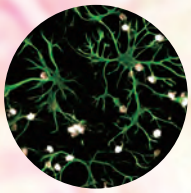
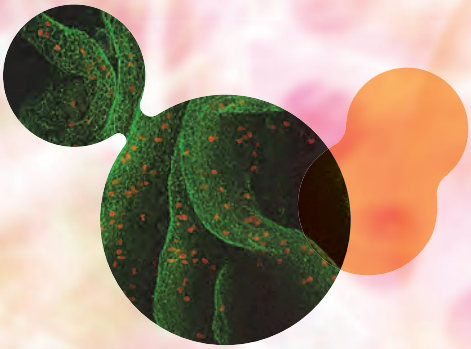


GRADUATE SCHOOL OF BIOSTUDIES,

KYOTO UNIVERSITY



2013

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GRADUATE SCHOOL OF BIOSTUDIES

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Greeting from the Dean of the Graduate School

Dean: ISHIKAWA, Fuyuki, MD, PhD

ESTABLISHMENT AND HISTORY OF THE GRADUATE SCHOOL OF BIOSTUDIES

Life Science is the study of life in all of its forms and complexity. It encompasses the totality of life forms from viruses and bacteria to human beings, and its analyses involve molecules, genes, cells, tissues, living organisms, and eco-systems in diverse phases. Life is not a "molecular machine". Therefore, it is necessary to bring the context of life into the research effort. It requires using various approaches, various disciplines, and various fields of study. In addition, those who wish to excel in the life sciences must bring to their studies a strong sense of ethics. Biostudies researchers must be more than manipulators of molecules.

Those trained in specialized disciplines within agriculture, medicine, and pharmacology, where studies in the life sciences were traditionally pursued in the past, have independently contributed greatly to the current knowledge base. These accomplishments notwithstanding, it is manifestly essential for researchers to place their work within the whole framework of "Life" and to encourage each other as people who love life. With such needs and expectations both internally and externally, the Graduate School of Biostudies was established in 1999, to engage in 21st Century Life Science as a comprehensive science.

It has been 15 years since the school was established. In that time, we have accepted numerous students and have sent into society graduates who were raised to be outstanding researchers through the leadership of our former deans, Kanji Ohyama, Mitsuhiro Yanagida, Kayo Inaba, Eisuke Nishida, and Shin Yonehara. Simultaneously, we have published many cutting-edge research findings.

In 2001, we were selected as an educational base of the MEXT Center of Excellence Formation Project (COE). This experience lead us to be selected as one of the schools of the 21ST Century COE Program (21 世紀 COE プログラム) in 2002. Furthermore, we were selected as a school of the "Initiative Project for Attractive Education in Graduate School (魅力ある大学院教育　イニシアティブ事業)" and the "Support Program for Education Reformation of Graduate School (大学院教育改革支援プログラム)" in 2006 and in 2008, respectively.

We are proud of our educational program. With support from a variety of projects, we have been diligent to provide bold and efficient curriculums that reflect the students' feedback and discussions with teaching staff and administrators, who are passionate to improve the graduate education system. We attach particular weight to nurturing students' autonomous attitudes, allowing students to develop their own thoughts and originality, to have their own voice and points of view presenting their own ideas, and to solve problems with innovative approaches. New discoveries arising from their daily training should be shared at the global level. With this goal in mind, a foreign professor, who is a native English speaker and experienced in Life Science research, instructs students to improve their discussion, writing, and presentation skills. Students are encouraged to present their research at international meetings, and dissertations are now accepted in either Japanese or English.

Our research has been frequently cited and is ranked at the forefront of the global scene. Our faculty, who have diverse backgrounds, explore new directions of research, sharing their own knowledge, skills, and ideas with frank discussion in the appropriate forums of the public and research environment. We are actively collaborating with private/public sectors and are attracting competitive external public funding for research. At the same time, we strongly hope that the fruits of our research will contribute to social happiness.

Most of our laboratories are located at the South Campus and the North Campus, improving their research

and education in the respective research complexes. Despite the physical distance between the campuses, the graduate students and teaching/administrative staff communicate closely, while upholding the tradition that respects diversity and free-ranging inquiry. This has also engendered a friendly and lively atmosphere to encourage each other.

All in all, we are pioneering a new Life Science with hope and responsibility. We recognize our responsibility and are full of hope and confidence that we can reach our goals. Although we are still a young organization, or perhaps because we are a young organization, we will do our best to bring our school mission and the research fields listed below to fruition. We sincerely appreciate your further support.

The three goals of the graduate school

(1) Provide education for pursuing the new biostudies at the world's top level

To meet the demands of the industry, college, research institutes and administrative organizations, individuals are educated in the life sciences and master the techniques for the society needs.

(2) Train individuals to apply the new life sciences for the protection of the global environment and for human welfare

Integrate the knowledge and technology in the old fields of science, agriculture, medicine and pharmacology, and nurture individuals who can contribute to the human society in the 21st century.

(3) Nurture individuals who can understand the various vital phenomena of the living organisms as a systemic function, and pursue these systemic functions

Nurture individuals who will be leaders in the human society to pursue their activities for the welfare and happiness of humans in the 21st century, where humans will be living in harmony with other living beings.

In order to meet the demands of the changing society in the 21st century, which will be impossible to cope with in the current research academic system for the life sciences, a new research and education system is installed to breakdown the walls that have hindered the research in the life sciences in the past. There are two courses in the Graduate School of Biostudies.

(1) The Division of Integrated Life Sciences: cell development, cell growth, genetic information and cell cycle regarded as a multicellular system, and the totipotency, the mechanism of signal transduction and the responses among the cell, living being and environment.

(2) The Division of Systemic Life Sciences: neuroscience, animal development and physiology, immunobiology and others.

AIMS OF THE GRADUATE SCHOOL OF BIOSTUDIES

(1) Training of individuals with the most advanced knowledge of the life sciences for the next generation

The graduate student studies a higher level of life sciences beyond the structures of past life science-related fields at each undergraduate level to understand the integrated life sciences. The goal is to nurture a new type of individual with creative and innovative abilities to cope with the various unknown themes to be confronted by human beings in the next generation.

(2) Training to establish self for society

In the Graduate School of Biostudies, individuals are trained to make a healthy and fair judgment based on the academic background of the staff and their prospects for the future; and, establish a new system to evaluate the effects of education from multiple aspects from the past.

(3) Activation and flexibility of staff in the human relations

Research is pursued by each staff member independently to develop a new life science based on active exchange among the various laboratories in the graduate school.

(4) Use of current post-doctoral system and evaluation of academic activities

Full use should be made of the current system, to provide the increasing necessary number of instructors per student, for the intensive training to become life scientists at an international level, for true development of a new research field.

Policy

Education and admission policy

The field of life sciences is transforming and evolving into an advanced branch of science that will build a future for humans. With this global trend as a backdrop, the Graduate School of Biostudies was established in 1999 as Japan's first independent graduate school of biostudies, with the aim of creating one of the world's top research institutions and developing human resources who will lead the next generation in the biostudies field. With a set of such basic units of life as "cells," "molecules," and "genes" as a common language, the Graduate School of Biostudies is home to innovative research and educational activities, where concepts about diverse organisms and the environments that comprise them are integrated to create new values concerning the future and respect for life.

In response to diverse, social demands that call for an increasingly sophisticated and complex life sciences field, the Graduate School of Biostudies strives to develop the following human resources:

1) Researchers who explore and discover the basics of life, pursuing the cutting-edge field of biostudies at the highest level in the world;
2) Researchers and highly skilled engineers who contribute to society at public and private research institutions, endeavoring to protect the global environment and maintain human health, well-being, and happiness; and
3) Educators and highly skilled practitioners who possess broad knowledge of diverse vital phenomena of living organisms and who contribute to society through education, industry, mass media, and the public sector.

Curriculum organization policy

1. In Master's programs, basic knowledge of life science and research competency are acquired.
2. In Doctoral programs, advanced knowledge and research competency in life science are acquired. Moreover, each student is trained to become a researcher who plays an active role internationally as a group leader.
3. All students are trained to become mature and highly capable researchers who can collaborate actively with foreign partners.
4. We offer a variety of educational curriculums including biology, medicine, and related areas.
5. We cultivate students with life ethics and a strong sense of responsibility for the world where humanity and nature must be harmonized.

Diploma policy

1. In the two-year Master's program, students must take 1 credit from compulsory subjects and at least 9 credits from elective subjects offered by the school. In addition, students are required to complete 20 credits of lab experiments and practice. The degree must be accredited through the examination of a Master's thesis.
2. In the Master's program, it is necessary for students to acquire and demonstrate knowledge and capability required for professional researchers in the field.
3. In the Doctoral program, students who take the lectures offered by the school and perform the research for a Doctoral thesis must be enrolled for 3 years (or less by way of exception). Students must take 1 credit from compulsory subjects and more than 1 credit from elective subjects. For lab experiments and practices, 8 credits are required. Doctoral students must submit a Doctoral thesis and pass the relevant examinations for the degree.
4. In the Doctoral program, each student must demonstrate that he/she has the ability to work as an independent researcher for successful completion of the program.
5. We expect that students will graduate with a shared ethical obligation to advance science in the best interests of mankind in harmony with nature.

Education curriculum and How to enroll

Educational Philosophy

We expect to develop the next generation of interdisciplinary leaders in the field of life sciences by providing the best academic research environment under the supervision of the finest graduate educators and PhD advisers. We emphasize the importance of the accomplishment of a research endeavor as well as academic performance in lecture, seminar, and laboratory practice. At the same time, the students are trained to discuss and debate scientific matters and research outcomes. Students are also trained to have a broad outlook and flexible thinking in life sciences, and are encouraged to travel to international scientific meetings.

"Global Frontier in Life Science"

The Graduate Schools of Biostudies, and Medicine, and Pharmaceutical Sciences offer "Global Frontier in Life Science", a joint educational program for Doctoral and Master's students as part of K.U. PROFILE (Kyoto University Programs for Future International Leaders: http://www.opir.kyoto-u.ac.jp/kuprofile/). This program, "Global Frontier in Life Science", is held entirely in English, including the entrance examinations, lectures, experiments, and discussions.

International as well as domestic students are welcome. In particular, the program welcomes those who show a respect for life and a desire to create a comprehensive and cutting-edge field beyond existing disciplinary boundaries in life sciences.

1) Doctoral Program in "Global Frontier in Life Science"

The three graduate schools hold independent entrance examinations for this program, and accept up to ten applicants. Our entrance examination for the Doctoral program is held in July. The guidelines for admission are posted in April on our web site (http://www.lif.kyoto-u.ac.jp/e/). The academic year starts on October 1st or April 1st for those who cannot obtain a "college student visa" by the end of September. Thus, applicants can select the starting date of either October 1st or April 1st in the next year. At the time of application, prospective students must identify which laboratory head will direct their doctoral research. Applicants can apply for only one lab. **Thus, applicants should contact the lab head and fully discuss potential research activities and availability before filing the application.**

Admission examinations for the Doctoral program consist of: 1) an English written test to evaluate reading comprehension and writing ability; 2) an oral presentation (in English) of a research project that applicants have conducted; 3) a subsequent oral examination to evaluate applicants' knowledge of their field, research competency, logical thinking skills, and ability to give presentations.

2) Master's Program in "Global Frontier in Life Science"

Our entrance examination for the Master's program is held in July. The guidelines for admission are posted in April on our web site (http://www.lif.kyoto-u.ac.jp/e/). The academic year starts on October 1st or April 1st for those who cannot obtain a "college student visa" by the end of September. Thus, applicants can select the starting date of either October 1st or April 1st in the next year. Applicants to the Master's program can apply for up to two labs in which they wish to conduct research. **Thus, applicants should familiarize themselves with faculty members' research interests and contact lab head(s) to fully discuss prospective research activities and availability before filing the application**.

Admission examinations for the Master's program consist of: 1) a set of written examinations of English proficiency and knowledge of general subjects in biology; and 2) an oral examination. The set of written examinations is given to all applicants.

