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Study of Marine Natural Product Chemistry

from Keio's Faculty of Science and Technology

Unique and new compounds derived from nature

Kiyotake Suenaga

Associate Professor
Department of Chemistry

Featured in this issue is Associate Professor Kiyotake Suenaga, whose research focuses on exploration of unknown substances from marine organisms.

Unknown substances from marine organisms are intriguing

Accelerating research for application to pharmaceutical development

How many substances are there on our earth? Associate Professor Kiyotake Suenaga of the Natural Product Chemistry lab makes an almost endless pursuit of unknown substances available from marine organisms, saying: "There must be an incredibly large number of effective substances yet to be discovered." A recent example of his discoveries is a substance isolated from cyanobacteria. It has been found that this substance has an action that is expected to be used for remedies against cancer and osteoporosis, thus opening up the possibilities of application for pharmaceutical development.

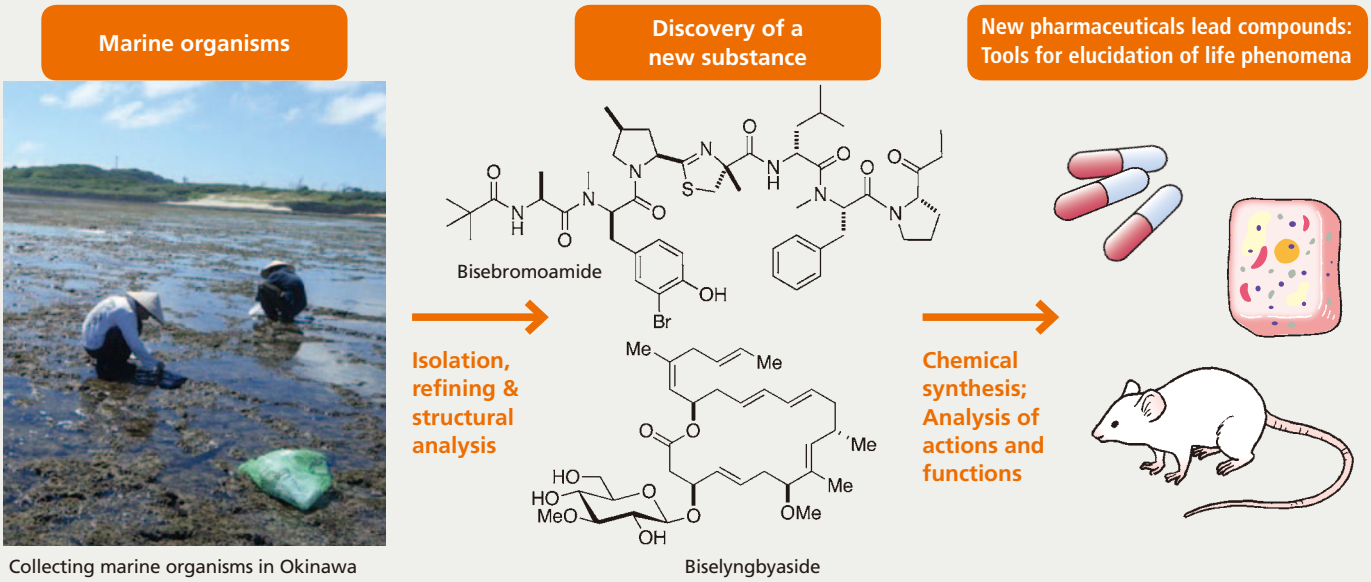
The beginning of the quest for unknown substances

A beach in Okinawa in May . . . A group of people, each wearing a long-sleeved shirt and a hat, was found intently looking for something under the glaring sunlight. This group was Associate Professor Suenaga and his students collecting marine organisms. The quest of unknown substances begins with an incredibly exhaustive work of gathering potential materials (Fig. 1).

Since Dr. Suenaga transferred to Keio University in 2006, he has been mainly collecting marine cyanobacteria. Cyanobacteria are a type of bacteria that have chlorophyll and perform photosynthesis. They are believed to have produced oxygen in the primeval times of the earth. Dr. Suenaga says that he chose cyanobacteria as his objective not because he felt special potential in cyanobacteria. "I had no particular theoretical reason for choosing cyanobacteria as my objective. No one knows that an exciting substance can be found in a particular organism," remarks Dr. Suenaga. Indeed, assumption is a taboo when it comes to exploration of unknown substances.

