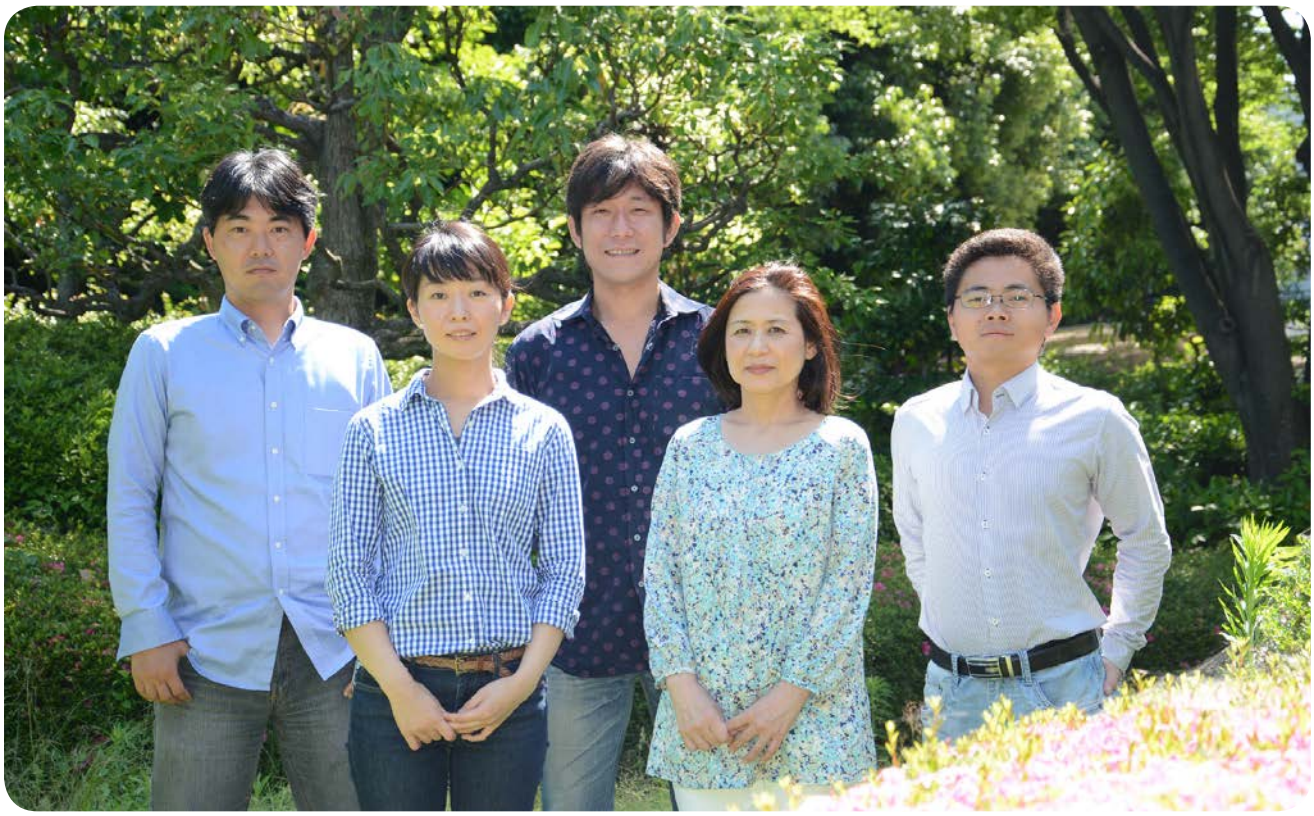
July 2016 Issue No.11

QBiC

NEWSLETTER OF RIKEN Quantitative Biology Center

QBiTs



Hello!

The Laboratory for Integrative Omics joins the QBiC Cell Dynamics Research Core. Unit leader Katsuyuki Shiroguchi and his team Kaori Fukuhara, Taisaku Ogawa, Keiko Ito and Jianshi Frank Jin (left to right).

Inside This Issue

CATCHING UP WITH

Takamitsu Morikawa takes his talents to Abott Japan

One year since Takamitsu Morikawa completed his PhD under QBiC's Tom Watanabe.

