



Volume
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Enzyme Wave

2020





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121st year for Amano Enzyme

~ Toward solving global social issues ~



President and CEO
Motoyuki Amano

Amano Enzyme was founded in 1899 when Amano Ennosuke began to sell medicine by household distribution. He founded Amano Seiyaku, a pharmaceutical business in 1948 and started developing medicines from enzymes and natural extracts. In 1996, the company changed form from a pharmaceutical business to a business specializing in enzymes, and the business expanded into food production. In the process of seeking global markets, the company name was changed to the current Amano Enzyme in 2000. Amano Enzyme celebrated its 120th anniversary on October 3, 2019. We would like to express our gratitude toward everyone who has supported us over the years.

About 15,000 companies in Japan have been in business for more than a century. This number is outstandingly large compared to other countries in the world. There are many theories as to why Japan has so many companies continuing for so long a period. My theory is that it is because of the unique characteristics of the Japanese who tend to pursue long-term profits and stability rather than short-term profits, who emphasize benefiting everyone, including business owners, customers,

and society, and who work to overcome difficulties as a team effort.

Meanwhile, the environment that surrounds us has been rapidly changing at a speed that continues to increase. The global population is expected to reach 10 billion people in 30 years. The exacerbation of global climate change, food crises, energy problems, environmental problems, and the realization of a recycling-based society have become shared challenges for people around the world. Microorganisms are said to be the last resource left to exploit on Earth. We believe that microorganisms and enzymes have huge potential in playing a major role in overcoming global challenges. We are committed to the development of unique products under our corporate philosophy, which has evolved over our 120-year history. We are also committed to using our product foundation and production technologies that have evolved for more than 70 years of enzyme production. We strive to deliver new value to society as a company that proposes solutions to realize a sustainable society from the standpoint of our clients. We appreciate your continuous support.



Group photo at the 120th anniversary ceremony



Dilemma between ethnic characteristics, science, and technology

Introduction of the author

Hisashi Yamamoto

Professor and director at Chubu University,

[Background]

Researcher at Tory Basic Research Laboratories, lecturer at the Faculty of Engineering, Kyoto University, associate professor at the University of Hawaii, professor at the School of Engineering, Nagoya University, and professor at the University of Chicago

The leading researcher of Lewis acid catalysis. Recently developed an innovative peptide synthesis method using Lewis acid catalysis as a base.

Received many awards, including the Medal with Purple Ribbon in 2002, Roger Adams Award in 2017, the Order of the Sacred Treasure, Gold Rays with Neck Ribbon in 2018, and the Person of Cultural Merit



Amano Enzyme in its 121st year is going to provide unique values founded on Japanese traditions and culture to the world. Articles on Japanese traditions and culture are going to be posted in the series. The first article is by Dr. Yamamoto, a leading researcher, describing how the ethnicity of the Japanese would affect science and technology.

Healthy decisions related to science, nology, and education by the national government do not necessarily result in success. Many people are aware that ethnicities reflect the inherent causes of successes and failures. Yet, not many people have a full understanding of why. Correct understanding of individual ethnicities can eliminate the dilemmas and shortcomings in education and research while enhancing strength, which consequently results in growth and prosperity for the nation.

The Japanese are said to be the only introverted race in the world, meaning that they tend to be inward looking. When they perceive a phenomenon, Japanese people perceive it based on superficial characteristics. They use their feelings to judge and comprehend the subject. This trait has had a great influence on the success and failure of science and technology in Japan.

Since the Japanese are not logical, they tend to place priority on relationships. In relationships, people are expected to remain in harmony through sensible unions. They aim to be selfless as a member of a group.

In a society of groups of inward looking people,

the external environment causes anxiety. People try to eliminate anxiety through meticulous planning. They create plans and then conduct research and education based on those plans. Therefore, when the results differ from the expectations, people struggle to find explanations that agree with their expectations. This often prevents them from flexibly handling and responding to the actual results they face. This is a major impediment to the advancement of science and technology, which are founded on invention, innovation, and discovery.

The Japanese attempt to overcome their introversion and rather negative mindset by first negating the distorted explanations linked to actions and phenomena to make a substantial leap toward unlimited possibilities beyond their grand plans, which are the unique and inherent tool of an introverted people. In other words, by adopting a style without fully comprehending it, people may perceive things in a totally different way from people who prioritize being diplomatic and logical. In the traditional Japanese cultural activities of sado, kado, judo, kendo, kyudo, and Zen, people first adopted styles while suppressing

the dilemma that result from an obsession with planning, the inherent practice of introverted personalities. They are expected to find answers that they can truly accept by rejecting quick, easy, superficial explanations. The time to achieve full mastership varies among people, and it is natural.

