II AminoScience Business

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The Outlines of AminoScience Business

Amino acid-related business development

In FY2009, the Ajinomoto Group's amino acid-related businesses recorded sales of 193.5 billion yen, a year on year decrease of 6.2 billion yen, and a relatively low level of profit with an operating profit of 5.2 billion yen, a year on year increase of 0.2 billion yen. Out of the five fields of feed-use amino acids, amino acids for pharmaceuticals and foods, sweeteners, intermediate pharmaceuticals, and specialty chemicals, the only field performing strongly was specialty chemicals (which included personal care ingredients, *Jino** brand amino acid

cosmetics, and *Ajinomoto Build-up Film*[®] (*ABF*) interlayer insulating material for semiconductor packages). In the fields of feed-use amino acids and sweeteners, which involved relatively high ratios of bulk business, factors such as price competition from manufacturers in the U.S., China, and South Korea and the appearance of new competing sweetener products made it particularly difficult for us to compete using our strengths of technological capabilities and marketing.

In the feed-use amino acids business, which had accounted for a large portion of sales and profits in the early 2000's, we were focusing on lysine, threonine, and tryptophan, but factors that included increasing competition led to wild fluctuations in the prices of these products. Therefore, in September 2011, we spun off the business to form Ajinomoto Animal Nutrition Group, Inc. (AANG) and based on the key principle of shifting to "specialty," we strengthened our competitiveness regarding lysine and threonine, which had become commodities, by advancing OEM procurement through an alliance with a Chinese manufacturers, and shifted focus to differentiated products such as $AjiPro^{*}-L$.

Furthermore, our performance in the amino acids for pharmaceuticals and foods business had been seesawing up to FY2012, but from FY2013 it began trending towards rising sales and profits and provided a support in terms of revenue to our amino acids business, which was undergoing structural reform. In November 2017, we invested 7.2 billion yen to make the U.S.-based medical foods company Cambrooke Therapeutics, Inc. (headquarters: Massachusetts) a full subsidiary and fully entered to market for medical foods targeting patients with amino acid metabolism disorders.

Figure II-1: AminoScience business strategy pyramid



Table II-1: AminoScience business results (FY2009/FY2019)

(Pillions of yon)

				(Dillions of yen
	FY2009		FY2019	
	Sales	Operating profit	Sales	Business profit
	193.5	5.2	231.6	19.5

Sources: IR Data Book 2020, INVESTOR'S GUIDE 2017

In the sweeteners business, which is centered on aspartame, we advanced a shift from bulk business to consumer business with a focus on *PAL SWEET*[®] and other products in Japan and *Refresco MID*[®] powdered beverages, which are marketed in South America. As a result of this shift, in FY2015 we moved the sweeteners business to the Food Products Division.

In FY2009, the intermediate pharmaceuticals (custom manufacturing of pharmaceuticals) business was struggling due to factors such as exchange rate fluctuations and declines in sales. However, it began to recover from 2011 and in July that year, S.A. Ajinomoto OmniChem N.V. (Belgium), which plays a central role in the business, established a joint venture company in India (and in August 2019 we announced our plan to take full ownership of this company) as a low cost, high quality custom manufacturing location in order to strengthen business structure. In 2013, we also acquired Althea Technologies, Inc. (headquarters: San Diego) to strengthen applications in the biopharmaceuticals market, including in the growing field of antibody drugs, and from that point onwards we maintained a firm upward trend in revenues. In 2016, we reorganized our structure for the contract manufacturing of nucleic acid drugs from small volume multiproduct production to mass production through the acquisition of GeneDesign, Inc. and we integrated the operation of contract development & manufacturing organizations (CDMO) in four locations – Japan, the U.S., Europe, and India – as "Ajinomoto Bio-Pharma Services" to build a structure for providing global services.

Our full-scale website business began in 1997 through sales of *Jino*[®] cosmetics. In 2005, we leveraged the business model developed through our *Jino*[®] efforts to begin sales of supplements by mail-order, and we then grew this business through advertisements in various media, including newspapers, TV, and websites. In FY2017, we integrated the *Jino*[®] and our proprietary website for direct sales of supplements and from FY2018, we grew in this business area by expanding the products handled to include nutritional care and website exclusive high value food products (examples include seasonings and soups).

Our sports nutrition business, which is centered around the *amino VITAL** series, aims to support conditioning when doing sports by developing unique amino acid compositions and deploying products based on the results of sports nutritional science research focused on sports physiology. We also entered the protein and jelly drink markets, through which we increased contributions to general consumers in a range of sporting scenarios. We have increased our customer base including foreign customers and have expanded the business to cover 10 countries. We have also been enhancing brand value by supporting Olympic and Paralympic athletes at the London, Rio de Janeiro, and Tokyo Games.

In the pharmaceutical peripherals field, in addition to engaging in the nucleic acid and antibody drugs businesses mentioned previously, we also created and developed new businesses in the disease risk evaluating service and pharmaceutical cell culture medium fields. In regard to disease risk evaluating services, in 2011 we launched *AminoIndex*[®] *Cancer Screening (AICS*[®]), a service for analyzing amino acid concentrations in blood that can assess the possibility of whether a person has cancer. Subsequently, we added an *AminoIndex*[®] *LifeStyle Diseases Screening (AILS*[®]) service, which assesses the risk of future strokes, heart attacks, and diabetes to deliver a combined package named *AminoIndex*[®] *Risk Screening (AIRS*[®]). This service is being provided by almost 1,500 medical institutions across Japan (as of February 2020). The tests can assess the risk of various diseases from a single blood sample, and in addition to being offered as an optional test in medical checkups, it is also being used as an item in local government and corporate health checks. With this service, we are directly contributing to society through our accumulated research into amino acids.

In the specialty chemicals business, while a stagnation in PC demand and other factors since FY2011 have had an impact in the electronic materials field, increased demand for server and communications applications since FY2013 have driven growth. In the personal care ingredients field, recent concern for the global environment has led to sales growth, particularly for amino acid-based surfactants, and both fields have experienced continuous growth. On a different note, since FY2017, *Jino*[®] operations have been the responsibility of the direct marketing business.

As a result of these initiatives, in FY2019, the AminoScience business (which absorbed the sports nutrition, direct marketing, and AminoIndex businesses following the dissolution of the Wellness Business Division in April 2015), achieved sales of 95.3 billion yen and business

Table II-2: Composition of the AminoScience Division

Category	Concept	Strengths	Relevant Businesses
Life support	We realize comfortable lifestyles for consumers and living with the society and the earth through specialty chemicals (electronics materials) business that contributes to the evolution of IoT and animal nutrition business which reduces environmental impact on land and water quality by adjusting the amino acid balance of animal feed.	 World-class knowledge of amino acids Highly safe material development capabilities and synthesis evaluation technology Global animal nutrition network 	 Ajinomoto Animal Nutrition Group Inc. Specialty Chemicals Department's electronic materials business
Healthcare	We provide a variety of unique materials, active ingredients, and technologies to pharmaceutical, cosmetics, toiletries, and other companies around the world. We also support comfortable lifestyles and improving quality of life for consumers through the provision of fundamental foods and amino acid supplements that leverage our knowledge of amino acid functions and benefits and ability to discover new applications.	 R&D capabilities and production technology for amino acids and other areas Ability to adapt to regulations Service providing capabilities 	Amino Acids Department Specialty Chemicals Department's personal care ingredients business Direct Marketing Department Sports Nutrition Department Pharmaceutical Custom Manufacturing Department (renamed as the Biopharma Service Department in April 2020) AminoIndex Department

profit of 7.1 billion yen in its life support business (animal nutrition and the electronic materials business in specialty chemicals), and sales of 136.3 billion yen and business profit of 12.3 billion yen in its healthcare business (amino acids for pharmaceuticals and foods, pharmaceutical cell culture media, the personal care ingredients business in specialty chemicals, direct marketing [supplements and cosmetics, including *Jino**], sports nutrition, pharmaceuticals custom manufacturing, and *AminoIndex**). The sum of both fields produced total sales of 231.6 billion yen and business profit of 19.5 billion yen. This demonstrated slight sales growth of 20% compared to FY2009, but profit was almost four times higher, showing the profitability of moving away from bulk business.

Going forward, we plan to grow sustainably through measures such as the full-scale development of an antibody drug conjugate (ADC) custom manufacturing business and the strengthening of our nucleic acid drugs business in the healthcare field, and expansion into domains adjacent to the electronic materials business (servers, communications applications, etc.) in the life support field.

2 The Animal Nutrition Business

(1) Establishment of Ajinomoto Animal Nutrition Group, Inc.

