



The print "Cow" (Kunio Sato). It depicts the scenery that Kenji Miyazawa referred to in his poem of the same title, including the "pulp mill," which may have been our company's Tomakomai Mill.

The crossing paths of Tomakomai and Hanamaki

Kenji Miyazawa and Denka

Kenji Miyazawa (1896–1933) is famous for works such as the poem "Ame ni mo Makezu" (Be not Defeated by the Rain) and the children's story "Night on the Galactic Railroad."

A teacher at Hanamaki Agricultural School, Kenji visited Tomakomai in Hokkaido in May 1924 on a school trip. At night, after his students had gone to bed, he went for a walk by the sea and wrote the following poem:

*A single Ayrshire cow stands rubbing her horns against the dewy grass.
Behind me, the glow of a pulp mill scorches the clouds in the night sky.
Across the low dunes, the waves pound on the shore.
The brass-colored moon looks as if it could be scooped up and swallowed.
No wonder the cow appears in such a good mood.
This time, she's knocking her horns on the fence.*

"Cow" from Kenji Miyazawa's Spring and Shura Vol. 2

One theory is that the pulp mill he's referring to is the Tomakomai Mill (Hokkai Carbide Plant), the birthplace of our company. At that time, it still belonged to Oji Paper, but it was a special place that supported the early days of our company. And that's not all. Denka Azumin Co., Ltd., a member of the Denka Group, is located in Kenji's hometown of Hanamaki City, Iwate Prefecture. Kenji was involved in fertilizer design and guidance for local farmers in Hanamaki, and Denka Azumin has been producing Azumin fertilizer for nearly 60 years, so both contributed to the development of agriculture. Leveraging the knowledge gained from Azumin, the Denka Group was able to enter the European biostimulant* market in 2019, and we are planning to provide further agricultural support going forward.

Kenji and Denka crossed paths several times. Their aspirations to contribute to agriculture overlapped and strengthened each other as they moved toward the future.

*A microorganism or substance that draws out the natural power of plants and contributes to the stable production of agricultural products.



The DenkaWay

Spring

2021 | Vol.07



Changing the Future of Agriculture with New Technologies Biostimulants

Contents

2 Challengers for Denka Value-Up

R&D Process Reforms
Through Reforms to the Next Stage

8 Think INNOVATION

There Are No Failures If You Take Action
by Nagi Yoshida, Photographer

9 Amazing the World with Innovation

Changing the Future of Agriculture with New Technologies
Biostimulants

16 New President Special Interview

DENKA TOPICS

18 LINK GLOBALLY, LINK FUTURE

20 Gunbai Column

Through Reforms to the Next Stage

Under the Denka Value-Up Management Plan, Denka has been striving to reform its R&D processes with the aim of commercializing as many products as possible, as soon as possible. The three pillars of the reformation are Theme Reforms, Information Reforms, and Human Resource Reforms. Based on these, a wide range of measures have been implemented, and we are already seeing the results. There is no end to reform. Only progress forward. Denka will continue taking on the challenge of reforming its R&D processes.

Theme Reforms

In addition to selecting themes that make sense at the time, we will optimally allocate resources and sequentially revise or abolish themes as necessary to realize efficient R&D.

Challengers for Denka Value-Up

Human Resource Reforms

Based on our policy of fostering "specialty human resources," we will collaborate with the HR Dept. to establish a program to train up ideal R&D personnel who can excel by global standards.



Information Reforms

We will establish an R&D support system and provide tools to support efficient R&D. Information that was previously managed separately by each business will be centrally managed and shared throughout the company (as a "data lake"). In doing so, we hope to speed up R&D and develop new applications for proprietary technologies.

Each and every Denka employee is a key player in the reform. On the following pages, we will introduce the results of R&D process reforms through interviews with employees.

Reforms on the Frontline

Here, we will examine recent cases of theme, information, and human resource reforms.



Leveraging the networks created through open innovation

Theme Reforms

Speedy Development of QuickNavi™ – COVID19 Ag



Shuntaro Komura
Business Promoting Dept.
Life Innovation

Responsible for planning and gathering information for new product development.



Shino Muramatsu
POCT Development Section, Vaccine & Diagnostics R&D Dept.
Gosen Site

Responsible for R&D of QuickNavi™ – COVID19 Ag. Involved in a wide range of activities, including filing regulatory applications.

“We’re relying on Denka.”

Komura: I have heard that creating an antigen testing kit usually takes at least two years from development to regulatory application. However, QuickNavi™ – COVID19 Ag was completed in just four months. That is honestly incredible. I am sure this feat was accomplished thanks to the efforts of the development team, but what other factors were involved?

Muramatsu: I think the biggest factor was that we had already established various networks through open innovation. Through these networks, we received information from research institutes and the Ministry of Health, Labor and Welfare and had our prototypes evaluated by medical institutions.

Komura: Those networks are a valuable company asset and a result of the efforts of everyone on the development team. When evaluating new businesses, we always consider which research institutes, universities, and companies we could collaborate with. However, it is difficult to work

with an organization with which you have no prior relationship.

Muramatsu: Precisely. It is important to have cultivated relationships. One of the professors at a university we collaborated with said, “We can make antibodies based on our basic research. However, we cannot commercialize them or deliver them to the world, so we are relying on Denka.” It’s very satisfying to be able to build win-win relationships and to contribute to society. Incidentally, we were also assisted by the Life Innovation division that you belong to.