Disruptive innovation is caused by negating conventional science and technology but is difficult for the introverted Japanese to accept. Disruptive innovation is uncomfortable for the Japanese people who prioritize selflessness over individuality. Meanwhile, innovation that realizes sustainable development is a perfect match for the characteristics of the Japanese. The introverted and sensitive ethnic characteristics enhance science and technology, as with craftsmanship, and Japanese people continue doing so until they establish a new market value or beyond. This is disruptive innovation in the Japanese style. There are countless numbers of such innovations, such as Japanese cuisine,

various forms of arts, carbon fiber, and endoscopes.

It was not necessarily easy for the introverted and sensitive Japanese to accept Western science and technology, which started with the conquering of nature. Rather than logically accumulated science and technology, inventions and discoveries, which are sensitively and directly linked to solutions, are the perfect match for the ethnic characteristics of the Japanese. Seki Takakazu, a Japanese mathematician in the late 1600s, said that there was only one truth, which should not be pursued through time and effort; it could be reached with intuition or as a eureka moment. This reflects the feeling-oriented personality of the Japanese. Most Japanese Nobel laureates have made great discoveries by listening to what nature says and remaining in balance with nature. It is a different attitude from the logical Western scientists who rely on emblems.



Trend

Frail - A Challenge in Realizing Long-life Society with Good Health -

The life expectancy in Japan is one of the longest in the world, and Japanese society is rapidly aging. Meanwhile, the healthy life expectancy, the period during which a person can live independently without needing medical or nursing care, is about ten years shorter than the actual life expectancy (Figure 1). Therefore, the enhancement of the quality of life (QOL) of the elderly and the lengthening of the healthy life expectancy are in demand in modern society. The prevention of the frail condition (weakened conditions caused by aging) is one of the largest health issues in aiming to realize a society based on good health and longevity.

The Japan Geriatrics Society introduced the concept of “frail” in 2014. A frail condition is roughly divided into physically frail, mentally frail, and socially frail (Figure 2). These frail conditions individually and combined cause weakness and lowered QOL in the elderly. In the physical aspects, malnutrition and sarcopenia (muscle loss) are considered problems. Malnutrition and sarcopenia often cause decreased appetite and negative spirals. It is important to eat well (especially high quality protein) and to exercise to prevent them. In the mental aspects, depression and age-related dementia are major problems. These conditions keep people from living independently. Physical and mental aspects are known to be mutually influential. Therefore, it is important to keep both aspects in the healthy

state. Problems of the elderly in the social aspects include living alone (loneliness), eating alone, decreased interaction with neighbors, and staying at home without going out. These conditions are increasing with changes in the social situation, such as the increasing number of nuclear families, decreased interaction among neighbors, and the increased use of the Internet. These are greatly affecting both the physical and mental aspects of the elderly.

Frail is a major social problem as discussed above. Amano Enzyme is going to explore what enzymes can do to overcome these problems and will keep making efforts toward that goal.