Establishment of Ajinomoto Animal Nutrition Group, Inc. as a spinoff of the animal nutrition business

The animal nutrition business of the Ajinomoto Group was launched in 1953 and began by selling defatted soybeans for feed, with the business getting fully under way with the establishment of Nippon Amino Feed Ltd. (currently ITOCHU FEED MILLS CO., LTD.) in 1961. The business's main product, lysine, was sold from 1957 for pharmaceuticals as a coproduct of MSG. Lysine production using a fermentation process began in 1965 at the Kyushu Plant, later being sold for feed use in September of that year. During this time, the production of tryptophan using a synthetic process began in 1964, followed by threonine production using a fermentation process beginning in 1969. The business grew overseas, expanding into Brazil in 1974, France in 1976 (via a joint venture), the U.S. and Thailand in 1986, and China in 1994 (via a joint venture), establishing a global production system. Our animal nutrition business was always a leader in its three core products (lysine, threonine, and tryptophan). However, in 1991, Archer Daniels Midland Company (ADM), a major U.S.-based grain production company, began producing lysine. This, combined with intensifying competition due to the entry of Chinese and South Korean manufacturers of lysine and threonine, drove business profits down. Following Masatoshi Ito's inauguration as President & CEO in 2009, a plan was launched to shift from bulk business to retail business and to focus on specialties, which also prompted structural reforms for the animal nutrition business.

Ajinomoto Animal Nutrition Group, Inc. (AANG) was spun off in September 2011, taking over our animal nutrition business. Because it became a separate company, it sought to strengthen its readiness towards sudden environmental changes worldwide, practice nimble decision-making, and establish an efficient system for business operation. With a mission to "contribute to more efficient use of limited food resources and achieve harmony with the irreplaceable global environment, contributing to a safe and high quality food supply,"¹ the new company began with a concept focused on not just serving the feed market but also the broader animal nutrition market over the medium- to long-term.

Soon after its establishment, AANG announced its medium- to long-term strategy for its animal nutrition business. The strategy included utilizing new techniques such as resource-saving fermentation technologies and using inedible raw materials to increase production of lysine, threonine, and tryptophan by 2016. It also laid out plans to roll out other feed-use amino acid products such as valine, isoleucine, and *AminoGut*[®], a glutamine formulation to aid piglet growth, as well as to develop and market value-added products such as *AjiPro*[®]-*L*, a lysine product for dairy cows and other products to satisfy market needs.

AjiPro[®]-*L*, which began production in April 2011, is a high value-added product that solves the problem of lysine breaking down in the first stomach of dairy cows and becoming impossible to absorb through the small intestine. In the feed-use amino acids market, in which product differentiation is generally difficult to achieve, *AjiPro*[®]-*L* is an example of successfully creating a specialty and became a top brand among lysine products for dairy cows in North America. In November 2014, a production facility (in Eddyville Plant, Iowa) of U.S.-based Ajinomoto Heartland, Inc. increased production capacity for this product from 1,500tons to 6,500tons annually.

 Corn and wheat have a lower lysine content than soybean meal. In general, the lysine content of 50kg of soybean meal is equal to that of 48.5kg of corn plus 1.5kg of lysine. Since the harvest volume of corn per unit area is much larger than soybeans, using lysine for animal feed allows for efficiently supplying soybeans and corn. Protein content in feed is also reduced, contributing to lower metabolic feeal nitrogen emissions, which in turn reduces levels of nitrous oxide, a greenhouse gas that has a global warming potential 298 times higher than CO₂. In response to a FY2013 business performance slump owing to competitors lowering prices, the FY2014-2016 Medium-Term Management Plan laid out plans to shift further towards being a specialty business while strengthening our competitiveness.

Making improvements to a business structure spanning five areas worldwide

AANG continued to make organizational reforms.

In April 2013, Ajinomoto Animal Nutrition (Singapore) Pte. Ltd. was established to serve as a regional headquarters. This was almost two years before the establishment of Ajinomoto SEA Regional Headquarters Co., Ltd. (in January 2015), and the company became a center for quick and precise decision-making and business management in the Asia-Pacific region, a place of top-level growth and intense competition. Then in 2018, Ajinomoto Heartland, Inc. was renamed to Ajinomoto Animal Nutrition North America, Inc. in April, followed by the renaming of AJINOMOTO EUROLYSINE S.A.S. to AJINOMOTO ANIMAL NUTRITION EUROPE S.A.S. in October. This solidified production and sales functions for our animal nutrition businesses in North America and Europe. With this move, in areas other than South America, where AJINOMOTO DO BRASIL INDÚSTRIA E COMÉRCIO DE ALIMENTOS LTDA. was in charge of sales, AANG established regional headquarters to handle business management and enable a speedy response.







AJINOMOTO ANIMAL NUTRITION EUROPE S.A.S.

(2) Building a system for flexible production and cost reduction

Restructuring the production system in China

As our animal nutrition business was being spun off in 2011, efforts began to restructure our production system. The structure that we had been concentrating investment into and that expanded through the mid-2000s had to be capable of responding to the commoditization and price decline of lysine and threonine as Chinese and South Korean manufacturers became stronger competitors. This was done to better position us for developing specialties.

In November 2010, Ajinomoto Co., Inc. conducted a gratuitous transfer of its entire holdings (70% share) in CHUANHUA AJINOMOTO CO., LTD. (Chengdu, Sichuan), a joint venture that had been producing lysine in China, to a joint venture partner SICHUAN CHEMICAL WORKS GROUP, LTD., a local chemicals manufacturer. Although CHUANHUA AJINOMOTO CO., LTD. expanded its production facilities for feed grade lysine in 2005 and boosted annual production capacity to 32,000tons, pressured by lower-priced local products, production was halted in the fall of 2008. After this, AJINOMOTO CO., (THAILAND) LTD. continued supplying feed grade lysine in China.

In March 2011, efforts were launched to sell feed grade threonine produced by Inner Mongolia Fufeng Bio-technological Co., Ltd. (based in the Hohhot Economic and Technological Development Zone) of Fefeng Group. under the Ajinomoto Brand. Under an agreement signed in November of the previous year, we began selling locally produced threonine, changing the previous system of importing threonine from the Group companies in the U.S. and France, and rebuilt our business platform in the highly competitive Chinese market. Then in August 2017, through AANG we signed an agreement with Meihua Holdings Group Co., Ltd. (based in the Langfang Economic & Technical Development Zone, Hebei), a large Chinese manufacturer of amino acid-related products, to have it manufacture feed grade lysine and threonine. From FY2018 on, AANG exported both of the company's products to the global market and began sales of Ajinomoto Brand products through sales companies in each market. With the discontinuation of in-house production in China and entrusting of production to two local companies, AANG now had a system for steadily shifting away from in-house lysine and threonine production to outsourcing in all regions globally, while promoting and accelerating further structural reform.

Increasing production for feed grade tryptophan in the U.S. and Europe

Meanwhile, tryptophan became central to AANG's efforts to shift from lysine and threonine. Feed grade tryptophan had long been produced by only two companies, the Ajinomoto Group and Germany-based Evonik Industries AG, which together controlled 80% of the global market. South Korea entered the market in 2010, but we made efforts to increase tryptophan demand, which succeeded in increasing demand by about 40% over five years. Because of this, in December 2014 AANG began expanding the Amiens Plant of France-based AJINOMOTO EUROLYSINE S.A.S. (currently AJINOMOTO ANIMAL NUTRITION EUROPE S.A.S.), formerly the only producer of tryptophan within the Group, completing construction in May 2016. This enabled the plant to increase its annual tryptophan production from 4,500tons to 7,500tons. Along with the expansion, we deployed new resource-saving fermentation technologies, successfully shared facilities for producing other products (lysine, threonine, and valine), and paved the way for expanding production capacity in the future with minimal investment.

In May 2017, we then began tryptophan production (3,000tons/year in production capacity) at U.S.-based production facility Ajinomoto Heartland, Inc.'s (currently Ajinomoto Animal Nutrition North America, Inc.) Eddyville Plant in Iowa.

Figure II-2: Results of amino acid balance improvement



(3) Patent lawsuit related to animal nutrition

Lysine lawsuit against Hong Kong-based Global Bio-Chem Technology Group Co. Ltd.

Because the animal nutrition business is an area where production technologies factor heavily into competitiveness, intellectual property protection has been a vital endeavor for the business.

In July 2013, Ajinomoto Co., Inc. together with France-based AJINOMOTO EUROLYSINE S.A.S. (currently AJINOMOTO ANIMAL NUTRITION EUROPE S.A.S.) filed a lawsuit for infringement of a lysine manufacturing patent with the Hague District Court in the Netherlands against Hong Kong-based Global Bio-Chem Technology Group Co. Ltd. (GBT) and three of its subsidiaries (the GBT Group). The GBT Group had already received injunctions against the sale of these products on three counts of patent infringement by courts across Europe. An analysis of products for which it had resumed sales on the basis of non-patent infringement found that the products in fact infringed on another patent, and we filed a motion to have the GBT Group suspend lysine sales, recall all sold products, and pay damages. In the same year, the judicial decision of the Supreme Court of the Netherlands regarding our patent infringement lawsuit

against the GBT Group in 2006 became final and binding in our favor. We also received a successful ruling by Germany's Federal Court of Justice as the GBT Group failed to appeal.

In the above-mentioned trial filed in 2013, although the first trial resulted in finding our patents invalid, this initial ruling was overturned via an appeal hearing in September 2016, confirming our victory. The final ruling prohibits the GBT Group from engaging in such actions as selling, using, or importing the infringing products in the Netherlands until the patent expire in 2025.

