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### EVOLVING BIOSCIENCE AND BIOTECHNOLOGY IN RECENT DAYS

Professor Mitsuo Sekine  
(Department of Life Science)



How are you, everyone who has gone on from the Department of Bioscience and Biotechnology, and the Graduate School of Bioscience and Biotechnology? I believe you have been active not only in Japan, but in the world. At your alma mater, the previous president, Masuo Aizawa played a great role for six years, and he is now more energetically contributing to society as executive member of the Bureau of Science and Technology Policy, and as steering person for Science and Technology Administration in Japan. A long time has elapsed since the first bioscience and biotechnology department in Japan was founded at Tokyo Tech. Since then, similar

departments and graduate schools have been established one after another at other universities, and Tokyo Tech's foresight has been highly evaluated accordingly. For faculty members of the Graduate School of Bioscience and Biotechnology, there have been almost no barriers among the courses, and the exchanges among them have been growing in an integrated atmosphere. Under such conditions, a research of the Graduate School has been selected as a Global COE Program since last year, and student support to doctoral course has rather been improved. In January this year, the

program, "Welcome Back to Tokyo Tech, Alumni/Alumnae!" has been started to exchange communication and information between current students and alumni/alumnae by asking the graduates who have been active in Japan and overseas to come back to the school and talk to their juniors about their experiences as an event of the global COE program. Since this will be held every year, it is my strong desire that you take this opportunity to visit your second native place. As the need for further international exchange is being required socially due to the globalization of universities, the Global Edge Institute was established, and several special assistant professors on a tenure track basis have been employed by this Graduate School.

In addition, as an activity of the Bioscience and Biotechnology Department, a contest named "Biocon" for making educational materials for elementary and junior-high school pupils has entered the third year, and the past performance so far has been recognized, and then lecture rooms, etc. on the second floor of the building B1 have been renovated to become a center for "Creation." Due to this infrastructure improvement, ingenious products demonstrating the creative abilities of freshman students of the Bioscience and Biotechnology Department are expected to be made from now on. If you have children, I hope you and your children will come to Tokyo Tech during the Biocon, enjoying yourselves at the center.

I left the buildings B1/B2, and now have my laboratory on the 8<sup>th</sup> Floor of the 20-story Building, J2 which was constructed 2 years ago. Half of instructors from the departments of Life Science and Bioengineering have moved here. If you are passing by, please feel free to drop in and see us. I would like to close by saying best wishes for your continued good health and success.

## STAFFS

### TOKYO TECH BIOCON 2008

Professor Hiroyuki Ohta  
(Center for Biological Resources and Informatics)

Research Associate Yoko Suzuki  
(The Suzukakedai Annex of Art and Crafts Education and Research Support Center)

The third biology education material development contest, "Tokyo Tech Biocon 2008" was held on Saturday, the 19<sup>th</sup> of January at Suzukake Hall on the Suzukakedai Campus.

At the Bioscience and Biotechnology Department of this institute, a class for fostering creativity, "Creative Design Course I" has been offered to freshmen since 2005. This unique approach that deals with "Development of the Educational Materials of Bioscience & Biotechnology that Elementary/Junior-High Pupils Can Understand" as a main issue was selected by the Ministry of Education, Culture, Sports, Science and Technology as "Support Program for Distinctive University Education (Distinctive GP)." In 2007, "the Suzukakedai-Annex of Art and Crafts Education and Research Support Center" was newly established and has become a center for student activities since then.



In this year, 155 students were divided into 20 groups, and they developed educational materials for a period of six months. In the ensuing contest for their performances, each group was provided with 15 minutes to make a presentation on education materials/tools. We were able to see the students put a lot of efforts into their works. The enthusiasm of the students came through in each of the contents. There were also some presentations that brought smiles to our faces. An exhibition space was provided at the corridor in front of the site this time, and the poster session was held, being highly successful.

As a result of the voting, "Easy Cultivation of Physarum Polycephalum, a Slime" of Group Q that devised a kit for growing slime molds won the first prize. It has been decided to award the winner a special prize by the Chemical Society of Japan from this year.

After the commendation ceremony, the judges gave them their evaluations, such as "there are lots of works that tackle the issues head-on as education materials," "they seem to be used for class," and "the level has become higher" to honor the students for their creativeness and efforts.