Figure 2 : The three elements of frail

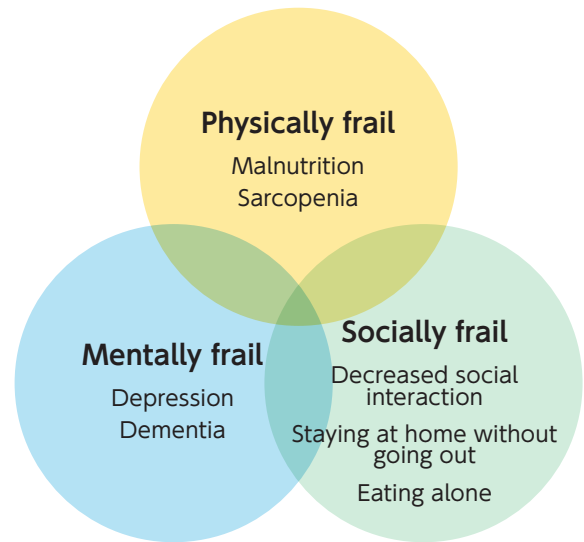
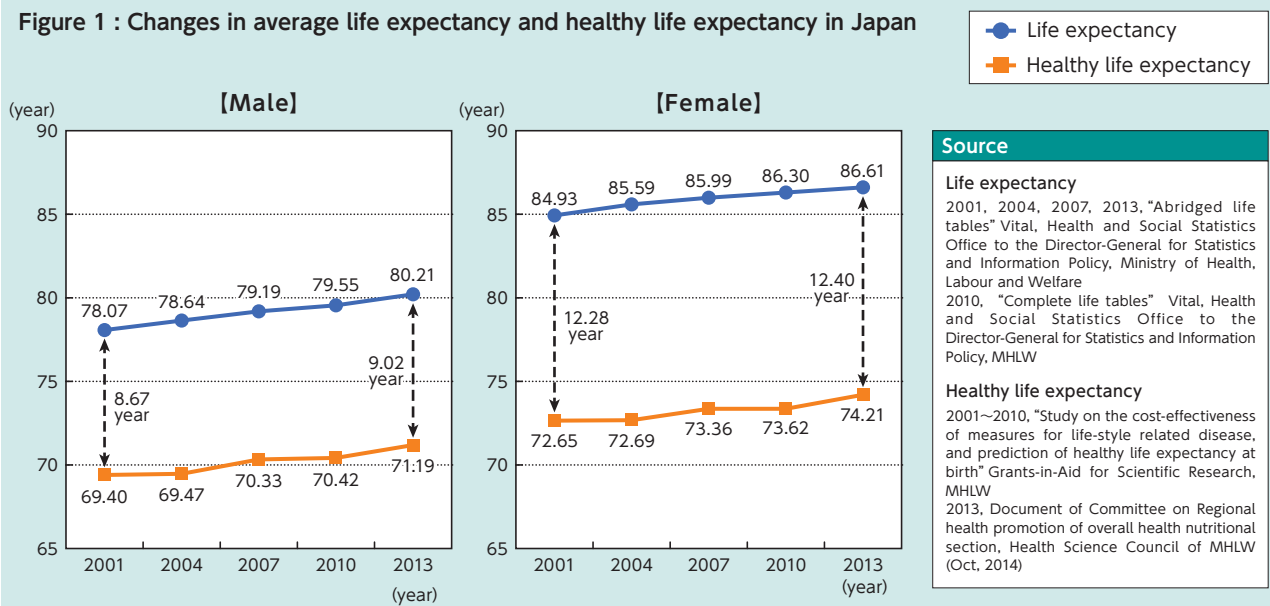


Figure 1 : Changes in average life expectancy and healthy life expectancy in Japan



Symposium on Enzyme Applications

- The establishment of the encouragement award in the food field -

Amano's 21st Symposium on Enzyme Applications will be held on Friday, June 12, 2020, at Jizendo Hall of Amano Enzyme in Kitanagoya City. This symposium was started in 2000 as the 100th anniversary event of Amano Enzyme. Amano Enzyme Science and Technology Foundation (established on June 1, 2017) started hosting the symposium in 2018. The 20th symposium was held on Friday, June 14, 2019. We appreciate the support of all stakeholders for supporting this symposium for 20 years.

This symposium celebrates a new start in 2020. Starting with the 21st symposium, the research encouragement award will have two fields: the biochemistry field and food field. The advancement of enzyme research in the food field is important as a response to the needs of the food industry from the viewpoint of enzyme applications. This is the reason that an independent field is established to encourage research in this field. To commemorate the establishment of the award in the food field, Professor Uehara of Tokyo University of Agriculture will give a lecture. Professor Uehara is conducting research to clarify the physiological functions of food elements at different levels, including the whole organization, cells, and molecules. She is one of the leading researchers in this field.

The technical report by San-ei Suicrochemical and Amano Enzyme is going to be about the development of Suppai Mizuame (translation: sour glucose syrup) mainly consisting of maltobionic acid produced using glucose oxidase.



Scenes of the symposium

In the annual speech by a person playing a vital role in their own field representing Japan, Ms. Seya will make a speech as someone who dedicates efforts to the recovery of conflict regions.