Both domestically and internationally, this series of victories in the lysine lawsuit made clear the uniqueness of our production technologies and stance on intellectual property protection.

Tryptophan patent infringement lawsuit in the U.S. and Europe

After the spin-off of the animal nutrition business, there was also a lawsuit concerning patent infringement for feed grade tryptophan, on which AANG had been focused.

In May 2016, Ajinomoto Co., Inc. together with U.S.-based Ajinomoto Heartland, Inc. (currently Ajinomoto Animal Nutrition North America, Inc.) and AJINOMOTO EUROLYSINE S.A.S. (currently AJINOMOTO ANIMAL NUTRITION EUROPE S.A.S.) filed a lawsuit for infringement of a tryptophan manufacturing patent with the U.S. International Trade Commission (ITC), the U.S. District Court for the Southern District of New York, and Germany's District Court of Düsseldorf against CJ CheilJedang Corporation and three of its subsidiaries (the CJ Group). The CJ Group had been manufacturing tryptophan at its Indonesian subsidiary and selling the product to a number of countries. Based on the finding that the CJ Group's manufacturing method infringed on our patent, we filed a motion against the CJ Group to cease the sale of infringing products and pay damages for products already sold. We also filed a similar patent infringement lawsuit concerning MSG production in August against the CJ Group.

In the U.S., a December 2017 ruling by the ITC found the CJ Group to have infringed on two of our patents, after which the CJ Group was prohibited from importing the infringing products. Ajinomoto Co., Inc. appealed the finding that a part of the strains used by the CJ Group did not infringe, while the CJ Group appealed the finding that certain strains did infringe. The ITC's ruling was then upheld by an appeal hearing ruling in August 2019 (the CJ Group has requested a final appeal with the U.S. Supreme Court). In Germany, Regional Court Düsseldorf issued a favorable ruling for us in February 2018, effectively prohibiting the CJ Group from selling tryptophan in Germany and from importing or selling infringing products to Europe through the CJ Group's German subsidiary, CJ Europe GmbH. This initial ruling was upheld in an appeal hearing ruling in October 2019 (the CJ Group is currently requesting a final appeal with Germany's Supreme Court).

3 The Specialty Chemicals Business

(1) Chronicle of the specialty chemicals business

Specialty chemicals business timeline

The following are the chief milestones achieved by the specialty chemicals business of the Ajinomoto Group.

- 1935: Established Takara Pharmaceutical Ltd. as a fully owned subsidiary (manufacturing lubricants for aircraft)
- 1942: Established joint venture company Nippon Specialty Oil Manufacturing Co., Inc.
 (on the grounds of Ajinomoto Co., Inc.'s Kawasaki Plant; renamed to Sanko Co. and became a fully owned subsidiary in 1946) (manufacturing lubricating oil for aircraft)
- 1946: Began production of insecticide DDT (Sanko Co.)
- 1950: Began production of paraffin wax-based flame retardant *Empara*[®] (Sanko Co.)

Thereafter, specialty chemicals business was carried out by three organizations: Ajinomoto Co., Inc. headquarters, Takara Industries Ltd. (renamed from Takara

Pharmaceutical Ltd. in 1964; conducted amino acid raw material packaging business), and Sanko Co. Following our development of amino acid-related technologies, new products were marketed up through the 1980s as listed below. These products are connected to our current product lineup.

- 1966: EPOMATE® epoxy resin hardener
- 1969: AJICOAT[®] polyamino acid resin (synthetic leather)
- 1971: AJIDEW[®] amino acid-based moisturizer
- 1972: Amisoft[®] amino acid-based surfactant
- 1973: Minon[®] weakly acidic amino acid-based cosmetic using Amisoft[®] technology (marketed by Yamanouchi Pharmaceutical Co., Ltd. (currently Daiichi Sankyo Co., Ltd.))
- 1982: PLENLIZER® ST series of vinyl chloride resin stabilizers from Sanko Co.
- 1988: PLENSET® one-component epoxy adhesive

Products launched in the 1990s included the *Eldew*[®] emollient oil, *Marinedew*[®] conditioning agent, *Amilite*[®] and *Aminosoap*[®] amino acid-based surfactants, and *Softshade*[®] UV absorber. The *JINO*[®] series of Ajinomoto Brand cosmetics based on amino acids were launched in February 1997 and were sold exclusively via mail order.

Establishment and growth of Ajinomoto Fine-Techno Co., Inc.

In October 1998, Ajinomoto Co., Inc. restructured the specialty chemicals business by integrating the specialty chemicals group at its headquarters with Sanko Co., which was renamed to Ajinomoto Fine-Techno Co., Inc. (AFT). Before this, from 1995 the specialty chemicals group had been developing an electronic material (for printed circuit boards) that utilized polymer technologies, and developed an original material for resists for tape automated bonding (TAB) that was used in liquid crystal displays and a liquid-based interlayer insulating material for printed circuit boards (PCBs). Moreover, *Ajinomoto Build-up Film** (*ABF*) launched in 1999, an interlayer insulating material for semiconductor packages that rectified the drawbacks of liquidtype PCBs, were used in the central processing units (CPUs) of Windows PCs,



Distant view of Ajinomoto Fine-Techno Co., Inc.

which swept the world, and became the de facto standard in interlayer insulating materials for semiconductor packages.

AFT later merged with Hokuetsu Carbon Industry Co., Ltd. (headquartered in Tsurumi-ku, Yokohama-shi) in 1999, to add the activated carbon¹ business, and has developed businesses in four areas, including electronic materials, industrial adhesives, and functional chemicals. It also bolstered its development and production structures with the establishment of Techno Center 1 and 2 (2000 and 2008) and the Gunma Plant (2007, in Showa-mura, Tone-gun).

Personal care ingredients business

Following the renaming of the Takara Industries Ltd. to Ajinomoto Takara Corporation, Inc. in 1989, the personal care ingredients business took over such operations as the sales of amino acids for pharmaceuticals, feed-use amino acids, and personal care ingredients from Ajinomoto Co., Inc. in Japan. Ajinomoto Takara Corporation, Inc. was renamed to AJINOMOTO HEALTHY SUPPLY CO., INC. (AHS) in 2005.

Specialty chemicals business development and overseas business expansion

In the FY2011-2013 Medium-Term Management Plan, the specialty chemicals business laid out two basic objectives: (1) in electronic materials, find new applications for *ABF*, an interlayer insulating material for semiconductor packages, and foster new businesses, and (2) in personal care, expand business scale by fostering major brands (retail business) and grow sales in emerging countries (personal care ingredients business). These objectives were succeeded in the period of the FY2014-2016 Medium-Term Management Plan, in which the personal care ingredients business aimed to accelerate overseas expansion with a focus on Southeast Asia and Latin America, and overseas production.

(2) Ajinomoto Fine-Techno Co., Inc.

Overseas business expansion of Ajinomoto Fine-Techno Co., Inc.

In line with the specialty chemicals business's focus on overseas business expansion, AFT, in charge of electronic materials business, established Ajinomoto Fine-Techno USA Corporation (a fully owned subsidiary) in California in 2015, bolstering its ability to act on the latest trends in Silicon Valley. It also focused on new product development: upon completing construction on a new headquarters annex in Kawasaki in 2016, it built the AFT Future Creation Center (AFCC) to promote open innovation, positioning the center as a place for developing new applications and businesses together with customers.

Finding new applications for Ajinomoto Build-up Film® (ABF)

ABF, an interlayer insulating material for semiconductor packages, is a core product of AFT, which handles electronic materials business. The material is a solution to the problems specific to a liquid-based material, i.e. that it can only work with the one side of the substrate at a time, it is difficult to fill in gaps between lines with it, and it readily adheres foreign materials to the surface. *ABF* was adopted in PC CPUs, which rapidly grew in performance while shrinking in size beginning in the 1990s, and it saw further improvements thereafter, boosting business performance.

Moving into the 2010s, while the wide spread of tablets and smartphones led to a decline in demand for PCs, *ABF* demand skyrocketed as the number of servers for use in data centers grew². *ABF* has since expanded even beyond servers to things like communications networks and video game consoles, making it a strong-performing product even in FY2019.

AFTINNOVA®, a next-generation performance material

While pursuing new applications for *ABF*, AFT has also been working to develop *AFTINNOVA*[®], a series of next-generation performance materials.

AFTINOVA[®] *Encapsulation Film (AEF)*, a product in this series, is an encapsulant for Organic Electroluminescence Displays (OELDs), which are replacing fluorescent lights and



AFT Future Creation Center

2. The wide spread of information devices such as smartphones and tablets, along with social media and video sites, is prompting a greater need for the ability to process large amounts of data faster, spurring development of high-performance networking devices. With semiconductor products at the heart of these devices, *ABF* is finding wider adoption for its ability to satisfy demand for larger capacities, higher-speed data transmission, and greater multi-layering in these products.