Komura: Our division has accumulated information obtained through contact with medical professionals. I am glad that the combination of your technology-oriented information and our market-oriented information led to quicker development.

Incorporating multiple perspectives into the design

Muramatsu: For this product, I was involved

in the entire process from R&D to regulatory submission, and I can confirm that it was only possible thanks to the support of a large number of people.

Komura: If we work together as a team, we can achieve great things. I think this was an excellent example of that. To order to create new businesses, our division is operating through working groups that include members of other divisions, R&D departments, and group companies. We believe that it is possible to create new ideas by bringing together a wide variety of knowledge.

Muramatsu: It is definitely important to incorporate the knowledge and perspectives of many different people. For example, when developing a testing kit, we need to know: Is it easy for medical professionals and patients to use? Is it easy to manufacture? Is it easy to market? Getting feedback from the various players helps us improve the design and finish the development as soon as possible.

Effectively passing on skills within the company

Ishizeki: I have not yet had an opportunity to use the wearable devices yet, but I heard that you provided remote technical support to a manufacturer in China.

Shimazaki: There was a plan to outsource the production of our special admixture to a cement manufacturer in China, and I had visited the site several times to provide technical support. We began implementing wearable devices due to the pandemic, but checking the firing of the ingredients takes an expert eye and is difficult to do remotely.

Ishizeki: What method did you use?

Shimazaki: Our local representative visited the factory with wearable device, and we gave them instructions while watching the scene in real time. However, on video, the color of the ingredients can look slightly different depending on the lightning, which can lead to misjudgments when evaluating the firing. For this reason, we asked them to arrange the finished materials in a certain place, with certain lightning, before taking a picture and sending it to us. We also used the

video to check the heat level of the kilns.

Ishizeki: I see. So even if you have got wearable devices, photos can still be useful in certain situations.

Shimazaki: We can get multiple people to check the videos and photos that they send us, so digital tools allow us to offer more advice.

Ishizeki: That is a big benefit. The special cement additives business has been around for 50 years, and we have some very experienced employees. I think wearable devices will be useful for passing down their skills to younger generations.

Shimazaki: It also helps to reduce travel expenses and allows me to spend more time writing research reports and applying for patents.

Ishizeki: In our case, it might also be useful for handling complaints. In the past, when a customer brought up a problem, a sales person like me would have to go to the site, and if the problem could not be solved on the spot, the sales person would take pictures and bring them back to show them to the technical staff. However, if we are working remotely, then the sales and tech people

can look at the pictures together and maybe solve the problem more quickly.

What you can gain in the field

Ishizeki: Due to the pandemic, it has become difficult to invite customers to the Omi Plant for on-site testing. We have done it remotely in the past, but most customers want to actually touch the product to confirm the hardness or adhesiveness. It is a problem of coming to terms with that. Especially, when you are looking at a product for the first time, you cannot make a decision without touching it.

Shimazaki: In our industry, a sense of craftsmanship is key. It is a challenge for us to respond to this. It is also important for us to obtain information from the field. I have heard that our predecessors often visited worksites as often as we would like now, I think we should remember to search for needs and strive to use our digital tools effectively.

Ishizeki: At the end of the day, it is all about people, isn't it?

Information Reforms

Provide Technical Assistance Remotely



Masato Ishizeki
Special Cement Additives Dept.
Infrastructure & Social Solutions

In charge of sales of Denka CSA, an expansive additive for cement. Also responsible for expanding sales of new products.



Daiki Shimazaki
Cement & Special Cement Additives Research Dept.
Omi Plant

Engaged in basic research for special cement additives. Also responsible for providing technical support to contract manufacturers.



Attending the concrete spraying process

Instructing workers on how to mix cement additives

Checking the firing with photos of a certain brightness

Digital tools are merely a means to ascertain local needs

Real-time connection with local sites through wearable devices



Charting your own growth path
to achieve greater results

Human Resource Reforms

Revision of Training System for Researchers



Daisuke Ueda
HR Dept.

In charge of organizational staffing in the HR Dept. Involved in personnel transfers and system design.



Fumiya Hoshiga
Materials Characterization Dept.
Advanced Technologies Research Institute

Belongs to the Data Science Group and is responsible for biological data analysis.

Fostering human resources required for the future

Hoshiga: My department sometimes holds programming workshops for young researchers, and I play the role of a lecturer. A special emphasis is placed on data science. Teaching our researchers how to utilize data in materials chemical and life science fields, such as materials informatics* and bioinformatics* should directly contribute to strengthening our future R&D capabilities.

Ueda: Currently, data scientists are in short supply and hiring is becoming very difficult. In our case, we require knowledge of materials and data science, and not many people have both. The most realistic solution is to develop those human resources inside the company, so I have high expectations for what you are doing.

Hoshiga: You do not necessarily need advanced skills, but if you have a certain degree of knowledge, you should be able to use it in your work. That's what I would like to contribute to.

Developing your own career

Ueda: I am in charge of designing our human resource system in the HR Dept. Our goal is to empower researchers and help them grow. I was also responsible for designing the system for the new overseas study program starting this April. Under the previous system, the researcher and destination were selected by the research department, and the HR Dept. would respond to their requirements. The new system uses an open application process, so anyone can apply. You can choose the topic you want to study and where you want to study, as long as it is related to one of our focus areas. The study period is 3 years, which is enough to deepen your insight.