From 2007, a lecture for juniors, "Creative Design Course II" has been started. We hope the Bio Contest itself can be further evolved and developed in the future as well as each student's growth.

synthesis system. After he got PhD in 1971, he moved to the Sasada's laboratory of Tokyo Institute of Technology, where he joined a research project on the communication/interaction between the world of genes and the world of proteins. However, as direct handling of nuclear acids and the related proteins was not so easy in that period, he started structural studies using model compounds containing nucleic-acid bases and amino acid side chains as a physical chemistry approach. He succeeded in discovery of several unique interactions, based on which he proposed interaction models between nucleic-acids and proteins. In 1992, the Crystallographic Society of Japan gave him the prize for a study on RNA recognition in assembly of tobacco mosaic virus. In parallel to this serial studies, he started X-ray analyses of proteins from 1980 and clarified their three-dimensional structures, but he did not satisfy in his interests.

In 1991, he had an opportunity to stay in France for 10 months. He joined the Dino's laboratory to crystallize a cross mixture of tRNA<sup>Asp</sup> from yeast and aspRS from *E. coli*. At the same time, he started structural study on electrostatic interactions in the process of aminoacylation reaction using the X-ray structures. However, he noted that the principal actors are always proteins in these research works. After he came back to Japan, he decided to switch the targets of structural study on functional nuclear-acids which work in important processes of the life, such as hammerhead ribozymes. Since many crystallographers were working on proteins, it was rather heretical to choose X-ray analysis of nuclear-acids, but it was a great pleasure when he obtained the new results in unknown field. Various experimental techniques must be developed individually. For the PhD students who have a limited time, the bottle-neck was crystallization. However, he was highly encouraged by receiving the JB prize for the structural composition of hammerhead ribozymes from the Japanese biochemical society.

Although three-dimensional structures of various nuclear acids were clarified in his laboratory, his interest was extended to ncRNA/ncDNA. Recent genomic analyses indicated that the total exons are accounted only 2% or less than that in human genome. In the remaining part (98%), there are found various repetitive sequences, including 53% of LINE/SINE interspersed type and tandem

## STAFFS

### TOWARD A NEW SCIENCE: THE STRUCTURE AND FUNCTION OF NCRNA/ncDNA

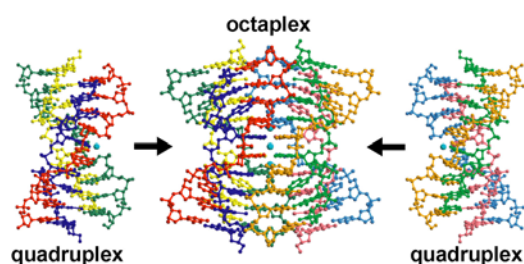
Prof. Akio Takénaka

(Department of Life Science)



When the author, who learned solid-state physics and X-ray crystallography under supervisions of both Prs. Isamu Nitta and Tokunosuké Watanabe in the graduate school of chemistry, read "The Double Helix" by J.D. Watson, he was highly interested in molecular biology, especially in protein

type repeats, 29% introns and 9% of unique sequences in hetero-chromatin. These parts are still unknown. The research subjects in his laboratory were (1) the loop stem bulge structure of LINE/SINE, (2) tandem repeats related to diseases, (3) segmental repetition of unique sequences which are located in hetero chromatin and (4) A-rich repeats found in 5'-UTR of mRNA of poly-A binding protein (PABP). The sequence of (ccGA[G]<sub>4</sub>Agg) is repeated by eight times in VNTR. From X-ray analysis of an analog of this repeats, he found that this repeat forms an octaplex which has an eightfold helical structure. For this discovery, he was honored with the IUCR prize from the International Union of Crystallography.



It is plausible that mRNA must have a specific structure, because a single chain of RNA can fold into a stable structure similar to protein folding. In other words, to keep an extended single stranded state, RNA requires several proteins which are specifically bound to RNA. Therefore, the specific parts of mRNA would have specific roles in protein synthesis. He is now challenging to their X-ray analysis. Another interest is aminoacyl-tRNA synthetase. This enzyme is classified into two classes different in binding to tRNA. This hypothesis suggests the existence of antisense-tRNA. He aims to prove that antisense-tRNA has a structure in mirror image of sense-tRNA. As described above, although the exons are important, but there are enormous unknown parts other than exons. This is a new science to be opened in the near future.

## ALUMNI

### THE SURVIVAL LIFE AS A POSTDOCTORAL FELLOW IN USA

Ken-ichiro Kamei

(previously Aizawa & Kobatake Lab.)

Assistant Researcher  
Department of Molecular & Medical  
Pharmacology  
University of California Los Angeles

Dear colleagues,

How are you doing in these days? It is my great honor to have an invitation and join the global COE forum. I would like to thank Profs. Okahata, Kobatake and Nureki to give me the opportunity to join this forum and to have a presentation for students. If possible, I would like to attend the next global COE forum again.

