

The Okinawa Institute of Science and Technology Promotion Corporation is an independent administrative institution launched in September 2005 to conduct outstanding research and to prepare for the establishment of a graduate university of science and technology in Okinawa. OIST News is a print publication intended to highlight current activities at OIST.

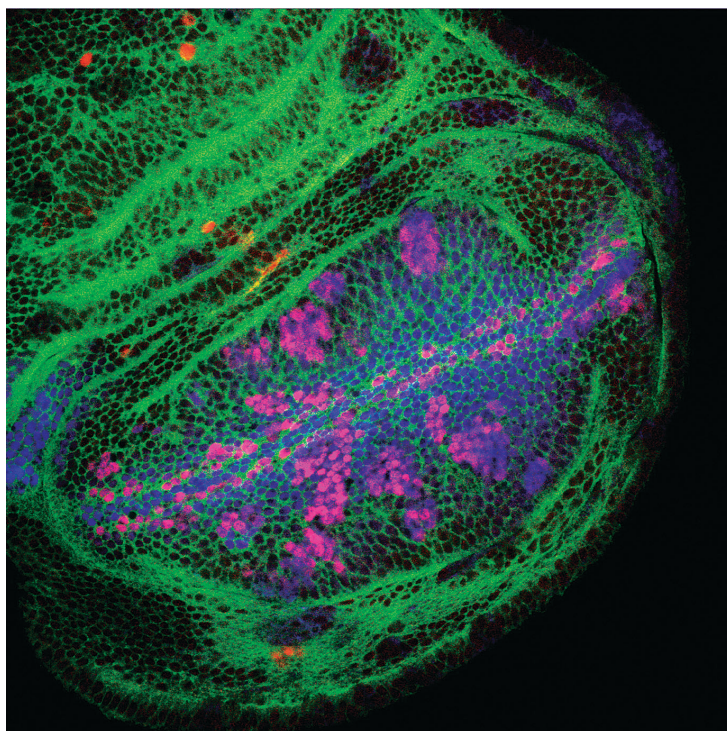


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Members of the Developmental Signalling Unit
Principal Investigator: Dr. Mary Ann Price (back row, second from the right)

The Developmental Signalling Unit, led by Dr. Mary Ann Price, was launched in May 2007. Born in Zama City, Kanagawa Prefecture, into a family stationed in Japan with the U.S. Army, Dr. Price spent four years of her youth living in Okinawa. After returning to U.S.A. and graduating from a local high school in Alabama, she went to the University of Montevallo to study chemistry. For her Ph.D., Dr. Price pursued biochemistry at Johns Hopkins University. She had post-doctoral research positions at the Imperial Cancer Research Fund (ICRF) in London, U.K. and Columbia University in New York, U.S.A. Following this, she held a research and teaching position at the University of Sheffield in the U.K. before joining OIST. In Okinawa, Dr. Price has continued her research from her previous labs, which is to identify protein components of a pathway involved in patterning of the fruitfly *Drosophila* wing.

Cover page: A wing imaginal disc of a fruitfly larvae, stained with three different antibodies shown in green, red and blue, demonstrating the effect of CK1 mutation on wingless signaling targets.

First love was sports and mathematics

Besides sports, my first love was mathematics. I liked the subject so much that I was already studying high school algebra in middle school. However, I became interested in biochemistry after meeting a very enthusiastic biology teacher in

my 10th grade. She taught us about genetic engineering and recombinant DNA, as well as cell mitosis and meiosis. I remember making a DNA model using gum drops and explaining to my parents every day what I learned in classrooms. My 11th grade chemistry teacher was also so immensely inspiring that I then decided to study the subject in university.



Dr. Price in the OIST fly room

First research

My first research project was on the structure of a stable form of sulfuric acid. The project took place between my third and fourth years at university when I participated in a summer research program at the University of Alabama. Since I had relatives who were teachers or university professors, I had long dreamed of becoming a high school science teacher. But this summer experience had me hooked on research after appreciating the thrill of becoming the first person in the world to find an answer to a question. It was very

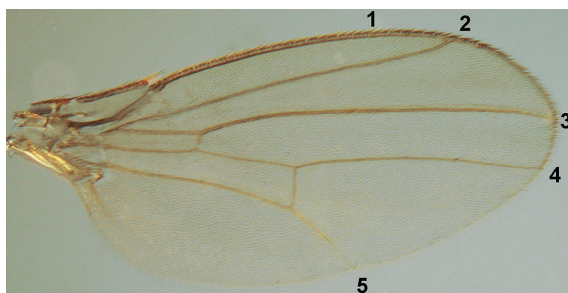
stimulating three months working full-time in a lab and sharing an apartment with fellow undergraduates. The research led to my first publication.

