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QBiC

NEWSLETTER OF RIKEN Quantitative Biology Center

QBiTs

Now you see us!

Tissue transparentization inventors and brain imaging experts Kwanghun Chung, Ali Ertürk, Josh Morgan, Hiroki Ueda and Takeshi Imai (left to right) appeared at QBiC Symposium 2016.

Inside This Issue

CATCHING UP WITH

Berkeley's Markita Landry reminisces with QBiC Director Toshio Yanagida

In the summer of 2009 Markita Landry spent four months in QBiC Director Toshio Yanagida's laboratory at Osaka University, sponsored by a short-term fellowship from the Japan Society for the Promotion of Science (JSPS). She has just recently started her own laboratory for Optical Nanomaterials and Single-Molecule Research at UC Berkeley. After her talk at QBiC Symposium 2016 she took a trip down memory lane with QBiTs.

What memories to have of your time in Yanagida's lab?
Markita Landry: It was seven years ago. I remember everybody in the lab was very professional. On Friday at ten o'clock everybody stopped their work and cleaned up the lab for 10 minutes. So the lab was always very clean. And data acquisition was very thorough. Colleagues always checked each other's data and algorithms.

So he was strict?
ML: I'd say rigorous. But at the same time there was a lot of freedom. We had freedom to have our own ideas and test our own ideas. As long as we were rigorous and consistent we were free to choose the problems we wanted to study."

So why pick the Yanagida lab?
ML: I was studying protein (telomerase) DNA interactions by optical trapping and force spectroscopy but there were several possible molecular mechanism that could explain the data I was getting.

It became clear we need to visualize what was happening, in additional to force measurements with optical traps. The Yanagida lab was one of the first to show really nice resolution of sub-diffraction limiting positioning of molecular motors.

I wanted to accomplish the same high resolution imaging, but with protein DNA interactions instead of proteins with molecular motors. We developed a DNA bridge assay. We made bridges on pedestals and watched the proteins move on the DNA. We were able to correlate the movement visualized in the Yanagida lab with the force readings from my home lab at the University of Illinois.

And this changed the direction of your carrier?
ML: Yes, I really liked optical imaging so I moved toward florescence imaging and eventually using single molecule tools to study near-infrared fluorescent nano-materials.

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Recent Science Events

• Jul 26, 2016 - QBiC Seminar
Kang Shen of Stanford University discussed efforts to characterize the regulatory mechanisms of KIF1A mediated trafficking of synaptic vesicle precursors and dynein mediated retrograde transport in *C. elegans.*

• Aug 5, 2016 - QBiC Seminar
Zev Bryant of Stanford University gave a talk titled "Engineering controllable molecular motors."

• Aug 12, 2016 - QBiC Seminar,
Hirokazu Tanimoto from Institut Jacques Monod in Paris, asked, "How do microtubule asters migrate in the cell?"

MEET THE LAB

Takanori Kigawa's Laboratory for Biomolecular Structure and Dynamics

Conventional structural biology observes phenomena as "snapshots" under purified and idealized conditions that ignore the high concentrations of proteins, nucleic acids, co-factors, and ligands in which biomolecules operate. The effect of this macromolecular crowding strongly influences the structure and dynamics of the biomolecules. Therefore, structural biology would be better served if it could observe biomolecules in the cellular environment.

NMR spectroscopy is an ideal tool for this purpose, because it is able to non-invasively observe the structural dynamics of biomolecules at atomic resolution. We are therefore studying the structural dynamics of biomolecules in the cellular environment by using NMR spectroscopy.

We are also developing new NMR technologies for sample preparations, stable-isotope labeling, measurements, and data analyses for this purpose. Furthermore, we are actively collaborating with teams in the Computational Biology Research Core at QBiC for a system-level understanding of these dynamics in cellular environments.

In collaboration with physicists and chemists in RIKEN, we've just started to improve the sensitivity of enhanced NMR by orders of magnitude by applying the Triplet-DNP [Dynamic Nuclear Polarization] technique. This will lead to improvements in detection limits, making it possible to apply in-cell NMR to a much broader range of targets. This research is part of a RIKEN Pioneering Project titled "Dynamic Structural Biology by Integrating Physics, Chemistry, and Computational Science." ■

HOT OFF THE PRESS

Recent publications from QBiC researchers

◆Yukio Imamura and Takashi Jin apply their Nano-Bio Probes in work published in *Molecules*: Near-Infrared Emitting PbS Quantum Dots for in Vivo Fluorescence Imaging of the Thrombotic State in Septic Mouse Brain.