Fig. 1 Marine natural product chemistry

Some marine organisms contain substances that have a unique chemical structure and bioactivity unavailable from terrestrial organisms. Discovery of such substances is extremely important, not merely as discovery of new substances, but also because they can contribute to pharmaceutical development and shed light on living phenomena.



He continues: "If I dare to give a reason, it's perhaps because cyanobacteria were attached to seaweeds which were the food of sea hares I was studying as a college student." Sea hares are known to have a unique substance, which is considered to be their food origin. That's why cyanobacteria have weighed on his mind since then.

Anticancer activity as a bench mark

The total amount of cyanobacteria that has been gathered in the past five years is approximately 150 kilograms, from which essence is extracted, allowing a "target" substance to be isolated. Isolation is a process of purifying (Fig. 2), making full use of chromatography*1 and other sophisticated techniques in the state where no substances other than the target are mixed. The bench mark for Dr. Suenaga to choose a target is whether the substance in question has an anticancer activity *2 or not. Therefore, most of the substances Dr. Suenaga has chosen thus far have an anticancer activity.

Then he proceeds with the examination of the target substances based on their chemical structures. Use of a nuclear magnetic resonance spectrometer (NMR)

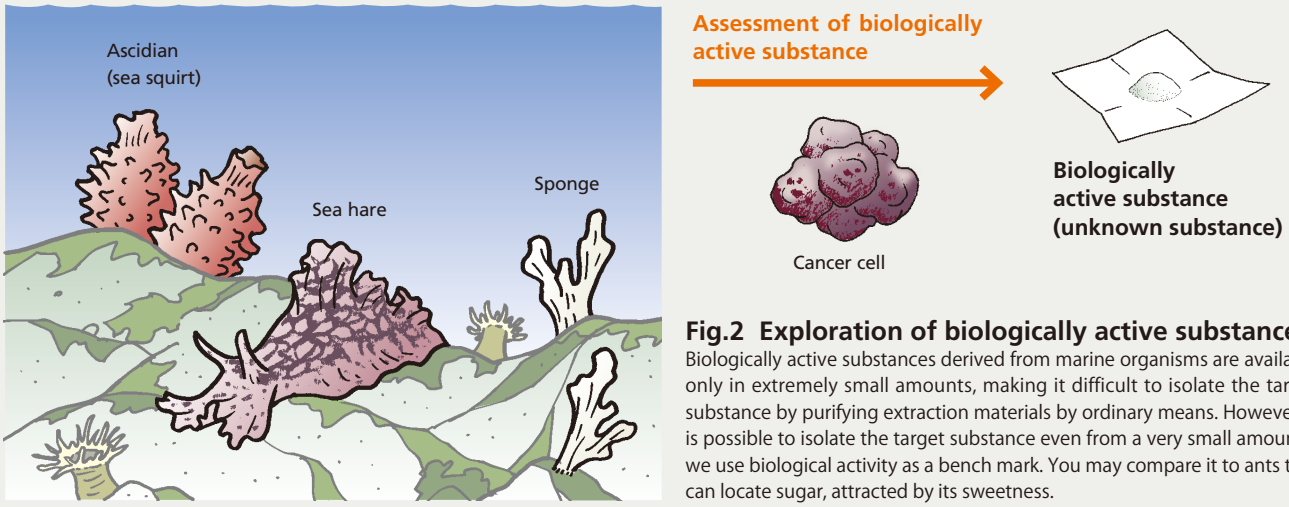


Fig.2 Exploration of biologically active substances
Biologically active substances derived from marine organisms are available only in extremely small amounts, making it difficult to isolate the target substance by purifying extraction materials by ordinary means. However, it is possible to isolate the target substance even from a very small amount if we use biological activity as a bench mark. You may compare it to ants that can locate sugar, attracted by its sweetness.

installed at the Keio campus enables a substance's chemical structure to be identified in a short period of time. If the chemical structure of a given substance is too complex, an NMR with higher resolution, available outside the campus, may be used. More specific aspects of the substances are determined based on their reactivity and crystal structure analysis. Once the structure has been identified, you can determine whether the substance is really unknown.

Bisebromoamide was the first substance discovered from an extract of cyanobacteria through such an exploration process. "We named it 'Bisebromoamide' because it was an amide containing bromine (Br) and found in cyanobacteria which were gathered in the seaside Bise district of Okinawa," says Dr. Suenaga. He makes it a rule to give a substance he has discovered a name based on the place of discovery and/or the main characteristic of its molecule. Bisebromoamide was successively followed by the discovery of biselyngbyaside and leptolyngbyolides. And even a fourth substance is likely to be discovered before long.