Lectures held in English for "Global Frontier in Life Science"

1) Doctoral program

Offered by the Graduate School of Biostudies

- Frontier in Life Science (1 credit : compulsory)
- Advanced English Discussion and Writing in Life Science I (1 credit)
- Advanced English Discussion and Writing in Life Science II (1 credit)

2) Master's program

Offered by the Graduate School of Biostudies

- Life Science : From Basics to Applications, from Molecular Biology to Systems Biology (1 credit : compulsory)
- Beginning Science (1 credit)
- Global Frontier in Life Science A (2 credits)
- Global Frontier in Life Science B (1 credit)
- Advanced Molecular and Cell Biology I (2 credits)
- Advanced Molecular and Cell Biology II (2 credits)
- Cancer Biology (2 credits)
- Basic English Discussion in Life Science I (1 credit)
- Basic English Discussion in Life Science II (1 credit)

Supplied by the Graduate School of Medicine

- Medical Science I (2 credits)
- Medical Science II (2 credits)
- Clinical Science Introduction (2 credits)

Requirements for completing programs

1) Requirements for completing the Doctoral program

- "The Life-Science Special Exercises" (8 credits : compulsory)
- Common Compulsory Subject (1 credit)
- Common Elective Subjects (at least 1 credit)

For graduation, the student must have enrolled for at least three years and have completed at least 10 credits. It is also required to pass the probation and the examination (thesis defense) upon completion of a Doctoral thesis written under the supervision of faculty.

2) Requirement for completing the Master's program

- "The Life-Science Experiments and Exercises 1" (10 credits : compulsory)
- "The Life-Science Experiments and Exercises 2" (10 credits : compulsory)
- Common Compulsory Subject (1 credit)
- Common Elective Subjects (at least 9 credits)

For graduation, the student must have enrolled for at least two years and have completed at least 30 credits. It is also required to pass the probation and an examination upon completion of the Master's thesis written under the supervision of faculty.

Features of Education

Features of Education

From 2006 to 2007, we conducted the "Biostudies Career-Development Program" supported by the Ministry of Education, Culture, Sports, Science and Technology. From 2008, we have launched the "Program for Developing Pharmaceutical Strategists" as one of the projects of "Reforming Programs in Education" at Kyoto University. This program, in cooperation with the Graduate School of Pharmaceutical Sciences, is aimed to reform the educational system of graduate schools in our university. Launched in 2011, we are conducting a new program named "Global Frontier in Life Science". In 2012, we were selected as one of the schools of the "MEXT Excellent Graduate School Hub Formation Project " and supported our Doctoral students with the subsidy. We are hoping that our students will understand the essential aspects of the programs and cooperate with us in achieving their goals.

Outline of Reforming Programs in Education

1) Lectures

In our Master's program, the curriculum is designed to make the students systematically understand life science and its related fields. We offer an inherent lecture for understanding, revealing, and cultivating the relationship between life science and our society. In our Doctoral program, advanced courses in life science are offered in addition to the seminars at the lab where each student belongs. This program has been ongoing since 2006. We gear the program to provide the requisite knowledge and experience for the students' future careers in various fields of Industry, Government, and Academia, at home and internationally.

2) Emphasis on English communication for life science, with support for attendance at international scientific meetings

It is now very important to give seminars in English, especially scientific presentations at international meetings. Historically, however, the graduate schools in our country scarcely cared about the development of English communication skills for students. Our school has been emphasizing the development of communication skills in English. We encourage and financially support our students to give talks at international conferences abroad. We also give them advice for their presentation skills.

3) Workshops organized by students

Students in life science fields tend to stay in their labs because they are busy working at the bench. However, it is highly important to communicate with other students studying life science inside and outside of our school during the course of education. We encourage and financially support the students to organize and conduct workshops by themselves.

4) Guidance by multiple supervisors

Heretofore, students who were assigned to their laboratories studied under the supervision of one faculty member. However, it would be highly stimulating for the students if they could have opportunities to discuss their research and other matters with other faculty members. In our school, each student is strongly encouraged to consult with two additional supervisors for his/her current research and also career objectives. We hope that the practice widens their vision on life science and on their future plans.

5) Global 30
(http://www.uni.international.mext.go.jp/)

The Ministry of Education, Culture, Sports, Science and Technology launched the "Global 30" Project for Establishing Core Universities for Internationalization, for the purpose of selecting universities that will function as core schools for receiving and educating international students. In 2009, thirteen universities including Kyoto University were selected. These core universities are playing a major role in dramatically boosting the number of international students educated in Japan as well as Japanese students studying abroad.

Description of Lectures held in English

Master's Program

Beginning Science

(Lecturers: Uemura, Hejna, Sengoku)

This class will cover the history of life science, the basic phenomena in this field, research methodologies, papers that impressed the lecturers themselves, seminars, and meeting other scientists, as the beginning of research. Moreover, rules of research and proper analysis of data will be discussed. Furthermore, to broaden students' views of their career path, and their future roles as scientists in the greater context of our society, we would like to discuss what Professionalism means, in terms of common sense, regardless of particular career objectives, and how to develop systematic and critical thinking skills.

Life Science :From Basics to Applications, from Molecular Biology to Systems Biology

(Lecturers: Hejna, Nagao, Kambe, Kumeta, Toyoshima, Harada, Inoue, Masuda)

This class will be conducted entirely in English, and is designed to acquaint students with a broad range of research areas and methodologies, while encouraging students to consider the adaptability or combination of methods in other systems. Topics will range from a quick review of basic molecular biology techniques, to presentations on differentiation factors, transport proteins, applications of fluorescence technology, single-molecule imaging, systems biology, synthetic biology, and the hot topic of RNA research. Discussion is also encouraged. The class is primarily for first-year Master's students. Other students, especially G30 students, are equally welcome.

Global Frontier in Life Science A

(Lecturers: Kakizuka, Shin, Gerle, Wang, Ebisuya, Carlton, Nakamura, Woltjen, Matsuo, Kalay, Altmann, Kim, Ishikita, Shiojiri, Imamura)

Lectures in this "Global Frontier in Life Science A." will be held in English, and aim to provide basic and fundamental concepts and knowledge in several different research fields in Life Science. Lecturers are mostly young scientists, who have recently started his or her own research as lab heads in Kyoto University. In addition, the lecturers will provide their experiences how they have found enthusiasm in life science researche.

Global Frontier in Life Science B

(Lecturers: Hejna, Chisaka, Nishihama)

International scientific communication is conducted virtually exclusively in English. Students in this class will be provided opportunities--and will be expected--to actively practice and refine their oral presentation skills in English. The class format will consist of medium-length (about 30 min.) student presentations (depending on enrollment and group discussions, in addition to impromptu exercises to further develop reading and listening comprehension. Each class will be a standard 90 min. class, scheduled from 10:30 am-12 noon. The class is meant to be a forum in which to improve English language fluency and presentation skills, and the content will cover current topics in bioscience.

Advanced Molecular and Cell Biology Ⅰ

(Lecturers: Yoshimura, Takeyasu, Yonehara, Kakizuka, Kengaku, Hejna, Kumeta)

This will be a lecture course with a limited number of students (up to 30). The students will be given 5-8 scientific papers to read. Special emphases will be on the biologists' way of thinking as well as the basic concepts on the gene/protein structure and function.

1. Logic and basic concepts in biology : What does a biologist do and what does a biologist know?
2. Methods in biology : What kinds of techniques does a biologist employ?
3. Specific topics deal with cell structure and function, the nucleus and central dogma

Advanced Molecular and Cell Biology Ⅱ

(Lecturers: Takeyasu, Ishikawa, Kohchi, Fujita, Hejna, Yoshimura, Endo, Kumeta)

This course is an intensive course to introduce the underlying cell signaling pathways and their me-

diators covering mammalian cells, plants and microbes. The final goal of this course aims to provide an overall knowledge regarding the diversity and significance of cell signaling events in response to various stimuli and physiological conditions, and the generality among species. The course will be held in combination with related paper discussion. Students interested in cell and molecular biology and cell signal transduction are encouraged to participate.

Cancer Biology

(Lecturers: Takeyasu, Ishikawa, Kakizuka, Yoshimura, Kumeta)

In this course, a wide variety of recent topics on cancer biology will be lectured by researchers working in different research fields and different countries. A Long-distance learning system combines Kyoto, Tsukuba and National Taiwan Universities to promote active interaction and discussion between lectures and students, as well as among students in different universities.

Basic English Discussion in Life Science Ⅰ

(Lecturer: Hejna)

Despite having excellent English reading and writing skills, most students, even native-English speakers, need to improve their oral English communication skills in order to thrive in the new international scientific community. This class is designed to provide students with ample opportunities to practice scientific discussions in English, while reviewing elements of English grammar and style as they arise. An added benefit will be coverage of a diverse range of current scientific topics; students will begin to look critically at scientific data, and its presentation.

Basic English Discussion in Life Science Ⅱ

(Lecturer: Hejna)

This class is designed to build upon existing reading and writing skills by developing strengths in oral presentation and discussion of science in English. Aimed at Master's students in particular, who may not yet have extensive research results to present, the class will consist of shorter (~30 min) student presentations, covering recent science news, methods, and technology. Students are expected to contribute to the class by commenting and raising questions, at the same time strengthening their ability to look critically at the way science is presented.

Doctoral Program

Frontier in Life Sicence

(Lecturers: Ishikawa, Ohshima, Nureki, Ishii)

Prominent leading scientists from several research fields of life science, especially those progressing astonishingly, will provide their research histories from their backgrounds to future prospects, to encourage young scientists to perform good science.

Advanced English Discussion and Writing in Life Science Ⅰ

(Lecturer: Hejna)

Like it or not, career advancement depends upon the ability of a researcher not only to read and write English, but to converse fluently in English. These skills are crucial for presentations at international meetings, international collaborations, peer review of manuscripts, and professional networking. This course will allow you to further develop your English language skills by giving oral presentations. In addition, a homework writing exercise will give you practice in writing a short document, such as an abstract, a cover letter, or peer review. Enrollment will be limited to just 3 students, to allow each student two 75-minute oral presentations, and ample opportunity for informal discussion in a low-stress environment.

Advanced English Discussion and Writing in Life Science Ⅱ

(Lecturer: Hejna)

This class continues the development of presentation and discussion skills in English, as in Advanced English Discussion and Writing in Life Science I, with the longterm goal of preparing you for an international scientific career. This course will allow you to further develop your English language skills by giving oral presentations. Group discussions will be friendly, but objective. In addition, a homework writing exercise will give you practice in writing a short document, such as an abstract, specific aims, or peer review. Enrollment will be limited to just 3 students, to allow each student two 75-minute oral presentations, and ample opportunity for informal discussion in a low-stress environment.

Outline and Composition of Departments

Research Laboratories in the Graduate School of Biostudies

We contribute for the improvement of future welfare and happiness of humankind

DIVISION OF INTEGRATED LIFE SCIENCE

❖ Genetical mechanism

- Department of Gene Mechanisms
- Department of Molecular and Cellular Biology

❖ How multicellular organisms work

- Department of Cell and Developmental Biology
- Department of Plant Gene and Totipotency
- Department of Molecular and Developmental Biology

❖ How organisms interact with environments

- Department of Applied Molecular Biology
- Department of Responses to Environmental Signals and Stresses

DIVISION OF SYSTEMIC LIFE SCIENCE

❖ How the brain and the body work

❖ How the body is built

❖ How the human diseases occur

- Department of Molecular and System Biology
- Department of Animal Development and Physiology
- Department of Signal Transductions
- Department of Functional Biology
- Department of Mammalian Regulatory Network

❖ Communications・Bioethics

- Department of Biostudies and Society

Living organisms

Human beings

Genes and cells

DIVISION OF INTEGRATED LIFE SCIENCE

This division consists of 17 laboratories including five cooperative laboratories one from Radiation Biology Center, two from Institute for Virus Research, and two from Institute of Integrated Cell-Material Sciences (iCeMS). Thirty-seven graduate students are accepted in the Master's Program annually, and 17 in the Doctoral Program. In this division, education and research are focused on the elucidation of basic mechanisms regulating the chromosome transmission, chromosome replication, RNA architecture, cell cycle, cellular transport, cell polarity, signal transduction, growth and development, developmental plasticity, bioconversion, and environmental adaptation. Experimental approaches are taken with microorganisms, plants, and animals. We pursue education and research to elucidate the molecular aspects of Integrative Life Science.