 Activated carbon has been used in the purification of MSG since the 1930s, and its main application is the same within the Group even now. light bulbs and are finding wider adoption in flat-panel displays as a successor to liquid crystal displays. This encapsulant is used to protect organic electroluminescence elements, which are vulnerable to moisture. *AFTINNOVA* * *Magnetic Film* (*AMF*) is a magnetic film material that lessens CPU power consumption. As this material must be both magnetic and insulating, we are working in tandem with major manufacturers to provide these features and satisfy customer needs.

(3) Personal care ingredients business

Overseas expansion of the personal care ingredients business

It is becoming a trend, especially in Europe, to use natural raw materials from plants that are both environmentally friendly and gentle on human skin. The result is growth in demand for personal care ingredients made with amino acids, and we are utilizing the sales network of the Group and expanding business worldwide in response. In February 2013, we established PT LAUTAN AJINOMOTO FINE INGREDIENTS (LAFI, located in Bekasi) as a joint venture with PT Lautan Luas, a listed chemical company in Indonesia. LAFI's purpose was to produce personal care ingredients (amino acid-based surfactants *Amisoft** and *Amilite**) in Indonesia, which is rich in raw materials such as palm oil, the main ingredient in personal care ingredients. Because of the start of operations at LAFI's plant in March 2014, the Group had increased the total supply capacity by roughly 30%, which includes the use of existing equipment at the Kawasaki/Tokai Plant and the Limeira Plant (producing mainly moisturizers) in Brazil.

In June 2019, we made the decision to construct a new plant for the production of amino acid-based surfactant *Amisoft*^{*} (liquid), a mainstay product made using personal care ingredients, within the grounds of AJINOMOTO DO BRASIL INDÚSTRIA E COMÉRCIO DE ALIMENTOS LTDA.'s Pederneiras Plant. Operations are slated to begin within 2020. This will increase the Group's production capacity of amino-acid surfactants by 60%.

Meanwhile, we built a laboratory for personal care ingredients at AJITRADE (THAILAND) CO., LTD.'s Ajitrade Cosmetics Application Center (ACAC), which is gaining more customers by providing services that meet their needs, including formula development and evaluation, as well as manufacturing prototype products. Through these activities, we have put together a sales network of more than 5,000 companies in 55 countries (as of 2019) for amino acid-based personal care ingredients. AHS has also played a role, building the Tokyo Customer Development Center (TCDC), where it conducts new business development, when AHS relocated its headquarters to Kyobashi, Tokyo in 2017.

(4) Cosmetics business

JINO[®], an original cosmetics brand, on the market for more than 20 years

JINO[®], one of our specialty chemicals businesses, is an original brand of amino acid-based cosmetics that was launched in February 1997. This series of skincare products (facial washes, toners, emulsions, and creams), which possesses a unique characteristic sufficiently differentiated from competitive products – containing an abundant and diverse array of amino acids – were promoted via direct marketing (mail-order sales). After that, the cosmetics business was developed as follows:

- 2007 Began directly managed store sales (two stores in Kanto and one in Kansai, as of 2019)
- 2009 Launched *L'ACTUA*[®], a brand that contains both amino acids and ingredients from lactobacillus, aimed at younger consumers (discontinued in 2014)
- 2010 Began selling *APIVITA*[®], a natural cosmetics brand from Greece (discontinued in 2013)

Through *JINO**, a precursor to our direct marketing business, we acquired a diversity of customer communication expertise, which included a strategy for attracting customers unique to direct marketing, trial kits and follow-up tools that gained us loyal customers, and the customer-communication know-how at our call center. Numerous campaigns were conducted in February 2017 to mark the 20th anniversary of *JINO**'s launch. *JINO** business was then transferred to

the Direct Marketing Department in April 2017, and it began selling the series in addition to its amino acid supplements.



JINO®

4

The Amino Acids Business Focusing on Pharmaceutical Peripheral Area

Full-scale production of amino acids for pharmaceuticals and foods in China

In addition to infusion solutions and medical foods, amino acids began finding use in various kinds of pharmaceuticals, drinks, health foods, and supplements. The Ajinomoto Group built a global supply structure consisting of facilities in Henan (March 1997 via joint venture) and Shanghai (February 1998 via joint venture) in China, and in Brazil (February 2005).

Demand for amino acids for pharmaceuticals and foods continued to grow since then: an annual demand in 2005 of 17,000tons hit 30,000tons around 2012, and was expected to grow further. Based on this, we made the decision to boost production capacity at Shanghai Ajinomoto Amino Acid Co., Ltd. in March 2013, allowing it to begin supplying amino acids in October 2013.

Conducting wellness business

Based on research into involving amino acids and related areas, we have been expanding specialty bulk businesses that solve health issues in Japan and overseas. In Japan, the businesses leverages the brand power of amino acid mix (e.g., *Amino L40**), providing customers with product design solutions in order to strengthen its downstream strategy (brand + inside strategy), which involves giving a variety of amino acid functions to foods. Furthermore, using the taste-improving function of polyglutamic acid (a long chain of amino acids), the main ingredient in the sticky strings of *natto* (fermented soybeans), the business is working with packaged food manufacturers, academic societies, experts, and governmental organizations to expand its usage of reduced-sodium foods.

Overseas, the business has launched supplement products¹ such as *CAPSIATE NATURA*TM (launched in July 2007; currently named *CAPSIATE GOLD*TM (launched in June 2015), followed by *Glysom*^{*} (2010) and *amino DEFENSE*^{*} (2013). These products were launched through clinics in the U.S., which put an emphasis on scientific evidence and safety with respect to health materials. To resolve food and health issues in overseas markets, the business makes a global effort to promote its downstream strategy, which centers on *Amino L40*^{*}. The multipronged strategy aims to transition from the supplement market to the food category, and from retail business to specialty bulk business.



 In 2012, CAPSIATE NATURATM and Glysom[®] were chosen as items in gift bags given to Academy Award nominees. The gift bags, which contain famous and soon to be famous products, are a hot topic every year among celebrities in the U.S.



CAPSIATE GOLD™



Glysom®



Amino DEFENSE®

The U.S. medical food business: Cambrooke Therapeutics, Inc. became a subsidiary

In November 2017, we, through Ajinomoto North America, Inc., acquired the U.S.based medical foods company Cambrooke Therapeutics, Inc. (headquartered in Massachusetts) as a fully owned subsidiary with an investment of roughly \$64 million (about 7.2 billion yen). Cambrooke Therapeutics, Inc. founded in 2000 deals in medical foods and low-protein foods for patients with amino acid metabolic disorders, ketogenic diet foods for patients with intractable epilepsy, medical foods for patients with protein allergies, and high-calorie foods for patients suffering from undernourishment due to conditions such as cancer or cystic fibrosis. The company supplies products to Europe and nations around the world, and has achieved continued growth with products more delicious and higher functional than competitors', with a focus on utilizing unique ingredients and practicing evidencebased product development.



Distant view of Cambrooke Therapeutics, Inc.

The U.S.'s medical foods² market was \$1.75 billion as of 2016 (about 198 billion yen), the largest in the world, with an average annual growth rate of about 10%. The U.S.'s medical foods market for patients with metabolic disorders accounted for about 40%, or \$660 million of this total (about 75 billion yen), and was estimated to have grown by 10% annually.

We, a seller of amino acids as ingredients for the medical foods market, have focused on the fact that medical foods lack in good taste and variety even though the patients with metabolic disorders can only eat the medical foods. As part of this focus, we made a full-scale entry into the medical foods market with the acquisition of Cambrooke Therapeutics, Inc., which underwent a name change in April 2019 to Ajinomoto Cambrooke, Inc.

The aim of this endeavor is to utilize scientific knowledge concerning the nutritional and physiological functions of amino acids, along with "deliciousness technologies" and food application technologies, in Ajinomoto Cambrooke, Inc.'s business in order to provide patients with a greater variety of more delicious foods. In addition, by expanding the range of targeted diseases and strengthening operations outside Japan using our sales channels, the company seeks to achieve sales of roughly \$90 million (about 10 billion yen) in 2027 and a global market share of 20% in the market for medical foods targeting those with metabolic disorders.

Furthermore, as a mutually beneficial synergy, we will put knowledge gained from Ajinomoto Cambrooke, Inc.'s medical foods business to use in our food-related businesses in Japan and overseas, including quick nourishments and supplements, and increase its lineup of high value-added health and nutrition products. 2. Classified by the Food and Drug Administration (FDA) as foods that fall between pharmaceuticals and dietary supplements and that are covered by insurance.



Ajinomoto Cambrooke, Inc. customers











GLYTACTIN BUILD™

KetoVie® series

The Overview of the Ajinomoto Group

Pharmaceutical cell culture media business

The cell culture media for regenerative medicine business is another business that has made much progress in recent years.

In August 1987, utilizing production technologies for highly purified amino acids, we began selling *Ajinomoto Serum Free (ASF) Media* series of serum-free medial for culturing animal cells. Cell culture media are nutrition solutions for growing and proliferating cells, and *ASF Media* contain no substances derived from animal extracts, preventing contamination. These media are also widely used in Japan and overseas as research reagents for biopharmaceutical production applications due to their superior cell proliferation performance (on par with serum culture) in Chinese hamster ovaries (CHO cells) and hybridoma cells, which are often used for biopharmaceutical production. *ASF Media* also feature high monoclonal antibody³ productivity in all cultivation forms, while also making it easier to refine product material with a consistent quality.