Studying patterning in the fruitfly wing

Developmental biology is the study of the process by which a single-celled fertilized egg develops into an embryo, and subsequently into different parts of an adult organism, such as the skin, bones and organs of the human. The mechanism by which embryonic cells proliferate and organize into diverse cell types is called pattern formation. In our unit, we are studying the patterning of the fruitfly *Drosophila* wing. A fruitfly is a small insect about 3mm long, of the kind that accumulates around spoiled fruit. The fruitflies have long been used as a model organism for biological research, because they have a short life cycle of just two weeks, and are cheap and easy to maintain in large numbers. The fly wing is a popular model for studying patterning during organ development because of the easily recognizable vein pattern in the adult wing, the ease of



White-eyed fruitfly (left) and wild-type fruitfly (right) anesthetized with CO₂ for examination



A wild-type fruitfly wing. The number indicates a particular vein. No. 1 is a thumb in humans, while No. 5 is a little finger in humans.

studying the larval tissue that gives rise to the wing, in which most of the molecular events of patterning take place, and most importantly – and perhaps most surprisingly – the shared features of fly wing development and vertebrate limb development.

Many developmental processes are controlled by communication between cells. The cell-cell interactions are mediated by a process called signal transduction, in which extra-cellular signaling molecules activate a membrane receptor that in turn alters intracellular molecules creating a response. Our unit's particular focus is Hedgehog (Hh) signal transduction, which gives cells information for the embryo to develop properly.

In 2000, a group of scientists successfully deciphered the

genetic code of the fruitfly and it was discovered that fruitflies share nearly 60% of human genes. The genes and proteins involved in the patterning of the fruitfly veins are very similar to human genes and proteins involved in the patterning of the human limbs as well as the nervous system. These genes and proteins make your little finger different from your thumb. Mutation of components of the Hh signaling pathway results in several inherited developmental disorders such as polydactyly, a term used to describe having extra fingers and toes. Inappropriate activation of the Hh pathway can also lead to many different types of cancer. By examining fruitflies with hedgehog component mutations, we are trying to identify new components of the pathway that we believe holds a key to better understanding of these conditions.

Joy of teaching and rewarding research

Aside from research, I have been actively involved in OIST education programs targeting students and small children in Okinawa. While there is a language barrier when interacting with these children who do not speak English, it is fun to think about how to engage young kids excited about science. Members of my unit and I have gone to local schools to give talks and hosted scientific experiments at public events, such as the OIST Open Campus and the Children's School of Science in Onna. When these children come and see what we do here at OIST and when they have the chance to do some simple experiments themselves, science becomes real to them. Japanese children are very well-behaved and they are a great joy to work with.

Scientific research can be frustrating because many experi-



Dr. Price's public lecture at Kumoji Community Center



Dr. Price at Onna / OIST Children School of Science



The Developmental Signalling Unit at OIST Open Campus 2010

ments do not work because of technical difficulties. Even if an experiment is successful, the results may be inconclusive. On top of it, cells or a living organism do not always grow as fast as we want, or they do not mate when we want, or they get contaminated. However, despite all these hurdles to overcome, I would say scientific research is very rewarding. Being at OIST gives me the opportunity to think about a

range of ideas, and I can spend time on research rather than writing grant applications. As a student and post-doctoral researcher in U.S.A. and U.K., I was thrilled by the excitement of science and research. I cannot wait for the first class of students to start at the OIST Graduate University so we can inspire young people from all over the world with the same excitement.

A Promising Star

Dr. Satoshi Hasegawa



Dr. Satoshi Hasegawa is from Niigata Prefecture. After graduating from Yamagata University, he went to Nagoya University's Graduate School and Faculty of Science to study the mechanism of zygote formation by budding yeast. As a post-doctoral researcher, Dr. Hasegawa worked at the now-defunct Mitsubishi Kagaku Institute of Life Sciences, Akita Prefectural College of Agriculture, and the Rockefeller University in U.S.A. before joining the RIKEN Center for Developmental Biology to pursue research on endothelial progenitor cells. He joined OIST in May 2006, and has been a member of the Developmental Signalling Unit since May 2008. Dr. Hasegawa discussed his role in the unit and his future goals.

