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Generating social value and economic value through R&D

Takeshi Kimura
Member of the Board & Corporate Vice President

April 10, 2018

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1. The Ajinomoto Group seen from an R&D perspective
2. Positioning of R&D and its overall picture in the FY17-19 MTP
3. Examples of solutions using technology
4. Descriptions of representative core technologies
5. Open and linked innovation concepts and initiatives

1. The Ajinomoto Group seen from an R&D perspective

1. The Ajinomoto Group seen from an R&D perspective
R&D framework: organizational structure and staff numbers

Approx. 1,700
R&D staff

Approx. 350
Ph.D. holders

R&D Planning Dept.

Intellectual Property Dept.

Business Units

Group Companies

Institute of Food Science and Technologies

Research Institute for Bioscience Products & Fine Chemicals

Research Labs. of Group Companies

Institute for Innovation

1. The Ajinomoto Group seen from an R&D perspective
R&D expenses

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(¥ Billions)

	FY2015 Result	FY2016 Result	FY2017 Forecast	FY2019 MTP
R&D expenses	26. 5	27. 1	28. 8	29. 0
(Japan Food Products)	3. 5	3. 4	3. 9	-
(International Food Products)	3. 3	3. 5	3. 8	-
(Life Support)	4. 8	5. 0	5. 4	-
(Healthcare)	2. 7	2. 5	2. 2	-
(Other)	-	0. 2	0. 6	-
(Corporate)	11. 9	12. 2	12. 9	-
Sales	1,149.4	1,091.1	1,187.0	1,311.2
R&D expenses/ Sales ratio	2.3%	2.4%	2.4%	2.2%

1. The Ajinomoto Group seen from an R&D perspective

Breakdown of R&D expenses and comparison with other companies (FY2016)

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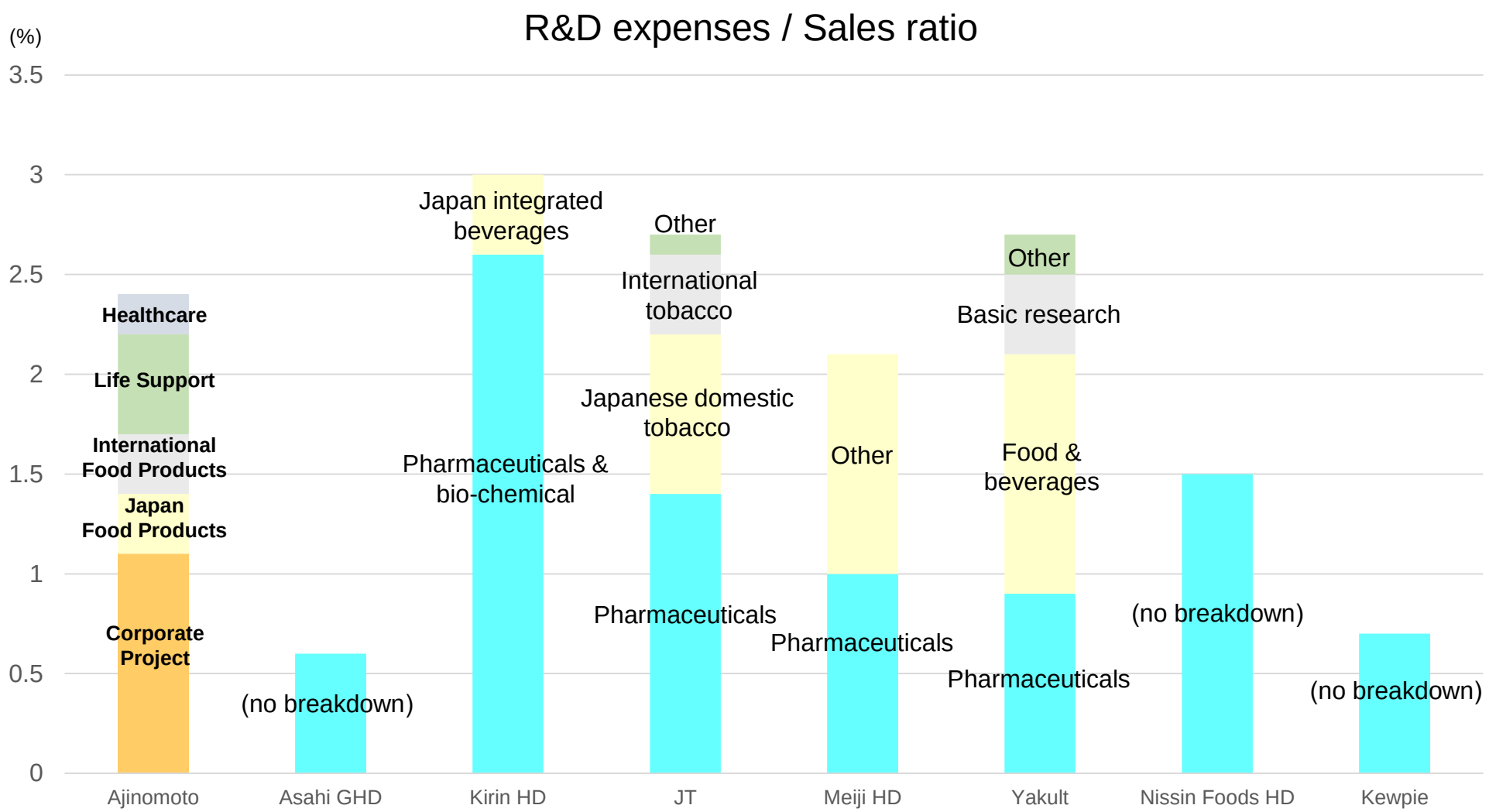

(Made by Ajinomoto Co. using securities reports from each company)

1. The Ajinomoto Group seen from an R&D perspective
Patents

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External assessment

Ranking by Patent Result Co., Ltd.* (comparison with domestic food product companies)

Food Products, 2017 Ranking of Patent Asset Holdings, top 10 companies

Announced Jun. 9, 2017

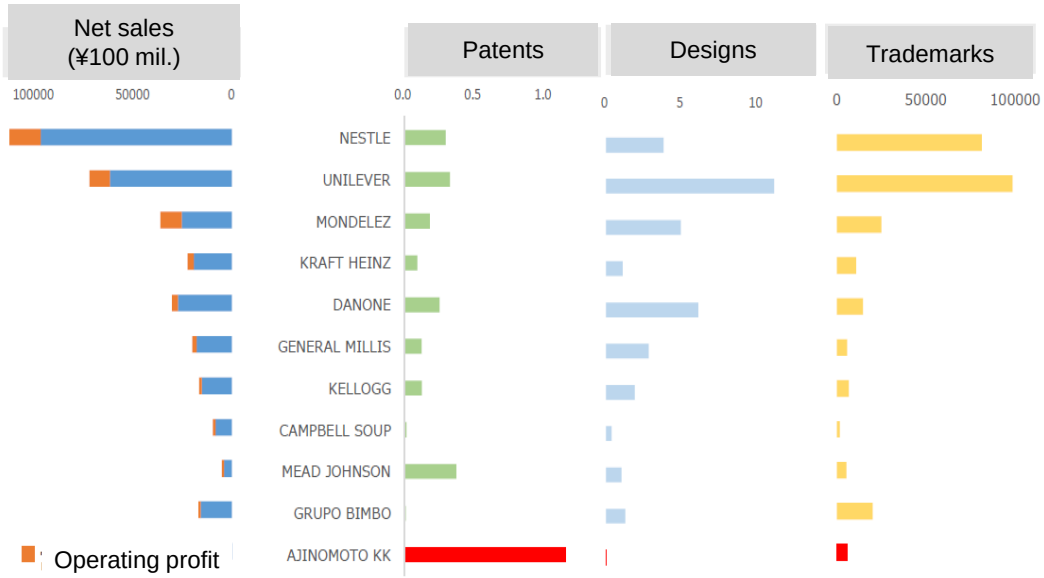
Rank	Prev. year's rank	Company name	Patent holdings (pt)	Number
1	5	Ajinomoto	3,941.5	100
2	6	NESTEC	3,724.0	91
3	2	Suntory Holdings	3,401.0	91
4	4	Meiji	3,283.0	109
5	13	Nisshin Seifun Group	3,168.8	94
6	7	Toyo Shinyaku	3,055.4	45
7	3	Kirin Holdings	2,899.0	91
8	1	Sapporo Holdings	2,727.2	48
9	8	The Nisshin OilliO Group	2,578.0	61
10	14	Philip Morris Products	2,286.9	56

* A company developing and marketing patent analysis software

Comparison of intellectual property number per ¥10 bil. of sales

(Comparison with top 10 global food product companies)