In November 2012, we established Ajinomoto Genexine Co., Ltd. (35.7 billion won in capital (about 2.5 billion yen), funded 75% by Ajinomoto Co., Inc.) through a joint venture with Genexine Co., Ltd. (headquartered in Seongnam, Gyeonggi-do) in South Korea, one of the world's largest markets for cell culture media. The company built a new plant in Incheon Free Economic Zone Songdo Area, South Korea and began production operations in July 2014. Using a production and quality control system compliant with Good Manufacturing Practices (GMP; production and quality standards established by the U.S. Food and Drug Administration (FDA)), the plant began supplying high quality culture media for animal cells used in the production of biopharmaceuticals.

Supporting regenerative medicine in cell culture media development for iPS and ES cells

Using proprietary analysis technologies and expertise in formulations, we also began developing cell culture media for iPS and ES cells. Both cells are multipotential stem cells (pluripotent cells) that can be differentiated into any cells, and are key to regenerative medicine.

In collaboration with the Center for iPS Cell Research and Application, Kyoto University (CiRA led by Professor Shinya Yamanaka⁴), we embarked on the development of safer cell culture media for iPS and ES cells that contain no ingredients derived from animals or humans. Conventionally, iPS cells have been cocultured with mouse cells called "feeder cells" in a culture medium containing bovine serum.

These efforts bore fruit in the form of *StemFit** *AK03*, a cell culture medium for iPS and ES, in February 2014. This medium, which uses a recombinant protein made with biotechnologies, can stably proliferate iPS and ES cells for long periods by bringing together our analysis and formulation technologies with expertise and research findings concerning iPS cells from Kyoto CiRA, and by achieving the optimal mix of factors needed for cultivation.

Along with providing the *StemFit*^{*} *AK03* to HEALIOS K.K., which became the first in the world to develop a therapy for age-related macular degeneration that involves transplanting retinal pigment epithelial cells derived from iPS cells, Ajinomoto Co., Inc. commercialized the following products in the course of continued industrialization research and development.

October, 2015 July, 2016 September, 2016 Launched⁵ StemFit[®] AK02N, a cell culture medium for basic research Launched StemFit[®] AK03N, a cell culture medium for clinical research Launched⁶ StemFit[®] Basic02, a cell culture medium for basic research developed for the global market based on StemFit[®] AK02N, intended for research institutes in the U.S., the global market leader 3. Antibodies obtained from clones derived from single antibody-producing cells. Accounting for roughly 30% of all biopharmaceutical products, they possess a high consistency and effectiveness due to the fact that they use the body's immune system to attack the target (antigen) when they bond with it.

4. Winner of the 2012 Nobel Prize for Physiology or Medicine for his discovery of iPS cells.

- 5. Outsourced sales to ReproCELL Inc. and Takara Bio Inc.
- Sales were conducted using distributors. (https://www.ajitrade.com/stemfit/ distributors/)



StemFit®

5

The Bio-Pharma Services Business

Chronicle of the pharmaceutical intermediates business

The Ajinomoto Group planned to get into the pharmaceutical intermediates business¹ using technological expertise cultivated through the development of amino acid and nucleotide manufacturing. In October 1989, we acquired Belgium-based contract development and manufacturing organization S.A. OmniChem N.V., then built a co-development structure with European and U.S. pharmaceutical companies, beginning full-scale business operations in the 1990s. In April 2004, S.A. OmniChem N.V. and AJINOMOTO EUROPE S.A.S were merged to create a system with integrated manufacturing and sales functions in the form of S.A. Ajinomoto OmniChem N.V. We also augmented our production facilities at the Tokai Plant in Japan.

Later, the business was thrust into a period of stagnation and recorded an extraordinary loss for the Tokai Plant equipment in the first half of FY2010. However, despite the 2010 problem (all large pharmaceutical patents expired at once around 2010, significantly impacting numerous pharmaceutical companies), decreased healthcare costs, and a drop in the number of new drugs approved, the production outsourcing trend saw no changes at large pharmaceutical companies.

To achieve contract manufacturing at low cost, in September 2011 S.A. Ajinomoto OmniChem N.V. established a joint venture company Granules OmniChem Private Ltd. with Granules India Ltd. (headquartered in Hyderabad), which manufactures and sells active pharmaceutical ingredients and pharmaceuticals in India. The new company began production at a new plant in the Visakhapatnam Special Economic Zone in Andhra Pradesh in July 2014. We acquired the company as a fully owned subsidiary in June 2020.

In April 2017, S.A. Ajinomoto OmniChem N.V. succeeded with a commercial-scale production trial that involved adapting a traditional multi-step batch process into a continuous flow chemistry platform. Continuous flow manufacturing brought several advantages, including overall processing time reduction, increased reaction selectivity, better product quality, temporary storage cost savings, and better control of the entire production process, making it a powerful tool for contract manufacturing.

Expanding business from Corynex® to biopharmaceutical contracting

Since the 2000s, the pharmaceuticals market has seen new drug development come to encompass not only conventional small molecules but also biopharmaceuticals that are medium to large molecules. As with small molecules, large pharmaceutical companies have outsourced manufacturing operations, including development operations such as the cultivation and conjugation with small molecules, which are needed for biopharmaceuticals. The field of biopharmaceuticals, in which pharmaceuticals are made through the analysis of genes and the use of biotechnologies, is a prominent new field for us, and one in which we possess technologies related to amino acids, nucleic acids, and proteins. Here we have focused on business in pharmaceutical cell culture medium (see p.83) and contract manufacturing for biopharmaceuticals.

Our contract manufacturing business began in earnest in 2009 with the launch of a service involving the use of the *Corynebacterium Expression System*, or *Corynex*[®] (see "History" p.47), a new protein and peptide secretory expression system using *Corynebacterium* bacterial strain that produce glutamic acid. This protein contract manufacturing service allows for significantly reducing production costs over conventional manufacturing methods by simplifying the purification process.

 Refers to compounds generated in the process of producing active pharmaceutical ingredients from raw materials. With some medicines, making an active pharmaceutical ingredient requires passing through more than 10 intermediates. Then in April 2013, we acquired U.S.-based contract development and manufacturing company for biopharmaceuticals Althea Technologies, Inc., which became Ajinomoto Althea, Inc. (see "History" p.44). With this acquisition, we inherited the former company's development and manufacturing functions, which were adapted to cGMP (current GMP (see "History" p.44 footnote; p.83 for GMP)), as well as its connections with customers, bolstering its business in the U.S.





Pharmaceutical intermediates business — Acquisition of GeneDesign, Inc.

In December 2016, Ajinomoto Co., Inc. and S.A. Ajinomoto OmniChem N.V. acquired GeneDesign, Inc. (headquartered in Ibaraki-shi, Osaka), a contract development & manufacturing organization (CDMO) for nucleic acid drugs.

Oligonucleotide drugs have a base structure of nucleotides chemically modified from DNA or RNA to stable structures. They are also being developed for diseases previously difficult to treat, and have strong potential for market growth in Japan and overseas. Applying synthesis technologies developed over the years, we developed oligonucleotides based on liquid-phase synthesis (better suited to large-scale production than solid phase synthesis, the common synthesis method for oligonucleotides) and marketed the *AJIPHASE** technology via CDMO business.

GeneDesign, Inc., founded in 2000, had received high acclaim from Japanese pharmaceutical companies and research institutes for being one of Japan's leading CDMOs for oligonucleotides, and for possessing sophisticated technologies related to solid-phase synthesis as well as rigorous quality control expertise.

This acquisition saw us bring *AJIPHASE*[®]-related technologies and S.A. Ajinomoto OmniChem N.V.'s pharmaceutical manufacturing functions and expertise together with GeneDesign. Inc.'s first-class solid-phase synthesis process, highlyexperienced personnel, and manufacturing functions compliant with cGMP. It paved the way to oligonucleotide CDMO business spanning from early-stage product development (high-mix, low-volume production using solid phase synthesis) to latestage development and post-launch operations (high-volume production via liquid phase synthesis).



Distant view of GeneDesign, Inc.

The birth of "Ajinomoto Bio-Pharma Services"

In October 2018, S.A. Ajinomoto OmniChem N.V. and Ajinomoto Althea, Inc. announced that they would integrate their business operations to form "Ajinomoto Bio-Pharma Services." The integration of S.A. Ajinomoto OmniChem N.V., which excels in small molecules, and Ajinomoto Althea, Inc., which have been involved in large molecules production and aseptic filling and packing services, realized a system for providing a wide range of services, and "Ajinomoto Bio-Pharma Services" sought to develop stronger relations of trust with customers by satisfying their needs.

Figure II-4: Overview of "Ajinomoto Bio-Pharma Services"



Through an integrated management system that includes GeneDesign, Inc. in Japan and Ajinomoto Bio-Pharma Services India Private Limited, "Ajinomoto Bio-Pharma Services" provides a wide range of cutting-edge platforms and functions ranging from pre-clinical and pilot programs to commercial mass production that include *Corynex*® protein expression technologies, oligonucleotide synthesis, antibody-drug conjugates (ADC)², high potency active pharmaceutical ingredients (HPAPI)³, biocatalysts, and continuous flow manufacturing.