That said, each of these substances is available in only an extremely small amount (several milligrams to several tens of milligrams). This makes it difficult to make detailed investigation into properties and actions of these substances. As a solution to obtain sufficient amount of substances, Dr. Suenaga is attempting artificial chemical synthesis. Synthesis methods for bisebromoamide and biselyngbyaside are expected to be established soon.

Key points for successful research

Dr. Suenaga's research work now appears to be progressing smoothly. But he could not find any promising substance at all in the first two years. There are countless marine organisms. Why didn't he switch to other organisms? "To tell the truth, I had been dealing with other marine organisms in my early years, but I couldn't achieve visible results. That's why I switched to cyanobacteria. Therefore, the idea of giving up cyanobacteria in a mere two years or so didn't occur to me at all." It seems that exploration of unknown substances also requires tenacity and toughness.

A turning point came to him when he began collecting cyanobacteria of different varieties from what he had been focusing on. "When talking about cyanobacteria, we tend to think, first and foremost, of those outstanding ones like impressive green algae. Having spent two years looking only at cyanobacteria, however, I suddenly noticed that cyanobacteria also exist that are plain and less conspicuous," he remarks. This change in approach fueled his advance.

Substances derived from marine organisms: a focus of attention

"Among the many substances I know, bisebromoamide is unique in that it contains D-amino acid, bromine (Br) and t-butyl group." Substances derived from marine organisms are intriguing not merely because of their structures. Dr. Suenaga continues, "Recently I'm often asked by researchers of my acquaintance, 'Do you have any interesting substance?' So I send a sample. Later on, I receive a report from that researcher saying that he/she found a particular action." For example, Prof. Je-Tae Woo of Chubu University informed him of the possibility that biselyngbyaside might become an effective remedy for osteoporosis.

Osteoporosis is a disease for which no effective remedy has been found to date. So biselyngbyaside has come to the fore as the key substance for an osteoporosis remedy. Dr. Suenaga humbly says, "Although I can gather and isolate unknown substances, I'm not in an environment where I can examine all of them in detail as to what actions these substances have. So I really appreciate other researchers' efforts and support in this regard." Despite his humble comment, it may not be an exaggeration to say that such a co-research framework can exist only because the substances discovered by Dr. Suenaga have been intriguing enough.

On March 23, 2011, the *Chemical Daily* ran an article reporting that full-scale pharmaceutical development endeavors would be undertaken using the substance discovered by Dr. Suenaga. Adding "Pharmaceutical development requires the highest possible safety and efficacy," he appears to be not placing too much expectation on the proposed pharmaceutical development and is determined to steadily pursue his research work. Yet, at the same time, he proudly says "Should it fail to come to fruition as a new drug, the significance of continuing in-depth quest of unknown substances remains unchanged because it will eventually help to shed light on mysteries of life phenomena."

"Many marine organisms have no shells to protect themselves and are slow in moving, making them apparently defenseless. Despite that, they are surviving. Decades ago, some scientists thought that such organisms must have a certain kind of defensive substance that enables them to survive despite their apparent weakness. This is believed to be the starting point of exploration of unknown substances peculiar to marine organisms. I'm not sure if this hypothesis is true or not, but as far as my research endeavors are concerned, I can confidently say that marine organisms do have many intriguing substances that are not yet known to us," concluded Mr. Suenaga. Natural product chemistry is bound to attract more and more attention in the years to come.

(Reporter & text writer: Akiko Ikeda)

*1: One of the methods to isolate a substance utilizing differences in affinity with the carrier.
*2: An action that inhibits growth of cancer cells.

I owe what I am today to my respected teacher

Discovering one unknown substance after another from marine cyanobacteria, Dr. Suenaga endeavors to approach and elucidate the usefulness of such substances. He has inherited his preparedness both as a researcher and educator to his respected teacher whom he encountered as a university student. Once a young student lacking an interest in chemistry, why and how did he become bent on the exploration of unknown substances?

How did you spend your childhood?

I was born in Aizu in Fukushima Prefecture and raised in Sendai in Miyagi Prefecture. Since I grew up in a leisurely, stress-free environment, there was nobody who attended a cram school. Also, I was never told by my parents to study hard. So until I graduated from junior high school, I had rarely studied at home.