A picture of a parent and child at a refugee camp in Rwanda that she saw when she was a third-year high school student made her decide to study conflict-related issues. She went to graduate school in the UK after graduation from a university in Japan, and she worked in Rwanda, Afghanistan, Sierra Leone, and Cote d'Ivoire as staff of the UN PKO, Ministry of Foreign Affairs, and an NGO after graduation. In 2007, she served as the secretary-general of the Japan Center for Conflict Prevention (JCCP) (has served as the president since 2013) and is making great efforts in the recovery of post-conflict societies for peacebuilding, improving security, disarming combatants, and promoting economic independence in Somalia, South Sudan, and Asian countries routed to local societies in conflict regions. In recognition of her contributions, she was honored with several awards, including the selection as one of the 25 Japanese People the World Respects by Newsweek Japan.

Ms. Seya has been consistent in her policy of not making excuses for not taking action, in order to find a breakthrough to resolve the issue when she faces difficulties. In her speech, she will talk about the world situation and Japan's position in it as well as her activities in conflict regions.

Amano Enzyme is committed to supporting the advancement of the enzyme industry through this symposium.

The following three guests are going to give lectures at the 21st symposium.

- i. Professor Mariko Uehara
(Tokyo University of Agriculture)
- ii. Technical report by San-ei Suicrochemical and Amano Enzyme
- iii. Ms. Rumiko Seya
(Director of the Japan Center for Conflict Prevention)

The 5th Sino-Japan Joint Symposium on Enzyme Technology



Scenes of the symposium

The 5th Sino-Japan Joint Symposium on Enzyme Technology was held at Jiangnan University in Wuxi, Jiangsu, China, on Saturday, November 9, 2019. This symposium, co-hosted by Jiangnan University and Amano Enzyme, started in 2011 to facilitate interaction among Japanese and Chinese enzyme researchers to promote enzyme applications in Asia. This symposium has been held every other year, and we celebrate the fifth symposium. The theme of this symposium is oil and fat processing. A total of about 100 people from Chinese universities, research facilities, and private companies mainly from oil and fat processing participated in this event. The expectation to enzyme has been increasing even in the oil and fat industry in China as environmental regulations become stricter every year. Participants in this symposium engaged in active discussions on using enzyme in this field and made this event a huge success.

Japanese and Chinese guest speakers gave lectures under eight themes. From Japan, we invited Professor Ryuichiro Sato from University of Tokyo and Professor Jun Ogawa from Kyoto University. Speakers and lecture titles are as shown in the table to the right:

Various events to celebrate the anniversary event were held before the symposium, and a



Greetings by President Chen (Jiangnan University)

video showing photos from past events was played to introduce the history of this symposium. Also, special awards were given to Japanese and Chinese researchers, Professor Emeritus Sakayu Shimizu (Kyoto University) and Professor Li Jianghua (Jiangnan University) in appreciation of their support for continuation of this symposium. The hall was full of celebratory mood prior to the following symposium.

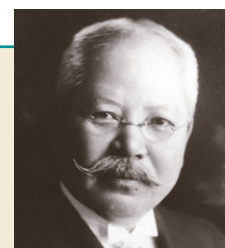
Amano Enzyme is going to continue this symposium for many years to come to strengthen technological interaction between Japan and China to support the advancement of the enzyme industry in both countries.

- i. **Dongping He** (China National Cereals and Oils Association Oil and Fats Branch)
"Application of enzymatic degumming in oil refining"
- ii. **Ryuichiro Sato** (University of Tokyo)
"Enzyme group that controls cholesterol metabolism"
- iii. **Shotaro Yamaguchi** (Amano Enzyme Inc., Japan)
"Lipases and their applications in fats and oils industry and Amano lipases"
- iv. **Jun Ogawa** (Kyoto University)
"Functional lipid production by microbial metabolisms and enzymes : beyond common polyunsaturated fatty acids"
- v. **Fang Cong** (Wilmar)
"Enzyme application in flavor oils"
- vi. **Mingming Zheng** (Oil Crops Research Institute, Chinese Academy of Agricultural Sciences)
"Construction and application of lipoenzyme molecular modification system"
- vii. **Yuanfa Liu** (School of Food Science and Technology, Jiangnan University)
"Application and industrialization status of edible oil processing enzymes"
- viii. **Qiuyu Xia** (Coconut Research Institute of Chinese Academy of Tropical Agriculture Sciences)
"Enzymatic preparation and stabilization of omega-3 concentrate"

Jokichi Takamine Study Group, NPO

Dr. Jokichi Takamine

Dr. Jokichi Takamine lived through the dramatic period of time from the end of the Tokugawa shogunate, Meiji era, and Taisho era. He left a great legacy as a scientist, entrepreneur, and an international goodwill ambassador. Dr. Takamine is called the father of modern biotechnology for his research and development of amylolytic enzymes derived from microorganisms, mainly Taka-Diastase.