Hoshiga: I studied abroad as a student. Although it was only a short period, it considerably broadened my knowledge. With three years, you should have enough time to deeply investigate your chosen theme.

Ueda: In addition to studying abroad, we also

provide employees with a variety of opportunities to expand their careers in Japan, such as going to graduate school to obtain a master's degree in technology management or broadening their technological horizons at a venture company.

Hoshiga: Studying at a university or research institute wouldn't be unusual, but working at a venture company is quite interesting. I am sure it would be inspirational. It is also nice that the researcher can choose where they want to go.

Ueda: Would you like to volunteer?

Hoshiga: I am already getting plenty of practice in my daily work, so I am fine for now (laugh).

However, I will definitely consider it for the future.

Ueda: I hope our young researchers will take advantage of this system and give me feedback so that I can make it even better.

*Materials informatics: Using statistical analysis to determine material properties and manufacturing methods from large pools of data.

*Bioinformatics: Using statistics and informatics to study and analyze large amounts of biological data.

Nobuyuki Yoshino, Managing Executive Officer, Discusses the R&D Process Reform

Carrying Out Reforms with an Eye on the Future



Nobuyuki Yoshino
Managing Executive Officer
Chief R&D Officer
In charge of New Business
Planning & Development Dept.,
Research & Development Dept.,
Intellectual Property Dept.

PROFILE

Joined the company in 1983 and was assigned to the former Central Research Laboratory. After serving as General Manager of the R&D Department at the Omuta Plant and of the Central Research Laboratory, he assumed his current position in April 2021. His hobby is golf, but due to the pandemic, he only played two rounds last year. These days, he occasionally goes out to practice his swings.

Accurately ascertaining market needs

Under the goal of "as many as possible, as soon as possible," we have been trying to reform our R&D process by focusing on the three pillars of Theme Reforms, Information Reforms, and Human Resource Reforms.

Theme Reforms

A longstanding issue in research and development is the setting of research themes. Our company belongs to the materials industry, and our products go through multiple companies before they reach the end user. That means it is difficult to ascertain market needs, and thus difficult to set research themes. Therefore, as part of our open innovation activities since 2014, we have been communicating with various companies and external research organizations to pick up market needs and work on developments that meet them. We also hold frequent technology exchange meetings where our young researchers and clients explore themes from a medium- to

long-term perspective, leading to increased motivation and connections among our young researchers.

Information Reforms

We are building a "data lake" to centrally manage information related to research and development, including research reports, technical reports, and analysis information. Based on that, we are working on practically applying materials informatics (MI) and bioinformatics (BI) using AI.

Eventually, we will expand the data lake to include information held by the sales department, with a view to developing new technologies and products by matching customer and market needs with our technologies.

Human Resource Reforms

With the aim of fostering world-class researchers, we have revamped our system to further encourage studying abroad and in Japan so that our researchers can acquire a wider range of advanced skills. We have also begun training them to independently

use MI and BI in their research. In addition, we encourage overseas presentations and internal presentations in English to improve communication skills.

Contributing to solving social issues

At the moment, all eyes are on the SDGs, and governments and companies are being asked what they can do to contribute to resolving these issues. The SDGs are intended to be achieved by 2030, so we are also planning to increase the number of research themes based on them. We must be sure to complete those themes.

In the longer term, we must take on the challenge of R&D to achieve carbon neutrality in 2050. In addition, Denka aims to realize not only CSR (Corporate Social Responsibility) but also CSV (Creating Shared Value). Improving our R&D processes is essential for creating value and becoming a company that is indispensable to society. Please continue reforming R&D with an eye on the future.



Think INNOVATION

Introducing articles that provide hints for innovation

No.07

There Are No Failures If You Take Action

Photographer



Nagi Yoshida

Born in 1986. At the age of five, she was astonished at the sight of the Maasai Tribe on TV. She taught herself photography and visited Africa alone in 2009. Since then, she has photographed and presented many ethnic minorities in Africa and other parts of the world. Her unique color usage and intuitive shots were well received, and in 2017, she was selected for Nikkei Business's "100 people who will create next generation" and PEN's "Pen CREATOR AWARDS." In the same year, she won the Kodansha Publishing Culture Award for Photography. In 2020, she released "DRAG QUEEN -No Light, No Queen-," a photo book featuring drag queens in Paris and New York.

I want to accurately express their charm

I first visited Africa when I was 23 years old. Since then, I have met many members of ethnic minorities. All of those encounters were memorable, but one ethnic group in Ethiopia stands out in particular. This tribe has no concept of "happiness." When you ask them, "Are you happy?" they have no idea what you are talking about. That being said, they are always happy, they just do not have a word to express it. They are sad if a person or animal dies, but apart from that, happiness is their default. Shouldn't it be that way for everyone? That really made me think.

I did not originally aspire to be photographer. I am completely self-taught. For me, cameras and photography are simply a method of conveying the wonder of minorities in all their glory. For most people, meeting a member of an ethnic minority group is a once-in-a-lifetime event. I definitely do not want the people who see my photos to think that it is not anything special.