As a small boy, I thought to myself that I would find employment with the Japan National Railways (now JR) in the future. For me this seemed to be a natural course of life since three generations of my family, from my grandgrandfather to my immediate father, had worked for the National Railways. So I was raised in official National Railways housing. The fact is, my father was one of the first-generation drivers of the Tohoku Shinkansen SuperExpress. When I was an elementary school boy, my father was studying hard to become a Shinkansen driver to prepare for the Tohoku Shinkansen line opening, which I still remember. My own son appears to respect his grandfather much more than his father (myself) because he has no idea about what I'm doing.

What was the impetus for you to make a decision to specialize in chemistry?

I was once reaching for the universe. In fact, my interest had been in physics rather than chemistry until I became a university student. But by the time it was time for me to choose a lab to study in, my interest had shifted to natural products and other complex substances. At Nagoya University in those days, however, studying in the organic chemistry group of the Graduate School of Chemistry required a kind of resolution. It was because there were two professors' labs available – Prof. Ryoji Noyori who was later to win a Nobel Prize, and Prof. Kiyoyuki Yamada, my teacher, both famous for being very strict. I finally decided to join Prof. Yamada's lab.

What was the atmosphere of your lab?

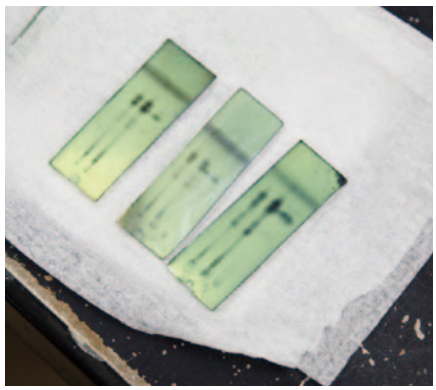
As a newcomer, I had no idea of what the Yamada lab was like, but soon I found that the lab was with great traditions. Dr. Yoshimasa Hirata, the predecessor and teacher of Mr. Yamada, is famous worldwide for his research on tetrodotoxin (globefish poison). Furthermore, Dr. Osamu Shimomura, awarded the 2008 Nobel Prize in Chemistry for his research into green fluorescent protein found in jellyfish, had once studied in Dr. Hirata's lab. By chance, I put myself in an environment that is one of the greatest centers of natural product chemistry.

Even today, I make it a rule to introduce my respected teacher Mr. Yamada's research work "Carcinogenic Substance of Bracken" at the beginning of the "Chemistry of biologically active molecules" class work for juniors of the Department of Chemistry.

What was the first research work in your life like?

My first research theme was chemical synthesis of Aplyronine A. This substance can be obtained from sea hares, a marine organism that looks like a large slug. Aplyronine A is an anticancer substance discovered by the Yamada lab. It interacts with actin, the knowledge of which was quite innovative in those days. I came within an inch of success by the end of the second year of the master's course. But the last reaction would not take place, which put me at the end of my rope after all. Reluctantly, I had to go far back to a substance of the early stage and rebuild the synthesis method. I was like a climber who reached the ninth stage of a mountain but was suddenly pulled back down to the third stage. Even so, I remained steadfast, thinking I should not abandon the project halfway. It was at the end of the first year in the doctor's course that I finally succeeded in the synthesis.

Incidentally, Dr. Hideo Kigoshi (University of Tsukuba), a disciple of Dr. Yamada, has taken over the research into the substance's action mechanism. At a recent academic meeting I had an opportunity to listen to Dr. Kigoshi's lecture that mentioned a new development in the study of the action mechanism.