Dr. Jokichi Takamine
(photo courtesy Great People of
Kanazawa Memorial Museum)

Jokichi Takamine Study Group, NPO

The year 2022 is the 100th anniversary since the death of Dr. Takamine. An NPO organization, the Jokichi Takamine Study Group is committed to engage in even more lively activities, such as the publication of magazines and hosting lectures so that many people will learn about Dr. Takamine, who was a great advocate of the development of scientific technologies and industrialization in modern Japan and made a substantial contribution to various activities, such as the establishment of friendly relationships between Japan and the U.S.

Main activities

The year 2019 became a historic year when the new emperor acceded to the Chrysanthemum Throne, and the era name was changed. The NPO enjoyed opportunities to give lectures at junior high schools, universities, and companies in Chiba, Nagoya, Kobe, Takaoka, and Kanazawa. Many people in different age groups and backgrounds attended the lectures. As the achievements of Dr. Takamine are being introduced through the media and textbooks more often than before, we are working to provide accurate information.

Topic Shofu-den

After the end of the Louisiana Purchase Exposition in 1904, Emperor Meiji gave Houou-den, the main building of the Japan pavilion to Dr. Takamine, who then moved it to New York. The name of the building was later changed to Shofu-den, which was used as the stage of interaction and socialization between Japan and the U.S. The deputy director of our NPO was in charge of the management of the building. A decision was made recently to move part of the Shofu-den to Takaoka City, Toyama, the birthplace of Dr. Takamine, and reconstruct it. The relocation and reconstruction are going to be completed in the spring of 2020. Wall paintings, ceiling paintings, and furniture that decorated Shofu-den are going to be exhibited. Please stop by and enjoy them.



Lecture at a private junior high school in Kobe



Internal view of Shofu-den

Notification of the recruitment of new members

The Jokichi Takamine Study Group is accepting supporting members.

Supporting members will receive publications related to Dr. Takamine and regularly issued newsletters. They also receive information about lectures, events, and news.

If you would like to join us, please write your name (if you are a corporate body, company/organization name and department), postal code, address, phone number (no cell phone number accepted), occupation, age, and sex on a letter or a postcard and mail it to us. We will return a bank transfer form to pay the initiation fee and the annual membership fee.

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*For more details, please visit our website.
<http://www.npo-takamine.org/ask.html>

Renaming of Gifu R&D Center to Amano Enzyme Innovation Center

We are delighted to announce that our research facility name will be changing to Amano Enzyme Innovation Center.

Amano Enzyme celebrated its 120th anniversary last year. Since the business started as a medicine delivery service in 1899, our accumulated business history includes the enzyme production business since 1948. Seventy years have passed since the start of our enzyme business. Since the early stage, we focused on enzyme research and development, and later, we constructed the Enzyme R&D Center in 1960 and the Tsukuba Research Laboratories in 1989 as the second research facility to introduce biotechnology. These two research facilities were integrated to become the Gifu R&D Center in 2000 at the time of changing the company name to Amano Enzyme. Since that time, we focused on developing special enzymes customized to suit the needs of clients.

Twenty years ago, we opened the Gifu R&D Center, and our business continues to change since that time. Today, innovation using enzymes is in higher demand by industries and society.

Globalization has progressed, and economic activities have expanded on a global scale beyond the boundaries of nations and regions. Companies are now expected to shift from the one-way economy of consuming and disposing of resources to a bio-economy, the sustainable economy based on collecting consumed resources to recycle and reuse. Enzyme-driven innovation to create new social value is attracting attention.

The Innovation Center will conduct research to develop specialty enzymes to contribute to society from a global perspective by increasing the opportunities to create value for our clients. The Innovation Center will also integrate Japan's advanced fermentation technology along with other cutting-edge technologies around the world around the world as essential for the research and development of specialty enzymes, which will surely create the future.

The personnel of the Innovation Center are committed to the advancement of enzyme research and development with pride in the history of progress as a R&D-oriented company. We appreciate your continuous support.