First of all, I would like to introduce myself. I graduated and obtained Ph.D under supervision by Profs. Kobatake and Aizawa from the Department of Biological Information, Graduate School of Bioscience and Biotechnology, Tokyo Tech in 2003. Then I moved to Prof. Havery R. Herschman's laboratory at Molecular Biology Institute, University of California Los Angeles (UCLA) to work as a postdoctoral fellow. It has already passed for five years to work at UCLA, and I had moved to the other laboratory (Prof. Hsian-Rong Tseng) at Crump Institute of Molecular Imaging at UCLA in that period. I feel it is very long to stay out of Japan for 5 years, however, since I have something important to finalize in USA, I will stay in USA for a couple more years.

At the forum, I had my presentation entitled "The survival life as a postdoctoral fellow in USA". In my presentation, I would



like to tell you through my experiences how the life as a post-doc in the USA is close to you. I know you might feel uneasy to live as a stranger in USA, furthermore, you worked as a post-doc which seemed a kind of unstable jobs rather than the others. Of course, you would have a lot of tough stuffs for the initial period. However, if you live once, you are going to be a tough guy under that situation, and you can elevate yourself at one higher level. I mentioned through my presentation about how to initiate to work as a post-doc, and what is the most important to survive in USA. I would like to say the most important things here, "Self-Motivation" and "Aggressiveness". I hope it would be helpful for you to release from your uneasiness and to start to survive as a post-doc in USA for near future.

This forum is great and helpful for students as well as me. I would really like to have this forum when I was a graduate student. Although I joined this forum as an alumnus, the seniors' talks should be very useful for us to make our future directions. The current students are very lucky and should use these great opportunities for your own.

Finally, you would obtain various experiences through living and working in USA, which you cannot in Japan. I would like to recommend going outside of Japan. Let's challenge!

## ALUMNI

### FROM TITECH TO THE WORLD

Dr. Yonggang Wang  
(previously Kobayashi Lab.)  
Assistant Researcher  
Department of Chemistry  
Graduate School of Science  
Kyoto University  
(presently Texas A&M University)

Dear all:

I am very pleased to have an opportunity to introduce myself on this newsletter. My name is Yonggang Wang and came from China. I joined Prof. Yuichi Kobayashi's lab as a



research fellow at TITech in 1999 and obtained my PhD degree in biomolecular engineering in 2006. Currently I am working as a JSPS post-doctoral fellow at Kyoto University with Prof. Keiji Maruoka and embarking on a research concerning environmental benign phase-transfer catalyst (PTC).

At TITech a fantastic opportunity was provided for my intellectual and professional growth. I am very grateful to Prof. Kobayashi, who is an outstanding chemist and a dedicated supervisor and from whom I has learned a great deal. During the period at TITech under the supervision of Prof. Kobayashi my academic background focused on development of novel and effective synthetic strategies toward total synthesis of antibiotic natural products including



anticancer, antitumor, antifungus and antibacterial molecules, and in my doctoral course I have fulfilled the total syntheses of bioactive targets of *fostricin*, *phoslactomycin B* (*phospholine*) and *the deamino analog thereof*, *macrosphelides H* and *G*, and *alaremycin*. Cooperation with other fellows in the lab I have also achieved the syntheses of *aristeromycin*, *quinine*, *quinidine*, *cannabidiols* and *tuberonic acid*. At TITech I gained a JSPS research fellow (2004-2006), and honorably received Tejima prize which was provided for distinguish foreign graduate student (2007).

After receiving my PhD degree, I moved to Kyoto University as a JSPS post-doctoral fellow (2006-2008) with Prof. Keiji Maruoka to pursue a research in the new field of organocatalyst. Currently my post-doctoral research is involved in design and application of environmental benign organocatalyst (chiral phase-transfer catalysts with biphenyl and binaphthyl backbone) toward practical asymmetric synthesis and development of novel asymmetric synthetic methodologies and

application to natural product synthesis. I hitherto have successfully developed chiral phase-transfer catalysts (PTC) with biphenyl backbone, which effectively promote asymmetric alkylation of glycine derivative with excellent enantioselectivity. In addition I have developed an effective methodology toward asymmetric synthesis of N hetero ring compounds (aziridine, proline and pyrrolidine) and enantioselective synthesis of hexahydroindolizine and octahydroindolizine through asymmetric conjugate addition promoted by PTC with binaphthyl backbone and reductive amination with perfect diastereoselectivity. By application of the elaborate strategy asymmetric syntheses of bioactive natural products 3-propylindolizine and (+)-monomorphine were also completed.

In the coming April I will end my research life in Japan and be moving to Texas A&M University commencing the research in the field of combination of organic synthesis and biotechnology involved in structural, synthetic, and biomechanistic investigations of natural products displaying potent physiological effects. So I can say all have been starting from TITech.