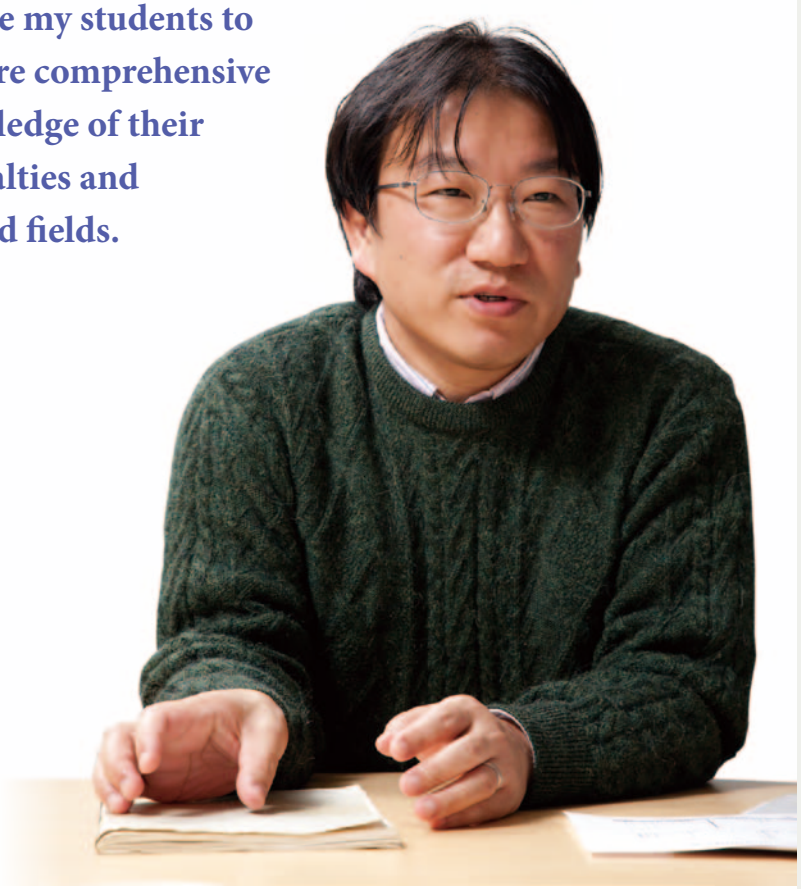


(Left) Marine cyanobacteria are being extracted using an organic solvent. After several days of extraction, the liquid is filtered and enriched inot an extract. / (Right) For research involving chemical synthesis, thin layer chromatography (TLC) is employed to examine the progress of reactions. TLC can also be used as a means for separation.

Kiyotake Suenaga

Dr. Suenaga's specialty is marine natural product chemistry. He is engaged in exploration of biologically active substances. Currently, his focus is on marine cyanobacteria. In 1992, he was enrolled in Nagoya University's Graduate School of Science. In 1995, he left the doctor's course to become a research assistant for the Department of Chemistry, Faculty of Science of the university. In 1997, he acquired a doctor's degree (in science). After serving as a research assistant for Shizuoka Prefectural University (Pharmaceutical Department) then as an assistant professor for the University of Tsukuba (Department of Chemistry), in 2006 he assumed the current position as an associate professor for Department of Chemistry, Keio University Faculty of Science and Technology. Dr. Suenaga was honored with the Inoue Research Award for Young Scientists in 1998 and the Chemical Society of Japan Award for Young Chemists in 2003.

I'd like my students to acquire comprehensive knowledge of their specialties and related fields.



Completion of the Aplyronine A synthesis method urged me to ask Dr. Yamada for permission to isolate it and determine its structure myself. It had been my wish to do the task if I had advanced to the doctor's course. I wanted to find a new substance on my own instead of synthesizing something that has been isolated and structure-determined by someone else. Dr. Yamada told me right away, "Isolate it yourself." I felt that my teacher must have known my wish before I put it into words.

Using an extract equivalent to 250 kilograms of the sea hare, I patiently repeated the isolation process over and over again and finally obtained about 0.5mg of substance called Aurilide.

Your research work seems to require great endurance. What are you doing for diversion?

My hobby is listening to music. Soon after joining the university, I began going to concerts in and around Nagoya. At one time, I went to concerts 50 to 60 times a year. Do you know there are nine professional orchestras in Tokyo? It's an exceptional boon to classical music enthusiasts like me. I'm a subscriber of the Tokyo Symphony Orchestra. Yesterday I went to a concert by the NHK Symphony Orchestra. At some concerts, childcare services are even available, which allows me to place my small sons (aged 6 and 3) under childcare. Sometimes I take my 9-year-old daughter to concerts, but she often sleeps during the performance. I think it's OK because I frequent concerts for my own pleasure (laughter). Anyway, enjoying music is truly refreshing.

I'm also trying to spare as much time as possible for communicating with my children. It's my rule to eat breakfast and dinner with my small ones. Since my home is close to the campus, I go home for dinner and take care of their bathing, then go back to the campus again for work. Being with children is another diversion for me.

What a wonderful papa! How are you dealing with your students?

You may call me a strict teacher. Every week we have one rinko session where lab students take turns reading a textbook written in English, a magazine meeting where students introduce scientific journals they have read, and a study meeting where they learn about instrumental analysis. Of the over ten lab students, five take charge of such meetings every week, meaning that one student will take charge of one meeting every two to three weeks. This is a rather heavy burden on the students as it requires significant amount of preparatory study.