So I am very particular about my photos. I only shoot for a total of two hours in the morning and evening, when I can capture beautiful skin tones. I have to finish shooting within that time limit, so it is actually the preparations that are harder. When I am interacting with them, I am constantly observing their facial expressions and gestures and thinking about how to photograph them. "That pose might work" or "Taking that child's picture from this angle would better show off their features." I will walk for hours looking for



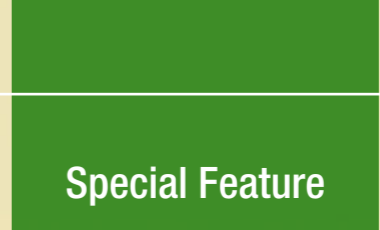
Photo taken in northeastern Ethiopia, December 2018

the best backgrounds. All because I want to convey their charm 300%.

Do what you want to do, and it will be your work of art

Then, I went from ethnic minorities to drag queens. To be honest, I was anxious about the large change in subject matter and environment. I was not accustomed to shooting indoors, and I could not help but wonder: "People know me for photographing ethnic minorities in Africa. Will they even recognize my work if I'm photographing drag queens in the big city?" It was the drag queens themselves who helped to dispel my fears. By interacting with these women, I felt more confident about the things I wanted to do and express. Regardless of what people think, if I am satisfied with a photo, then it is my work. I did what I wanted to do, and that is all that matters. As a result, I was satisfied with the photos.

The COVID-19 pandemic has made it impossible for me to go overseas, but I have become interested in the beauty of Japan and its traditional culture. In my own way, I would like to capture this country's charm in my work. If there's something I want to do, I take action. That's what I have decided. I do not mean to suggest that you should not think about it rationally, but if you do not take action, then nothing will change. Even if things do not work out, you can always think of another way. As such, I believe that there is no such thing as a failure.



Special Feature

Changing the Future of Agriculture with New Technologies

Biostimulants

Every day, we consume vegetables, fruits, grains, and other plants without a second thought.

Today, however, agriculture is facing challenges such as produce shortfalls due to population growth and damage caused by climate change.

Let's take a look at a new technology that could potentially save the agricultural industry.



Amazing
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Towards a Sustainable Society

New Solutions to Change the Future of Agriculture

The agricultural industry is facing various challenges, including food crises due to population growth, declining levels of arable land, and labor shortages. However, in recent years, biostimulants have been attracting attention as a potential solution capable of changing the future of agriculture. The market for biostimulants is expected to grow to approximately 290 billion yen by 2021. Here, we will take a look at this cutting-edge new solution.

What are biostimulants?

A variety of substances or microorganisms that improve the yield and quality of plants. By adding resistances to various environmental stresses (abiotic stresses), they effectively draw out the potential of plants. Since biostimulants can contribute to more efficient harvests, it is expected that they will help to solve social issues that make it difficult to secure enough food in the face of population growth and global warming.

Global Agricultural Issues

An ever-increasing population

The world's population, which is currently at 7.7 billion, is expected to reach 9.5 billion by 2050. If this trend continues, the amount of food per capita will decrease.

Declining levels of arable land

It is said that the total arable area of the earth is about 1.5 billion hectares. The expansion of desertification on a global scale will cause a decrease in cultivated land.

Climate change caused by global warming

The rise in average global temperatures will limit the amount of areas suitable for growing crops. Record high temperatures and lack of sunlight will also lead to lower crop yields.

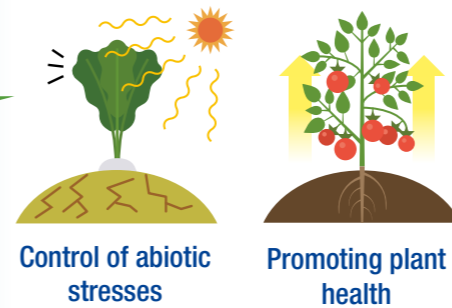
Aging farmers and labor shortages

Japan's population is on the decline and the aging of farmers, labor shortages, and abandoned farmlands are among the issues being addressed.

Conventional solutions in agriculture

- Development of superior crop genes
- Provision of plant nutrition
- Control of biotic stresses (pests, weeds, diseases)

New solutions with biostimulants



Controlling abiotic stresses (drought, heat damage, salt damage, cold damage, etc.) can reduce the damage caused by adverse climate and soil conditions, leading to healthier plants.



Higher crop yield efficiency



Enhanced nutrient absorption



Improved quality of crops



Abiotic stress tolerance

Expert Interview

What Denka can do as a pioneer.



Osamu Sudo
Director
Japan Biostimulant Association

The term "biostimulant" may be unfamiliar to many people. Fertilizers are used to help plants by providing nutrients, while biostimulants activate the absorption of the nutrients. Many materials, such as humic acids contained in humus, have been used in agriculture since ancient times. It was only in the 1950s that full-scale research began to define and study these materials, which had previously been scattered across various industrial fields. Therefore, it is still considered to be a new field of study.

Today, many countries, including Japan, have begun focusing on building sustainable food production systems. Especially in Europe, which aims to drastically reduce the use of pesticides and insecticides, there is a need to maintain and improve production. As one of them, expectations for biostimulants with less environmental impact are increasing.

Denka has been dealing with humic acids for more than 50 years and is a pioneer in this field. I hope that Denka can contribute to the development of the biostimulant industry by utilizing their accumulated knowledge and excellent material development capabilities.

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Focus Project: Marketing Biostimulant Market Development

Keeping the World Green Forever Unprecedented Challenges by Young Pioneers

In 2019, the Denka Group announced its full-scale entry into the biostimulants market. More than five decades ago, Denka Azumin developed an agricultural material that utilizes humic acid, a substance formed when animal and plant remains decompose in soil. Today, the company not only conducts business domestically but is also expanding overseas under the PRULA brand. We asked these young pioneers about their aspirations in the face of this unprecedented challenge.