Announced Jun. 9, 2017



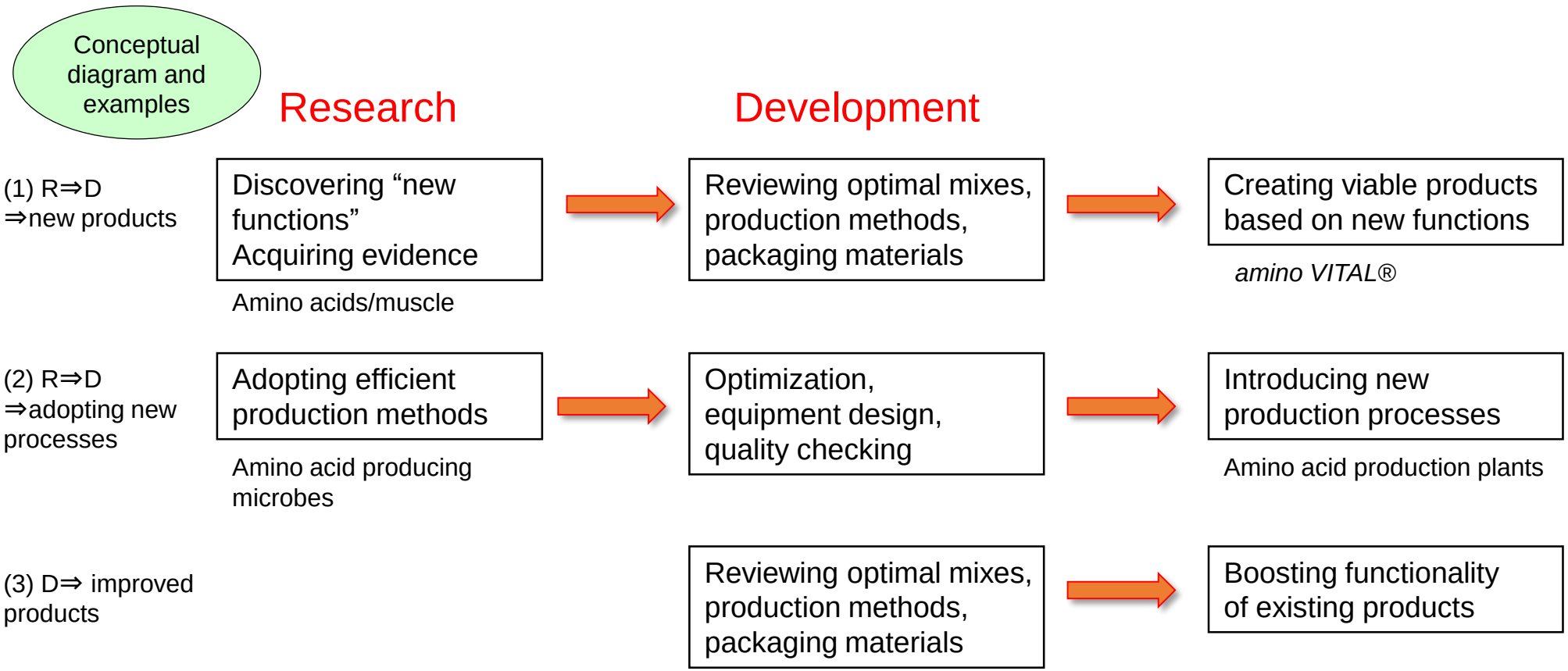
Patents: DWPI family patents (inventions) 11-14 average
Designs: Designview applications (total no.), no specific time period
Trademarks: SAEGIS applications (total no.), valid trademark rights only

Patents have been filed (or trademarks registered) for all examples in this presentation

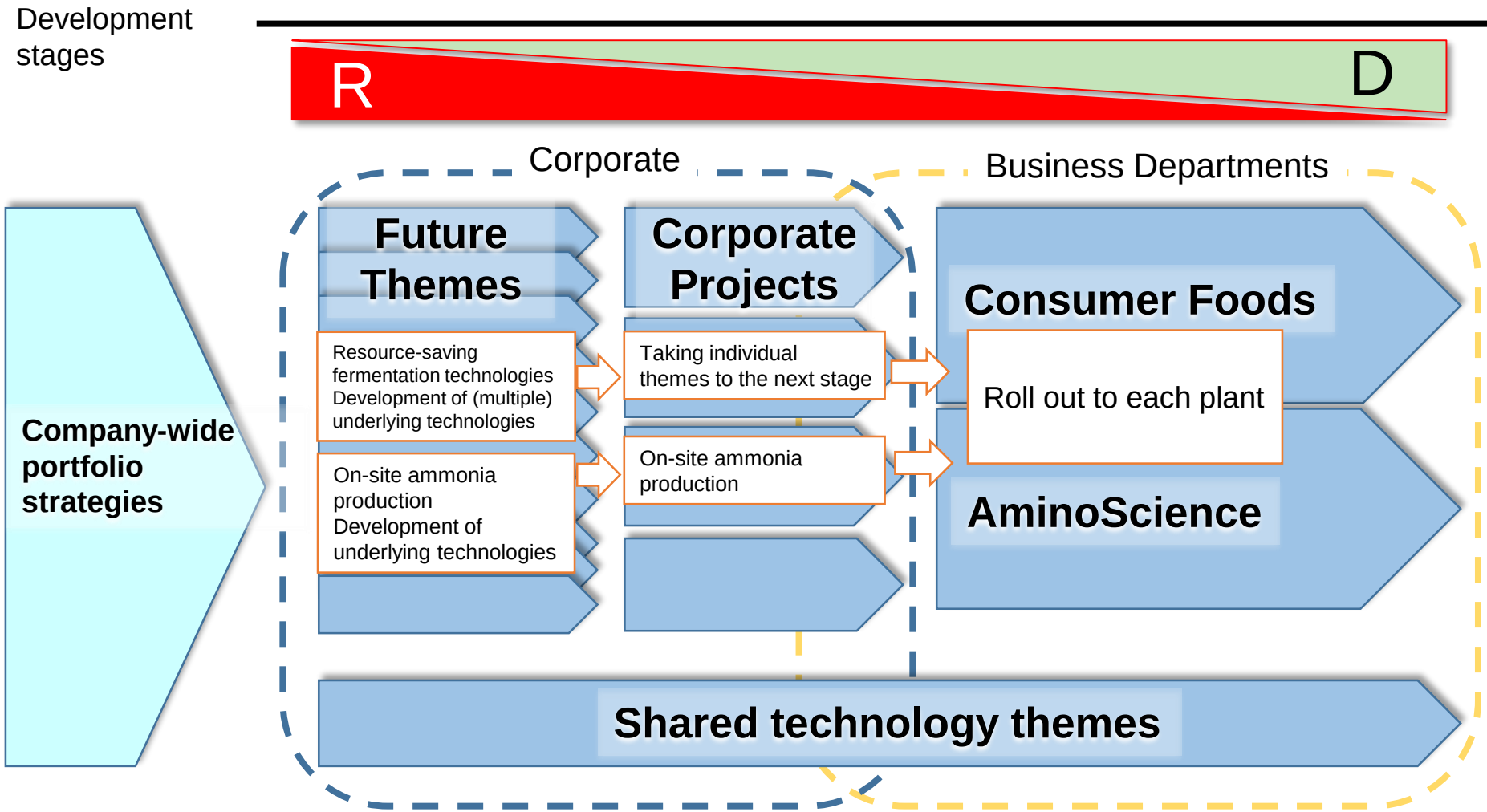
1. The Ajinomoto Group seen from an R&D perspective Conceptualization of “R” and “D”

- “R” (Research): creation from 0 to 1
- “D” (Development): from 1 to 10 (creating viable products, introducing new production processes, etc.) through to finished results

Conceptual diagram and examples



1. The Ajinomoto Group seen from an R&D perspective
Theme management



Depending on the stage of development, separate themes led by corporate or by business departments
→ foster medium- and long-term themes
Business departments also contribute to company-wide strategic themes for smooth leadership transition
→ avoid the “valley of death”