As a small child, I enjoyed observing living organisms and collecting insects. I used to play in the field all day and come home with an insect cage full of mantises. By the time I reached high school, I had already developed interest in pursuing a scientific career, particularly in the field of biology or global environmental issues. For my undergraduate study, I chose Yamagata University because I wanted to enjoy skiing in the prefecture known as a Mecca for various winter sports.

In the Developmental Signalling Unit at OIST, I use culture *Drosophila* fruitfly cells to determine novel interacting factors responsible for the activation and regulation of Hedgehog (Hh) function. Hh is a secreted intercellular signal molecule, involved in establishing the basis of fly body plan. Hh binds to cell surface receptor(s) and cause the changes in the cells. The transcription factor Cubitus interruptus (Ci) is one of the components in the Hh pathway involved in making such changes. In the presence of Hh, full length Ci acts as a transcription activator. On the other hand, when Hh is absent, Ci undergoes processing by proteasome and the processed Ci acts as a transcription repressor. We

believe that identifying novel factors involved in Ci processing, as well as in regulating other aspects of Hh signaling, will result in better understanding of and perhaps treatment in Hh-related disease.

I enjoy living and conducting research in Okinawa. While it takes additional travel to reach this island, I believe a few cases of successful research at OIST can easily attract researchers from around the world. At the Rockefeller University where I worked in the 1990s, I enjoyed meeting world-renowned scientists in their respective fields for lectures, lunches and dinners. This kind of face-to-face interaction is essential and OIST has the connections, beautiful locations and other great assets to realize similar inspiring experiences. After meeting such famous people, one realizes that Nobel Laureates are not so different from an average scientist. My ultimate personal goal is to understand the biological mechanism that separates talented from not so talented people since I strongly believe that a slight difference in gene expressions and intracellular reactions between these two groups results in the birth of great masterpieces of art, music and literature by those called geniuses.

Formation and Regulation of Neuronal Connectivity Research Unit (established in July 2010)



Principal Investigator
Dr. David Van Vactor

The mechanisms that control the formation and maintenance of accurate and functional synaptic connections are vital to the operation of the nervous system. Advances in genetics have provided a better understanding of the mechanisms that regulate normal development, or in disease states, compromise the function or survival of neural circuits. The goal of the Formation and Regulation of Neuronal Connectivity Research Unit, led by Dr. David Van Vactor, is to better define such regulatory strategies, using the fruit fly *Drosophila melanogaster* as a model system to allow genetic dissection of neural development and neurodegeneration. Dr. Van Vactor earned his Ph.D. from the University of California, Los Angeles, after which he conducted his postdoctoral research at University of California, Berkeley. He concurrently serves as Professor in Cell Biology at Harvard University.

Optical Neuroimaging Unit (established in September 2010)



Principal Investigator
Dr. Bernd Kuhn

One of the key questions in neuroscience is how behavior arises from cellular activity and how information is processed in the brain. Unfortunately, our ability to measure the neuronal activity is still very limited because of the complex, fine, and intermingled structure of the brain and its fast and simultaneous activity. The Optical Neuroimaging Unit, led by Dr. Bernd Kuhn from Germany, will develop new techniques to go beyond the current limitations of signal detection in the intact brain, bringing us a step closer to answer the questions of behavior arousal and information processing. Dr. Kuhn obtained his doctorate from the Technical University of Munich doing his research at the Max Planck Institute of Biochemistry and has subsequently worked at the Max Planck Institute for Medical Research and the Princeton Neuroscience Institute at Princeton University, U.S.A.

International Workshops

OIST has been hosting international workshops and seminars to enhance cooperation with research institutions at home and abroad. These workshops and seminars also help introduce the vision of establishing a graduate university in Okinawa to the worldwide scientific community. Below is a list of workshops that took place between June 2010 and March 2011.

2010

June 14-July 1 "Okinawa Computational Neuroscience Course (OCNC) 2010"
Organizers: Drs. Erik DeSchutter, Kenji Doya, Klaus Stiefel, Jeff Wickens (OIST)

July 12-22 "Developmental Neurobiology Course 2010"

Organizers: Drs. David Van Vactor, Mary Ann Price, Ichiro Masai, Robert Baughman (OIST), and Dr. Akinao Nose (The University of Tokyo)

October 3-6 "JAPAN-U.S. Brain Research Cooperative Program Workshop 'The NeuroPhysiome: Bridging Computational Neuroscience and Systems Biology'"

Organizers: Dr. Erik DeSchutter (OIST), et al.