*PRULA, KEY TO THE FUTURE LANDSCAPE and the logos are trademarks or registered trademarks of Denka Company Limited.



Strawberries with larger roots (bottom left) and cucumbers with healthy foliage (top) grown using Denka's biostimulant products

YouTube video explaining AZU Liquid, a liquid fertilizer



Yuta Uchida
Agri-Products Dept.
Denka

Joined in 2015. He is in charge of overseas sales focusing primarily on market development in China.



Hideto Kimura

Joined in 2018. He is in charge of sales in Japan and digital marketing using advertising and social media.



Kiyomi Maeda

Joined in 2019. She is in charge of sales for North America and product branding strategy.

Opening up overseas markets with the PRULA brand

"Our mission is to deliver Denka's products to farmers around the world and to help them solve their agricultural problems," says the three members of the Agri-Products Department responsible for marketing biostimulant products.

AZUMIN, manufactured and sold by Denka, is an agricultural material with a history of over 50 years. It is a granular fertilizer that utilizes humic acid, one of the biostimulants, and is effective in improving the rooting of plants. It has contributed to the improvement of crop yields mainly for domestic farmers. In 2016, the company started selling Azu Liquid, a fast-acting liquid fertilizer, and is now developing the overseas markets in addition to the domestic market. "We want to contribute to the development of sustainable agriculture through our products. It is with this in mind that we decided to make a full-scale entry into the biostimulant market in February 2019," explains Kiyomi Maeda.

However, the overseas market was fiercely competitive with many major agricultural material

manufacturers. With limited time and resources, Denka had to find a way to quickly demonstrate its strengths. After much discussion, Maeda decided to utilize the power of the brand. "We conducted a series of interviews with our internal sales and R&D members to define the key factors of our brand. We determined that our strength lies in creating products that weave a new story for the agricultural industry through our unique technologies that utilize the power of science. That is how we came up with the concept of 'KEY TO THE FUTURE LANDSCAPE.'" Based on this concept, they decided on the keyword "Preserve Your (U) Landscape" and launched it globally as the PRULA brand. Currently, they are conducting trials with farmers and research institutes in ten countries, including China, Spain, the U.S., and Brazil. There, they have been able to confirm the beneficial effects, such as improved growth and increased yields. "My dream is to have farmers around the world use our products. I want to make it a world renowned brand." Preparations are still underway for full-scale sales in overseas markets in 2021.

Overcoming difficulties with digital marketing

It has not been easy to get to this point. Originally, the company would have conducted local information sessions and visited farmers directly to promote the product, but the COVID-19 pandemic in 2020 made it impossible to conduct face-to-face sales. Yuta Uchida, who is in charge of overseas sales, explains, "The sales of agricultural materials cannot be done through theoretical discussions alone. Only by actually using our products and experiencing their effectiveness will farmers adopt them in the long-term. It's the same for the domestic market. Since we were not able to visit farmers and retailers directly, we needed to establish a new marketing method."

To overcome this difficulty they decided to try digital marketing. In March 2020, under the leadership of Hideto Kimura, the company launched a digital marketing campaign using social media and other channels. Currently, they are marketing to domestic farmers via Denka's official YouTube channel. "To be honest, I was skeptical at first, because

the average age of farmers in Japan is really high. However, we received a tremendous response, with one of our videos receiving over 100,000 views within four months of its release. The number of product inquiries increased more than tenfold from the previous year, far exceeding our expectations. We are currently analyzing case studies and thinking of new ways to get farmers to view our videos." The access logs showed that half of the viewers were over 65 years old and viewing the videos on smartphones, proving that this method was effective in reaching the target market. "Going forward, we plan to expand our business to overseas markets. We will accumulate knowledge in Japan to support sales expansion in overseas markets."

Uchida continues, "There are many areas overseas that have poor farming environments compared to Japan. We want to help as many farmers as possible, so we will continue searching for new marketing methods to expand interest in our products overseas." The three ambitious challengers will continue to protect the green landscapes of the world.

Farmer's Comments

A product that meets farmers' needs



Miguel Henrique Rosa Franco
Fazenda Santa Julieta

I run a maize and soybean farm in Brazil. In order to meet the increasing global demand for cereals, we are trying to utilize new agricultural technologies. Denka's PRULA is a promising product which fulfill our needs. In our field trials using PRULA, results showed enhancement in root development and increase in yields. We hope PRULA will be widely used in Brazil.

Researcher's Comments

Expected to contribute to Brazilian agriculture



Prof. PhD Regina M. Q. Lana
Federal University of Uberlandia

Brazil is one of the world's leading agricultural countries, and in recent years there has been a growing demand for biostimulants which are environmentally friendly and relieves stress caused by abiotic factors. Denka's PRULA has been proven here in Brazil to be effective in improving crop yields through its great capacity to vitalize plants. I expect that PRULA will contribute to increase productivity of Brazilian agriculture.

**Amazing
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New Product Development × Open Innovation

Uncovering the Secrets of Fertile Soil Passed Down Through Generations

The Denka Innovation Center is located in Machida, Tokyo.

There, they conduct research to develop new biostimulant products through open innovation.

A new product containing a high concentration of fulvic acid, which is said to have a strong effect on plants, is scheduled to be launched in 2021.