What have you been up to since you left QBiC?
I currently work at a foreign-owned pharmaceutical company, Abbott Japan R&D, as a researcher. We are working on the development of diagnostics.

Is there any relation to what you did at QBiC?
My current work is not directly related to my work at QBiC, but the attitude and the approach to research I learned in QBiC are the things I try to keep alive even now.

Did you enjoy your time at QBiC?
Yes, it was very fun. We had free exchanges with the world's top class researchers and I was able to participate in some of the world's most advanced research. It was a very precious time.

What was the best thing that happened at QBiC?
I succeeded in observing protein crowding inside cells under fluorescence microscopy in 2012. I believe this observation was a first in the world, so I am the first person to have observed it in the world. And, I was very glad when our observations correlated nicely when compared with the existing methods.

Your research on the protein crowding sensor was recently published in Nature Scientific Reports.
It was my great pleasure, and I owe a debt of gratitude to everyone who helped with that manuscript. One

regrettable thing is that we had the paper rejected by *Nature Methods* after the first revision because of my immature experimental skills.

Can you talk about that research a little bit?
We developed a fluorescent probe GimRET to visualize molecular crowding in the cell. The intracellular environment is very crowded with proteins and nucleic acid and so on. The crowding affects the folding and function of proteins and therefore the function of the cell. With insertion of a glycine residue in yellow fluorescent protein (YFP), I succeeded in fabricating mutants (YFP1G) exhibiting a sensitivity to molecular crowding. By combining YFP1G and a blue fluorescent protein (CFP) that does not have the sensitivity to molecular congestion we created GimRET short for Glycine inserted mutant fRET sensor based on the ratio of the fluorescence intensity of the YFP1G and CFP. The ratio changes in accordance with the molecular crowding in the cells and crowding can be visualized. continued on page 7

Recent Science Events

• Jun 22-23, 2016
QBiC's Shuichi Onami and Yukako Tohsato, and professors from Osaka University jointly organized "Bio-image Informatics Workshop 2016" at Osaka University Suita campus.

• May 18, 2016
QBiC co-hosted "The First Whole Brain Architecture Symposium" held at Panasonic Center Tokyo. QBiC's Koichi Takahashi gave a talk.

• Mar 25-26, 2016
QBiC co-hosted the symposium "Molecular Mechanism and Mathematics for Biological Dynamics" at the Sheraton Grand Hiroshima Hotel. Makoto Taiji and Yuichi Taniguchi each gave talks.

• April 19, 2016
QBiC and CDB Joint Workshop
Quantitative and Developmental Biology

Recent Science Events

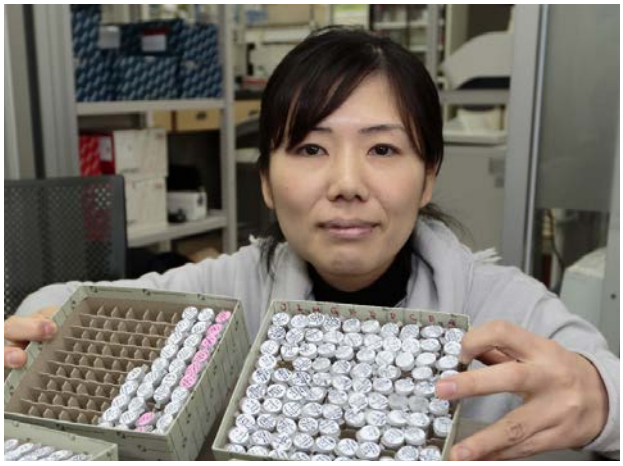
MEET THE LAB

Miki Ebisuya's Laboratory for Reconstitutive Developmental Biology

Our research aim is to reconstitute developmental mechanisms by building synthetic gene circuits, especially mechanisms for multicellular self-organization.

We have recently succeeded in reconstituting a mechanism for spontaneous cell differentiation, namely intercellular symmetry breaking. We are currently working on reconstitution of cellular patterning as well as tissue deformation.