Division of Integrated Life Science

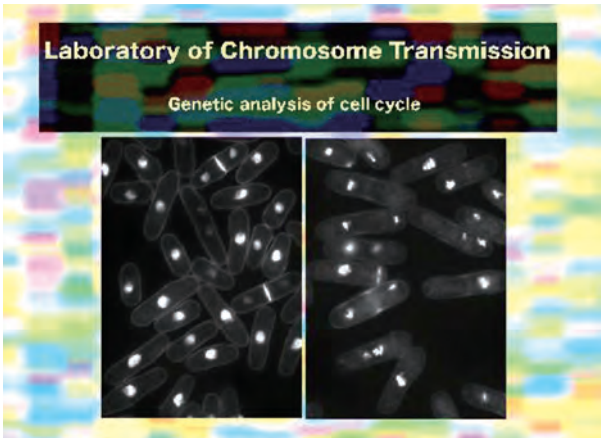
Department of Gene Mechanisms

Laboratory of Chromosome Transmission

■ Associate Professor **NAKASEKO, Yukinobu**

■ Main theme

Main theme in this laboratory is the analysis of eukaryotic cell cycle regulation. Especially, regulation of chromosome separation and segregation during mitosis has been extensively studied. Fission yeast Schizosaccharomyces pombe is used as a model system. This yeast has all basic features involved in cell cycle regulation which are conserved among all eukaryotic cells. And wide variety of approach can be taken for analysis such as genetical, biochemical, molecular biological technique. Identification of individual genes involved in regulation of the cell cycle is start point. Elucidation of whole net work of the function of these genes is one of a goal in this research.



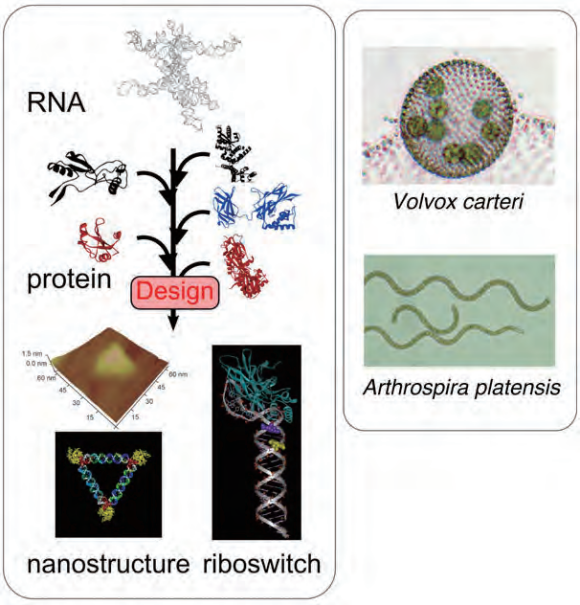
Laboratory of Gene Biodynamics

■ Professor **INOUE, Tan**
■ Associate Professor **SHIRAISHI, Hideaki**
■ Assistant Professor **FUJITA, Yoshihiko**

■ Main theme

Research in this laboratory focuses on Synthetic Biology of RNA and RNP (RNA-protein complex). Topics of interest include design and development of new functional RNAs (RNPs), and RNAs (RNPs)-based synthetic genetic networks. The design and development is performed based on the structure of naturally occurring RNA molecules and also in vitro and in vivo evolution technique.

Also used for research in this laboratory is an edible filamentous cyanobacterium, *Arthrospira platensis*, and a multicellular green alga, *Volvox carteri*. By using these organisms, we are investigating growth, development and evolution of photosynthetic microorganisms.



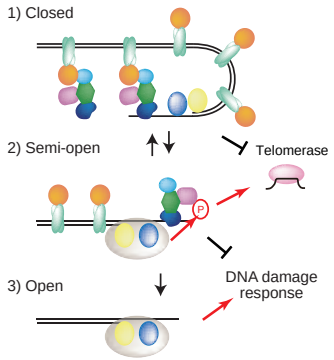
http://kuchem.kyoto-u.ac.jp/seika/

Laboratory of Cell Cycle Regulation

■ Professor **ISHIKAWA, Fuyuki**
■ Assistant Professor **TARUMOTO, Yusuke**

■ Main theme

Our research activity focuses on the molecular mechanism of the flow of genetic information. Chromosomes, the vehicle of genetic materials, show both faithful and flexible behaviors, in different time scales, from a single round of the cell cycle to the evolution of species, and in different conditions, such as development, aging and cancer. These apparently opposite behaviors of chromosomes can be explained by the need of genetic materials to be transmitted robustly. We are particularly interested in how functional domains of chromosome, such as telomeres, are established and maintained, and how chromosomes respond to external stimuli, as exemplified by the genetic instability found in cancer cells. We are trying to understand these questions by experimental approaches based on genetics, biochemistry, and molecular and cellular biology in various model systems, such as fission yeast, *Xenopus*, and mammalian cells.



Telomeres consist of DNA ends and the shelterin protein complex.
1) Long telomeres form a closed state competent to protect telomere ends. 2) Moderately short telomeres recruit telomerase to elongate telomere DNA. 3) Very short telomeres are deprotected, activating the DNA damage response. Phosphorylation of the shelterin protein regulate these processes. Yamazaki et al. Genes & Dev. 26:241 (2012)

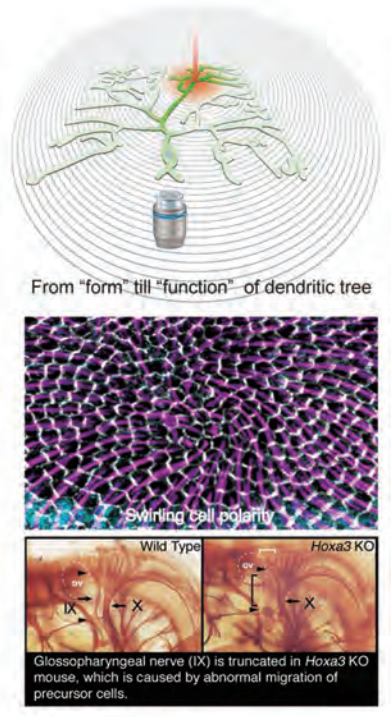
http://www.lif.kyoto-u.ac.jp/labs/fish/

Laboratory of Cell Recognition and Pattern Formation

■ Professor **UEMURA, Tadashi**
■ Associate Professor **CHISAKA, Osamu**
■ Assistant Professor **USUI, Tadao**

■ Main theme

We are investigating mechanisms that control epithelial cell polarization and pattern formation of neuronal dendrites and axons during development. The research subjects include: 1) To explore the molecular basis of development, regeneration, and life-long maintenance of neuronal dendritic trees. 2) To elucidate how cell-to-cell recognition contributes to planar cell polarity (PCP). 3) To reveal mechanisms of controling cell migration in vertebrate embryos. To conduct these studies, we employ a variety of molecular, cellular, genetic, and computational approaches, and use Drosophila, vertebrates, and cell lines. Our long-term goal is to shed light on pathogenesis of human diseases that are caused by defects in the epithelial or neuronal morphogenesis and integrity.



http://www.lif.kyoto-u.ac.jp/labs/cellpattern/

Division of Integrated Life Science

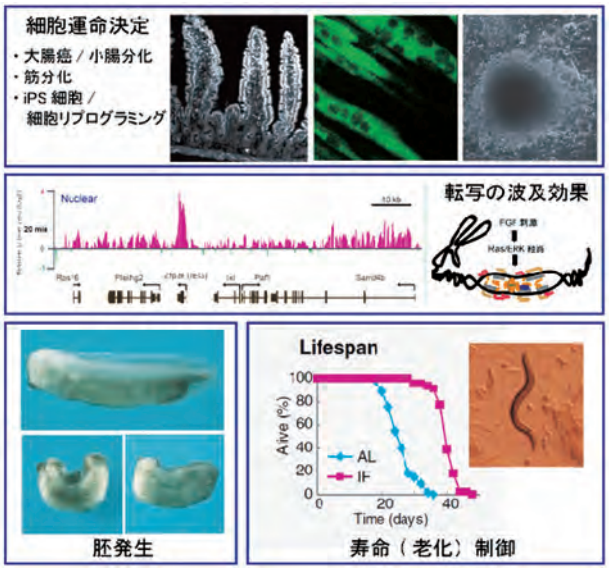
Department of Plant Gene and Totipotency

Laboratory of Signal Transduction

■ Professor **NISHIDA, Eisuke**
■ Assistant Professor **MIYATA, Yoshihiko**
■ Assistant Professor **KUSAKABE, Morioh**

■ Main theme

We are interested in identifying and elucidating molecular mechanisms that regulate cell proliferation, cell differentiation, cell cycle, aging and developmental processes. The current topics include 1) regulatory mechanisms and functions of the MAP kinase cascade pathways, 2) identification of novel signal transduction mechanisms, 3) molecular mechanisms for life span regulation, 4) roles of protein kinases in cell cycle progression and regulation, 5) growth factor signaling mechanisms in developmental processes, 6) regulatory mechanisms for mammalian circadian clock.



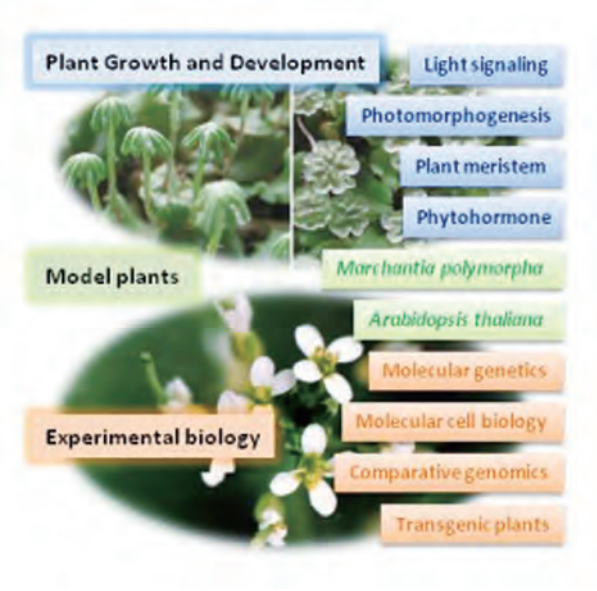
http://www.lif.kyoto-u.ac.jp/labs/signal/

Laboratory of Plant Molecular Biology

■ Professor **KOHCHI, Takayuki**
■ Lecturer **NISHIHAMA, Ryuichi**

■ Main theme

Research in this laboratory focuses on the adaptive regulation of growth and development to environmental conditions using model photosynthetic organisms. Topics include mechanism of photomorphogenesis and meristem development. We study molecular mechanisms of light sensing by photoreceptors and downstream genetic network of signal transduction. Approaches by molecular genetics and comparative genomics are taken with Arabidopsis and liverwort (*Marchantia polymorpha*). In particular, the genetic analysis of *Marchantia* is unique and efficient as its phylogenetically basal position in land plant evolution, haploid-dominant life cycle, and simple transgenesis. Genome analysis of *Marchantia* is also conducted in this laboratory.