December 1-3 "Computational Ecology Workshop"

Organizer: Dr. Satoshi Mitarai (OIST)

December 6-11 Winter Course 2010 "Evolution of Complex Systems"

Organizers: Drs. Sydney Brenner, Noriyuki Satoh (OIST) and Michael Levine (University of California, Berkeley, U.S.A.)

2011

February 23-26 Garuda Four Workshop on Software Platform for Healthcare Research and Services
Organizer: Dr. Hiroaki Kitano (OIST)

March 14-18 4S (Sun, Sea, Science Student) Workshop

Organizer: OIST Student Affairs and Admissions Section



4S Workshop participants

International Symposium and Workshop Toward the Development of an R&D Cluster in Okinawa



On October 6-7, 2010, OIST hosted a symposium and workshop entitled "Towards the Development of an R&D Cluster in Okinawa." One of the goals of the meetings was to find ways for OIST to contribute to the formation of an R&D cluster based on scientific and technology. More than 170 attendees from academia, industry, and government agencies in Japan and abroad attended the public symposium, in which remarks were made by distinguished guests including Senior Vice Minister Yoshinori Suematsu, Okinawa Governor Hirokazu Nakaima, and U.S. Ambassador to Japan John V. Roos. The symposium also included a keynote address by Mr. Philip Yeo, Chairman of SPRING Singapore and a panel discussion by five experts from Japan and abroad.

Remarks

Senior Vice Minister Yoshinori Suematsu of the Cabinet Office stated that OIST presents an opportunity and a challenge to the people of Okinawa to bring out the OIST potential in a way that past and future generation of the Okinawa people can be proud of. He pledged utmost support by the Cabinet Office to realize the goal. Governor Hirokazu Nakaima of Okinawa Prefecture said the wish of the Okinawa people is for OIST to benefit not only Okinawa but also Japan, Asia, and the world at large. He also expressed his hope that achievements of OIST researchers and students will contribute to progress of the humankind and the development of Okinawa.

U.S. Ambassador to Japan John V. Roos noted that thriving entrepreneurial business environments around the world all have the presence of strong institutions of higher education, particularly with leading programs in science and technology. He added that world-class research institutions like OIST can play a central role in inspiring emergence of high-tech entrepreneurial ecosystem.

Keynote Address

In his keynote address "Singapore's Experience: Economic Development with Science and Technology," Mr. Philip



Senior Vice Minister
Yoshinori Suematsu



Okinawa Governor
Hirokazu Nakaima



U.S. Ambassador to
Japan John V. Roos

Yeo, Chairman of SPRING Singapore and Special Advisor for Economic Development, Singapore Prime Minister's Office, talked about the economic development his country has achieved. Citing the Biopolis, Singapore's regional and international biomedical sciences research-development center which opened in October 2003, Mr. Yeo emphasized the importance of both bringing in the best minds from all over the world while also nurturing young talent. Many in the audience were surprised when he described how promising young international students are supported for their entire graduate training and given full Singaporean citizenship with the condition that they must remain in Singapore to work for 5 years after finishing their doctorates. Stating that Singapore has shifted its focus from electronics, chemical and precision engineering to biomedicine, Mr. Yeo emphasized the importance of sustaining economic development by strategically creating a new industrial sector every five years.



Mr. Philip Yeo

Panel Discussion

The symposium ended with a 90-minute panel discussion, during which discussants exchanged opinions on the role of a university in developing an R&D cluster, and how an academic institution like OIST can contribute to promotion of entrepreneurial activities. Citing existing R&D clusters in Japan and overseas while also taking into view Okinawa's



strength and its potential in science and technology, the panelists pointed to the geographical advantages Okinawa has in being at the center of the Asia-Pacific region and its similarities with San Diego in California, U.S.A. The discussants all expressed their expectations for OIST to produce outstanding research results in particular areas that will lead greater to international recognition, saying that this in turn will result in companies coming to Okinawa to form an R&D cluster with OIST at the center as a catalyst.



(From left) Mr. Miyata, Dr. Kitano, Dr. Somekh, Mr. Taira, Mr. Tsukamoto, Ms. Wright

Moderator: Mr. Mitsuru Miyata, Chief Editor - Medical, Nikkei Business Publications, Inc.