◆Earthworm muscle driven bio-micropump, the next in a series of eye popping titles from Yo Tanaka and Yaxiaer Yalikun and the Laboratory for Integrated Biodevice, was published in *Sensors and Actuators B: Chemical.*

◆Shuichi Onami's lab has made their Systems Science of Biological Dynamics (SSBD) database accessible at ssbd.qbic.riken.jp and the write-up is in *Bioinformatics*, titled SSBD: a database of quantitative data of spatiotemporal dynamics of biological phenomena. Joint first authors Yukako Tohsato and Ken Ho were joined by Koji Kyoda and Onami as coauthors.

◆Yuji Sugita published on GPU Acceleration and Parallelization of GENESIS for Large-Scale Molecular Dynamics Simulations, in *The Journal of Chemical Theory and Computation*.

Recent Science Events

• Aug 30, 2016 - QBiC Seminar
Sadao Ota from the University of Tokyo discussed the potential uses of his newly developed high throughput fluorescence imaging flow cytometry in a talk titled "Imagining beyond imaging"

•Sep 5-7, 2016 - QBiC Symposium 2016
The symposium, titled "Decoding Organisms by Quantitative Cell Profiling" was the second of the series. It was held at the Senri Life Science Center in Osaka and attended by about 140 researchers from Germany, Indonesia, the United States and of course Japan.

REACHING OUT

Shining microbes catch the eyes of Nara Super Science High Schoolers

One weekend day this summer, QBiC's Yusuke Morimoto, Hidenori Hashimura, and Yoichiro Kamimura shared their love for microbes with twenty students from Nara and Unebi Super Science High Schools.

Yoichiro Kamimura, Hidenori Hashimura, Yusuke Morimoto and Eri Kurosawa (back row right to left) with the participants

Students enjoyed Dr. Morimoto's lecture on how amebae find each other and exchange signals with each other, which can be visualized with fluorescence imaging. Then with their interest piqued, the students formed groups to examine the amebae under microscopes. The students observed amebae at the single cell and aggregated stages and discussed methods to measure their sizes and to estimate the number of cells in the aggregated stage.

The all-day event was organized by Nara High School science teacher Eri Kurosawa who was formerly known as Dr. Nishihara, a QBiC researcher.

Mrs. Kurosawa says of her current role, "I bridge the gap between high school and university and research institutions. Instructing students' research activities in the Super Science High School class. It is important for young people to understand through real experiences not just from the TV or the internet. I want high school students to feel, and build their own sense through experience. By being with researchers, they can experience real research and the passion of researchers directly. By developing their own sense they can grow the root of a researcher in themselves and gain confidence in their goals."

QBiC outreach activities

◆Jul 29, twenty Students from Tatsuno highschool in Hyogo prefecture visited QBiC. QBiC's Yuichi Taniguchi showed his state-of-art microscopes in the lab and Kazunari Kaizu taught them how simulation works.

◆Aug 9, twenty students from Nagasaki-Minami highschool visited QBiC's Okada lab and Furusawa lab. They enjoyed looking at zebrafish and culture cells under microscope.

◆Sep 8, eleven students and young researchers from Rajiv Gandhi Center for Biotechnology visited QBiC. They were hosted by Okayama University as part of Japan-Asia Youth Exchange Program in Science. In QBiC they saw supercomputer MDGRAPE4 close by and seemed to enjoy the huge noise of it. QBiC's Arno Germond explained to them his microscopes and other projects in Watanabe lab.

◆Sep 10, the Kigawa lab had Quiz and hands-on attraction for families in RIKEN Yokohama open campus day.

Much of the work in the Laboratory for Cell Signaling Dynamics, where these researchers have worked, utilizes the shapeshifting model organism *Dictyostelium discoideum*, a so-called slime mold. These ameba live as single cells which aggregate into multicellular structures. This fascinating natural history also makes a nice analogy for the life of a researcher. Kurosawa explains, “I wanted high school students to feel that the organism is interesting and research is interesting. So I consulted QBiC to plan a training session that uses 'slime mold', a creature full of wonder. I also wanted the students to know that research isn’t done alone, and should be done by team. So I asked to plan the training with a focus on group work.”

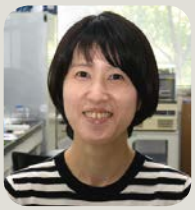
With such a positive outlook on research it may seem strange that Kurosawa moved on to High School education but she has an answer for that too, “Life is learning. In that sense it is a continuation. I am having a new kind of inspiration from my students. Also, I wanted a stable job to immerse myself in my hobby, mountain-climbing" she said with a laugh. "But in reality I have never be able to do so, so far. So, when I thought what I can do, I thought I can transmit how I feel about research to young people. That is why I chose to be a high school teacher. It would be my pleasure if I can give them the opportunity to be researchers.”