Best Regards,

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## ALUMNI

### YOU MIGHT LEAVE A PLACE BUT A PLACE NEVER LEAVES YOU...

Ms. Jackie Njoro

University of Texas Southwestern  
Medical Center  
(Previously, Kajiwara Lab.)

Dear Colleagues:

“The places that you go, the people that you meet, the things that you experience will always stay with you”; so was my life in Japan and at TIT in particular. I moved to Japan from Kenya in 2000 and joined TIT as a transfer student in 2005. And even though I did not enroll until a few years after I arrived, TIT influenced the course of my life in Japan almost from the minute I got there.



I initially heard about TIT was from a ‘sempai’ who was planning to attend one of the annual ‘Open Days’ at the Yokohama campus. His exuberance about the whole experience stayed with me and after attending two Open Days and having a faculty member come to my college, I knew that TIT was the place I wanted to be. Once at TIT, I joined Dr. Kajiwara’s lab where I did research on *Candida albicans*. Through classes and research I discovered what it meant to be a good scientist; this helped me as I transitioned into graduate school here at the University of Texas Southwestern Medical Center where I am currently working on enterohaemorrhagic E.coli (EHEC) while pursuing a PhD in Molecular Microbiology and a Masters in Public Health. The work ethic that my mentors in TIT instilled, particularly in the Kajiwara lab where self motivation and independent thinking were highly encouraged, helped me choose a lab where I could continue to do what I love. I will admit that language was a hurdle I had to overcome but my lecturers, lab mates and classmates were extremely helpful; we were able to communicate in a language common to all of us – Science.

Though I gained much from TIT, something that I think would improve on the overall learning experience would be to include reading of scientific literature as early as possible in the biosciences curriculum. Discussions on the latest research related to the lectures given would put a current spin to the basic concepts taught while giving students a chance to practice their English. I would encourage young TIT scientists to place more emphasis on experimental design; critically evaluating what other researchers have done to end up with a particular published work helps come up with better protocols and more innovative ideas that would aid young TIT bio-scientists become even better investigators.

Whatever future scientific achievements I may have in my career, what I gained from TIT will have contributed immensely, for that I am and will always be grateful.

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**STUDENTS****BRAND NEW DDS**

Kok Chee Han

(M1, Handa &amp; Wada Lab.)

Dear all readers,

As one of Takamiya Award recipients, I was both surprised and honored when I was asked to introduce myself in this newsletter. Here we go!

Before I was transferred to Tokyo Tech in April, 2005, I was studying chemistry at Suzuka National College of Technology for three years. Ever since DNA was first known to human beings, I have always aspired to be a biotechnologist, or any professional that deals with DNA for that matter. Some people may wonder why I didn't choose biotech as my major. It'll take pages to answer that, but to cut a long story short, let's just say that one thing led to another, and I ended up in a chemistry department. Some people told me that I could still study biotech in university later, and that helped keep my hopes up. That being said, I enjoyed studying chemistry too. After all, chemistry is fundamental to understanding all the life sciences, isn't it?

During my final year in college, I did some research on universities. Tokyo Tech came on top of my choices since many top universities do not allow students without proper background from transferring to their



department of life sciences. When I was checking out the profile of each lab at Tokyo Tech, Handa • Wada laboratory caught my attention the instance I browsed their homepage because they are conducting some fascinating research on Drug Delivery System (DDS) using viral vector. Like any man in the street, I knew little, if not nothing at all about viruses except that they are deadly. The concept of using viruses to deliver therapeutic materials into human's body was simply mind-boggling to me back then. Yet, it aroused my curiosity inside me to learn more about it.

Today I am researching on a brand new DDS using SV40 virus at Handa • Wada Lab. Although I am frequently stumped with problems, getting discouraged and daunted to the extent that there were times I thought of quitting, the reality hit me that who on earth, including those

Nobel laureates, never went through all kinds of hurdles before they made the ground-breaking discoveries? Thomas A. Edison once said, "I have not failed. I've just found 10,000 ways that won't work". That's the spirit! That's how to keep us highly motivated all the time. My fellow young scientists, let's keep his spirit alive and help making the world a better place for our posterity with cutting-edge technologies.

Best regards

## From the Editors

We are pleased to send you News Letter No. 10 with the help of members of the committee of BIOTITECH News Letters and the alumni/alumnae of Faculty of Bioscience and Biotechnology in Tokyo Institute of Technology. We hope that this letter helps you grasp how our School is developing and growing for the future.

With best wishes,

March 31, 2008

Dr. Yuichi KOBAYASHI

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*Changing the Campus, Changing the Bioscience and Biotechnology*