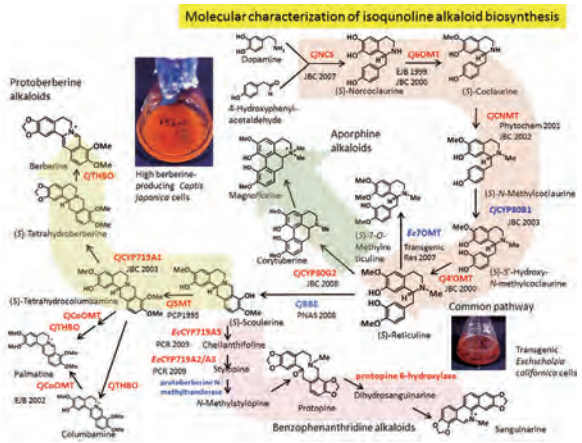
http://www.lif.kyoto-u.ac.jp/labs/plantmb/

Laboratory of Molecular and Cellular Biology of Totipotency

■ Professor **SATO, Fumihiko**
■ Associate Professor **ENDO, Tsuyoshi**
■ Assistant Professor **IFUKU, Kentaro**

■ Main theme

Molecular and cellular biological studies on totipotency in plant cells have been carried out in this laboratory using in vitro cultured cells and transgenic plants. Especially, cell/organ differentiation from undifferentiated cells, functional differentiations, e.g. oxygen evolving complex in photosystem II, cyclic electron transfer and gene regulation in chloroplast, as well as molecular biology of secondary metabolism, such as biosynthesis of isoquinoline alkaloids in plant cells have been investigated to understand the totipotent functions in plant cells. Development of novel genetic engineering techniques such as differential RNAi, metabolic engineering and synthetic biology of secondary metabolism for industrial application have been also investigated.



http://www.lif.kyoto-u.ac.jp/labs/callus/

Laboratory of Biosignals and Response

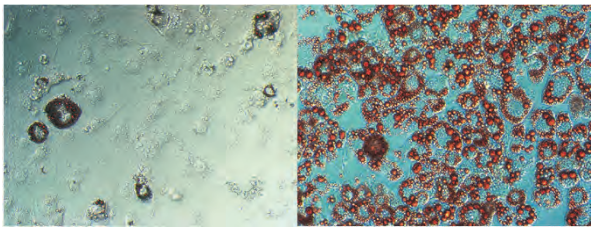
■ Professor **NAGAO, Masaya**
■ Associate Professor **KAMBE, Taiho**
■ Assistant Professor **MIYAMAE, Yusaku**

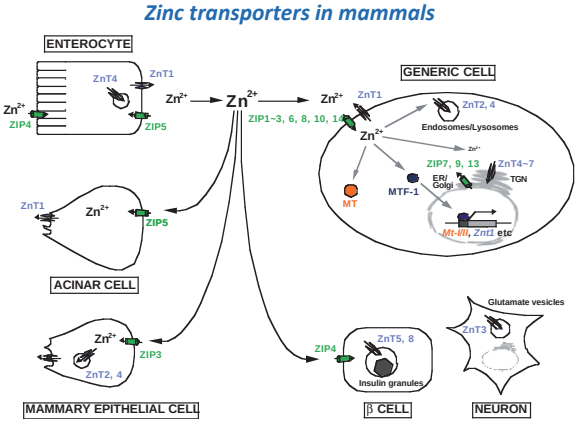
■ Main theme

Bio-prospecting, a research strategy searching for compounds that possess beneficial activity for health from natural sources, is one of the projects in this laboratory. Especially, at present, compounds that prevent hepatic fibrosis and replication of hepatitis C virus are the main targets of our bio-prospecting.

We are also studying how organisms perceive environmental signals and transduce these signals into changes in gene expression, focusing mainly on the molecular and cellular basis of zinc metabolism (such as uptake, storage, delivery, and maintenance of metal concentration in cells) in mammal.

Stimulation of lipid accumulation by plant extracts





http://nucleus.lif.kyoto-u.ac.jp/labs/seitaijoho/

Division of Integrated Life Science

Laboratory of Applied Molecular Microbiology

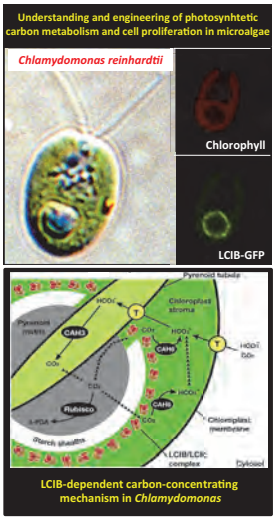
■ Professor **FUKUZAWA, Hideya**
■ Assistant Professor **YAMANO,Takashi**
■ Assistant Professor **KAJIKAWA,Masataka**

■ Main theme

We are focusing on the molecular bases of biological functions of microorganisms contributing to production of food, energy and industrial materials, and also to environmental remediation by photosynthesis. Especially we employ a green alga, *Chlamydomonas reinhardtii*, as a model eukaryotic photosynthetic microorganism using its genomic information, mutants, and molecular/biochemical techniques.

The current projects are

(1) Molecular characterization of the carbon-concentrating mechanism supporting photosynthetic carbon fixation, energy production, and cell proliferation,
(2) Elucidation of regulatory network systems controlling photosynthesis by sensing environmental factors including changes of levels in CO_2 concentration and light,
(3) Metabolic engineering for production of poly-unsaturated fatty acid, polysaccharide, glycoprotein, glycolipid and hydrocarbon,
(4) Molecular control and signaling of sexual reproduction by nutrient starvation.



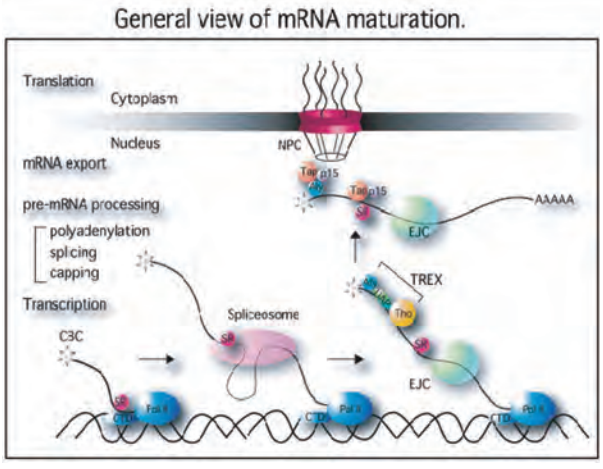
http://www.lif.kyoto-u.ac.jp/labs/molecule/

Laboratory of Molecular Biology of Bioresponse

■ Associate Professor **MASUDA, Seiji**

■ Main theme

Research in this laboratory focuses on the mechanism of RNA maturation in the nucleus mediated by a number of proteins and small RNAs. Messenger RNA is synthesized as pre-mRNA by RNA polymerase II. Pre-mRNA undergoes the multiple processing and become mature mRNA. Then, mRNA is exported to the cytosol to produce protein. During these processing, a large number of proteins are conducted to process each step adequately. At present, we are focusing on the several projects to understand the maturation and quality control of RNAs in the nucleus. The main projects are (1) The role of TREX complex and the AREX complex, which couples transcription and export of mRNA, (2) mRNA export pathway in the mammalian cells and enhancing the protein production by optimizing the packaging and export of mRNA and (3) the RNA quality control in the nucleus to produce the adequately processed RNAs.



http://www.lif.kyoto-u.ac.jp/labs/bunshioutou/

Laboratory of Plant Developmental Biology

■ Professor **ARAKI, Takashi**
■ Assistant Professor **ENDO, Motomu**
■ Assistant Professor **YAMAGUCHI, Ayako**

■ Main theme

We are interested in molecular mechanisms underlying plant's responses to environment. Plants have evolved plastic developmental programs with both genetic and epigenetic basis to adapt their sessile mode of life to changing environment. Using an angiosperm, Arabidopsis thaliana and a liverwort, Marchantia polymorpha as model systems, we have been investigating (1) regulation of growth phase transition (especially, flowering) and aging in response to environmental and endogenous signals, (2) long-distance systemic signaling in control of development, (3) tissue-specific roles of circadian clock for optimal environmental responses, and (4) origin and evolution of regulatory systems for plastic development.

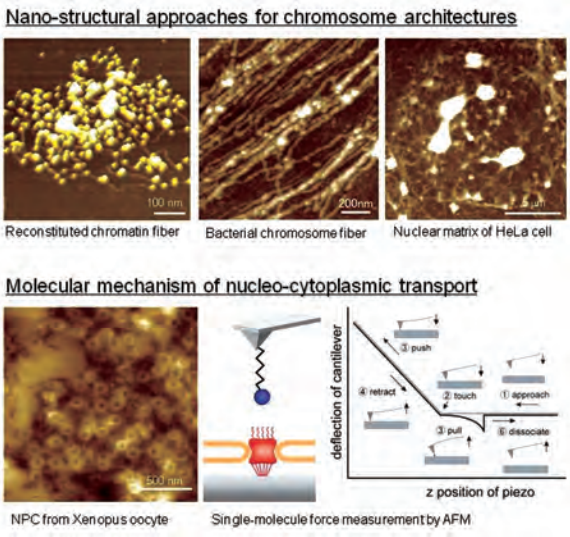
http://www.lif.kyoto-u.ac.jp/labs/plantdevbio/

Laboratory of Plasma Membrane and Nuclear Signaling

■ Professor **TAKEYASU, Kunio**
■ Associate Professor **YOSHIMURA, Shigehiro**
■ Assistant Professor **KUMETA, Masahiro**

■ Main theme

We are interested in how the cell signaling is regulated by specific molecular elements. By using a variety of techniques in biochemistry, molecular and cell biology, and structural biology, we have been investigating the structural and functional relationship between the signaling elements (e.g., membrane receptors and transcription factors) and their targets (e.g., specific enzymes and DNA). The current projects deal with (1) higher-order architectures of prokaryotic and eukaryotic chromosomes, (2) transcriptional regulation in the context of chromatin structure, (3) cross-talk between nuclear matrix and chromatin, and (4) molecular mechanism of macromolecular transport between cytoplasm and nucleus via nuclear pore complex. The approaches to these problems include single-molecule imaging and force measurement using scanning probe microscopy, as well as general biochemistry and molecular biological techniques. This consolidation should reveal a large part of the overall picture of regulation of cell signaling in eukaryotes and prokaryotes.



http://www.lif.kyoto-u.ac.jp/labs/chrom/

Division of Integrated Life Science

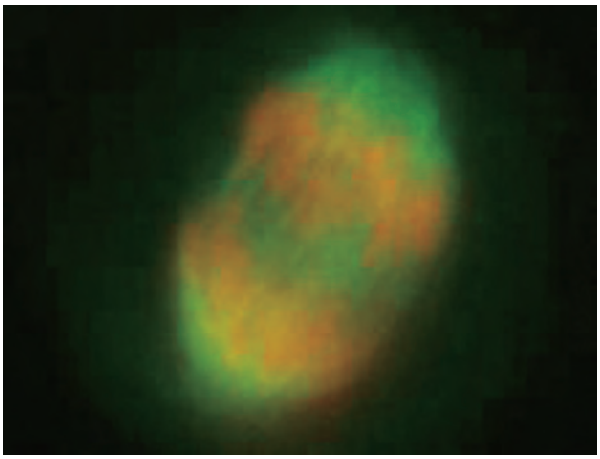
Department of Molecular and Developmental Biology

Laboratory of Genome Maintenance

■ Professor **MATSUMOTO, Tomohiro**
■ Assistant Professor **HABU, Toshiyuki**

■ Main theme

The spindle checkpoint, our major research subject, is a surveillance mechanism to regulate cellular apparatus for compliance with this rule. It is a unique negative feedback that converts/amplifies a physical signal sensed by kinetochores (attachment of the spindle and/or tension) and regulates the timing of the sister chromatid separation. Mad2, a signal carrier of this feedback, plays a vital role in the spindle checkpoint. It is specifically localized at unattached kinetochores that are the origin of the checkpoint signal. Mad2 targets CDC20 and inhibits its activity to promote sister chromatid separation. We study Mad2, a central player of the spindle checkpoint, to reveal mechanisms, which regulate the activity of Mad2.



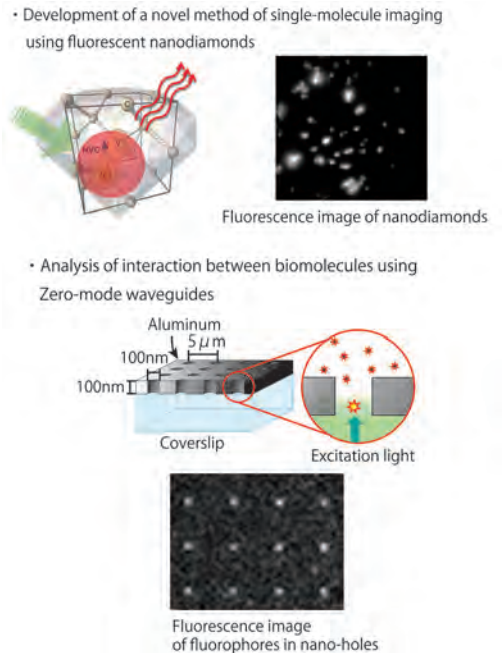
http://www.rbc.kyoto-u.ac.jp/radiation_system/m-index.htm

Laboratory of Nanobiology

■ Professor **HARADA, Yoshie**

■ Main theme

We are developing novel single-molecule imaging techniques to investigate dynamic processes of intracellular substances and DNA-protein interactions related to genome DNA maintenance. To characterize dynamic processes of DNA-protein interactions, we are constructing Zero-mode waveguides. This method enables us to visualize single-molecule fluorescence at high concentration. Using Zero-mode waveguides, we focus on characterizations of proteins involved in homologous recombination or epigenetics such as RuvAB protein complex or nucleosome binding proteins. We are also developing a novel method for the selective imaging using nanodiamonds. Using this novel method, we study dynamic processes of intracellular substances of interest.