Kurosawa looks back on her time at QBiC fondly, “Ties with the people are invaluable. I had the opportunity to know researchers who are the experts in their field. I have received a lot of stimulus through a number of conversations with them." And as for the future, “I have a 3-year-old daughter and one year old son. I hope to climb various mountains with them!” ■

NEWCOMERS at QBiC

Ai Niitsu
Team Sugita
Sports: Baseball, football, rugby, and table tennis
Hobbies: Classical music, knitting, and travelling
Food: Cake!

Yamato Yoshida
Team Taniguchi
Sports: Baseball.
Hobbies: Trekking
Food: Soba



Yuko Mogi
Team Taniguchi
Sports: I am not good at sports...
Hobbies: Traveling
Food: Chili con carne

Masashi Ohmachi
Team Yanagida
Sports: Folk dancing
Hobbies: Go (not Pokemon)
Food: House Fruiche

Hitoshi Koyano
Team Shibata
Sports: Jogging
Hobbies: Playing with cats at a NEKO cafe
Food: Sake

QBiC researcher Michio Hiroshima (far right) with the conference participants at the Victoria peak in Hong Kong

QBiC was there

Director Toshio Yanagida co-chaired Gordon Research Conference "Single-molecule Microscopy: Life at a Higher Resolution", which was held at the Chinese University of Hong Kong, June 3 to 8. QBiC's Yasushi Okada was the discussion leader of the Neuronal Biophysics session and Masahiro Ueda was a speaker at the Cell Signaling session. Several young researchers from QBiC also presented posters. The climate there was even more humid than in Japan but everyone seemed to enjoy the friendly atmosphere of the conference and the cool ocean breeze at the top of the Victoria peak.

Experience all things Japan in Kobe

Japan is a land of contradictions. The world famous Shinkansen, bullet train, for example, has long been among the fastest and most technologically advanced trains in the world and tickets are not cheap. But when you go to buy a ticket most people will be paying in good old-fashioned paper money and in a smaller station the change for your ticket may be calculated on a most ancient of computers, the abacus! Everyone who spends more than a short layover in Japan will certainly have a story or two of seemingly inexplicable contradictions.

Perhaps no one city better exemplifies these contradictions than Kobe. A city with a historically international bent that remains Japanese to the core. Conveniently wedged on a narrow strip of land between mountains and the Osaka bay, this compact city allows you to cram a full Japan experience into one long day.

The city is centered around the Kobe-Sannomiya station area. This station which serves five distinct transport companies and their train lines, lies a single subway stop south of the Shinkansen station. The most convenient and economical train from QBiC is the Hankyu lines (see box for details).

Leaving Hankyu Kobe-Sannomiya Station from the west exit you will be facing north and directly toward a three story tall bas-relief of a golden, horn playing cherub on the side of a white building across the street. Cross the street, turn left and start down the wide covered walkway. Here you will find a variety of drugstores, coffee shops and convenience stores as well as restaurants, bars and karaoke parlors. At the end of the walkway turn right and you will see a green archway labeling the street Ikuta Road. Two short blocks north of here you come to a busy intersection with a neon archway for Higashimon Street to the right and to the left the giant green hand on the side of the Tokyu Hands DIY and craft focused department store. This description of Tokyu Hands really doesn't do the store justice and an hour or so here, taking in the variety of retail goods available to the people of Japan is an anthropology study well worth undertaking.

A dendrochronology study can be undertaken at the stump of a 500-year-old sacred camphor tree which can be found in the grounds of the popular Ikuta shrine, just behind Tokyu Hands to the north. The tree had survived being burnt during aerial bombardment in 1945 but has since died. The tree stump which has a cross section turned on its side so the rings can be counted is near the very small Ikuta woods and the row of bright red gates leading to a sub shrine in the northeast corner of the grounds. Another survivor of World War II air raids is the Kobe Mosque, Japan's first mosque, which serves the community to this day in its home a few blocks to the northwest of the shrine. Ikuta shrine is an important shrine in the Shinto religion and it is also famous for being the settings of a traditional Japanese drama, Noh, titled Ikuta Atsumori which is performed at the shrine during the fall festival.

Continuing north along the east side of Ikuta shrine you will pass through a second Higashimon Street archway and exit this shopping and nightlife district. Cross the six lane road, and continue north, uphill. As you enter the Kitano Ijinkan area the architecture quickly gains a decidedly European influence. Ijinkan are foreign style houses from the Meiji era. Mostly tourist attractions now, many of the houses can be toured for a fee or enjoyed while sipping a cup of tea or coffee, as some have been converted to storefronts. Even Starbucks has taken over a house on one of the busier streets in the area and lovingly restored it in green and white of course. This area also has many Thai and Indian restaurants and a number of establishments offering Kobe Beef.