Panelists: Dr. Hiroaki Kitano, Principal Investigator, OIST
 Dr. Sass Somekh, President, Musea Ventures, U.S.A.
 Mr. Toshiaki Taira, Chief Operating Officer, Okinawa Industry Promotion Public Corporation, Japan
 Mr. Yoshiaki Tsukamoto, Executive Director, Bio Industry Association, Japan
 Ms. Julie Meier Wright, President & CEO, San Diego Regional Economic Development Corporation, U.S.A.

Workshop

Following the symposium, 33 global experts from various fields met for a 2-day workshop to discuss the issues more deeply and extensively. Three breakout sessions took place, with each session divided into three groups. While Session I took up issues in R&D cluster development, Session II focused on ways to lay the foundation for innovation and entrepreneurship. Session III explored practical recommendations for innovation and entrepreneurship. In order to find practical approaches to form an R&D cluster in Okinawa with OIST at its center, the participants held vigorous discussions, which included presentations by two executives of the local venture capital and two OIST principal investigators about the technology and project they had developed. The workshop brought about three major challenges in the realization of an R&D cluster formation. In order to nurture entrepreneurs, the participants called for human capital development. In order to promote entrepreneurship, which has not been traditionally encouraged in the country, they proposed a wide range of ways for the promotion. Lastly, the discussants emphasized the need for identification and investment in high-growth sectors since R&D activities on the island are currently limited. Practical recommendations were made based on Okinawa's various potential and challenges.



Dr. Katherine Ibatá-Arens, Associate Professor, DePaul University



Mr. Wako Kinjo, President of Okinawa Human Capital



OIST President-elect Dr. Jonathan Dorfman

Recommendations Chart

Recommendation 1: Educate & Train

- Establish an international Math-Science High School in partnership with a university
- Expand students' access to computers and the Internet
- Foster faculty outreach to high schools
- Invest in broad-based English learning through education, incentives, and partnerships
- Provide full scholarships to qualified students from low-income families to attend universities in Japan and abroad
- Commit to building OIST into world-class university; improve infrastructure and programs at existing Okinawa universities; partner with other Asian academic institutions
- Devise income tax measures that encourage philanthropic donations to universities and research institutes

Recommendation 2: Recruit Globally

- Ease immigration restrictions to support efficient issuance of temporary or permanent residency for qualified workers
- Offer flexible employment arrangements to recruit the world's best researchers and educators
- Provide assistance to integrate foreign families into Okinawa life: job placement, international schools, promotion of culture and arts

Recommendation 3: Build Entrepreneurs

- Include entrepreneurship training and mentoring in the curriculum of Okinawa universities and high schools
- Establish Entrepreneurship Training and Entrepreneur-In-Residence Programs at universities
- Build real and virtual networks of local and global entrepreneurs

Recommendation 4: Promote Risk-taking

- Undertake broad public awareness campaign to promote stories of local entrepreneurs and those who have found success overseas
- Create government seed venture fund for repeat entrepreneurs, particularly those who have previously tried and failed

Recommendation 5: Commercial Zone

- Streamline regulatory environment for starting, operating, reporting, and closing new ventures
- Make all of Okinawa into a special economic zone to attract entrepreneurs, investors, and their companies
- Provide favorable tax treatment for emergent businesses: waive corporate taxes for the first 10 years of new company operations
- Provide significant tax-breaks for established businesses to re-locate operations to Okinawa

Recommendation 6: Expand Private Investment Sector

- Institute non-punitive tax system based on global standards
- Allow for zero capital gains tax for investments held for 5 or more years
- Deregulate pension funds to allow their participation in venture funds
- Establish government-backed seed venture funds
- Provide incentives for Corporate Japan to locate R&D facilities in Okinawa
- Provide incentives to establish Angel, Venture, and Private Equity groups

Recommendation 7: Build New Industrial Sectors

- Universities rent lab space to emergent businesses
- Establish privately-managed venture business incubators and structure them to maximize sustainability
- Allocate funds specifically for collaborative research projects between academia and industry; ease regulations where necessary
- Encourage local companies that can competitively provide services to the university
- Strengthen the role of the Okinawa TLO
- Universities to establish own IP development and business innovation units

Recommendation 8: Expand Viewpoint Globally

- Aim for global markets for locally produced goods and services
- Establish binational foundations to stimulate, promote, and fund industrial R&D of mutual benefit
- Reduce the high cost of inter-Japan and inter-Asia air travel

Recommendation 9: Develop S&T Strategic Plan

- Develop focused S&T strategic plan for Okinawa that guides investments by government and also serves as a benchmark