2. Positioning of R&D and its overall picture in the FY17-19 MTP

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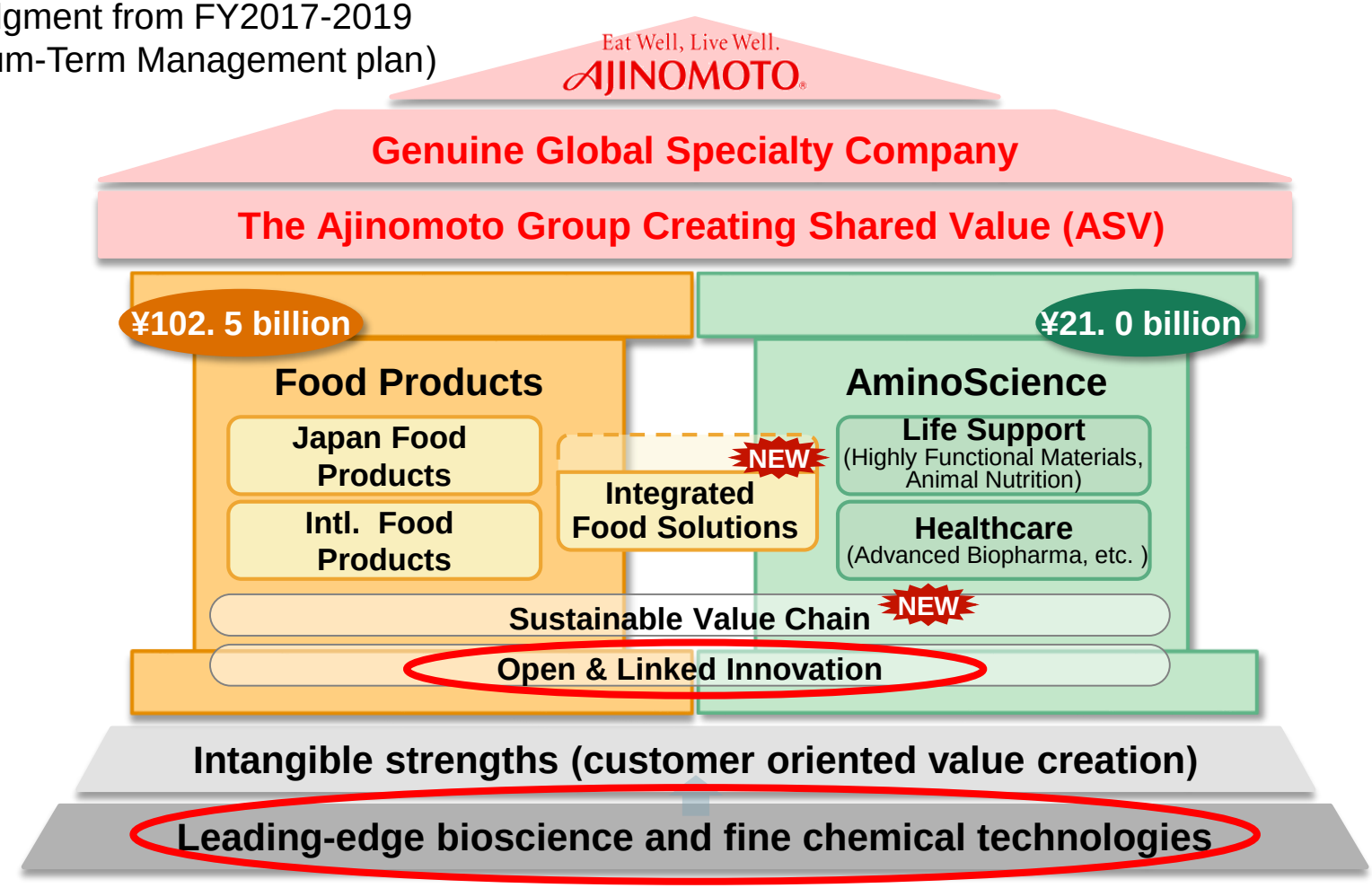
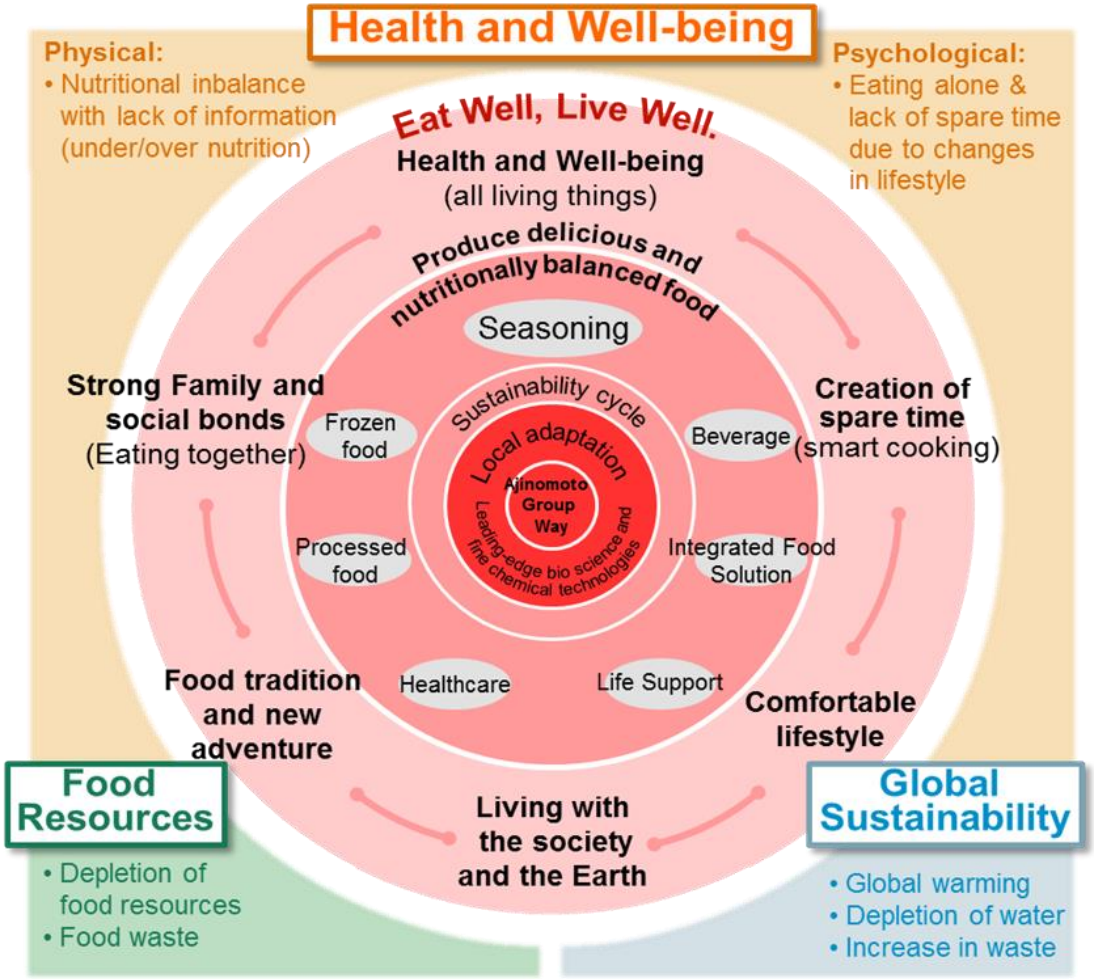
(Abridgment from FY2017-2019
Medium-Term Management plan)



Technology is the platform supporting Ajinomoto Co.'s business

2. Positioning of R&D and its overall picture in the FY17-19 MTP
Social issues to be solved and value creation targeted



ASV Value Creation Stories

1. **We contribute to health and well-being by utilizing our leading-edge bioscience and fine chemical technologies which also leads to deliciousness technologies, and by delivering good and healthy food**
2. **We contribute to the development of a society that enables strong family/social bonds and diverse lifestyles through eating well**
3. **We contribute to the sustainability of the society and the earth, with our customers and local communities, across the value chain from production to consumption**
4. **We co-create value with each region through the perspectives of the customers, with our global, top-class and diverse talents**

2. Positioning of R&D and its overall picture in the FY17-19 MTP

Business development and the technologies that contribute to it — based on amino acid functions

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Starting with the discovery of umami substances as a base, using the functions of amino acids, refining the technology in the field of “leading-edge bioscience & fine chemicals,” and apply to various fields

Dr. Kikunae Ikeda discovers (1908) that glutamic acid is the central flavor component of *dashi* broth

Discovery of umami substances

Evaluation technologies	Flavor receptors	Sensory evaluation	Physical property evaluation	Statistical analysis	Pharmacolo-gical evaluation	Functional evaluation	Engineering evaluation

Amino acid functions		
	Flavoring function	Science of “deliciousness” --> moving toward non-umami flavoring substances/functional foods and frozen foods fields
	Nutritional function	Elucidating nutritional value --> moving into human and animal nutrition fields
	Physiological function	Elucidating new physiological functions --> moving into diagnostic and supplement fields
	Reactivity	Creating amino acid derivatives --> moving into fields other than food

Underlying technologies	Analysis	Fermenta-tion	Enzymes	Chemistry	Processes	Packaging	IT

On-going research on each theme

3. Examples of issue solutions using technology

Current business structure and the technologies supporting it; social issues Ajinomoto Co. is contributing to solving

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Amino acid functions*
Flavoring function: building deliciousness
Nutritional function: delivering nutrition
Physiological function: restoring physical condition, delivering health
Reactivity: creating new functions

Analytic technologies
- Researching
- Discovering

Production technologies
- Cultivating
- Extracting
- Making
- Increasing

Processing technologies
- Shaping
- Mixing
- Converting

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3. Examples of solutions using technology

3. Examples of solutions using technology (1)

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3. Examples of solutions using technology (1) Contributing to needs for quicker cooking and preparation

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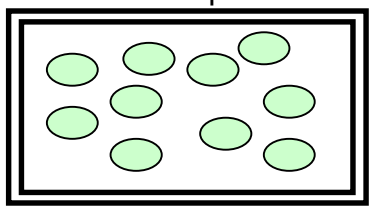
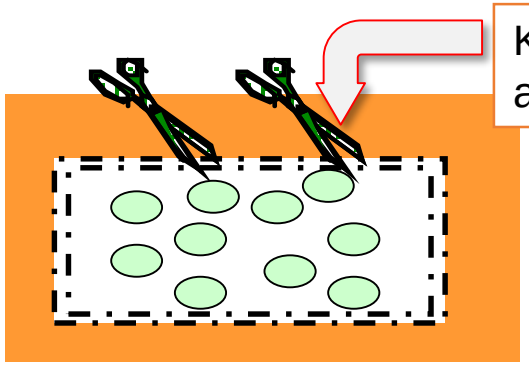
Raw Japanese radish
Before cooking

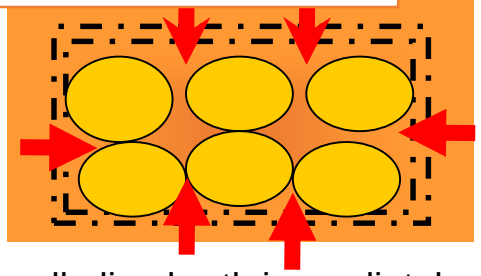
Cell walls of Japanese radish





Knowledge of applied amino acid technologies

The root vegetable softener makes the broth alkaline to break down the cell walls quickly, allowing the flavor to soak into and soften the vegetables.