Experiments are one important thing, but there is another more important thing; I would like my students to build up their academic capability by learning broadly. Concerning our specialty, I'd like them to acquire comprehensive knowledge of organic chemistry. Suppose a student who is engaged in isolation and structural determination lacks knowledge of organic synthesis reactions, or a student who is focused on synthesis of a natural product knows nothing about biosynthesis. I don't want my students to be like that.

Looking back at myself, I was thoroughly educated during my student days. In retrospect, many of the tough experiences I had as a student are now proving to be assets for me. A friend of mine who found employment with a private company says the same thing.

◎ Just a word from . . . ◎

● **Student M:** I have an unforgettable memory. Due to our mistake or other reason, we knew that our reservation for rooms at a family-run inn in Tokunoshima Island was not made. In the gathering dusk, I solicited the inn to provide us with two rooms (connected) somehow or other and finally secured the rooms. Even under such circumstances, we energetically gathered cyanobacteria as we normally would. Our teacher's power is always a driving force for us students.

● **Student N:** I joined this lab because it has been my wish to create a variety of substances by using organic chemical reactions. I'm happy and comfortable here because I'm allowed to do almost whatever I want. When I'm in trouble, my teacher thinks together with me and is willing to listen to my proposals.

(Reporter & text writer: Kaoru Watanabe)

For the full text of this interview
http://www.st.keio.ac.jp/kyurizukai

Days in the Life of Kiyotake Suenaga

Weekday November 25, 2011 (Friday)

6:30 ~
Woke up, ate breakfast, and read newspapers.

8:00 ~
Saw my eldest daughter off to school and left home for the campus to work.

8:30 ~
Arrived at the lab and copied materials for class work.

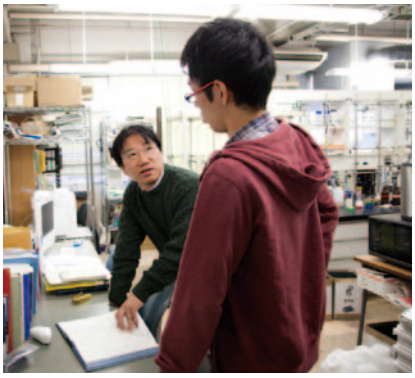
9:00 ~
Class work ("Chemistry of biologically active molecules" for juniors). The theme of today's lecture was ß-Lactam antibiotics. This theme is close to my specialty, so I enjoyed giving a lecture.

10:40 ~
Time for office work, such as processing of slips.

12:00 ~
Lunch (box lunch)

12:30 ~
Discussion with students. Then I received a call that something was wrong with the measuring instrument (NMR), but it was soon fixed by making some adjustments.

15:00 ~
Conducted some research, read theses, etc.



18:00 ~
Went home temporarily. On the way, I dropped in at my daughter's music school to pick her up and escorted her back home. Took a bath together with children (two elder ones for today). Then ate dinner.

20:00 ~
Went back to the lab. Had a discussion with students, which might help solve a problem that was hard to deal with.

22:00 ~
Set the NMR for all-night measurement. It's been a long time for me to measure by myself. Anxious about the run of events, I took a look at the state of measurement several times.

0:00 ~
Returned home. Listened to music while enjoying alcohol (beer and sake). Went to bed around 2:00.

Holiday November 27, 2011 (Sunday)

7:00 ~
Got out of bed. After eating breakfast, watched TV. After watching a couple of children's programs (like "Masked Rider"), I enjoyed "Untitled Concert" from 9:00.

10:00 ~
My entire family of five visited the Shibuya district. Since the Tokyo Metropolitan Children's Hall was closed, we switched to "Children's Castle."

13:00 ~
Took late lunch on the way to the NHK Hall.

15:00 ~
Went to NHK Symphony Orchestra's subscription concert (Mahler's Symphony No. 4 and others; conducted by Jun Märkl). Placed two pre-school children under childcare services. There are many chances to listen to Mahler's music recently since the year 2011 falls on the centennial of Mahler's death. Next Sunday, I also plan to enjoy Mahler's Symphony No. 8 at NHK Symphony Orchestra's subscription concert.

18:00 ~
After coming back home, I ate dinner while enjoying alcohol (beer and wine). Chatted with family, watched TV, etc. Later, I took a bath together with my children.

21:00 ~
Watched the movie "The Antarctic" on TV at the request of my children. They are now reading a book which I read in my childhood ("The Story of Sakhalin Dogs – Taro and Jiro" authored by a member of Japan's wintering party in the Antarctic). Went to bed at 23:00.