Our ultimate goal would be a synthetic tissue and even a synthetic morphogenesis. Our reconstitution study should be useful for identifying the minimum requirements for the self-organization mechanisms and to find out novel principles. Also, a self-organizing "smart tissue" should provide a novel approach to tissue engineering.



Our lab started originally at the RIKEN Center for Developmental Biology (CDB) in 2013, and then moved to QBiC in 2014. Thus, another mission of the lab is to promote research collaboration between CDB and QBiC and to combine developmental biology and quantitative biology. ■

HOT OFF THE PRESS!

Recent publications from QBiC researchers

◆Arno Germond is first author on a *Biophysical Reviews* article with Tom Watanabe's team: "Design and development of genetically encoded fluorescent sensors to monitor intracellular chemical and physical parameters."

◆Yoshihiro Shimizu's lab published "Mass spectrometry-based absolute quantification reveals rhythmic variation of mouse circadian clock proteins", in *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*.

◆Yo Tanaka's lab made a battery from an electric ray! The details are published in *Scientific Reports*.

◆Takanori Kigawa's team published in *PLOS One* in the article titled "Intracellular Delivery of Proteins via Fusion Peptides in Intact Plants."

◆We better understand how slime mold chemotaxis works thanks to Masahiro Ueda's research published in *PNAS*, titled Heterotrimeric G-protein shuttling via Gip1 extends the dynamic range of eukaryotic chemotaxis..

◆Yaxiaer Yalikun with Yo Tanaka published "An all-glass 12 μm ultra-thin and flexible micro-fluidic chip fabricated by femtosecond laser processing" in *Lab on a Chip*.

Nobutoshi Ota in the Laboratory for Integrated Biodevice

◆Takashi Jin's work in *Shock* is titled "Effect of Histone Acetylation on N-Methyl-D-Aspartate 2B Receptor Subunits and Interleukin-1 Receptors in Association with Nociception-Related Somatosensory Cortex Dysfunction in a Mouse Model of Sepsis."

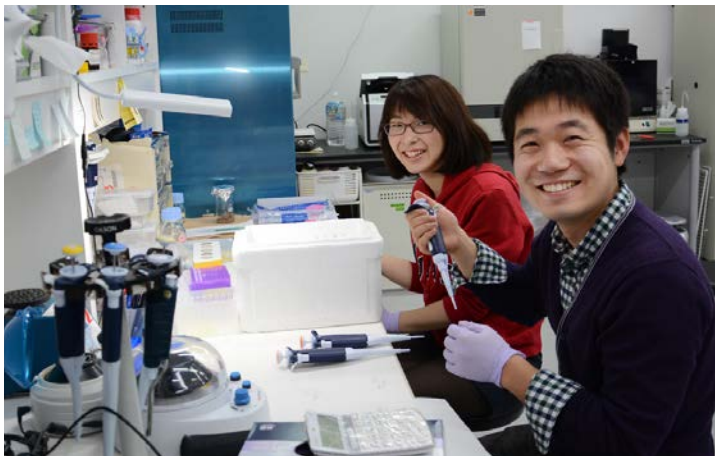
◆Takao Otsuka of the Makoto Taiji team is first author on a *Physical Chemistry Chemical Physics* article applying constrained density functional theory.

◆Nobutoshi Ota of Yo Tanka's lab published "Micro/nanoparticle separation via curved nano-gap device with enhanced size resolution" in the *Journal of Chromatography A*.

To find out more go to www.qbic.riken.jp/english/news/

REACHING OUT

QBiC Spring Course



Yumeno Koga (left) and Yuya Karita in Toshio Yanagida's QBiC Lab

QBiC is one of the youngest centers in RIKEN, having been established just five short years ago. QBiC is also the youngest center in RIKEN by average age of the researchers. Nobody is getting younger, so QBiC looks to recruit fresh young talent through the spring course.

QBiC first started the spring course as a lecture only offering in 2012 for undergraduate students and graduate students in their first two years. The reception was so enthusiastic that additional hands-on training days were added in subsequent years. This year, more than 40 undergraduate students from throughout Japan were invited for the four day training course.