The alkaline broth immediately penetrates from where the cell walls are broken, speeding up gelatinization of the starch to create a pleasing texture in a short time.

Simmering time
Using *Kyo-no Ohzara*®: approx. 10 min.
Standard radish cooking time: 40-50 min. **(source: Cookpad)**

Economic value: *Cook Do*® brand YoY sales comparison
- FY11→FY12: 124% (*Kyo-no Ohzara*® pre-sales in the Tokyo metropolitan area)
- FY12→FY13: 116% (*Kyo-no Ohzara*® nation-wide sales)
  Steady growth since FY13

3. Examples of issue solutions using technology (1) Contributing to sports nutrition

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(1) Leveraging the utility of amino acids (umami; functional applications), which is the specialty of the Ajinomoto Group

Umami amino acids
for delicious, healthy food

Since amino acids are the source of "deliciousness," they can make any dish in the world more flavorful.

Functional amino acids
for better formulations

Since amino acids are the body's building blocks, they can get one in condition.

(2) Providing support to top athletes through the activities of the Victory Project®
→ a meal program (nutritional habits) followed by top athletes to produce results

As needed: holding Kachi-Meshi® study sessions during practice and training camps for top athletes


During athletic events: holding close discussions with athletes and creating Nutrition Planning Sheets with customized nutrition plans.



3. Examples of solutions using technology (2)

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3. Examples of solutions using technology (2) Expanding into the field of regenerative medicine

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Leading-edge bioscience and fine chemical technologies

- Research on amino acid nutrition/metabolism
- Blending technologies Nutritional supplement development technologies
- Analysis technologies
- Bio-technologies

Business and Product

Infusions

***Elental* enteral nutritional supplement**

ASF Medium®

aminoindex

AminoIndex®

PROTEIN
CORYNEX™
EXPRESSION SYSTEM

CORYNEX®

Cell Culture Medium for Regenerative Medicine

Economic value: sales of iPS/ES culture media
- FY16→FY17: 120% projected growth
- FY25 and on: aim for ¥10 bil. or higher

June 2017
Confirmed as superior to other companies' products by an authoritative British laboratory

3. Examples of solutions using technology (3)

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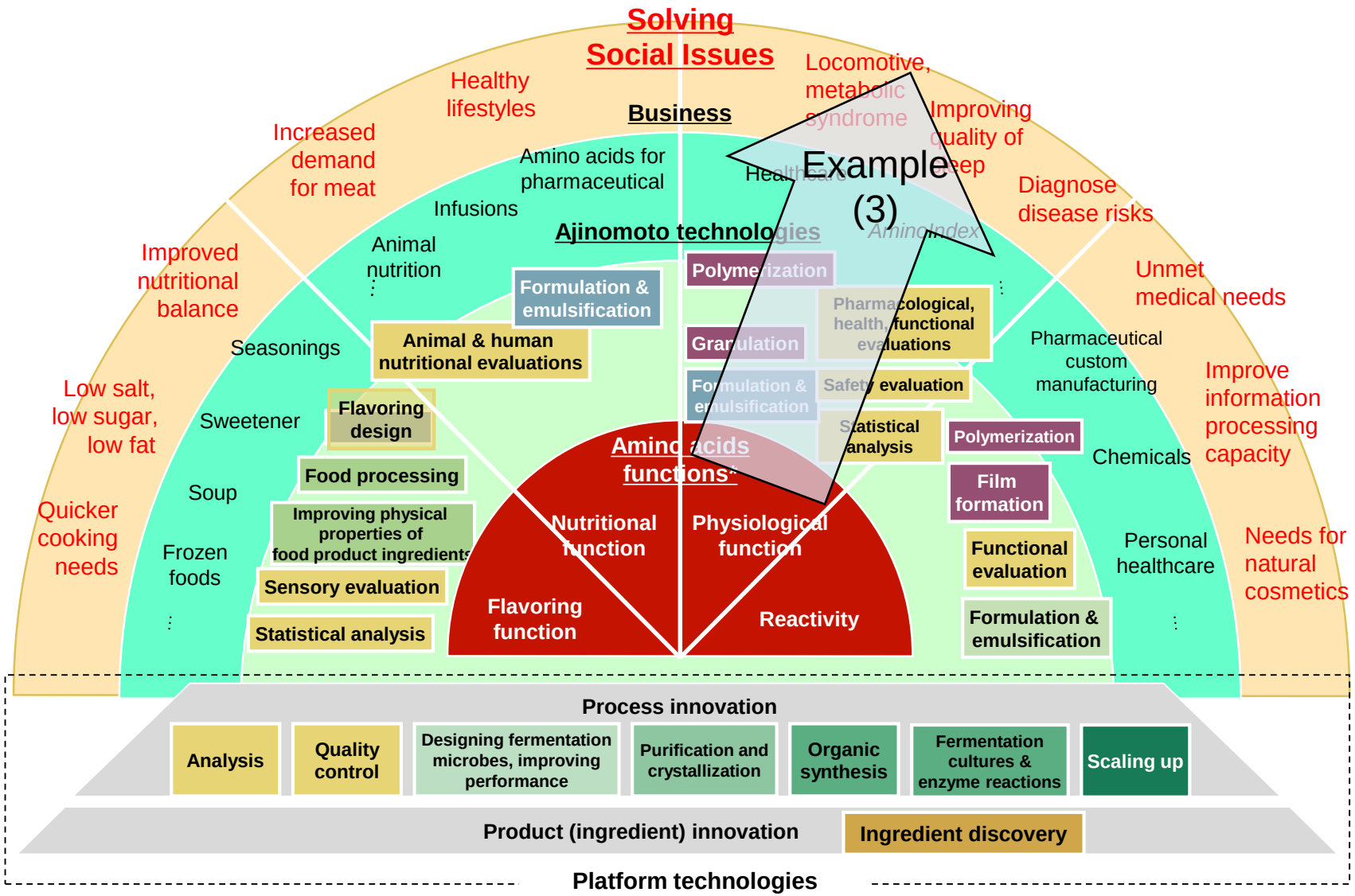

3. Examples of solutions using technology (3)

Easily understanding a person's condition of physical health; providing appropriate solutions

Fusing diagnosis and solutions to further solve social issues

Social value: number of health care institutions able to give *AminoIndex*® exams

- FY12 (end): 372 institutions
- FY16 (end): 1,191 institutions

Economic value: *Amino Aile*® sales and YoY comparison

- FY15: approx. ¥1.6 bil. (247%)
- FY16: approx. ¥2.3 bil. (147%)
- FY17 Q3 total: approx. ¥3.0 bil. (169%)