Conference presentation

In 2019 Amano Enzyme has decided academic presentations such as the following. Please look forward to the activities of the future of Amano Enzyme.

Conference/Meeting	Date	Title	Speaker
38 th The Society for Cytoprotection	Mar. 15 th , 2019 (Kyoto, Japan)	Usefulness of gluten degrading enzymes for non-celiac gluten sensitivity.	Sasaki, M., Ido, H., Kasugai, K.
354 th Regular Meeting of The Japanese Society of Gastroenterology, Kanto	Apr. 13 th , 2019 (Tokyo, Japan)	Actual digestive activity of medical digestive enzymes at low pH in the duodenum such as after chronic pancreatitis and pancreatic surgery.	Ko, S., Takahashi, A.
2 nd Meeting of The Society for Allergic Digestive Disorders	May. 9 th , 2019 (Hiroshima, Japan)	Usefulness of gluten degrading enzymes for non-celiac gluten sensitivity.	Sasaki, M., Ido, H., Kasugai, K.
50 th Annual Meeting of Japan Pancreas Society	Jul. 13 th , 2019 (Tokyo, Japan)	Actual digestive activity of medical digestive enzymes at low pH in the duodenum such as after chronic pancreatitis and pancreatic surgery.	Ko, S., Takahashi, A.
microbe week 2019	Jul. 22 th -27 th , 2019 (Tokyo, Japan)	Construction of heterologous expression host based on commercial strain developed by mutation breeding.	Matsubara, H.
1 st Japan-Germany-Switzerland Workshop for Enzyme Technology and Bioprocess Development	Sep. 10 th -12 th , 2019 (Toyama, Japan)	Protein engineering of FAD-GDH: Circular permutation combined with disulfide bond formation	Ishihara, S., Nishio, K., Koikeda, S., S, Lutz.
Enzyme Engineering XXV	Sep. 15 th -20 th , 2019 (Whistler, Canada)	Enzyme engineering of fungal-derived FAD-GDH by circular permutation.	Ishihara, S., Nishio, K., Koikeda, S., S, Lutz.
71 th Annual Meeting of The Society for Biotechnology, Japan	Sep. 18 th , 2019 (Okayama, Japan)	Support regenerative medicine field with enzymes – for islet transplantation – (Luncheon seminar presented by Amano Enzyme Inc.)	Yamagata, Y.
50 th Annual Meeting of Japan Digestive and Absorption Society	Oct. 5 th , 2019 (Tokyo, Japan)	Comparison of digestive activity of digestive enzyme formulas with the digestive tract model (Poster session)	Ko, S., Takahashi, A.

Journal/Book	Date	Title	Author
BIO INDUSTRY 2019, Vol.36, No.5	May, 2019	Development of Maltotriosyl Transferase and Use Thereof for Starch Processing	Hoshi, Y.
Digestion and Absorption 2019, Vol.41, No.2 p.143-151	Sep, 2019	Evaluation of the enzymatic activities of pre-existing domestic pancreatic enzyme formulas and pancrelipase.	Takahashi, A., Ko, S.

2020 Exhibitions

Date	Exhibition	Location
April 22-24	ifa Japan 2020	Tokyo (Japan)
April 26-29	2020 AOCS Annual Meeting & Expo	Montreal (Canada)
May 5-7	CPhI North America 2020	Philadelphia (USA)
May 12-14	Vitafoods Europe 2020	Geneva (Switzerland)
May 19-20	2020 Protein Trends & Technologies Seminar	Itasca (USA)
May 27-28	Chemspec Europe 2020	Cologne (Germany)
June 22-24	CPhI China 2020	Shanghai (China)
July 12-15	IFT20	Chicago (USA)
July 15-17	15 th Food Proteins Course North America 2020	Chicago (USA)
August 30 -September 3	10 th International Congress on Biocatalysis	Hamburg (Germany)
September 9-11	Food Ingredients Asia 2020	Jakarta (Indonesia)
September 23-24	Vitafoods Asia 2020	Singapore
October 13-14	Food Matters Live 2020	London (UK)
October 14-16	16 th Plant-Based Foods & Protein Summit Europe 2020	Lille (France)
October 29-30	Supply Side West 2020	Las Vegas (USA)
November 19-21	IFATS 18 th Annual Meeting	Fort Lauderdale (USA)
November 25-27	CPhI India 2020	Delhi (India)

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Amano Enzyme

World Network



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