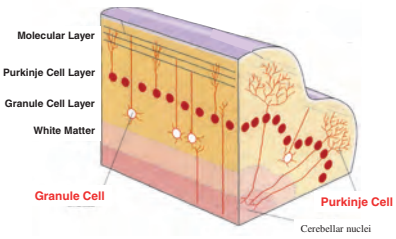
http://www.harada.icems.kyoto-u.ac.jp/en/

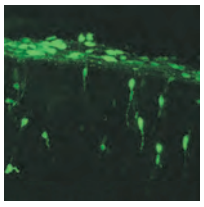
Laboratory of Developmental Neurobiology

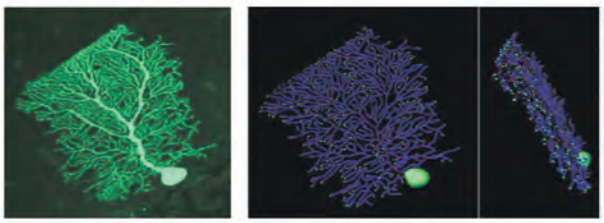
■ Professor **KENGAKU, Mineko**

■ Main theme

Neurons in the mammalian brain are orderly arranged in cortices and nuclei for integration into specific neural circuits. During development, neurons directionally migrate from the birthplace to their destination within the cortex, and then arborize well-patterned dendrites and axons to contact with their specific synaptic counterparts. The major goal of our research is to clarity the mechanisms of cortical lamination and functional wiring of neurons in the brain. We seek to identify the molecular signals regulating neuronal migration and dendrite patterning. We also aim to develop imaging techniques for real-time observation of molecular and cellular dynamics of neuronal migration and dendrite patterning to discover novel phenomena and rules in neuronal motility in the developing brain.







http://www.kengaku.icems.kyoto-u.ac.jp/

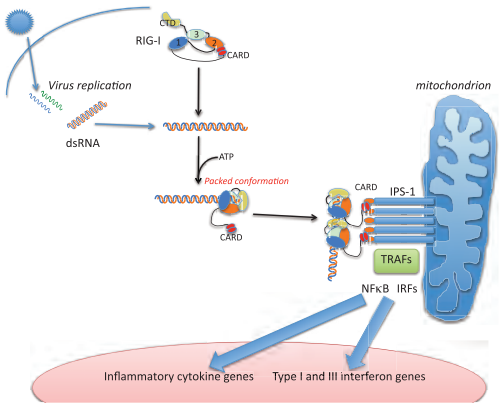
Laboratory of Molecular Cellular Immunology

■ Professor **FUJITA, Takashi**

■ Associate Professor **KATO, Hiroki**

■ Main theme

Virus infections, such as influenza A epidemic and Chronic Hepatitis C virus infection are still important diseases and outbreaks of newly emerging viruses are serious problems for modern society. Higher animals, including humans, are genetically equipped with mechanisms, collectively known as innate immunity, to counteract viral infections. During the course of replication, many viruses generate double-stranded (ds) RNA, which is virtually absent in normal cells and likely serves as a "foreign molecule" in cells. An RNA helicase, RIG-I, functions as a sensor for viral dsRNA. RIG-I is composed of three domains : a Caspase recruitment domain (CARD), a DExD/H helicase domain, and a C-terminal domain (CTD) (Figure). CTD senses viral dsRNA produced in the cytoplasm, leading to a conformational change. This conformational change releases CARD, which signals to downstream, resulting in the activation of genes including those for type I interferon and other cytokines. The purpose of our project is to clarify the molecular mechanism underlying the antiviral innate immunity regulated by RIG-I, and to develop new diagnostic and therapeutic means for viral infections.



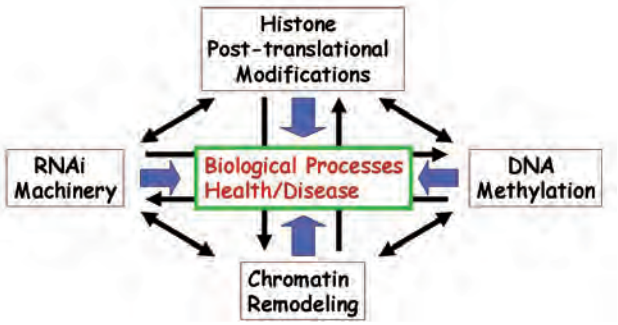
http://www.virus.kyoto-u.ac.jp/Lab/bunshiiden2012/English/index.html

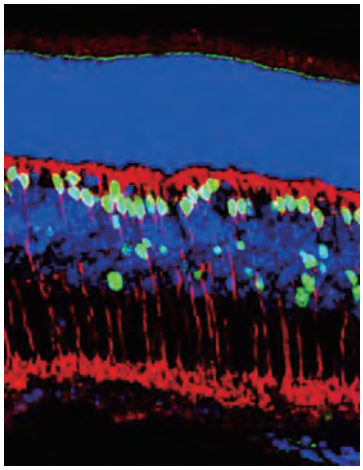
Laboratory of Mammalian Molecular Biology

■ Associate Professor **TACHIBANA, Makoto**

■ Main theme

Our principal objective is to understand the molecular mechanism of epigenetic gene regulation and roles of epigenetics in health and disease. We also study how germ-lineage cell development in mammals is regulated. To address above questions, we transgenic and gene-targeting technology.





http://www.virus.kyoto-u.ac.jp/Lab/mousemodel.htm

DIVISION OF SYSTEMIC LIFE SCIENCE

This division consists of 13 laboratories including 5 cooperative laboratories from Institute for Virus Research, Graduate School of Medicine, Osaka Bioscience Institute, and RIKEN Center for Development Biology. Thirty-eight graduate students are accepted in the Master's Program annually, and 16 in the Doctoral Program. In this division, education and research are focused on the elucidation of the fundamentals of molecular and systemic biology, cell biology and immunology. Experimental approaches are taken with viruses, microorganisms, cultured cells and animals. We pursue education and research to elucidate the molecular aspects of Systemic Life Science.

Division of Systemic Life Science

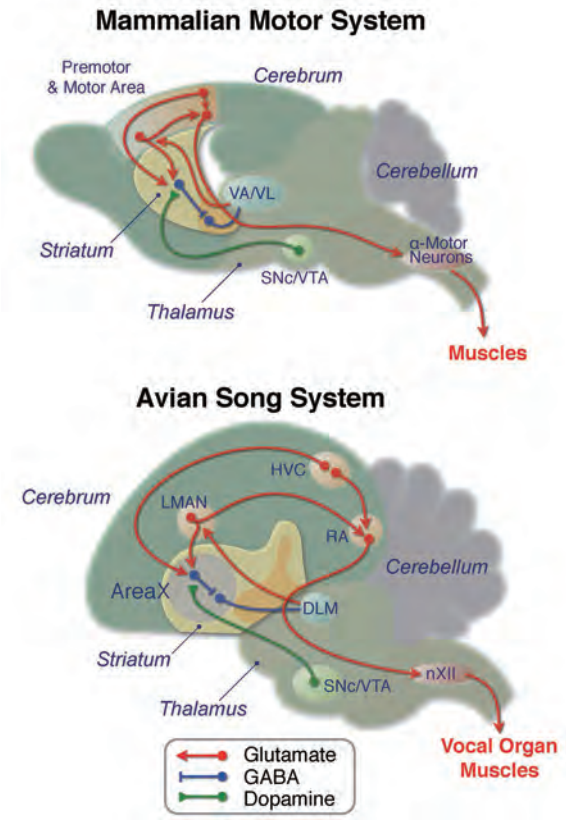
Department of Molecular and System Biology

Laboratory of Neuroscience

■ Professor **WATANABE, Dai**
■ Assistant Professor **ABE, Kentaro**
■ Assistant Professor **MATSUI, Ryosuke**

■ Main theme

Research in this laboratory deals with molecular mechanisms underlying brain function and dysfunction. The main theme of research is the study of synaptic mechanisms responsible for memory and learning, motor movement and sensory perception. The regulation and function of neurotransmitter receptors and ion channels in synaptic transmission and integration are extensively studied.



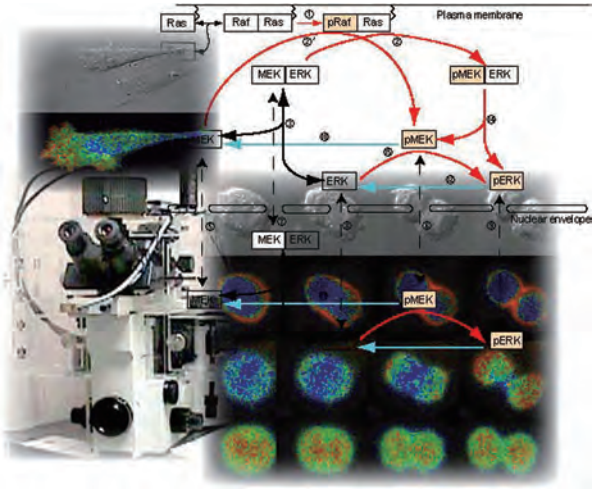
http://www.phy.med.kyoto-u.ac.jp/

Laboratory of Bioimaging and Cell Signaling

■ Professor **MATSUDA, Michiyuki**
■ Assistant Professor **IMAJO, Masamichi**

■ Main theme

We are visualizing the growth signal transduction cascades in living cells by using biosensors based on the principle of Foerster resonance energy transfer (FRET). These FRET videos are processed to extract parameters that characterize the property of each signaling molecule. We use these parameters obtained in living cells to build kinetic simulation models of growth signal transduction cascades.We are also developing transgenic mice expressing FRET biosensors to observe the signaling status in living mice with two-photon excitation microscopes.



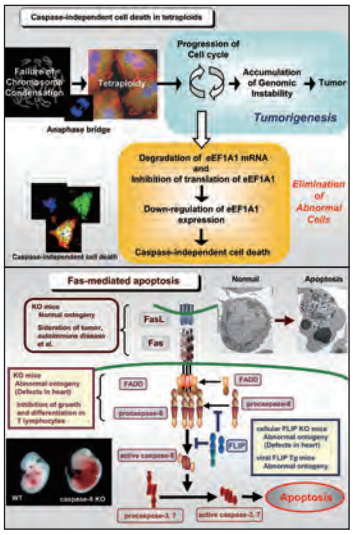
http://www.lif.kyoto-u.ac.jp/labs/fret/e-phogemon/

Laboratory of Molecular and Cellular Biology

■ Professor **YONEHARA, Shin**
■ Associate Professor **SAKAMAKI, Kazuhiro**
■ Assistant Professor **LEE, Kyung-Kwon**

■ Main theme

Apoptosis, or programmed cell death, plays an important role in many biological processes, including embryogenesis, development of immune system, maintenance of tissue homeostasis, and elimination of virus-infected and tumor cells. We found cell surface Fas antigen (Fas), which can directly mediate apoptosis-inducing signals into cells by stimulation with agonistic anti-Fas mAbs or Fas ligand (Yonehara S, et al., 1989; Itoh N, et al., 1991). Our main research project is to understand the intracellular signal transduction mechanism of cell death including apoptosis and caspase-independent novel types of cell death, and the biological significance/physiological role of cell death and cell death-regulating molecules. In conjunction with these studies, we have been trying to identify other cell death-related molecules that play a key role in embryogenesis, tumorigenesis or immune system. Investigations of molecular mechanisms and physiological roles of cell death and its related molecules are important for a better understanding of mammalian embryogenesis, tumorigenesis and immune system.