3. Examples of solutions using technology (4)

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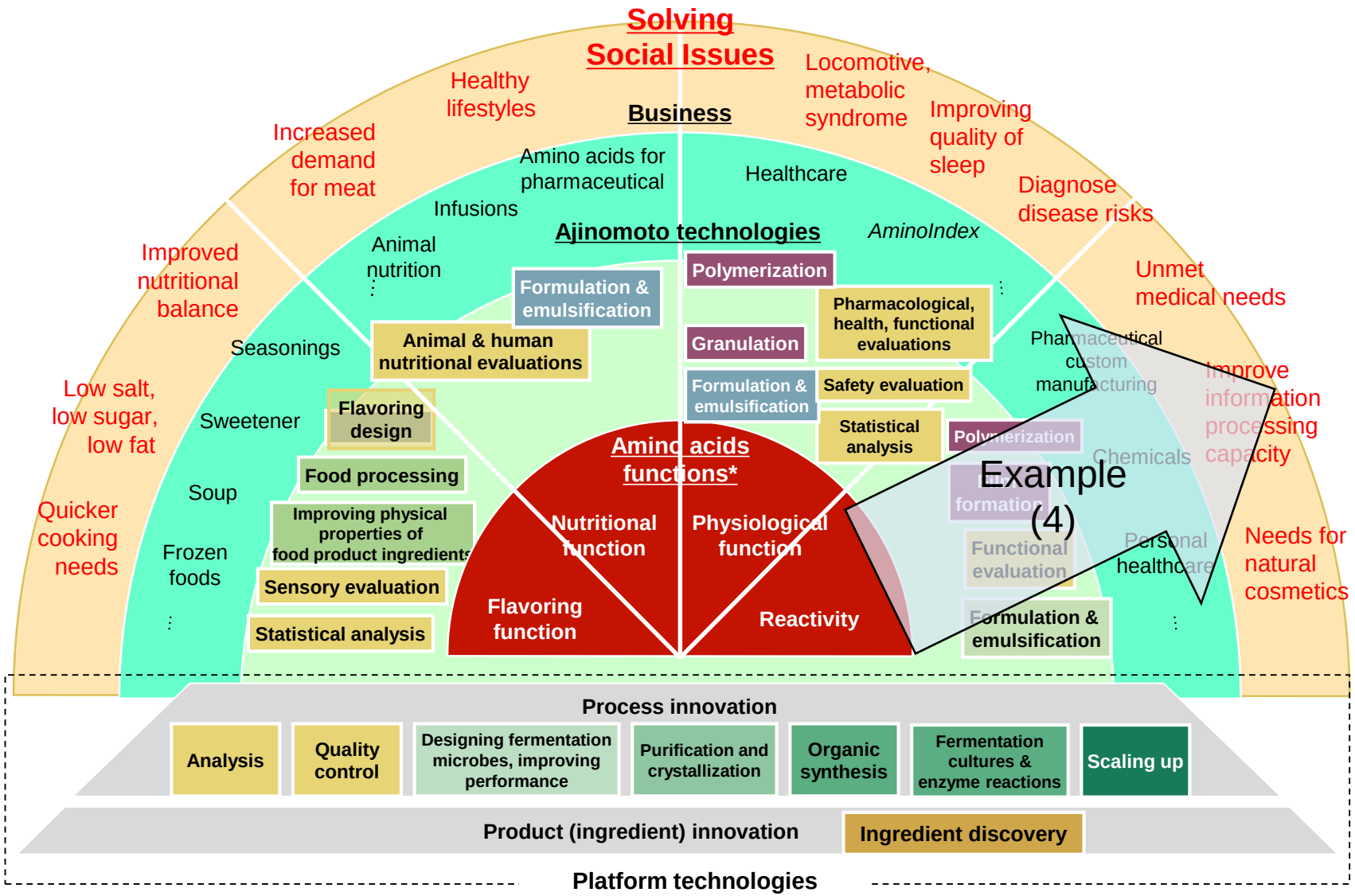

3. Examples of solutions using technology (4)

Contributing to new technologies that require improvements in information processing capabilities

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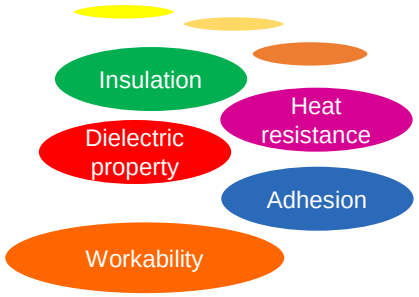
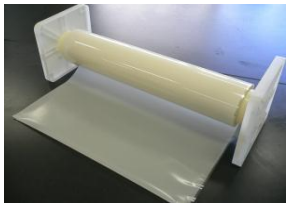
Ajinomoto Build-up Film (ABF) for insulating semiconductor package substrates

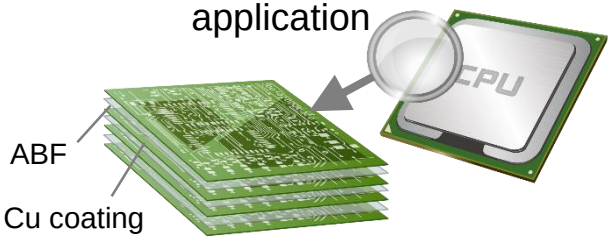
Amino acid chemical synthesis research



Film



Example of technology application



Nearly 100% share of CPUs for PCs

Current final products

PC & Smartphone

Fields with expected usage growth in the future

Servers that are the key to the IT age

Next-generation applications, such as driverless cars

Economic value: YoY comparison of ABF unit sales volume
FY14→FY15: 97%; FY15→FY16: 106%
While use in servers is showing steady growth

3. Examples of solutions using technology (5)

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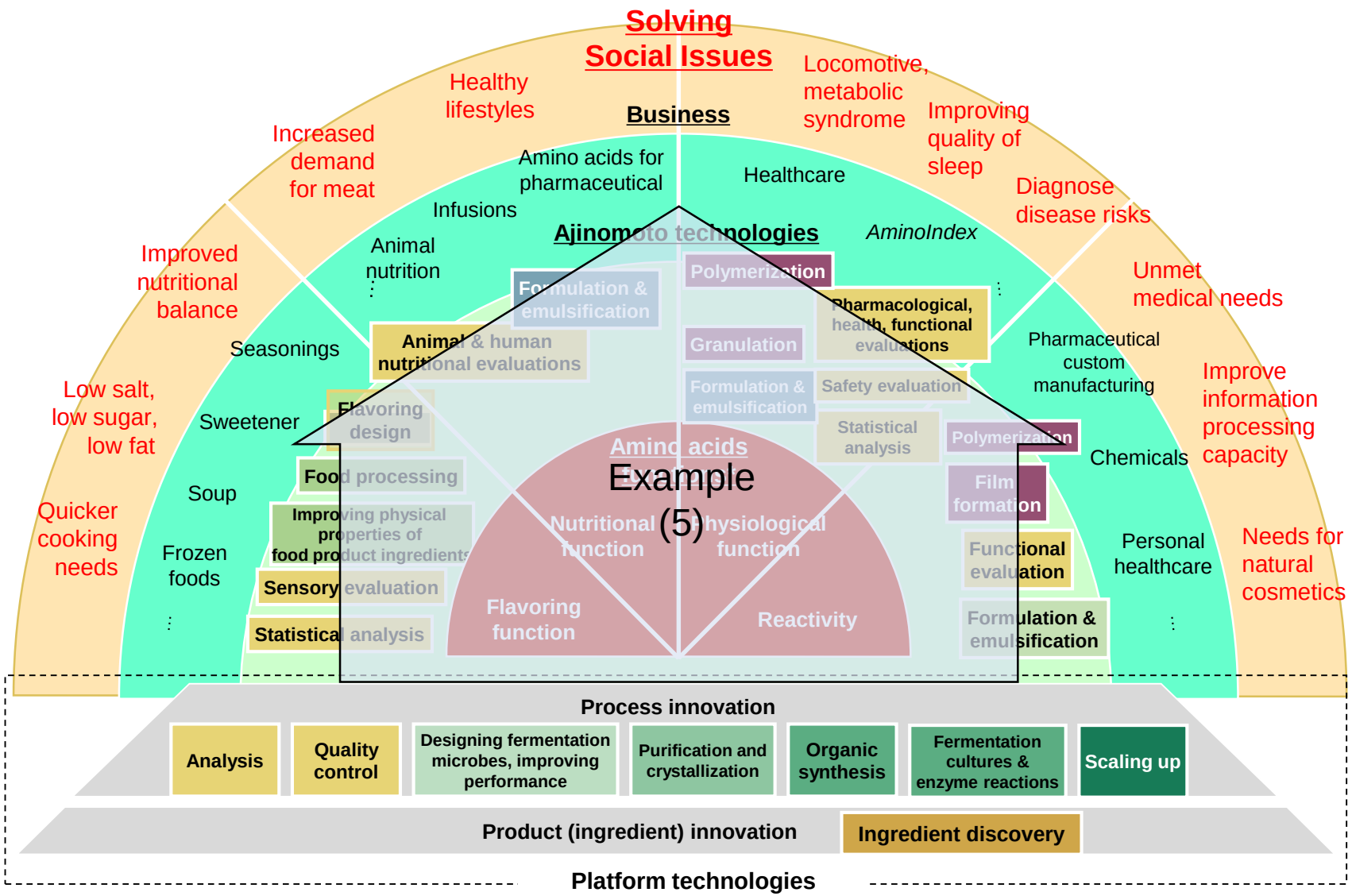

3. Examples of solutions using technology (5)
Contributing to solving various social issues through platform technology

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Fermentation technology
- Further advancements
- Expanded scope of application

→ Toward solving various social issues

Depletion of natural resources	Animal welfare	Waste products
	Providing solutions	
"Natural" production methods using the power of microorganisms (natural product extract alternatives) E.g.: flavors	**"Non-animal products"** made from vegetable oils **E.g.: animal extract alternatives**	**"Sustainable"** production methods **E.g.: biological cycle**

(2) Expanded scope of application

Feedback & application

Fermentation technology (Amino acids & nucleotides)

(1) Further advancements

- Resource-saving fermentation technologies
- On-site ammonia production, etc.

Economic value: cost reductions from resource-saving fermentation technologies
FY14-FY16 cumulative performance: ¥8.7 bil.; FY17-FY19 MTP target: ¥6.0 bil.