Ajinomoto Bio-Pharma Services

- Abbreviation for Antibody-Drug Conjugates. Conjugated antibodies that target cancer cells with a potent anticancer agent, ADC are anticancer drugs that attack cancer cells with a minimal impact on healthy cells.
- 3. Abbreviation for High Potency Active Pharmaceutical Ingredients. As substances with extremely powerful pharmacological effects, HPAPI must be carefully controlled to prevent leaks or contamination, and strict care must be taken when handling them, including containment and washing.

6

The Functional Supplemental Food Business

A focus on supplements and skincare

The Ajinomoto Group's in-house mail-order sales began with mail-order sales company Ajitsu Corporation¹ (liquidated in 2003), established in 1986, but full-scale mail-order business began through sales (exclusively via mail order) of *JINO*[®] cosmetics series, which launched in February 1997. Conducted primarily through catalogs and advertisements in newspapers and magazines, mail-order sales became even more commonplace with the spread of the Internet and popularization of TV shopping beginning in the 2000s.

Our BtoC health foods in Japan were handled by the Direct Marketing Group, which was part of the Health Service Development Department established in 2002. *Glyna*[®] was launched in August 2005 and *Capsiate Natura*[®] in September 2006.

The history of the Direct Marketing Group is given below.

The Direct Marketing Group was incorporated into the Wellness Business Division, established in April 2009, and became the Direct Marketing Department. Although the department then became the Direct Marketing Group of the Wellness Business Department when it was incorporated into the AminoScience Division in April 2015, it once again became the Direct Marketing Department in April 2016. In April 2017, the Direct Marketing Department took over the *JINO** business, which was previously under the purview of the Specialty Chemicals Department.

The Direct Marketing Department deals in four categories of products, namely supplements, nutrition care foods, selected products, and skincare product *JINO**, through the sales company Ajinomoto Direct Co., Inc. (established as A-Direct Co., Inc. in July 2005 and renamed in April 2019). By providing these products, along with information, tailored to consumers' needs, the department boosted sales and began turning a profit in FY2011.

Fundamental foods for greater variety

Fundamental foods, supplements handled by the Direct Marketing Department, are a group of products developed by Ajinomoto Co., Inc. With these products, we aim to "achieve foods that enhance 'the ability to live healthfully' that all people innately have and contribute to vibrant everyday life as a company that has been involved with food and health for over 100 years." Fundamental foods are characterized by two features: A) new health ingredients (new functions from amino acids and plants), and B) scientific evidence (concerning safety, usefulness, and mechanisms).

The product lineup consists of *Glyna*[®] (August 2005), a rest support supplement containing the amino acid glycine; *Capsiate Natura*[®] (September 2006), which contains a proprietary capsinoid extracted from a non-spicy variety of red pepper; "*Teiko Katsuryoku*[®]"



Glyna®

Cystine and Theanine (December 2007), which enhances resistance in the body with a patented blend of the amino acids cystine and theanine; *Glucosamine & Chondroitin* (December 2007) with a blend of three ingredients² that support light movement, and *DHA & EPA*, (launched in October 2008), a source of omega-3 fatty acids³ important for staying healthy. Products sold included foods introduced on the Japanese TV show "Gochisousama," solely sponsored by Ajinomoto Co., Inc.



Zeitaku Yasai®



Capsiate Natura®

2. Glucosamine, chondroitin, and hydroxytyrosol.

 Docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), and alphalinolenic acid. The acids in this product are derived from blueback (DHA/EPA) and flaxseed (alpha-linolenic acid). The products below were added in 2009 and beyond.

January 2011:	Puru Puru Amino and Collagen
	Supports firm, moist skin with two main ingredients:
	Puru Puru Amino Acids®, a proprietary blend of four amino acids (valine,
	leucine, isoleucine, and glutamine), and ultra small-molecular-weight
	collagen, which has excellent absorption due to its nano size
November 2013:	Amino Aile®
	Contains vitamin D and Amino L40, a leucine-enriched essential amino
	acid mixture, and supports flexibility and strength in active seniors
April 2014:	Kashikoi Oyatsu® DHA
	Containing DHA made from algae produced in sanitary cultivation tanks,
	this product is a gummy-style supplement for children that is eaten like a
	snack
January 2017:	Mai Asa Histidine®
	The essential amino acid histidine was discovered to be useful for fatigue
	care during in-house bonito stock research. This supplement utilizes these
	research findings to be useful for fatigue care and bright intelligence

As Food with Functional Claims⁴ (FFC) system began in August 2015, starting with *Glyna*[®] in August 2015, this product lineup is being expanded with scientifically-proven products, namely *Amino Aile*[®], *Capsi*[®] *EX*, and *Mai Asa Histidine*[®].

In March 2017, we invested \$15 million (about 1.7 billion yen) in Hinoman Ltd., an Israelbased venture capital firm, acquiring exclusive sales rights in Japan for the company's plant material *Mankai* (roughly 45% of the nutrients in the dried powder are protein). We are currently working with the company to commercialize the product. 4. Food products that are registered by Japan's Consumer Affairs Agency as those whose packaging makes functional claims based on scientific evidence under the food business operator's own responsibility.



Teiko Katsuryoku[®] Cystine and Theanine



Puru Puru Amino and Collagen



Kashikoi Oyatsu® DHA



Mai Asa Histidine®



Amino Aile®



Capsi® EX

The Sports Nutrition Food Business

(1) Chronicle of the sports nutrition business

Providing ongoing athlete support as JOC official sponsor

The Ajinomoto Group's sports nutrition business began in 1992 with nutrition science research centered on amino acids. The business came into its stride with the launch of *amino VITAL* * *PRO*, a blend of 12 amino acids, vitamins, and minerals, in March 1995. Sales later soared when the amino acids market entered a boom period in 2001. The business has been involved in the following Olympics-related activities.

February 2003:	Became an official partner of the Japanese Olympic Committee (JOC)
June 2003:	Launched the $VICTORY PROJECT^*$, a program aimed at supporting athlete
	development, with the JOC
2004:	Provided nutrition support to the Japanese national team at the 2004 Athens
	Olympic Games. Launched similar support programs in South Korea, the
	U.S., and other countries
June 2005:	Chosen as an official partner for sports supplements by the American
	Olympic Association

These events led to a basic agreement with the JOC in May 2009 in which we acquired naming rights for the National Training Center (Nishigaoka, Kita-ku, Tokyo; opened in 2008) for four years¹. The facility was thereafter renamed to the *Ajinomoto National Training Center*². It was also decided that we would provide athletes with nutrition support in the nutrition management cafeteria at the Center, nutrition advice from our contracted nutritionist, and guidance on how to use amino acid supplements. At the signing of this contract, we also updated the partnership agreement with the JOC, moving up to the JOC Gold Partner program rank, the highest for official partners in Japan.

In July 2009, the Amino Acid Consumer Products Department, which was in charge of the sports nutrition business, came under the purview of the Wellness Business Division. After becoming the Sports Nutrition Department in April 2010, it began providing a wide range of support for athletes. In September 2010, we signed an official sponsorship agreement with Japan Swimming Federation. After the *VICTORY PROJECT** was launched, we continued providing nutrition-related support to the Japanese national swimming team and sponsoring for the Japan Inter College Swimming Championships, building trust-based relationships. At the 2012 London Olympic Games, we developed *amino VITAL** *GOLD London Special*³, an amino acid supplement, and distributed it free of charge. We also signed an additional partnership agreement with the JOC to add frozen foods to the contract category, further strengthening our ties with athletes. In May 2012, we acquired the naming rights for Nishigaoka Soccer Field (built in 1972; located next to the *Ajinomoto National Training Center*), the only national soccer-exclusive stadium in Japan, and named it *Ajinomoto Field Nishigaoka*.

Through these continued efforts, in March 2016 we became an official partner of the 2020 Tokyo Olympic and Paralympic Games (providing cooking condiments, dehydrated soups, amino acid-based granules, and prepared frozen foods), adding coffee (coffee beans and instant coffee powder/granules) to the agreement in November 2018. As at the 2012 London Olympic and Paralympic Games, the 2016 Rio de Janeiro Olympic and Paralympic Games saw us provide



amino VITAL® PRO

- Naming rights allow a sponsor company to pay to have its name and brand names put on sports facilities and other buildings. It is a key means of raising money to build or operate professional sports facilities.
- Ajinomoto Co., Inc. signed a naming rights agreement with Tokyo Stadium Co., Ltd. in November 2002, the first naming rights agreement signed with a public facility in Japan. This gave rise to the *AJINOMOTO STADIUM* in March 2003.



amino VITAL® GOLD London Special

3. Developed through joint research with the Sports R&D Core of the University of Tsukuba, which was given the Team Japan Multi-Support Project, an R&D project from the Ministry of Education, Culture, Sports, Science and Technology. the Japanese national team with a total of 300,000 amino acid-based granule products, including *amino VITAL* * *Rio 2016 Japanese national team Special*. We provided similar support for the 2018 PyeongChang Olympic Winter Games.