In this article, we will take a look at a challenging R&D topic with the potential to change the course of agricultural history.



Toju Iino
Agri Team
Infrastructure & Solutions
Development Research
Institute
Denka Innovation Center

Joined in 2019. He is the project leader for new product development.



Hiroki Ito

Joined in 2020. He is currently studying the effects of humic substances on crops at the molecular level.

Uncovering the true nature of humic substances through open innovation

When looking over farmlands, you will notice hectares of black or dark brown fertile soil. This fertile soil has been handed down from generation to generation by farmers as soil best for growing plants. The black appearance of the soil is believed to be due to humic substances, which Denka uses as a biostimulant material. However, it is still unclear why humic substances have a positive effect on plants. In addition, the use of humic substances has been shown to

enhance tolerance to environmental stresses caused by climate change and biotic stresses such as pests. However, this is based only on the experiences from farmers. There are currently no scientific explanations.

The Infrastructure Solution Development Research Institute at the Denka Innovation Center is working to solve this long-standing mystery. Through open innovation (Fig. 1), they are trying to identify the mechanisms by which humic substances affect plants.

Hiroki Ito is mainly responsible for gene expression analysis using model plants such as tomatoes. By comparing gene expression levels from

extracting RNA from tomatoes that have been treated with humic substances and those cultivated under normal conditions, he aims to identify the positive effects of humic substances on plants. "By analyzing the gene expression involved in plant growth, we will be able to determine the optimal concentration and frequency of our products to be applied to crops. We will continue our research step by step through trial and error, and hope to expand product sales," says Ito. He takes pride in the fact that his team is steadily accumulating gene expression data through open innovation. The results of the research will be shared with the Agri-business departments and used for product promotions.

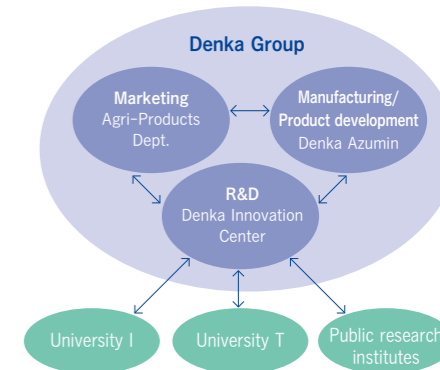
Delivering biostimulant products to the world and the future

In 2021, Denka will launch a new biostimulant product. This new product features a high concentration of fulvic acid, which has a strong effect on plants. In addition to improving rooting and enhancing resistance to environmental stresses, it also has the added benefit of not precipitating when mixed with liquid fertilizer, allowing for effective spraying. The company plans to market it as a premium model with high added value within the PRULA brand. "Our mission is to identify the mechanisms of humic and bioactive substances as early as possible in order to expand our products to the world. We will continue to

develop next-generation products while also considering other biostimulant materials, such as seaweed extracts and amino acids," says Toju Iino.

As for his future vision, Iino continues, "Our dream for the future is to propose solutions for each step of the farming process—from seeding, harvesting and soil management to seeding for the next season—and to establish an integrated management system. If we can use our accumulated research data on soil and microorganisms to make proposals on everything from optimal seeding to the use of agricultural materials, we will be able to greatly contribute to the agricultural industry. We will also be able to contribute to achieving the Sustainable Development Goals 2 (Zero hunger), 13 (Climate action) and 15 (Life on land). This is no easy task, but I believe it is possible with the support and comprehensive strength of the Denka Group." Ito concludes with, "In the future, I would like to work together with breeding companies to research products that can maximize the features of agricultural crops. If we can create products that increase yields in developing countries with poor growing environments, it will help solve food shortages. I believe in the potential of biostimulants and will continue striving to push this technology further." Slowly but surely, Denka will change the future of agriculture.

Open Innovation Structure (Fig. 1)



Collaborator's Comments

More healthy vegetables with humic substances



Kazuhisa Kato
Associate Professor
Horticultural Science
Graduate School of Agricultural
Science, Tohoku University

Humic substances are known to increase soil strength, fertilizer effect, and root activity. They are also known to increase tolerance for environmental stresses, but the mechanisms at the molecular level are not yet clear. Evidence guaranteeing the effectiveness increases the product value and is an important factor in explaining the product to customers.

In October 2019, we started a joint research project to identify the mechanism from a molecular biological perspective. Using tomatoes, we developed various experiments testing the effects of humic substances by growing them in an artificial climate chamber where environmental conditions can be set. We are currently conducting experiments to verify that treatment with humic substances improves genes related to growth and stress tolerance in plants. To increase the number of healthy vegetables with stress tolerance in the future, we will also focus on the effects of antioxidant properties and physiological disorders such as blossom-end rot.

**Amazing
the
World
with Innovation**



New President Special Interview

Toshio Imai took over as president on April 1. In order to learn more about him, we had a young employee interview him.



I was the interviewer!

Yuka Murata
Business Promoting Dept.
Life Innovation
(Joined Denka in April 2020)

Toshio Imai

Representative Director,
President

Born in Kanagawa Prefecture in 1959. Joined Denka in 1982. After serving as General Manager of the Styrene Dept. and other positions, he was appointed Representative Director, President in April 2021. He loves baseball, and although he's a Hanshin Tigers fan, he specifically looks up to Ichiro. He was moved by Ichiro's comment upon achieving 4000 career hits: "To get those 4000 hits, I went through more than 8000 frustrating misses."