Talk by Dr. Akito Arima

On February 8, Dr. Akito Arima, Co-chair of the OIST Board of Governors, gave a talk at a monthly meeting of the Okinawa Employers' Association. About 110 people came to the event, filling a hotel reception room in Naha City. In his talk, entitled "Education and Science & Technology in Japan," Dr. Arima cited statistics from several international surveys to explain that what appears to be a large decline in the level of academic achievements by Japanese schoolchildren is in fact an inaccurate interpretation of the survey results. Pointing out that the number of participating countries in these surveys has increased, he said the decline relative to the increased pool of other countries was only modest. However, Dr. Arima did point out that while Japanese children have great understanding of and interest in science and technology, the degree of the interest starts to wane as they grow older, underlining the importance of higher education.



Dr. Akito Arima

Dr. Arima further discussed higher education in Japan, saying that a comparison between Japan and other developed countries in the world highlights the strikingly low numbers of foreign students and faculty in Japanese universities.



Members of the Okinawa Employers' Association

He emphasized that the numbers must increase for Japanese universities to be internationally competitive and underlined the significance of the OIST Graduate University.

Visit by Tancha Residents

On February 27, about 60 residents of Tancha, the district of Onna Village in which the OIST campus is situated, visited OIST, led by Tancha District Chief Mr. Kazuya Ohama. The visit began with an address by Executive Director Dr. Robert Baughman in which he described the preparations being made for OIST's transition to a graduate school. The Tancha residents were then led on a tour of the facilities which included an in-depth look at the electron microscope room. For most of the visitors, this was the first time they had ever been on the OIST campus, but one woman reminisced about the time she used to work at the Grand Park Zoo and Botanical Gardens which used to occupy the hill where OIST now stands.



Tancha residents

Science Talk with Dr. Torsten Wiesel

On February 11, twelve local high school students in Okinawa visited the OIST campus to meet with Dr. Torsten Wiesel, Co-chair of the OIST Board of Governors (BOG), President Emeritus of Rockefeller University, and the 1981 Nobel Laureate in Physiology or Medicine. The two-hour session, entitled "Science Talk with a Nobel Laureate," began with self-introduction by four boys and eight girls, who each described what they enjoy studying in classrooms and which profession they are aspired to. Following this, Dr. Wiesel discussed his youth in his home country Sweden, why he became a scientist, and how visual information is processed in the brain, the very research that won him and the Nobel Prize in 1981.

In the exchange with the students, Dr. Wiesel underlined the importance of not giving up easily, and being ready to take up new challenges. He told the students who wanted to be doctors that the desire to heal people was of the highest importance. To those who had expressed interest in becoming a scientist, Dr. Wiesel advised that research is very competitive, but emphasized the joy of making a discovery. Asked how his life has changed before and after receiving the Nobel Prize, Dr. Wiesel said he unfortunately no longer found time for research as he took on administrative responsibilities at various universities and institutions. On the other hand, he said how much he enjoyed the opportunity to speak to young people and hopefully inspiring them to pursue scientific careers.



Dr. Torsten Wiesel listens to a student

Ms. Ayaka Yagi, tenth grader at Okinawa Shogaku Senior High School, said she was interested in biology but found medicine attractive after listening to Dr. Wiesel. Mr. Kazuki Hiyane, tenth grader at Okinawa Prefectural Kaiho High School, said he while he is not good at interacting with people, he learned making a good presentation is crucial for scientists to receive grants. Ms. Rina Yamada, tenth grader at Okinawa Prefectural Kyuyo High School, said she wanted to become a surgeon, and had learned that being open to all opportunities is the key to developing one's potential. Ms. Aki Zukeran, eleventh grader at Okinawa Prefectural Naha Kokusai High School, said she was very inspired by Dr. Wiesel's talk and understood that scientific research can help many people in the world.



Dr. Wiesel (front row, center), OIST executives, students, and teachers

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Onna Campus

1919-1 Tancha, Onna-son, Okinawa 904-0412, Japan
TEL : +81-98-966-8711
FAX : +81-98-966-2887

Seaside House

7542 Onna, Onna-son, Okinawa 904-0411, Japan
TEL : +81-98-966-8712
FAX : +81-98-966-8715

Research Laboratory

12-22 Suzaki, Uruma-shi, Okinawa 904-2234, Japan
TEL : +81-98-921-3835
FAX : +81-98-921-3836



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