4. Descriptions of representative core technologies

4. Descriptions of representative core technologies: Fermentation technologies
Process overview

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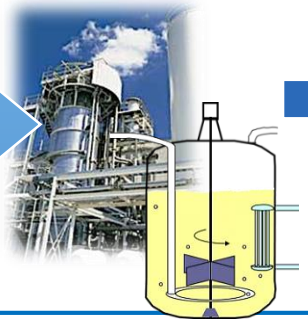
Technology for producing bioactive ingredients (metabolic products) in large volume at high purity and at reasonable prices

Fermentation, isolation and purification

Raw materials

Molasses, starch, etc. (C source)
Ammonium, urea, etc. (N source)

Fermentation



Isolation & purification

Products

> Amino acid
> Nucleic acid
> Organic acid
> Peptide
> Enzyme
> Secondary metabolite
> Further roll out of vanillin (flavor), etc.

Strength

Skillfully use main raw materials
--> move toward use of biomass
Secondary raw materials
--> move toward on-site production
Energy --> biomass cogeneration

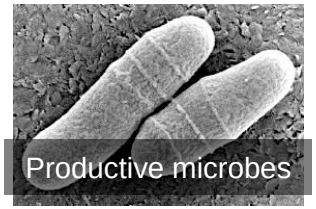
Technology & expertise
for scaling up; equipment
& process design

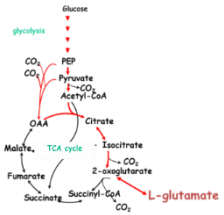
Strength

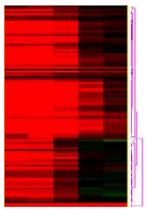
Technology & expertise
for scaling up; equipment &
process design
Quality control

Strength

Designing and improving the performance of fermentation microbes







> Gene engineering
> Metabolic engineering
> Bioinformatics

Strength

Ajinomoto Co.’s strengths are utilized at each step with core technologies and an overall process other companies cannot beat.

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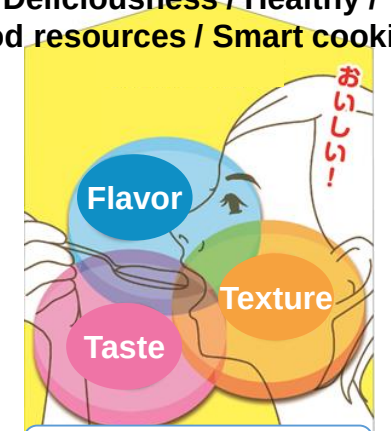
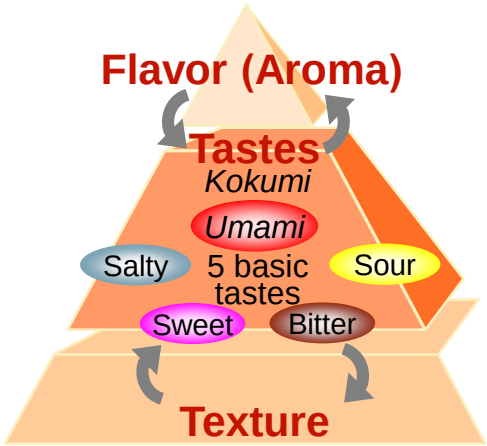
Strengthening our regional portfolios of food products and connecting this to solutions for food-related issues

Deliciousness / Healthy / Food resources / Smart cooking



Deliciousness in three-dimensions



Deliciousness technologies

Why do we sense deliciousness?

1. Deeper understandings of biological mechanism for deliciousness

How is deliciousness expressed?

2. Technologies to control deliciousness freely

What kinds of deliciousness can we provide?

3. Technologies to optimize deliciousness for local preferences

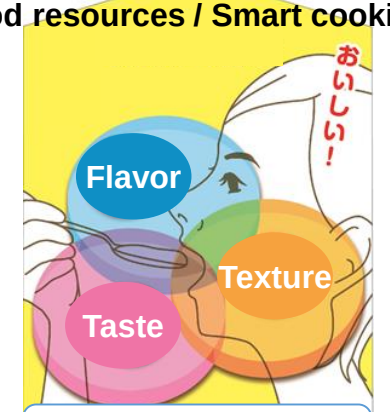
Moving from groups to individuals

Digital technologies to deliver more deliciousness to individual consumers

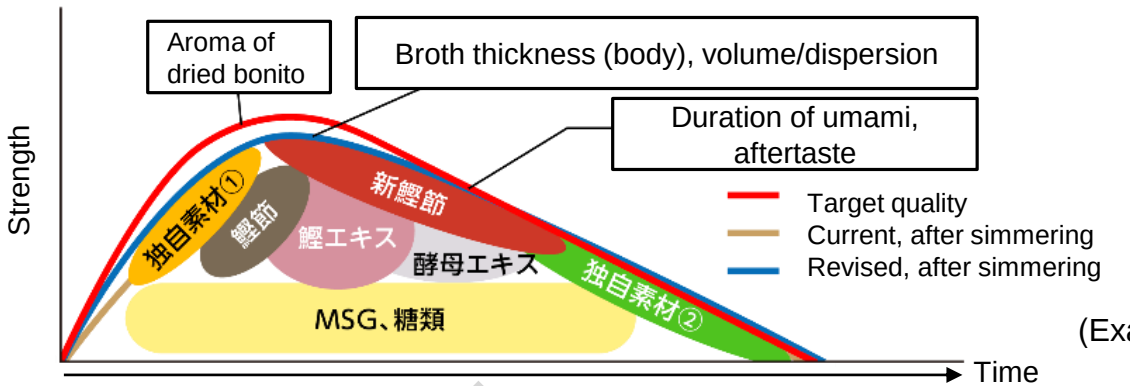
4. Descriptions of representative core technologies: Deliciousness technologies
Analyzing and reproducing mechanisms expressing deliciousness

The three elements of taste, flavor (aroma), and texture change with time

Deliciousness / Healthy / Food resources / Smart cooking



Deliciousness in three-dimensions



(Example of *HON-DASHI*®)

Evaluation of existing ingredients

Development and discovery of ingredients

Application of our proprietary ingredients & technologies

Technologies with competitiveness in terms of flavor receptors, aroma analysis, sensory evaluation, etc.

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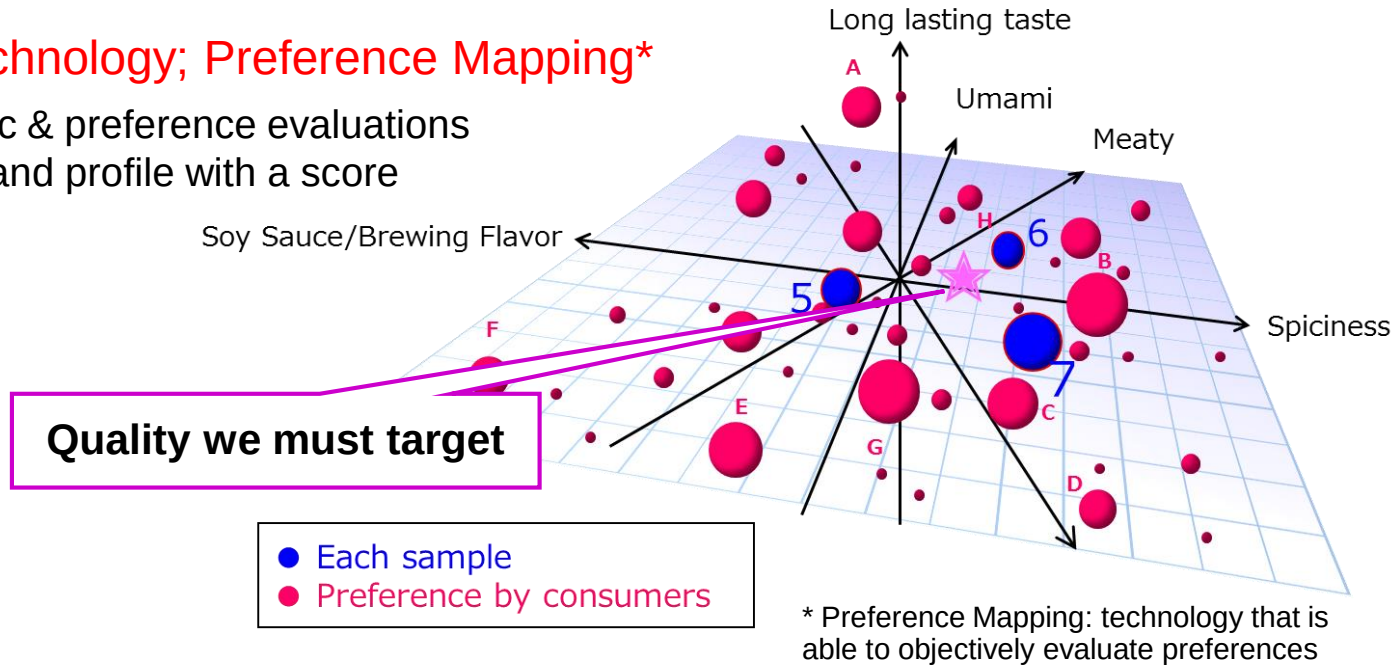
Sensory evaluation technology; Preference Mapping*