Yumeno Koga, a sophomore majoring in Life Science at Waseda University, and Yuya Karita, a senior majoring in Physics at University of Tokyo, pictured above, trained in QBiC Director Toshio Yanagida's Laboratory for Cell Dynamics Observation. They discussed their experience with QBiTs.

Mr. Karita started by describing the scene in the photo, “We are preparing an experiment to take measurements of myosin filaments in a single molecule analysis experiment. We used TIRF (total internal reflection fluorescence) microscopy on the actomyosin system. We had so much fun doing these experiments.” Ms. Koga concurred, “It was something total new for both of us and a really great experience.”

She went on to describe why she enrolled in the spring course, “A friend of mine had done the spring course last year and recommended it to me. I selected Director Yanagida’s lab because the research is very impressive.”

On how the spring course may affect her future plans, she said, “I consider this experience to be a guide for my future. I am considering going on to graduate school and I would like to work in QBiC or a similar research center."

Mr. Karita also shared ambitions to work at QBiC, “I am interested in biophysics and although I have never done experiments exactly like this before, the methods are the same as some physics experiments I have done. So I am familiar with some of the technology, such as optical

QBiC outreach activities

◆Open day at RIKEN Wako

The biggest RIKEN open day of the year took place in Wako, at RIKEN's central campus near Tokyo on April 23. Seventy-eight hundred people, including families with kids, high-schoolers, and university students enjoyed exhibits from around 100 RIKEN labs. The QBiC displays of posters and the transparent mouse from Hiroki Ueda’s Lab attracted the young and old alike. Takaharu Mori of Yuji Sugita’s team showcased programing code from molecular-dynamics simulations with easy to understand annotation.

◆Saito Bioscience Seminar

On April 27, Osaka Bioheadquarters and Bio-Sight Capital hosted a seminar at Saito Hills Club, Ibaraki, Osaka. Tom Watanabe discussed industry collaboration in a lecture titled Comprehensive Bioimaging in RIKEN and Building Relationships with Industry about how to transfer the technology to industry.

◆Koichi Takahashi spoke at an art and science joint event sponsored by Artificial Intelligence Art and Aesthetics Research Group on June 19.

tweezers. I would like to pursue a graduate degree in biophysics so this is a great experience. Maybe someday I can be a postdoc or PI in QBiC!"

Another student, who declined give his name, chimed in “The spring course was wonderful but I am very sleepy because I was up late last night preparing our final presentation.” Despite the lack of sleep he said "Now I am going out to eat with my new friends."

New friends, long days and fun, a great way to sum up the spring course.

For hands-on experience at QBiC, in addition to the QBiC Spring Course, unfunded internships are possible throughout the year. Please contact QBiTs or the lab PI directly for more information. ■

NEWCOMERS at QBiC

Chamidu Atupelage
Team Onami
Sports: Cricket
Hobbies: Gardening, Playing with kids
Food: Sashimi

Jianshi Frank Jin
Team Shiroguchi
Sports: Basketball, I like watching NBA games.
Hobbies: Reading history books and watching history talk shows
Food: Seafood

Taisaku Ogawa
Team Shiroguchi
Sports: Kendo
Hobbies: Collecting vintage clothing
Food: Very spicy food

Suyong Re
Team Sugita
Sports:3S, Soccer, Ski, Swimming
Hobbies: Petit travel
Food: Yakiniku!

Ai Tsujita
Team Watanabe
Sports: Walking
Hobbies: Camping, Do it yourself woodworking
Food: Okonomiyaki, Yakisoba, Sushi

Minako Izutsu
Team Furusawa
Sports: Basketball
Hobbies: Watching movies
Food: Cheese

◆Tour for Pharmaceutical Sciences students
Twenty Students from Ritsumeikan University, visited QBiC on June 3. They discussed how to use supercomputer for drug design with Noriaki Okimoto of the Laboratory for Computational Molecular Design. They also met with Tsutomu Masujima about the use of single cell Mass Spectrometry in drug evaluation.