I encourage attending concert

My hobby is listening to classical music. I took up this hobby soon after I became a university student, which means this pursuit has continued longer than my research career. I attend concerts about 30 times a year, including concerts by the Tokyo Symphony Orchestra of which I am a subscriber, as well as those of the other Tokyo-based orchestras and chamber music performances. In Tokyo and Kanagawa, there are as many as nine professional orchestras. In addition, foreign artists and orchestras continually tour Japan. There are many concert halls offering superb acoustics. Tokyo/Kanagawa may be one of the world's best music locales. Won't you become a concert-goer?

Concerts I recently enjoyed

- **Tokyo Symphony Orchestra conducted by Lorin Maazel (at Showa University of Music)**
  Beethoven and Mahler: Symphony No. 1 (Nov. 12)
  This concert attracted attention as it featured the world-famous master as a guest conductor. Highlighting the latter half of the concert was Mahler's symphony, during which the conductor imparted uniquely individualistic expressions. The eight horns arranged in a line side by side were visually entertaining as well.
- **Tokyo Symphony Orchestra conducted by Hubert Soudant (at Suntory Hall)**
  Schönberg: Expectation / Fauré: Requiem (Nov. 19)
  Fauré's music for the latter half of the concert pleased me with clear and serene resonance; the string music and female chorus were especially impressive. The soprano's (Maki Mori) transparent voice was wonderful, coupled with the effective stage direction of letting her sing in an elevated section of the hall seats – her voice was nothing less than angelic. I was impressed by the program composition: the performance for first half of the concert was characterized by uneasy and tense emotions, which were compensated for by the healing music in the latter half.

My favorites for 2011

The performance I liked best was Tokyo Symphony Orchestra's concert (conducted by Krzysztof Urbanski): Shostakovich's Symphony No. 10 and others (Jun. 12). The second best was the same orchestra's concert (conducted by Jonathan Nott): Ravel's Daphnis and Chloe (full-length performance) and others (Oct. 7).

My favorite composers

Schumann and Sibelius are my best favorites. I also like Beethoven, Schubert, Brahms and other composers of the Romantic school, Franck and his disciples, Fauré, North European and Russian composers, Bartók, Akira Ifukube (famous for the screen theme music "Godzilla"), and Piazzolla.

私の本棚

My favorite books

Introduction to Organic Chemistry

This is the textbook I used during my student days, for which I've spent much more hours than for other books. The book I bought in those days already worn out, so I'm using a second one now. While we see many colorful textbooks these days, this one is printed in black and white. But this textbook, to which I'm accustomed, is the best for me. Various textbooks are available today, but I'd like my students to read the book of their choice thoroughly to reinforce the foundation of their specialties.

Natural Product Chemistry – Marine Organisms

This book was co-authored by several researchers who are specialists of marine natural product chemistry. Its contents are comprehensive, ranging from isolation, structural determination, total synthesis and biosynthesis of biologically active marine natural products, elucidation of life phenomena of marine organisms, and chemical biology. Despite its rather technical contents, the book is written in a relatively easy-to-understand way. The history and research trends of this field of study are also available. I was also responsible for one section of this book.

The World's Best-selling Medicine

The world's best-selling medicines are lipid-lowering agents generally termed as "statin." Statin is based on a substance discovered in Japan. This book is an account of Dr. Akira Endo's past half as the discoverer of statin for the first time. It depicts a drama of how statin was discovered and what destiny it encountered. Some parts of this book may be a bit difficult for you, but you will surely feel the researcher's ambition, resolution and painstaking efforts that enabled him to overcome a number of challenges.

Maps

Apart from science-related subjects, I liked geography as a student. As a map lover, I still like to look at maps. Recently, I often enjoy maps on the PC screen – maps and aerial photos of beachside areas of Okinawan and Amami islands while giving thought to potential sample gathering locations. These days I bring a digital camera with a GPS function, which allows me to take a GPS log and follow the routes I passed along before. GPS is so useful that I use it in sample collection for the sake of research.

Modern Methods of Organic Synthesis

We use this book as reading for our lab's rinko session. While I use this book mainly for my students, it also helps put my own knowledge in order. During my student days, my lab was using the former version of this book. Since the original author has passed away, I thought it would not be revised. But one of the author's disciples took over his teacher's work and recently published a revised version for the first time in 20 years or so. The book is rich in examples of reactions from natural product synthesis, including new reaction examples. I recommend this book as the best one for students to acquire broad knowledge of organic synthesis. Once you have read it through, I'm sure you'll find your knowledge and ability much improved.