Q Why made you join Denka in the first place?

The second oil crisis took place when I was a student, so I developed an interest in Japan's energy security. I joined Denka, because I was impressed that they had their own limestone and hydroelectric power plants.

Q Please tell us about a memorable working experience.

Thirty years ago, I had a memorable experience working in Silicon Valley. Under bright blue skies in a beautiful city surrounded by greenery, my job was to sell magnetic disks, which was completely different from what I had done before. Using English, of course. It was very difficult, but I enjoyed it.

Q Please tell us about a turning point in your career.

Ten years ago, I was transferred to the Corporate Planning Dept. Since I had been working in business divisions my whole career, it was a valuable opportunity to experience overall company management for the first time.

Q What do you do on your days off?

Before the pandemic, I used to enjoy golf, but it is just not the same playing by yourself, especially when you cannot enjoy the get together after the golf. These days, I spend more time reading. A book is the culmination of an author's passion, so reading is a very constructive way to pass the time.

Q Do you have a message for young employees?

While working at Denka, I hope that you will be inspired by the people around you, inspire others, and experience a sense of growth. I will strive to manage the company in a way that facilitates your growth.

Q Are there any personal beliefs that have helped you in your career?

My motto is "Truth, Goodness, Beauty." Whenever I judge something, I consider whether it is true (scientific or logical), good (consistent with my beliefs or aspirations), or beautiful (harmonious as a whole).

I also think it is important to believe that the world is inherently good. There is an aphorism that says, "Pessimism is a matter of mood; optimism is a matter of will." The world tends to be a pessimistic place, so I try to make a point of being positive and cheerful.

Q What do you think Denka's strengths are?

That we have a number of world leading businesses and excellent human resources.

President Imai >>> Young employees

Honestly speaking, how was the past year?

"I also have a question for you," said President Imai. He asked Ms. Murata the following:

Q You joined Denka in 2020 and spent the whole year working under pandemic conditions. In retrospect, how was it?

Although I did not know what it was like before the pandemic, I felt that we were in a period of great change. Since I could not meet people directly, I noticed the importance of spending time with others, and I started several new hobbies that I could do alone, like reading and aromatherapy. I also got the sense that I could contribute as a digital native, so in the future, I would like to find out what I can do and work on it.

After the interview:
I was impressed at what a positive person the new president is. I am going to cherish the inspiration from people around me.



DENKA TOPICS

Introducing Denka Group news topics from January to March 2021

Jan. Shinomigawa Power Plant begins operations

On January 29, the Shinomigawa Power Plant, a new hydraulic power plant recently completed in Itoigawa City, Niigata Prefecture, began transmitting power. Construction was completed over a six-year period with the cooperation and support of local residents and government organizations. To ensure long-term stability and prepare for natural disasters, it features state-of-the-art remote-control functions and reinforced facilities. It is expected to reduce CO₂ emissions by approximately 13,000 tons per year. With the SDGs as our guide, we will continue promoting a variety of environmental conservation and protection initiatives to contribute to the realization of a sustainable society.



Jan. Daiichi Sankyo submits application for Oncolytic Virus G47Δ

Daiichi Sankyo has submitted a new drug application for G47Δ (delta), an oncolytic virus for which Denka has developed the commercial production technology. G47Δ holds promise as a completely new cancer treatment, and once approved, Denka will be responsible for manufacturing it. Moving forward, we will continue contributing to improving quality of life for people around the world through the development and manufacturing of products in the areas of prevention, diagnosis, and treatment.



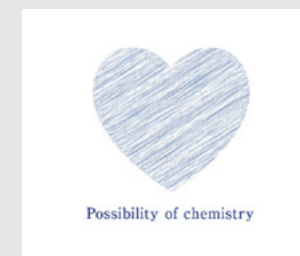
Feb. Online press conference held for change of president

Following the resolution passed by the Board of Directors on February 5, a press conference was held online with President Yamamoto and Senior Managing Executive Officer Imai, who will take over as the new president on April 1. During the conference, President Yamamoto discussed the background of the changes, and Senior Managing Executive Officer Imai expressed his determination to 1) continue promoting Denka's Value-Up strategy, 2) promote environmental management, and 3) create a company where employees can experience job satisfaction and grow through their work.



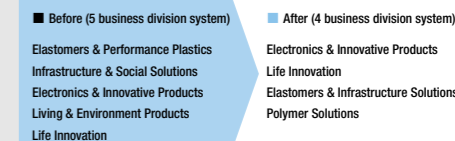
Jan. Application filed for simultaneous COVID-19 and influenza diagnostic kit

We have developed an antigen rapid diagnostic kit that can simultaneously diagnose COVID-19 and influenza with a single device and have applied to the Pharmaceuticals and Medical Devices Agency (PMDA) for domestic approval as an in vitro diagnostic agent. Since both of these conditions are difficult to diagnose through symptoms alone, we expect that this combination kit will contribute to appropriate treatment methods and reduce the burden on medical personnel.



Feb. Executive appointments and business reorganization

At a meeting held on February 5, the Board of Directors passed a resolution to approve new executive appointments and changes in the business structure. The number of directors was reduced from twelve to nine to better clarify roles on the Board of Directors and the Executive Committee, improve discussion efficiency, and speed up decision-making. In addition, the previous five divisions were consolidated into four new divisions to expand each division's business and promote overall optimization.



