unique bioprocess that supplies CO_2, hydrogen, oxygen, and small amounts of nutrients to microorganisms.

3. Promoting carbon neutrality

Rearing livestock for meat requires a great deal of water and land for raising livestock and growing their feed, and consequently involves huge volumes of GHGs. If the livestock industry continues to expand in response to the growing world population and the normalization of meat-eating in developing countries, it will place a large burden on the global environment.

As the following table shows, GHG emissions from plant-based food are about one-tenth those of conventional meat. The manufacture of plant-based food, cultured meat, and microbial proteins also requires far less water and land.

The "with Earth" food initiative will help resolve future food crises and help coexistence with the Earth, and is the area in which the Ajinomoto Group is concentrating on most as a growth area of the Geen area. Additionally, the Ajinomoto Group has set a goal of achieving net zero greenhouse gas emissions by 2050 and hopes to contribute to the construction of a sustainable food system. In April 2023, the Group concluded a joint research and development agreement with Logomix Inc., a biology-oriented start-up company possessing the technology for large-scale genome construction. The Group intends to combine its amino acid fermentation techniques and expertise with this technology to promote the development of sustainable amino acid production methods that will reduce the impact that the fermentation process places on the environment through factors such as CO_2 emissions, seeking to produce green amino acids through innovation in the amino acid production biocycle. The ability to contribute to the well-being of humanity and the Earth through the action of amino acids is a significant strength of the Ajinomoto Group.

We believe that the Ajinomoto Group's "AminoScience" will lead the "with Earth" era.

Alternative proteins have a low environmental impact!

		Conventional (Beef)	Plant-based food	Cultured meat	Microbial proteins
Ingredients					
Environmental impact	GHG emissions	100	11	2.4	0.5
	Water usage	100	13	21	0.2
	Land area usage	100	4.0	5.1	0.5

Comparison of environmental impacts of conventional livestock meat and plant-based foods, cultured meat and microbial proteins. The environmental impact of cultured meat and microbial proteins with new technologies are overwhelmingly small, and carbon negative can also be achievable.