1) Connect characteristic & preference evaluations
2) Define target quality and profile with a score



* Preference Mapping: technology that is able to objectively evaluate preferences

Local adaptation of product development

Grounded in foundational technology fostered in Japan (R&D)

+

Product development in each country (D)

4. Descriptions of representative core technologies: Deliciousness technologies
Cycle for achieving target deliciousness

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Understanding needs

Evaluation of existing ingredients (food products, additives)

Addition & omission test

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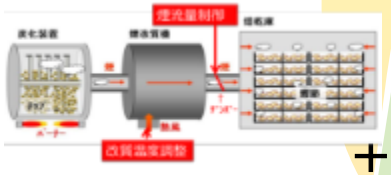
Development and discovery of ingredients



Develop and make ingredients that will be key

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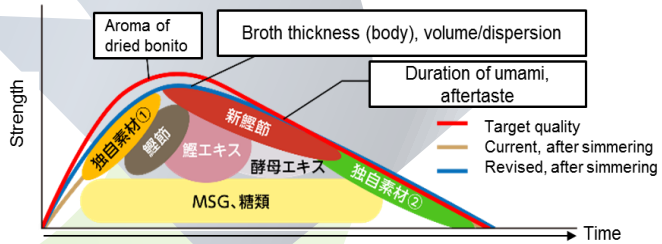
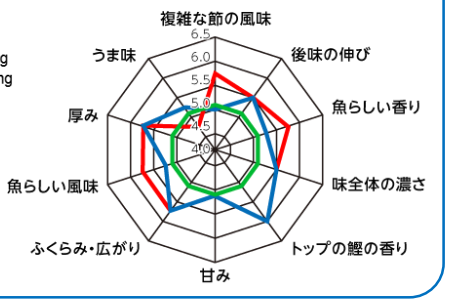
Application of our proprietary ingredients & technologies (IVA, KF001, etc.)

Realization of target quality

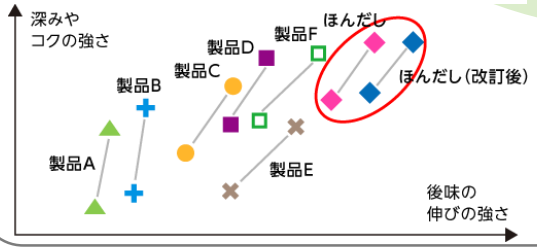


(Example of *HON-DASHI*®)

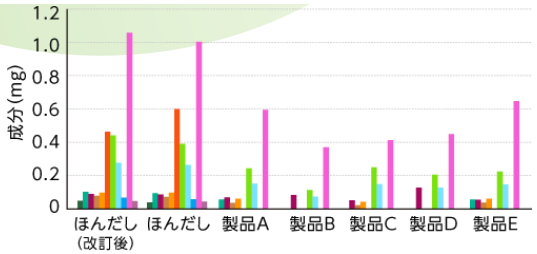


Evaluation of quality

◎ Positioning (sensory evaluation)



◎Analysis (odor analysis by GC)



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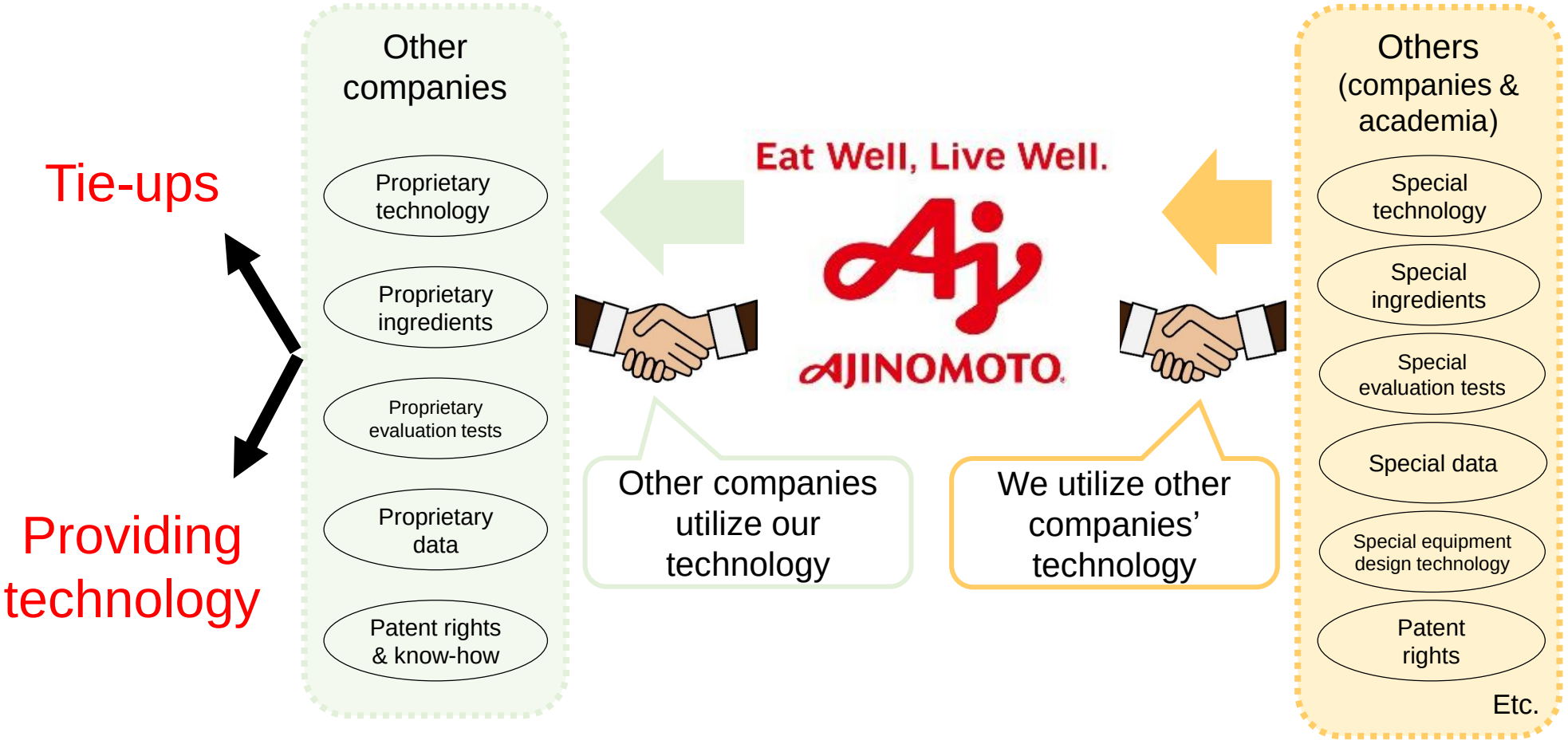
5. Open and linked innovation concepts and initiatives

5. Open and linked innovation concepts and initiatives
Fundamental approach

Much of the R&D carried out (now and to date) in the Ajinomoto Group has been in collaboration with external parties
(currently, we have more than 100 tie-up projects and approx. 10 researchers are posted at universities and elsewhere)



5. Open and linked innovation concepts and initiatives
Examples of our initiatives

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Inbound: generating innovation incorporating external technology

Connecting joint research and corporate tie-ups with commercialization

Publicly open program: Ajinomoto Innovation Alliance Program

Strategies for strengthening R&D from a long-term perspective

Technology scouting: uncovering external technology

Participating in various conferences & matching events

Tie-ups with university TLOs, regional clusters, outside companies

Corporate tie-ups: collaborative corporate projects

Start-up investing: start-up company investing strategies with an eye for future commercialization

Group tour planned:
Client Innovation Center

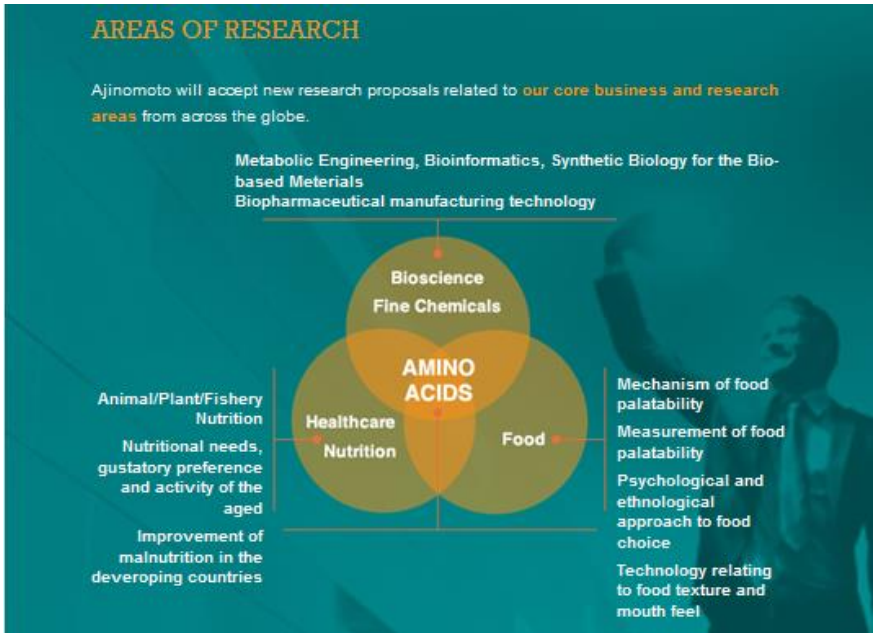
Outbound: generating innovation by providing technology