In addition to supporting the activities of the Japanese national team, we fashioned the concept of *Kachimeshi**, a creation born from support provided to athletes at the SAKURA Dining cafeteria in the *Ajinomoto National Training Center*. We also published a book entitled *The Japanese Olympian's Diet Program: "Kachimeshi**" *Recipes for Strong Youth* (July 2013), launched the *Kachimeshi** Journal website, making the recipes more widely known (see "History" p.67-70 for more information about activities involving the Olympic and Paralympic Games, and *Kachimeshi**).

Starting in 2010, we began entering into group portrait rights agreement with several sports associations, granting us the right to use athletes' photographs. Particular support was given to swimmers, badminton players, and figure skaters such as Mr. Yuzuru Hanyu, greatly contributing to enhancing our corporate image.

In November 2015, We launched three *amino VITAL*[®] products in Taiwan, followed by the launch of *amino VITAL*[®] *GOLD* (via online order) in Brazil in September 2016.

(2) Sports nutrition product development

"amino VITAL "" brand business

A pillar of the sports nutrition business, amino acid-based nutrition food *amino VITAL*[®] was launched in a variety of forms beginning in 1995, including as granules, bottled drinks, jelly drinks, and tablets. With the release of powder type, which is prepared by mixing with water, the *amino VITAL*[®] series was available in almost every form.

New *amino VITAL*[®] products containing additional benefits were later released. *amino VITAL*[®] *Capsi*[®], released in April 2010, is an amino acid supplement containing capsinoids (see p.87) for supporting burning during exercise.

In 2012, a series of products released in new fields.

In February, we launched *amino VITAL® Perfect Energy*, a jelly-based energy food supplement containing a proprietary blend of amino acids and carbohydrates. The intake of amino acids and carbohydrates enables the body to better utilize kinetic energy and supports performance towards the end of exercising.

In March, we launched *amino VITAL*[®] *Amino Protein*, a hybrid product containing essential amino acids and whey protein, at sporting goods stores throughout Japan. While Japan's sports protein market was growing steadily, users had many dissatisfactions with existing products, including that they were not very portable, tasted bad, or were difficult to mix into drinks. This product solved these dissatisfactions: one serving was only 4.4g (one stick, generally containing about 20g of protein per serving), and users could drink the product as is without first mixing in a shaker (lemon, chocolate, and blackcurrant flavors were released in February 2013, October 2014, and February 2018, respectively, in response to target consumers' preferences).

In August, we made a nationwide launch of *amino VITAL** *GOLD* (see p.89), an amino acid supplement developed for the Japanese national team at the 2012 London Olympic Games. Containing 4,000mg of essential amino acids, with a high volume of leucine, in particular, the product provided athletes with speedier post-exercise recovering (a jelly drink version was additionally released in August 2015).

With the release of the following products, the *amino VITAL*[®] series became a product supporting a variety of consumers, as well as athletes. Jelly drinks, in particular, enlarged the market as demand grew for convenience foods, increasing the size of the business significantly.

February 2010:amino VITAL* Jelly Drink Guts Gear* Muscat. This contains
130mg of calcium and 1,500mg of amino acids, providing 200
calories (the amount of energy in more than two bananas, yogurt
and apple flavors were added in February 2012 and February 2015
respectively)



amino VITAL® Rio 2016 Japanese national team Special



amino VITAL® Capsi®



amino VITAL® Perfect Energy

August 2017:

amino VITAL® Amino Shot®

This low-volume jelly drink contains a high concentration of amino acids produced via proprietary technology, and can be consumed in the midst of endurance sports such as running

August 2019:

A full-scale overhaul of the *amino VITAL*[®] *PRO* and *amino VITAL*[®] products, the first overhaul since their launch

Drawing on research conducted for the Japanese national team at the 2012 London Olympic Games and 2016 Rio de Janeiro Olympic and Paralympic Games, *amino VITAL* * *PRO* contains a proprietary mix of essential amino acid (LEAA⁴, patented), and both products were designed to support full-body conditioning with a blend of cystine and glutamine. These products also feature improved palatability thanks to technologies for reducing the bitterness of amino acids and to granule production technologies that enable the contents to quickly melt in the mouth. This prompted us to better communicate that *amino VITAL* * (popular version containing 2,200mg of amino acids), renamed to *amino VITAL* * *Active Fine*, is a product for sports lovers.



amino VITAL® GOLD



amino VITAL® Jelly Drink Guts Gear®



amino VITAL® Amino Shot®



amino VITAL® PRO



vannia

4. Leucine-enriched Essential Amino Acids mixture



amino VITAL® Active Fine

Launch of No-Mikata® hangover care

Following on the launch of *Kanpai Iki-iki* in 2003 and *amino de Kan pai*[®] in 2006, *No-Mikata*[®], a supplement released in August 2009 containing amino acids, is a somewhat unconventional product in the sports nutrition field that quickly replenishes the amino acid alanine to care the negative effects of alcohol consumption.

Alanine is an amino acid found in abundance in shellfish, particularly freshwater clams. Freshwater clams have long been said to have salutary effects, and numerous health foods touting their freshwater clam ingredients were released around this time. Each stick of *No-Mikata*[®] has the alanine content of 160 freshwater clams, and since amino acids need not be broken down to be digested, the alanine is absorbed in around 30 minutes. *No-Mikata*[®] also contains glutamine, to protect the body from the inside. Taking the form of granules that rapidly melt in the mouth, *No-Mikata*[®] is a fast-acting product of care for hangover able to be taken without water.

At product release, we launched a website for mobile phones that provided product information through links to game and foodie websites. We also worked to familiarize the target demographic (men and women in their 20s and 30s) with the product, including distributing product samples to 100,000 people and holding events downtown.



No-Mikata®

The Overview of the Ajinomoto Group

II. AminoScience Business

8 The AminoIndex Business

Assessing health and disease risk based on balance of amino acid concentrations

In April 2011, the Ajinomoto Group launched the *AminoIndex*[®] *Cancer Screening* (*AICS*[®]) service for assessing existing cancer risk and analyzing the balance of amino acid concentrations in the blood.

The service is powered by two technological developments: high-speed amino acid analysis beginning in the early 2000s, and multivariate analysis, which analyzes the concentrations of 20 types of amino acids in the blood (multiple independent data are analyzed together). Although it was previously known that the balance of amino acid concentrations in the blood changes in different ways with different diseases¹, analyzing amino acid balance was only done in cases such as congenital metabolism disorders and liver disease due to large individual differences among patients and the difficulty of reproducing amino acid analysis results.

Figure II-5: Changes in concentration balance of amino acids in the blood



However, in 2002, we developed a technology that reduced the time needed to analyze one sample from roughly two hours to about seven minutes by derivatizing amino acids before they are separated² and using Liquid Chromatograph/Mass Spectrometry (LC-MS). The Health Informatics (HI) Han was formed thereafter, in July 2006. In around 2008, the target for this service was focused on cancer, and with support from healthcare facilities and physical exam providers, we collected and stored a vast amount of clinical data for building evidence to use as a platform for multivariate analysis. Although we struggled to find more research collaborators, persistent efforts to accumulate data and explain the importance of the tests won us broader cooperation from many medical facilities. Ultimately, we were able to show that the amino acid concentration balance in the blood of cancer patients differs from that found in healthy people, depending on the type of cancer they have.

In July 2009, the HI Han was incorporated into the newly-established Wellness Business Division, and was thereafter promoted to the AminoIndex Department in April 2011 with the start Proteins make up about 20% of the human body, and amino acids compose these proteins. There are 20 types of amino acids in the blood, and a constant balance of amino acids is maintained in the blood of healthy people. When a person contracts a disease, however, one's metabolic balance changes along with amino acid concentrations in the blood.

 A pre-analytical preparation to simplify LC-MS analysis by reacting a compound (in this case, amino acids) with derivatization reagents to improve volatility and heat stability. of the *AICS*[®] service. The department's operations were then transferred to the AminoScience Division in April 2015, and the AminoIndex Department was formed within the AminoScience Division when the target conditions for the *AminoIndex*[®] service were expanded to cover brain stroke and myocardial in April 2019.

Launching of AminoIndex® Cancer Screening (AICS®)

*AminoIndex** *Cancer Screening*, launched by Ajinomoto Co., Inc. in April 2011, was the world's first service to measure and analyze amino acid balance in the blood for assessing existing cancer risk. The service analyzes blood samples (about 5ml) and expresses cancer risk as a number between 0.0 and 10.0 (the AIC indicator), with a higher number indicating a higher cancer risk, and as either rank A, B, or C to facilitate early detection and treatment.

In launching the service, we signed a joint venture agreement with clinical testing company SRL, Inc. in November 2010. The two companies played different roles, with SRL, Inc. collecting blood samples, analyzing amino acids, conducting sales operations, and sharing test results, and Ajinomoto Co., Inc. examining analysis data, providing academic support, and developing products. The companies then tried to apply it to physical examinations and other tests. The service covered five cancers that develop in the bodily organs: gastric, lung, colorectal, prostate, and breast cancers.