◆QBiC Director Toshio Yanagida was one of the panelists in the First Joint Symposium on Next Generation Artificial Intelligence Technology sponsored by New Energy and Industrial Technology Development Organization (NEDO) on April 25.

◆RIKEN Evening Seminar
In this new seminar series RIKEN scientists explain their research to industry representatives. QBiC's Hiroki Ueda talked about whole body cell analysis in transparent mice relationship to sleep and psychiatric diseases on April 13 and Koichi Takahashi talked about his E-cell platform for whole cell modelling and the use of AI for acceleration of life science on May 25.

◆Takashi Jin explained his new molecular probes in New Technology Presentation Meeting sponsored by Japan Science and Technology Agency (JST) on May 31.

GET OUT!

Cheer on Gamba Osaka in the Suita City Football Stadium and ride the Ferris wheel at Expocity

Suita's own entertainment, culture and shopping hot spot, forty-six years in the making, is just a short monorail ride away from QBiC. Centered around the recently opened Expocity shopping and entertainment center, the area features top class soccer and the huge Expo Commemoration Park, site of the 1970 World's Fair.

Leaving from QBiC the fun lies just one monorail stop away at the Banpakukinenkoen Station. You'll know you're there when through the train window, the huge gold face of the Tower of the Sun sculpture is staring down at you. The sculpture, by the "Japanese Picaso," Taro Okamoto who created this monstrosity for the World's Fair, has been lovingly restored numerous times over the decades is a nationally known symbol of Suita.

The Tower of the Sun and surrounding 100-hectare park are situated immediately north of the monorail station, while another nationally known symbol of Suita, Gamba Osaka, the professional soccer club, play their home matches in the new Suita City Football Stadium which is just a few minutes' walk south of the station.

The soccer specific facility, which was built through fan support and fundraising efforts, was donated to the city of Suita in 2015. In addition to being the home ground of Gamba Osaka, it hosts international fixtures and can also serve as an earthquake resistant, disaster response facility should the need arise. The environmentally friendly stadium has LED field lighting and roof top solar panels. For Gamba fixtures the stadium also features rabid home supporters and very reasonably priced field-side tickets, if you don't mind sitting next to the away fans, in the family-lower section. The food selections are interesting if not as reasonably priced and bringing in your own food seems to be the norm.

Gamba Osaka have been quite successful over the last few years, capturing the Treble in 2014, including consecutive Emperor's Cup championships. The quality of the soccer can hardly be topped anywhere in Asia. But just the same, the team's mascot and cheerleaders, who appear to take their look from the Dallas Cowboys cheerleaders, will do something to entertain those not impressed by the quality of the surroundings, the food or the sporting competition.

For those who believe shopping is the only sporting competition of any consequence the LaLaport Expocity shopping center is even closer to the train station than the stadium. Immediately in front of the station exit ramp, this large indoor mall has all the expected features, including shoe stores, clothing stores, toy stores, bookstores, sporting-goods stores, coffee shops, pastry shops, home-goods stores, and of course, a large food court with dozens of dining options. Before even entering this shopping heaven, however, it should quickly become clear there are some features which most malls lack.

Leaving the station and heading toward the mall, the "interactive aquazoo" NIFREL is on the left. NIFREL, which claims a tiger among other animals, has the appearance and style of a modern art museum more so than traditional zoo. Next to NIFREL is the Pokemon ExpoGym, said to be the only real Pokemon Gym in the whole world. Across from these are the 109 Cinemas and

Osaka English Village, where one can experience tourist activities from jolly old America without leaving Japan. There are a dozen more restaurants in this area, along the path beyond the sword fighting Gundam robots and the nation's tallest Ferris wheel. The conveyor belt sushi restaurant has an English menu on touch screen and of course the chance to just pick something that looks good off the conveyor belt circling the restaurant.

For those who'd rather get away from the madding crowds, head toward the Tower of the Sun and the expansive Expo Commemoration Park just across a footbridge before the mall. The 250-yen admission fee grants access to all areas of the park except the museums of ethnology and folk art, and the paddle boat pond.