Out-licensing: out-licensing research that did not reach commercialization, as well as unused patents

Corporate tie-ups: collaborative corporate projects

“Carve out” businesses: launch start-up companies (still under review)

5. Open and linked innovation concepts and initiatives
Ajinomoto Innovation Alliance Program



- Solicited fields: research fields matching our business strategies
- Implementation period: April 1, 2013 on
  (Amino acid research: 2005-2012)
- Projects accepted: 3/yr.
- Research grants: $100,000/yr. Max. of 2 years of research

In target fields…
・Uncover new themes
・Uncover unknown researchers
Start-ups from developing joint research

5. Open and linked innovation concepts and initiatives
Example of solutions to an issue through acquisitions

Eat Well, Live Well.
AJINOMOTO

Unmet medical needs
(E.g.: rare diseases)

Social issue we want to solve

More active development of oligonucleotide pharmaceuticals

Key point for solutions

Toward a solution for production methods in the Ajinomoto Group

Accelerate growth of nucleotide pharmaceutical business by collaborating with pharmaceutical manufacturers from the development stages

Present

GeneDesign, Inc.
Vast experience with small-lot production

AJIPHASE®
Only holder of technology for large volume production

There had been no production method able to handle the early development stage through to approval, and small to large volumes

Past

5. Open and linked innovation concepts and initiatives
Example of a solution to an issue through industry-academia tie-ups

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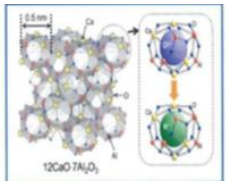
The Ajinomoto Group
- Buys and uses vast amounts of ammonia for fermentation processes
- Requires tremendous energy for transportation and storage

For the production of ammonia
- Requires much energy; high temperature (300-600 °C) and high pressure (100-200 Pa)
- Requires a large scale plant

Catalyst of Prof. Hideo Hosono, Tokyo Institute of Technology



Establish Tsubame BHB Co., Ltd.

Low environmental impact NH_3 production method

Locate ammonia production equipment at the production site

Reduce energy for transportation & storage

(Social value)

Achieve ASV

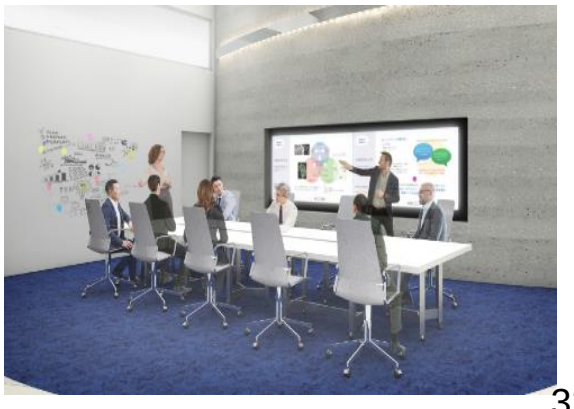
Cost reductions

(Economic value)

5. Open and linked innovation concepts and initiatives

CLIENT INNOVATION CENTER Overview

- Venue for bringing together business partners and Ajinomoto Co.
- Introduce Ajinomoto Co.'s technology in easy-to-understand illustrations, videos, hands-on experiences, etc.
- Share information on latent and overt challenges faced by society and our business partners, prompted by technology explanations.
- Communicate co-creation of new value by fusing both parties' technologies for solving issues.

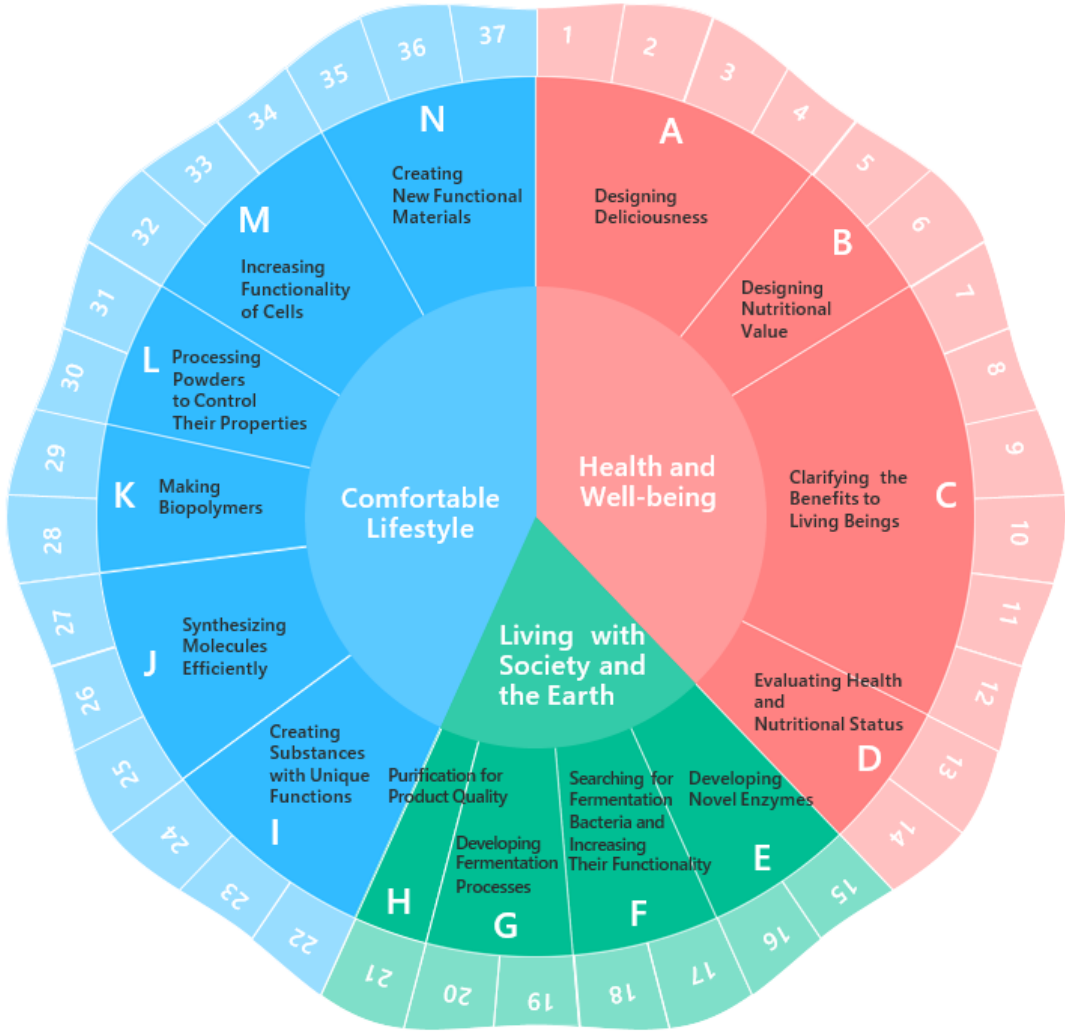


➡ INNOVATION!

Ajinomoto Co.’s representative technology clusters introduced at the CIC

Eat Well, Live Well.

AJINOMOTO



- 2 Deliciousness analysis
- 3 Deliciousness formulation
- 4 Deliciousness production
- 5 Nutritional design
- 6 Applying nutritional functional materials
- 7 Evaluation of taste receptor activity
- 8 Analysis of intestinal flora
- 9 Physiological analysis of plant growth and development
- 10 Evaluation of digestion and absorption
- 11 Skin evaluation
- 12 Evaluation of functional health materials
- 13 Analysis of nutritional status
- 14 AminoIndex®~Risk assessment of various diseases~
- 15 Enzyme screening and modification
- 16 Developing enzyme reaction processes
- 17 Designing fermentation bacteria
- 18 Creating high-performance bacteria for fermentation
- 19 Fermentation/cultivation
- 20 Designing fermentation facility
- 21 Purification and crystallization
- 22 Discovery of taste materials
- 23 Personal care ingredients development
- 24 Surface control and dispersion
- 25 Molecular synthesis
- 26 Precise synthesis
- 27 Manufacturing by special facilities
- 28 Protein manufacturing
- 29 Peptide/oligonucleotide synthesis
- 30 Enteric products for animal feeds
- 31 Granulation of powder mixtures
- 32 Designing culture medium composition
- 33 Culture medium manufacturing
- 34 Evaluation of iPS cell culture
- 35 Cosmetics formulation
- 36 Designing combined resin products
- 37 Selective adsorption of substances

Eat Well, Live Well.

Thank you.