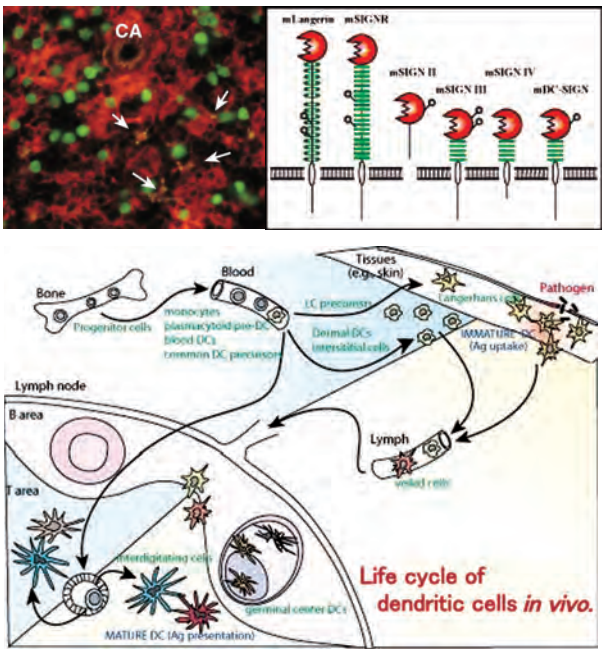
http://www.lif.kyoto-u.ac.jp/labs/Fas/

Laboratory of Immunobiology

■ Professor **INABA, Kayo**
■ Lecturer **TAKAHARA, Kazuhiko**
■ Assistant Professor **IYODA, Tomonori**

■ Main theme

Our interest is the induction and control of immunity and tolerance. We focus on dendritic cells (DCs), which are a primary antigen-presenting cell in the immune system. Studies have been conducted at three levels: antigen uptake and presentation, surface molecules and cytokines that mediate cell-cell interactions, and pathways for function in vivo. Our current major topics include the development of DCs from precursor cells, control of differentiation and maturation of DCs, antigen handling mechanisms, migratory characteristics from blood stream through peripheral tissues to T area of lymphoid organs, and activation of antigen-specific CD4 and CD8 T cells. DCs have been applied clinically in immunotherapy as nature's adjuvant to induce and amplify immune responses. For better vaccine design, control of DC function using molecular techniques to introduce functional genes and molecules are also conducted.



http://zoo.zool.kyoto-u.ac.jp/imm/

Division of Systemic Life Science

Laboratory of Molecular Cell Biology and Development

(Matsuzaki Laboratory)

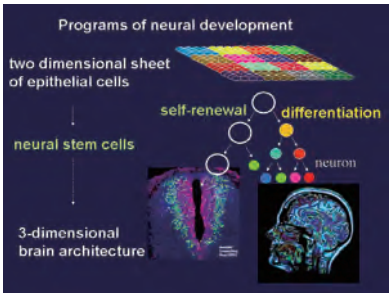
■ Visiting Professor **MATSUZAKI, Fumio**

■ Main theme

We seek to explore the molecular mechanisms underlying the organization of cells into highly ordered structures in the developing brain. The vertebrate brain comprises a considerably larger number of neurons arranged in a vastly complex functional network, which develops from a single layer of epithelial cells that function as neural stem cells. Those cells initially proliferate to expand the stem cell population. Subsequently neural stem cells undergo asymmetric cell divisions to generate self-renewing and differentiating daughter cells. Thus the transition from the proliferative phase to the neurogenic phase is critical for the determination of the brain size. Asymmetric cell division also appears to play an essential role in the neuronal production. However, little is known about mechanisms controlling those critical events in the brain development.

We use both an invertebrate (Drosophila) and vertebrate (mouse) model systems to understand principles for the brain organization such as:

1. How the timing of the proliferative to neurogenic transition is determined in the brain development.
2. How neural stem cells simultaneously generate self-renewing and differentiating cells.
3. How cell polarity contributes to control asymmetric cell division of neural stem cells.
4. How diverse neuronal types are generated from a single neural stem cell over time.
5. How the global brain architecture is dictated by the structure and activity of neural stem cells



http://www.cdb.riken.jp/en/02_research/0201_core07.html

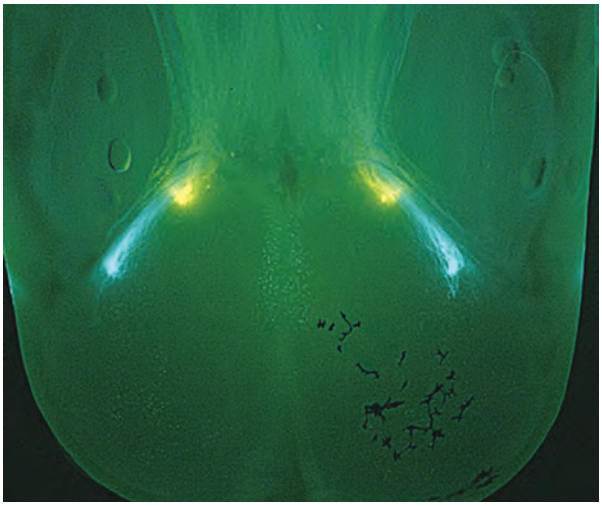
(Imai Laboratory)

■ Visiting Associate Professor **IMAI, Takeshi**

■ Main theme

Neural circuit formation in vertebrates depends on peripheral inputs to a certain extent. We are studying how the neural circuits are constructed from periphery to the central nervous system in a hierarchical manner. We focus on the mouse olfactory system as a model system. We are particularly interested in how the odorant receptor control axonal projection of olfactory sensory neurons and how the peripheral inputs instruct specific neuronal circuits in the olfactory bulb. We are also trying the single-cell transcriptome analyses, in vivo imaging, and novel genetic tools to approach these issues.

Axonal projection of olfactory sensory neurons to the olfactory bulb.



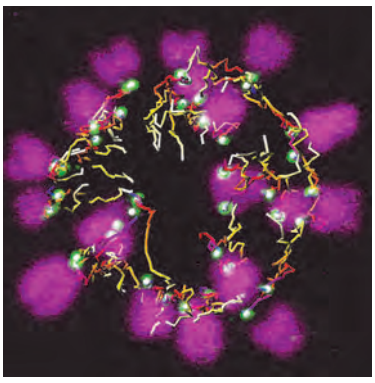
http://imai.uijin.com/english.html

(Kitajima Laboratory)

■ Visiting Associate Professor **KITAJIMA, Tomoya**

■ Main theme

In order to maintain genetic information across generations, cells must segregate chromosomes equally to daughter cells during mitosis. Meiotic divisions of the mammalian oocyte, however, are known to exhibit a higher frequency of errors in chromosomal segregation than in other cell types. Moreover, oocyte chromosomes behave in ways distinct from those in other cells, and these unique dynamics may provide insights into novel mechanisms for chromosome segregation. Taking advantage of our established live imaging technologies, we seek to conduct detailed and comprehensive analyses of the chromosome dynamics and the molecular machinery that underlies chromosome segregation during mammalian oocyte meiosis. We also seek to identify the causes behind age-related increases in chromosome segregation errors during oocyte meiosis.



Prometaphase belt of chromosomes

http://www.cdb.riken.jp/en/02_research/0202_creative28.html

(Kuranaga Laboratory)

■ Visiting Associate Professor **KURANAGA, Erina**

■ Main theme

The development of multicellular organisms involves the collective effect of multiple events at the level of the individual cell, such as proliferation, differentiation, adhesion, and migration. Programmed cell death, for example, is a process by which cells are selected for death at set times in development, allowing for the sculpting of tissue, and is used in the adult organism to maintain homeostasis by eliminating cells that have developed abnormalities. Perturbations in cell death signaling can thus affect an organism's physiological stability, and result in developmental defects, tumorigenesis, or neurodegenerative disease. Cell death plays an important role in maintaining the cellular society not only by eliminating unneeded cells at given sites and stages, but in other functions, such as regulating the proliferation and migration of neighboring cells, as well. Such cellular behaviors give rise to cell networks capable of organizing into tissues, the study of which requires a experimental approach to spatiotemporal information in living systems, such as can be obtained through the real-time live imaging of biological phenomena.

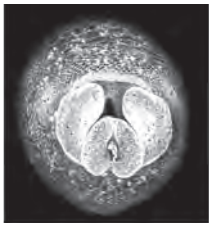
We have chosen the fruit fly Drosophila melanogaster as our primary research model, seeking to take advantage of its utility in developmental studies and wealth of genetic data in studying the coordination of morphogenesis through live-imaging and genetic screens. We especially focus on the morphogenetic processes that involve cellular migration and cell death, such as the looping morphogenesis of fly male terminalia and the abdominal epidermis rearrangement, to understand the principles for the morphogenetic dynamics as follows,

1) The physiological roles and regulating mechanisms of cell death during development

2) Non-autonomous mechanisms to induce cell death during regeneration

3) Mechanics and molecular mechanisms for unidirectional motion of collective cellular movement

Figure: Caudal view of developing fly male terminalia expressing DE-Cadherin:GFP



http://www.cdb.riken.jp/en/02_research/0202_creative27.html

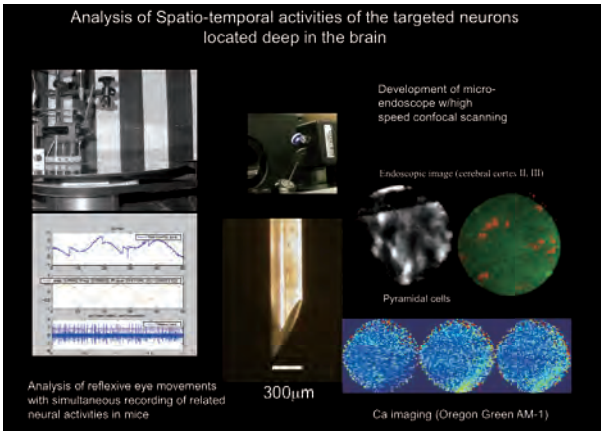
Division of Systemic Life Science

(Funabiki Laboratory)

■ Visiting Associate Professor **FUNABIKI, Kazuo**

■ Main theme

We analyze neural circuits related to the reflexive eye movements in mice. Reflexive eye movements are good models to study neural mechanisms for motor control and learning, because the inputs (vestibular, visual stimuli) are precisely controlled and the outputs (eye movements) are quantitatively measured. In the neural circuits related to reflexive eye movements, we focus on the cerebellar flocculus and the vestibular nucleus. We record Purkinje cell response of the cerebellar flocculus in alert mice with simultaneous recording of eye movements. Recently we developed a fluorescence micro-endoscope which can observe spatio-temporal pattern of neural activities in vivo. We apply this endoscope for the analysis of cerebellar granular layers in alert mice to elucidate neural mechanisms for motor control and learning.



http://www.obi.or.jp/japanese/introduction/set_systemsbiology.html

Laboratory of Molecular Neurobiology

■ Professor **NEGISHI, Manabu**
■ Associate Professor **KATOH, Hironori**
■ Assistant Professor **OINUMA, Izumi**

■ Main theme

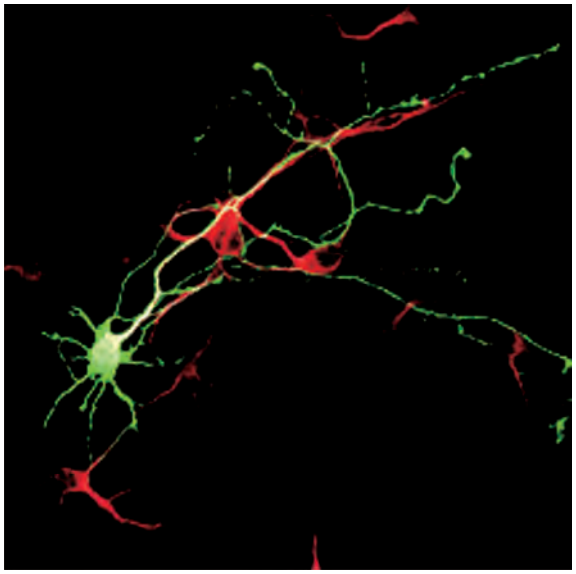
Outline of Teaching Activities

The laboratory provides seminars which review and discuss recent progress in molecular mechanisms of neuronal functions

Outline of Research Activities

The main themes of research in this laboratory are the molecular mechanisms underlying neuronal network formation and neuronal signal transductions.