The park has flower gardens, streams, play fields, an elevated treetop walkway, picnic areas and barbeque pits for rent. There is a train, running along one of the circumferential roads, that can expedite sightseeing. For those who opt to stroll about the park on foot there is a footbath west of main entrance to sooth your aches and pains.

The park plays frequent host to cultural and culinary fairs, such as the Ramen festival and the Curry festival. Even without a food fair, it is simple enough to pick up lunch at the grocery store in the mall or the convenience store within the station building and find a cool, shady spot for a relaxing picnic. Hotspots are also scattered throughout the park, featuring Osaka Free Wi-Fi.

A trip around the park will reveal several other gates for access to the park. In fact, the west gate is less than a kilometer from QBiC and makes for an easy entry point to this pastime paradise. ■

Transport: One-way ticket from Yamada Station near QBiC ¥200. From Yamada Station take a Kadomashi-bound Monorail to Bampakukinenkoen Station. Turn left out of the exit.
Gamba Osaka Tickets: Adults from ¥2,000
Aquazoo NIFREL: Adults ¥2,000, grade school and middle school students ¥1,000; children older than three years old ¥600.
Ferris wheel: ¥1,000 for all older than four years.
109 CInema: ¥1,800 General admission.
Expo Commemoration Park: Adults ¥250

Takamitsu Morikawa of Abott Japan

continued from page 2

Was that the question you were trying to answer in your PhD research?
Rather than trying to find the answer to a question I carried out research with the goal of developing new tools that can advance life science.

What were the pros and cons of doing your PhD research in QBiC?
The research equipment and facilities are superior to what can be found in other laboratories. Adding that to the world class researches in the surrounding labs makes it the best environment to do a PhD. As for cons, I hear some students say they feel a little isolated from other students as QBiC is off the University campus, but I did not feel this was a problem.

Did you feel you were treated equal to other researchers?
As a student, I was treated very well. Everyone was very kind to me. I spent a very good time during my PhD course at QBiC. I am really very grateful for my time at QBiC and I am very thankful to the Watanabe team, and all the members of QBiC. ■

Goodbye

QBiC says goodbye to Urs Frey and the Initiative Research Unit

All good things must come to end. And so after five fruitful years, the amazing journey that brought a Urs Frey and his family and his lab to Kobe, Japan from Switzerland has come to an end.

The Urs Frey Initiative Research Unit, was part of the Initiative Research Unit Leader Program, which was established in 2008 to offer scientists with outstanding, internationally recognized achievements the opportunity to pursue independent, interdisciplinary research of their own design at RIKEN.

"It was great!" Frey says of working in QBiC, "We had tremendous freedom." The now terminated Initiative Research Unit Leader Program was intended to provide the unit leader with wide ranging freedom in building their laboratory, choosing their team and directing their research.

The Unit focused on bioelectronics and biosensors, which are multidisciplinary research fields at the interface of engineering, biology, and nanotechnology.

QBiC Director Toshio Yanagida presents Urs Frey with a tiger as a memento from his time in Kansai

The research themes are part and parcel of QBiC and the lab was a collaborator with Yo Tanaka's Laboratory for Integrated Biodevice as well as the Bio Engineering Laboratory of ETH Zurich. Now after just five short years Urs Frey is returning to ETH with some of his PhD students.

We wish Urs and his lab the best of luck!

The Chow Down

Tahitian Salad

Ingredients

450g sashimi grade tuna
1 onion
2 carrots
1 cucumber
1 lemon, juiced
1 dozen cherry tomatoes
Salt and pepper
2 tablespoons olive oil

Recipe

1. Cut the tuna, onion, carrot and cucumber into bite sized pieces.
2. Mix ingedients with lemon juice and olive oil and refrigerate for 30 to 60 minutes.
3. Season with salt and pepperr to taste.

QBiC
Published by the Office for Science Communications, RIKEN Quantitative Biology Center.
Editor: Kylius Wilkins
If you have any suggestions, comments, or would like to contribute to the newsletter, please send an email to: qbits@riken.jp

RIKEN 2016-046