Mar. Development of high temperature insulation boards and molding materials that contribute to CO₂ reduction

We have developed high temperature insulation boards and molding materials that contribute to CO₂ reduction and will start test sales in the first half of this fiscal year. These products combine Denka Alcen with CA6 (calcium hexaaluminate), a highly heat-resistant, porous ceramic material developed in-house, to reduce solid and gaseous heat conduction and improve thermal insulation performance, especially at high temperatures in the 1,400°C range. With 60% less CO₂ emissions compared to conventional refractory materials and improved erosion resistance due to iron oxide, they are expected to find success as environmentally friendly products in the steel industry.



A movie about the project to supply raw materials for Avigan® Tablets is now available. You can use the QR code on the right to access it.
▶ <https://www.denka.co.jp/covid-19/>





Japan

Takayuki Nomura
Sales Dept.
Denka Elastlution Co., Ltd.

I love ramen!
Lately, I enjoy the light and refreshing type.

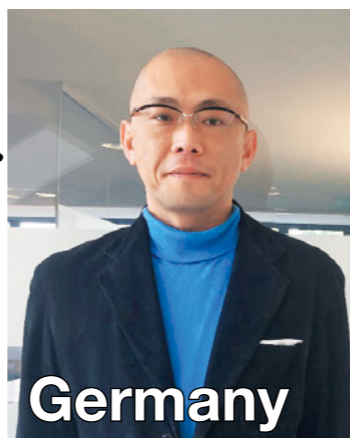
Joined the company in April 2000. As deputy sales manager, he aims to become an all-rounder who can handle any kind of rubber products.

We are currently focusing on thermal expansion fire-resistant materials, which are materials that prevent fire spreading in an emergency. In recent years, we have had more opportunities to work with other Group companies and interact with users in various fields. It is also encouraging to work as a group toward a single goal. We will continue proposing specialty products that meet the needs of users by utilizing the sales channels of the Denka Group.



How are things in Japan, Nomura?

How are things in Germany, Kang?



Germany

Soon Sa Kang
Automotive Material Solutions Department
Denka Chemicals GmbH

I like old cars and traveling!

Joined the company in September 2018. He is responsible for introducing prototype products to European automakers and Tier 1 suppliers.

I greatly respect Tsuneichi Fujiyama, who laid the foundations of electrochemistry in Japan, and it gives me great pleasure to work at Denka, the company that he founded. Currently, I am working with a German car manufacturer that my late father loved, and I am very happy to be able to experience the development of the automobile industry firsthand.

Material Excellence!



How are things in the USA, Gavin?



USA

Gavin Diaz
Sales Manager
Denka Corporation

I love New York City!

Joined the company in October 2014. As manager of sales and marketing, he manages the businesses of Denka Alcen, Denka Tokkon, and Denka Agriculture Products for North and South America.

Through my work in the Infrastructure Solution field, I feel that I am helping society advance in a positive direction. Whether meeting with researchers in Brazil to determine the best paths for optimal crop development with PRULA, discussing advanced industrial applications for Alcen's bulk fiber, or engaging in construction projects with the Tokkon team, I feel that my work at Denka is meaningful to the progress of humanity as a whole.

Dynamic Progress

How are things in Singapore, Joel?



Korea

Kie-Seok Lee
Denka Korea

최첨단 기술개발에 기여
Contributing to the development of cutting-edge technologies

I love zombie movies!

Joined the company in June 2017. He is in charge of phosphor sales in Korea.

It's when I hear about the latest technology trends from a wide range of industries and am able to use them in a useful way. I like electronics, so I enjoy visiting customers and being the first to get information on new automotive technology, smartphones, TVs, monitors, etc. Sometimes I can even use that knowledge in my private hobbies. We also share information among employees who are in charge of different products, regardless of the industry, and it makes me happy when unexpected synergies are created that benefit us both.

How are things in Korea, Lee?



LINK GLOBALLY, LINK FUTURE

Group members around the world, working toward the future of Denka

The Denka Group has 6,000 employees around the world. We posed the following question to members from different countries.

Theme The moments you are glad you joined Denka

A workplace where people care for each other

田心いやいのある職場!

I like playing Go. After the pandemic, I want to travel to Japan!

Joined the company in July 2017. In charge of sales of styrene resins in China. In addition to following up with existing customers, he is working on the development of new products and applications.

It has been over three years since I joined Denka, and I can think of many memorable occasions when I have been helped by people at the company in both my work and private life. I was particularly impressed in February last year, when COVID-19 was spreading rapidly in China, that the head office sent us masks, which were difficult to obtain in China at the time. The pandemic is still spreading around the world, but I hope that countries will work together to overcome it, just as Denka's bases worked together.



Shanghai

Shao Junwei
Performance Plastics Department
Denka Chemicals Shanghai Co., Ltd.

How are things in Shanghai, Shao?



Singapore

Joel Chia
Tropical Viruses MDx Team
Denka Life Innovation Research Pte. Ltd.

I love playing the piano, guitar, and ukulele.

Joined the company in April 2020. As a research scientist in the Molecular Diagnostics Team, he aims to develop state-of-the-art technologies to create new value in the area of diagnostics.

When I learned just how many Denka products are part of our everyday lives and how these innovations have positively impacted and improved them, I was intrigued by the possibility of chemistry. I take pride that all of us in Denka can play our part to contribute to this great vision and effort.



Thankful for Everything