1. Neuronal functions and signal transductions of GTP-binding proteins
2. Molecular mechanisms for axon guidance
3. Regulatory systems of synaptic transmission
4. Signal transduction of neuronal polarity formation



http://www.lif.kyoto-u.ac.jp/labs/negishi/j/toppu.html

Laboratory of Genetics

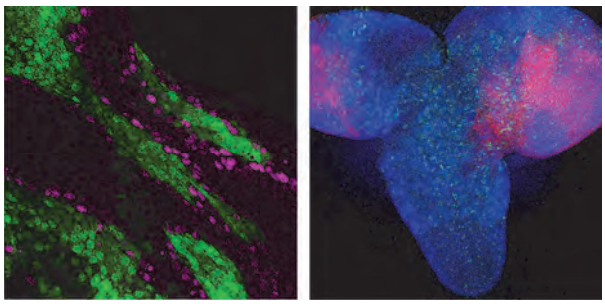
■ Professor **IGAKI, Tatsushi**
■ Assistant Professor **NAITO, Yuko**

■ Main theme

Our research focuses on the molecular basis of cell-cell communication that governs tissue growth, homeostasis, and cancer. We take advantage of the powerful genetics of Drosophila.

■ Research subjects:

1. Mechanism of cell competition
2. Genetic basis of tissue growth regulation
3. Molecular basis of tumor progression and metastasis



Left:Polarity-deficient cells (green; losers) are eliminated from epithelium by wild-type cells (magenta; winners) through cell competition.
Right:Malignant tumor cells (magenta) are invading and metastasizing from the eye disc to the brain (blue) in Drosophila larva.

http://www.lif.kyoto-u.ac.jp/labs/genetics/

Division of Systemic Life Science

Department of Functional Biology

Laboratory of Functional Biology

■ Professor **KAKIZUKA, Akira**
■ Lecturer **HORI, Seiji**
■ Assistant Professor **OHIZUMI, Hiroshi**

■ Main theme

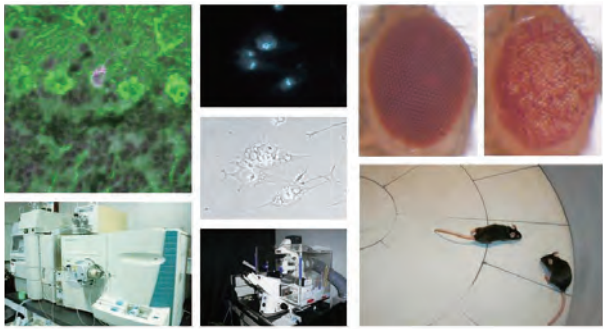
The major experimental themes being analyzed in our laboratory are the following: (1) The molecular and biochemical basis of cell death

The aim of this research is to understand the molecular mechanisms underlying carcinogenesis and neurodegeneration and to develop new strategies for the treatment of cancers and neurodegenerative disorders.

(2) The molecular basis of gene expression networks determining energy expenditure and obesity

One of the main features of life science research in the coming years will be that the results obtained from fundamental research should ideally be directly connected to thegood of society. From this standpoint, in addition to handling topics with high scientific significance, we aim to contribute to the development of treatments for neurodegenerative diseases and cancers from our research results.

We hold the same view on scientific education, and through training individuals to communicate their ideas logically yet effectively, as well as by nurturing their creativity, in addition to strengthening their practical research skills, we aim to cultivate opinion leaders standing at the core of life science research in the 21st century.



http://www.lif.kyoto-u.ac.jp/labs/funcbiol/

Department of Biostudies and Society

Laboratory of Science Communication and Bioethics

■ Main theme

In our laboratory, we aim to identify essential issues in the interface between biostudies and the society, and to propose possible actions or solutions.

Currently, we are focusing on the following three areas.

1.Theoretical and practical analysis of science communication.

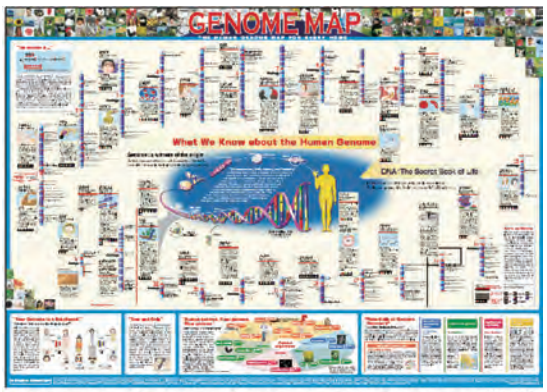
In addition to organizing practical activities such as "Genome Square", a public event (http://hiroba.genome.ad.jp/ in Japanese language only), we analyze the effects and significance of science communication. This includes the communication between scientists and the general public, and that among scientists and scientific communities.

2. Analysis of bioethical issues in biostudies.

We study ethical, legal and social implications of biostudies such as human genome research and human stem cell research.

3. Analysis of modern history of biostudies.

We analyze the development and changes of biostudies in the last 20 to 30 years through literature surveys and interviews with scientists.



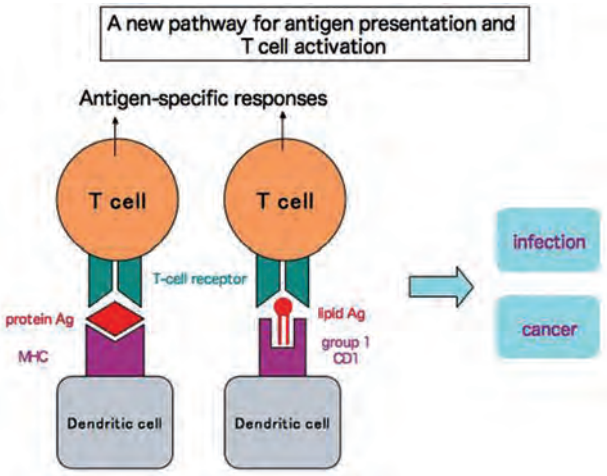
The genome science poster: A human genome map for every home. (downloadable from: http://stw.mext.go.jp/20081025/) We produce science communication tools such as this to convey scientific information to non-specialists, and we are also studying ethical, legal and social issues arising from bioscience research.

Laboratory of Cell Regulation and Molecular Network

■ Professor **SUGITA, Masahiko**

■ Main theme

Full attention of the recently set up Sugita's laboratory has been directed to a novel lineage of antigen-presenting molecules, CD1. Unlike conventional MHC molecules that present protein-derived peptide antigens, molecules of the human group 1 CD1 family (CD1a, CD1b, CD1c) mediate presentation of lipid antigens to specific T lymphocytes. By taking cell biological and immunological approaches, this group wishes to establish a molecular and cellular basis for CD1-dependent immunity and determine how CD1 has been evolved to function critically in host defense. An important extension of this study is a challenge for developing a new type of lipid-based vaccines against cancer and microbial infection.



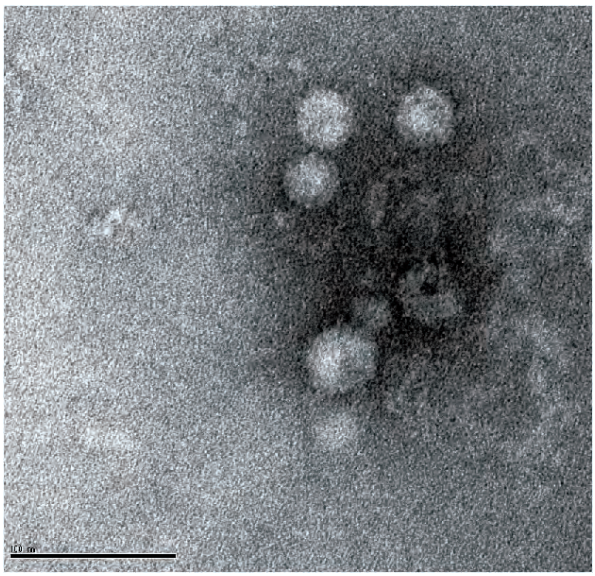
http://www.virus.kyoto-u.ac.jp/Lab/SugitaLab.html

Laboratory of Viral Oncology

■ Professor **TOMONAGA, Keizo**
■ Associate Professor **HIJIKATA, Makoto**
■ Assistant Professor **HONDA, Tomoyuki**

■ Main theme

The researches carried out in our laboratory are focused on several RNA viruses, including bornavirus, influenza virus and hepatitis C virus. All our projects aim to understand the fundamental mechanisms of the replication and pathogenesis of these viruses. We are investigating the replication and persistent mechanism of the bornavirus in the cell nucleus. The understanding the biological significance of the endogenous element of bornaviruses in mammalian genomes is one of the main focuses of bornavirus researches. We also aim to develop a novel RNA virus vector using bornavirus, which can express stably functional small RNAs. In Influenza virus researches we examine the response of host cells to the virus infection. The understanding of the molecular mechanism of tumorgenesis caused by hepatitis C virus infection is also the main purpose of our laboratory.



http://www.virus.kyoto-u.ac.jp/virus/ganvirus.html

Division of Systemic Life Science

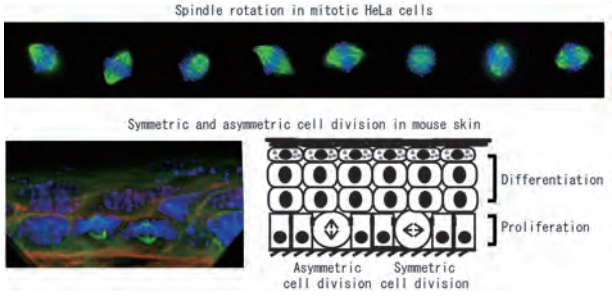
Laboratory of Cell Division and Differentiation

■ Professor **TOYOSHIMA, Fumiko**
■ Assistant Professor **MATSUMURA, Shigeru**
■ Assistant Professor **MAEKAWA, Momoko**

■ Main theme

Oriented cell division, which is determined by the axis of a mitotic spindle, plays an essential role in morphogenesis, asymmetric cell division and stem cell self-renewal. There is increasing evidence for the implication of spindle misorientation in mammalian diseases, including tumorigenesis and polycystic kidneys. Our group seeks to explore the molecular mechanisms underlying the determination of cell division axis in both culture cells and in developing mouse embryo. Our research is focused on the following subjects:

1, Oriented cell division in culture cells and in mouse skin.
2, Cell division and differentiation of ES cells.
3, A role of lipid metabolites in the control of cell division.
4, Control mechanisms for the membrane traffic during mitosis.



http://www.virus.kyoto-u.ac.jp/Lab/toyoshima.html

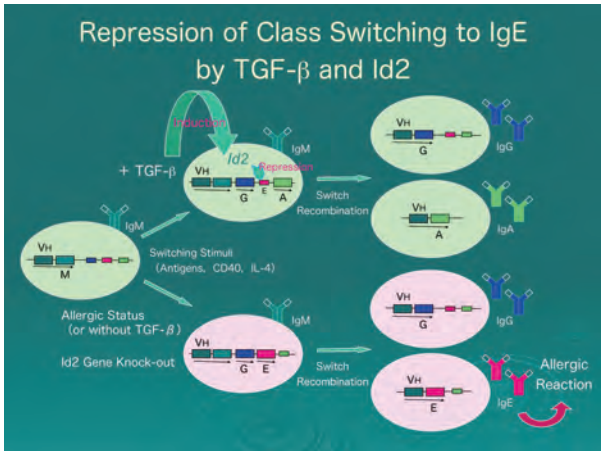
Laboratory of Genetic Information

■ Professor **SHIMIZU, Akira**

■ Main theme

Major goal of research in this laboratory is to understand molecular and cellular mechanisms underlying highly systemic functions of living things, such as immune and neural systems. For this purpose, structure and regulation of genetic information responsible for such systemic functions are being analyzed using model animals, for example, transgenic or gene disrupted mice. Our research is focused on the following subjects:

1. Analysis of molecular mechanisms and regulation of chromatin modification, gene expression, gene rearrangements and RNA processing during lymphocyte differentiation.
2. Making and characterization of model mice of immunodeficiency or autoimmune by introduction of, or targeted disruption of interleukin, immunoglobulin or other genes.
3. Analysis of molecular and cellular mechanism for lymphocyte mobility and formation of immuno-microenvironment during development and immune reaction.