Six months later, in October 2011, the results of a large clinical study that had been conducted with the Department of Gynecology and Obstetrics of Yokohama City University proved the usefulness of the index based on AminoIndex technology in assessing the risk for three types of cancer exclusive to women – cervical, endometrial, and ovarian cancer – leading to the adding of this test to the service in May 2012.

In the meantime, in December 2011, the "AminoIndex Technology" was designated as an effort of the field of "personalized and preventive medical treatment" in the Keihin Waterfront Life Innovation International Strategy Specialized Zone in the cities of Yokohamashi and Kawasaki-shi in Kanagawa, by the Cabinet Office of Japan. These zones are aimed at strengthening the international competitiveness of Japanese industry, and the Keihin Zone is aimed at achieving personalized and preventive medical treatment needed by the next generation of healthcare professionals to solve healthcare problems faced in Japan, a super-aged society.

Through joint research with Nara Medical University, in December 2013 we demonstrated the mechanism whereby changes in amino acid balance in the blood, the key to *AICS*[®], lead to proteins in normal cells being broken down into amino acids and some of them being leaked into the blood due to the function of a protein known as HMGB1, which is secreted from cancer cells. This research therefore also served to elucidate the physiological effectiveness of *AICS*[®].

AICS[®] was expanded to cover pancreatic cancer in August 2015, and as of the end of 2019, close to 1,500 healthcare providers were using the service.

Towards AIRS®, now capable of assessing future lifestyle disease risk

Concurrent with efforts to commercialize $AminoIndex^{\text{*}}$ Cancer Screening (AICS^{*}), we began to use its $AminoIndex^{\text{*}}$ Technology for other diseases.

One step in this process was the forming of a partnership with Kao Corporation in May 2012. With a focus on middle-aged and elderly individuals with metabolic syndrome, Kao Corporation embarked on research as well as the development and sale of healthcare products. It also began conducting QUPiO, a program to prevent metabolic syndrome. The program is provided by the group company Healthcare Committee, Inc. for health insurance societies and similar organizations. We acquired a share in Healthcare Committee, Inc. and created a health portal service that combines the health checkup-related expertise offered by QUPiO and our information about proper diets and metabolic syndrome screening information based on amino acid analysis using "AminoIndex Technology." Through this partnership, we built up knowledge of lifestyle disease prevention and acquired valuable experience through an alliance strategy.

In April 2014, we began joint research with Massachusetts General Hospital (Boston) using data from the Framingham Heart Study³, an epidemiological study commissioned by the U.S. Congress. Through research involving individuals who had received physical examinations, we discovered a link between fluctuations of the balance of amino acid concentration in the blood

Figure II-6: AminoIndex® Risk Screening (AIRS®) features



and visceral fat deposits. Meanwhile, a research group with Massachusetts General Hospital released a paper explaining how the risk of diabetes or cardiovascular disease could be predicted about 10 years in advance by analyzing the strong correlation between the balance of amino acid concentration in the blood and the risk of such diseases occurring. This joint research aimed to establish a universal risk prediction model that could be applied worldwide, transcending such differences as country or race.

Following these developments, in November 2017 we expanded AICS® with the launch of the AminoIndex® Risk Screening (AIRS®) service as an additional service to AminoIndex® Lifestyle Disease Screening (AILS®). AILS® (risk of diabetes) assesses the risk of developing diabetes within four years based on a person's balance of amino acid concentration in the blood. AILS® (amino acids level) assesses such things as low amino acid levels based on the concentration in the blood of 10 essential and semi-essential amino acids that people must get from their diet. The results of these two assessments are categorized into four types, and examinees are provided with "AILS® Lifestyle Improvement Guide" booklets according to their type. These assessments therefore help prevent disease. In April 2017, we formed a joint venture agreement with BML, Inc., a clinical testing company, and built a two-company sales structure consisting of SRL, Inc. and BML, Inc. Then in April 2019, AILS® was expanded with an assessment to determine a person's risk of having a brain stroke or myocardial infarction within 10 years. The top three diseases resulting in death among Japanese are cancers, brain strokes and myocardial infarction. There are also 20 million Japanese with diabetes, including those at risk, and diabetes can also cause numerous complications. As we seek to help extend the healthy life expectancy of people and support comfortable lifestyles, we will continue working to provide services to support the early detection and prevention of various diseases.



The pharmaceuticals business restructuring

Establishment of AJINOMOTO PHARMACEUTICALS CO., LTD.

With its origins in the sale of amino acids for pharmaceutical use, the Ajinomoto Group's pharmaceutical business started in the 1970s. We launched products based on amino acid and its derivative research, including *MEDIF** (1974), a diet for protein-energy malnutrition; *ELENTAL** (1981), the world's first elemental diet; *LENTINAN** (1986), an anti-cancer drug; *AJICEF** (1987), an antibiotic agent; *LIVACT** (1996), an amino acid formula for liver cirrhosis; and *FASTIC** (1999), an anti-hyperglycemic agent.

During this time, the Pharmaceuticals Department was formed in 1985, becoming the Pharmaceuticals Division in July 1999, focusing on clinical nutrition and infusion solutions. We acquired Hoechst Marion Roussel Ltd.^{1'}s infusion business in December 1999 and established Ajinomoto Pharma Co., Ltd. After becoming a pharmaceutical company in April 2002, we expanded in size with the acquisition of Shimizu Pharmaceutical Co., Ltd. in December of that year. From April 2005, Ajinomoto Co., Inc. was responsible for business strategy, reliability assurance, and R&D functions, Ajinomoto Medica Co., Ltd. (renamed after Ajinomoto Pharma Co., Ltd.'s production and logistic functions to Shimizu Pharmaceutical Co., Ltd.) for production and logistics functions, and Ajinomoto Pharma Co., Ltd. for sales and marketing functions.

The 2000s saw a series of mergers following massive investment into new drug development by pharmaceutical companies, making it an age of fierce competition among large pharma companies². In April 2010, the Pharmaceutical Company of Ajinomoto Co., Inc., Ajinomoto Medica Co., Ltd., and Ajinomoto Pharma Co., Ltd. concluded a merger, forming AJINOMOTO PHARMACEUTICALS CO., LTD. and establishing an integrated production, development, and sales structure.

Establishment of EA Pharma Co., Ltd. with outside collaboration

AJINOMOTO PHARMACEUTICALS CO., LTD. recorded 85.8 billion yen in revenues for FY2008, falling short of 100 billion yen. At this level, AJINOMOTO PHARMACEUTICALS CO., LTD. lacked the wherewithal to survive in the pharmaceuticals industry in Japan, let alone the global industry. Seeking a way out through collaboration with external organizations, we established AY PHARMACEUTICALS CO., LTD. as a joint venture with Yoshindo Inc. in July 2013 (equity share: Yoshindo Inc. 51%/Ajinomoto Co., Inc. 49%), and transferred its infusion solutions and dialysis business to the new company via divestiture. We dissolved the joint venture in 2016, and Yoshindo Inc. acquired AY PHARMACEUTICALS CO., LTD as a fully owned subsidiary.

Meanwhile, with regard to AJINOMOTO PHARMACEUTICALS CO., LTD., we formed a strategic partnership with Eisai Co., Ltd. in October 2015, which led to the decision to move the latter's gastrointestinal disease business to AJINOMOTO PHARMACEUTICALS CO., LTD. April 2016 saw the establishment of EA Pharma Co., Ltd. (equity share: Eisai Co., Ltd. 60%/ Ajinomoto Co., Inc. 40%) as a specialty pharma focused on the gastrointestinal tract. EA Pharma Co., Ltd. now aims to satisfy the needs of patients and their families as a human healthcare company specializing in the gastrointestinal tract, utilizing an extensive range of knowledge derived from experience and data unique to the two groups.

- With investment from Ajinomoto Co., Inc., contract pharmaceutical sales company Morishita Pharmaceutical Co., Ltd. merged with France-based Roussel Medica Co., Ltd. to form Morishita Roussel Co., Ltd. The company then merged with Germany-based Hoechst AG in April 1998 to become Hoechst Marion Roussel Ltd.
- 2. These include the U.S.-based Pfizer, Inc. and Merck & Co., Inc., Switzerlandbased Novartis International AG and F. Hoffmann-La Roche AG, Francebased Sanofi S.A., and UK-based GlaxoSmithKline PLC, each recording sales of 4-6 trillion yen in FY2017. Takeda Pharmaceutical Company Limited, Japan's largest pharmaceuticals company, had sales of 1.7 trillion yen. It became the eighth largest in the world with its 2018 acquisition of Irelandbased Shire PLC.

These efforts constituted a restructuring of our pharmaceutical-adjacent business, and we went on to expand business in cell culture media for regenerative medicine (see p.83), Contract Development and Manufacturing Organization (CDMO, see p.84-86) and *AminoIndex*[®] (see p.93-95), specializing in and focusing on areas in which we could exercise a strength: state-of-the-art amino acid research and a wealth of bioscience and chemical synthesis technologies.

The Overview of the Ajinomoto Group