Rivers

This picture book depicts how water is created from melted snow on the mountains, flows downstream through the countryside and urban areas to empty into the sea. The author, Satoshi Kako, personally made elaborate pictures depicting various riverside landscapes. Looking at details of the pictures is another enjoyment for me. In addition to this book, I still remember picture books such as "Typhoon" and "Paper is Weak but Becomes Strong When Fabricated." My parents preserved these picture books, which my children are now reading. Dr. Satoshi Kako's science books are not only good intellectual stimuli for children, but also informative for their parents.

High expectations for breakthrough drug development

We take a drug when we have a headache, fever or a stomachache. There are many types of drug, from over-the-counter drugs to those that require doctor's prescription, and those used when we are hospitalized due to a disease or injury.

These drugs are created using a variety of substance. It is said that about one-third of drugs currently available are based on substances derived from natural products. For example, FK506 (tacrolimus) – an immunosuppressant – is a drug created in Japan based on a substance discovered in the soil of Mt. Tsukuba.

It is very difficult to create drugs completely artificially. But nature offers an unlimited source of undiscovered substances, which are a great treasury allowing us to explore substances for potential drugs.

Associate Professor Suenaga, featured in this issue, focuses on marine organisms among the many natural resources. Many substances derived from marine organisms are known to have unique chemical structures and biological activity. As such, they are coming to the fore as a major source of substances for candidate pharmaceuticals. Intensive studies on these substances began in the 1970s.

However, the amount of promising substances available from marine organisms is extremely limited. What's more, their molecular structures are so complex that it is difficult to chemically synthesize them – a major impediment to practical application.

Under such circumstances, "Eribulin" designed and synthesized based on Halichondrin B, which was obtained from a kind of sponge (Halichondria okadai), was authorized as an anticancer agent in April 2011. It is Japan's first anticancer agent derived from a marine organism. The discoverer of Halichondrin B is Dr. Daisuke Uemura who belonged to Keio's Faculty of Science and Technology (April 2008 – March 2011).

Studies into substances derived from natural products are on the rise. Expectations are high for the birth of an increasing number of new pharmaceuticals based on such substances.

Science and Technology **Information**

The KLL Industry-Academia Collaboration Seminar "Exploring Electron Properties!"

Date: February 24 (Fri.), 2012 15:00 ~ 17:30
Place: Multi-purpose Room 1, 2nd floor, Kyosei-kan Bldg. on Keio Hiyoshi Campus
Admission free; Prior applications required
http://www.kll.keio.ac.jp/

This is a KLL-organized seminar for industry-academia collaboration. This seminar is intended to introduce research endeavors for the quest of physical properties and workings of electrons which will contribute to the foundation of innovative electronics technology. The seminar will be followed by a social and opinion-exchange meeting. Please apply for participation via the above URL.

Strategic Management Chair for Creating Innovations (a Sony-donated chair) Open Symposium 2011 Toward a New Phase of Development of Humankind and the Future: "The 4th Symposium – Toward the Creation of New Values"

March 2, 2012 (Fri.), 18:00~
Place: Fujiwara Hiroshi Memorial Hall, Kyosei-kan Bldg. on Keio Hiyoshi Campus
Admission free; Prior applications required
http://www.koukai-sympo.net/portal/

This is the final open symposium in the 4-event series under the Sony-donated chair which is set in the Graduate School of Science and Technology. Dr. Mario Tokoro, Chairman and CEO of Sony Computer Science Laboratories, Inc., who is also a specially appointed professor of our Graduate School, will preside over the symposium, inviting guests: Mr. Shinichi Takemura (professor of Kyoto University of Art and Design, and representative of Earth Literacy Program) and Dr. Hideaki Koizumi (director-status fellow of Hitachi, Ltd.). Please apply for participation via the above URL.

The Yagami Campus in snowscape.

Editor's postscript

Associate Prof. Suenaga compares his research work to treasure hunting. "My work is to locate 'treasures' which are miniscule amounts of active substances from among the countless organisms living in the immense oceans and foster them," he remarks. During an interview, I found something symbolic of his research life that requires "tenacity and toughness" – large-sized notebooks worthy of at least six years of work that he has been using since he served as a teacher at the University of Tsukuba. His untiring research, based on a long-term perspective, is bound to inspire unprecedented discoveries that will support our good health.

(Saori Taira)

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