At the northeast end of the Kitano area is the terminal of the subway green line and the Shinkansen's Shin-Kobe Station. Just down the block from here is the Kobe Nunobiki Herb Gardens and Ropeway, which is long name for a tram up the nearest part of the Rokko Mountains which provides excellent views of the area. Roundtrip tickets are available, as is a one-way option which means you'll be walking back down the mountain. Be aware that the hours of operation depend on the season and the day of the week. There are a number of other trams and funiculars in the Kobe area and the popular Rokko Mountains.

Returning to Kobe-Sannomiya on foot is a downhill stroll through the Kitano and Higashimon Street areas, the latter presenting a seedier and decidedly different face of Japan in the evening. Like much of the country, Kobe is exceedingly safe and orderly but crowded and inclined towards seeking entertainment in nightlife districts such as Higashimon Street. Watching the crowds and characters emerge at night can be entertainment enough but if you want something more, the Cave British-style Pub claims to have live music, "Beetles and so on…" and for another take on the style Hub Pub is a fish and chips chain with televised sports.

In the end, Kobe is a port city encroaching ever further into the Osaka bay with manmade islands such as the Port Island which is becoming an internationally known biomedical research cluster. The island is home to large research hospitals, pharmaceutical companies, and several RIKEN centers including some QBiC laboratories and most famously the K Computer. ■

Transport: One-way ticket from Yamada Station near QBiC ¥400. From Yamada Station take a Umeda-bound Hankyu train to Juso Station. Change to a Shinkaichi Station-bound express train. Use the west exit.

Kobe Nunobiki Herb Gardens and Ropeway: The roundtrip ticket includes access to the herb gardens, Adults ¥1400, grade school through high school aged youth ¥700. One-way tickets (only available at certain times) ¥900 and ¥450, respectively. Preschool aged children are free of charge.

Markita Landry of UC Berkeley

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Were there many other JSPS fellows in the lab at the time?
Toshio Yanagida: There was one from Germany I think and one from Canada. But she is the first foreign JSPS fellow I've had who went on to start her own lab so I am very proud of that.

What do you remember of her time in your lab?
TY: When she was here the lab was huge. There were 40 or more post-docs and students in the lab at the time so unfortunately, I couldn't spend that much time with her. But she was very popular in the lab.

ML: When I walked into the lab the first day everyone already knew who I was or had seen me because I was a winner of the *Science Magazine* "dance your PhD" competition.

TY: And one of my colleagues misunderstood that she always dances her results!

ML: The video is probably still on YouTube! ■

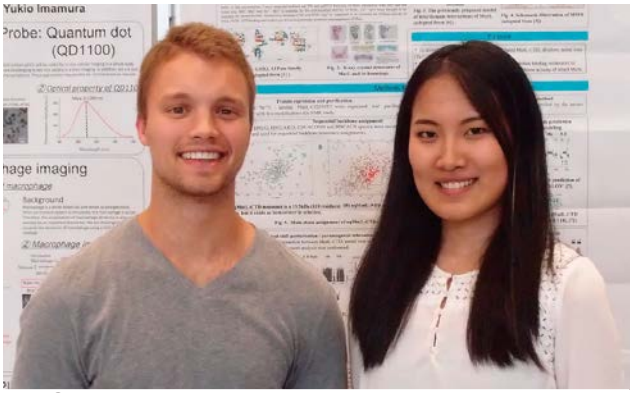
SAYONARA

QBiC says goodbye to summer interns

Matthew Dysthe who joined the Taniguchi lab from the University of Wisconsin-Madison has moved on to a laboratory in St. Paul, Minnesota. He says, “My favorite place and activity was the Gion Matsuri festival in Kyoto. It was really cool seeing all of the traditional Japanese outfits and temples - and the street food was incredible!

Before I arrived, “I obviously wish I knew a lot more Japanese, but other than that I wouldn't know what to say. I had no idea what to expect when I landed in Japan so I came in with a really open mind and didn't have any expectations.”

On life in Osaka, “At the Osaka International House, they hosted a dinner where people brought staple dishes from their home country. There was plenty of different/weird food that I tried there, but I can't remember any dishes in particular.”



Summer interns Matthew Dysthe and Zhang Liying

Zhang Liying joined the Watanabe lab from Jacobs University Bremen discussed her time in Osaka. “My favorite place in Japan is the house in Shibahara where I lived during my three-month stay. My friends, old and new, were all there with me. Although getting out of the door and going to cultural places in Japan was indeed superb.”

“Somehow I was constantly tired (because of work maybe) and really enjoyed wasting time in my cozy home. My second favorite place is a small underground fried-food-on-stick restaurant owned by an elderly lady in Umeda. It's just so awesome and special. I went there four times with different people. And I liked Japanese food. I'm Chinese so there's no such thing as weird food!”

“What I want share is that my summer experience was utterly mind-blowing. Japan was not the same as I imagined before, I don't even remember what I imagined. I'm a bit different after this adventure.” ■

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