Organization (2013)

DIVISION OF INTEGRATED LIFE SCIENCE

Department	Laboratory	Professor	Associate Professor	Lecturer	Assistant Professor
Gene Mechanisms	Chromosome Transmission		NAKASEKO, Yukinobu		
	Gene Biodynamics	INOUE, Tan	SHIRAISHI, Hideaki		FUJITA, Yoshihiko
	Cell Cycle Regulation	ISHIKAWA, Fuyuki			TARUMOTO, Yusuke
Cell and Developmental Biology	Cell Recognition and Pattern Formation	UEMURA, Tadashi	CHISAKA, Osamu		USUI, Tadao HATTORI, Yukako
	Signal Transduction	NISHIDA, Eisuke			MIYATA, Yoshihiko KUSAKABE, Morioh
Plant Gene and Totipotency	Plant Molecular Biology	KOHCHI, Takayuki		NISHIHAMA, Ryuichi	
	Molecular and Cellular Biology of Totipotency	SATO, Fumihiko			ENDO, Tsuyoshi IFUKU, Kentaro
Applied Molecular Biology	Biosignals and Response	NAGAO, Masaya	KAMBE, Taiho		MIYAMAE, Yusaku
	Applied Molecular Microbiology	FUKUZAWA, Hideya			YAMANO, Takashi KAJIKAWA, Masataka
	Molecular Biology of Bioresponse		MASUDA, Seiji		
Responses to Environmental Signals and Stresses	Plant Developmental Biology	ARAKI, Takashi			ENDO, Motomu YAMAGUCHI, Ayako
	Plasma Membrane and Nuclear Signaling	TAKEYASU, Kunio	YOSHIMURA, Shigehiro		KUMETA, Masahiro
Molecular and Developmental Biology *	Genome Maintenance[1]	MATSUMOTO, Tomohiro			HABU, Toshiyuki
	Nanobiology[2]	HARADA, Yoshie			
	Developmental Neurobiology[2]	KENGAKU, Mineko			
Molecular and Cellular Biology *	Molecular and Cellular Immunology[3]	FUJITA, Takashi	KATO, Hiroki		
	Mammalian Molecular Biology[3]		TACHIBANA, Makoto		

*Cooperation Course 1) Radiation Biology Center, 2) Institute for Integrated Cell-Material Sciences (iCeMS), 3) Institute for Virus Research

DIVISION OF SYSTEMIC LIFE SCIENCE

Department	Laboratory	Professor	Associate Professo	Lecturer	Assistant Professor
Molecular and System Biology	Neuroscience	WATANABE, Dai			ABE, Kentaro MATSUI, Ryosuke
	Bioimaging and Cell Signaling	MATSUDA, Michiyuki			IMAJO, Masamichi
Animal Development and Physiology	Molecular and Cellular Biology	YONEHARA, Shin	SAKAMAKI, Kazuhiro		LEE, Kyung-Kwon
	Immunobiology	INABA, Kayo		TAKAHARA, Kazuhiko	IYODA, Tomonori
	Molecular Cell Biology and Development **	MATSUZAKI, Fumio[6]	IMAI, Takeshi[6] KITAJIMA, Tomoya[6] KURANAGA, Erina[6] FUNABIKI, Kazuo[7]		
Signal Transductions	Molecular Neurobiology	NEGISHI, Manabu	KATO, Hironori		OINUMA, Izumi
	Genetics	IGAKI, Tatsushi			NAITO, Yuko
Functional Biology	Functional Biology	KAKIZUKA, Akira		HORI, Seiji	OHIZUMI, Hiroshi
Biostudies and Society	Science Communication and Bioethics	INABA, Kayo			
Mammalian Regulatory Network *	Cell Regulation and Molecular Network[4]	SUGITA, Masahiko			
	Viral Oncology[4]	TOMONAGA, Keizo	HIJIKATA, Makoto		HONDA, Tomoyuki
	Cell Division and Differentiation[4]	TOYOSHIMA, Fumiko			MATSUMURA, Shigeru MAEKAWA, Momoko
	Genetic Information[5]	SHIMIZU, Akira			

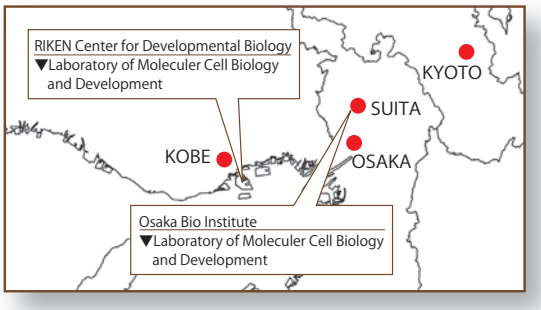
*Cooperation Course 4) Institute for Virus Research, 5) Graduate School of Medicine
**Collaboration Course 6) RIKEN Center for Development Biology, 7) Osaka Bioscience Institute

Global Frontier in Life Science

	Program-Specific Professor	
	HEJNA, James Alan	

Map & Access

Getting to Kyoto University
URL: http://www.kyoto-u.ac.jp/en/access/getting/getting_1.htm



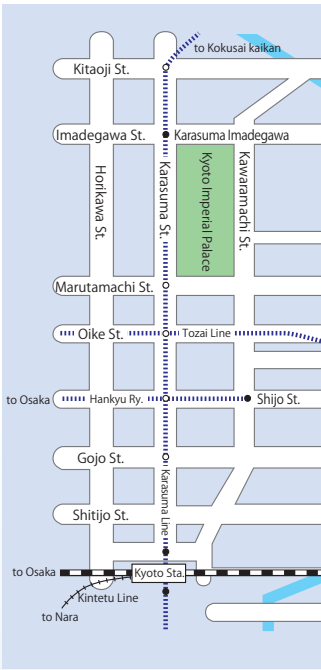
Faculty of Medicine Bldg.F
Laboratory of Bioimaging and Cell Signaling

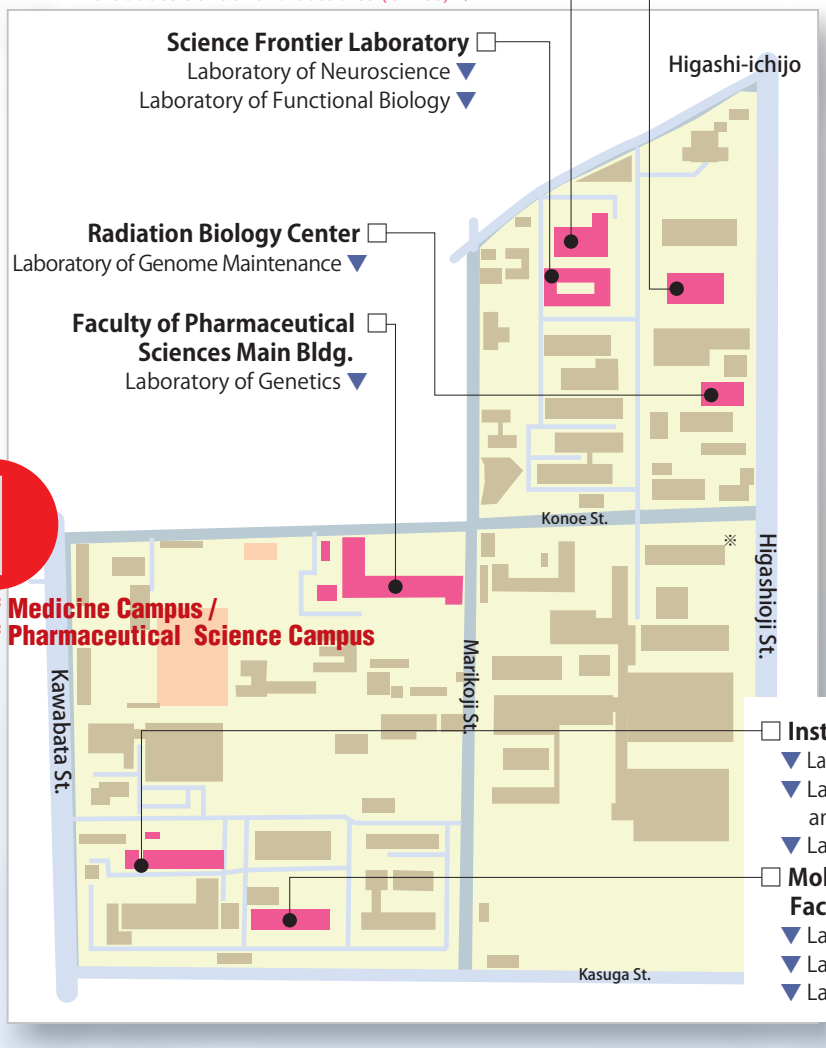
South Campus Research Building for Integrated Life Sciences / Building G
Laboratory of Chromosome Transmission
Laboratory of Cell Cycle Regulation
Laboratory of Cell Recognition and Pattern Formation
Laboratory of Plasma Membrane and Nuclear Signaling
Laboratory of Molecular and Cellular Biology
Laboratory of Immunobiology
Laboratory of Molecular Neurobiology
Graduate School of Biostudies (Office)

Science Frontier Laboratory
Laboratory of Neuroscience
Laboratory of Functional Biology

Radiation Biology Center
Laboratory of Genome Maintenance

Faculty of Pharmaceutical Sciences Main Bldg.
Laboratory of Genetics





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Faculty of Medicine Campus / Faculty of Pharmaceutical Science Campus

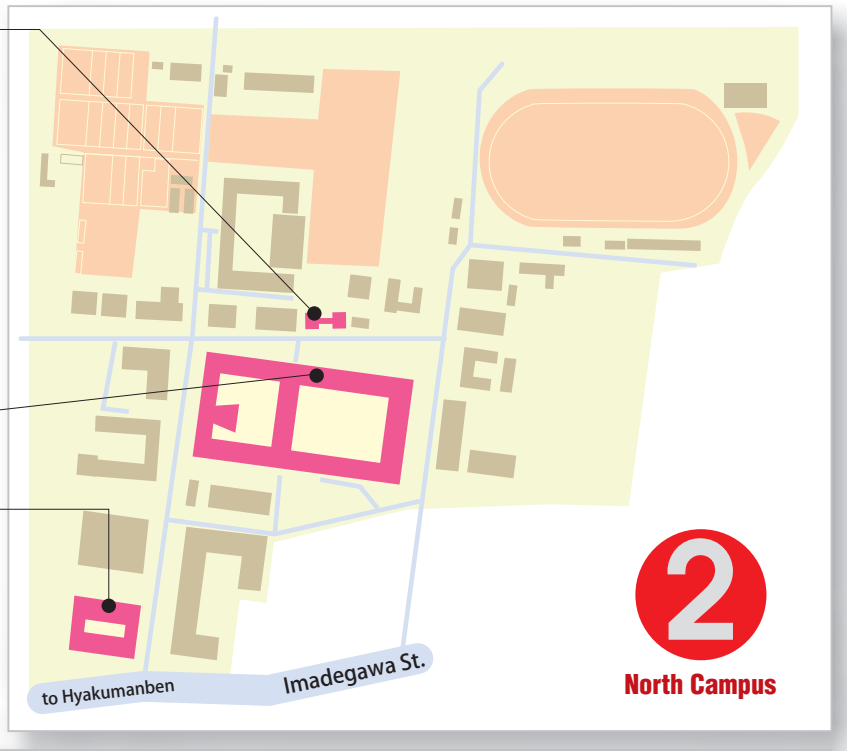
Institute for Virus Research Main Bldg.
Laboratory of Molecular and Cellular Immunology
Laboratory of Cell Regulation and Molecular Network
Laboratory of Cell Division and Differentiation

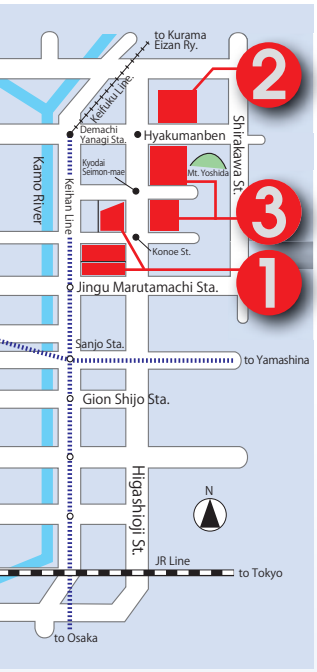
Molecular Biology Research Bldg.
Faculty of Medicine Center for Genomic Med
Laboratory of Mammalian Molecular Biology
Laboratory of Viral Oncology
Laboratory of Genetic Information

North Campus Research Building for Integrated Life Sciences
- Laboratory of Gene Biodynamics
- Laboratory of Plant Molecular Biology
- Laboratory of Biosignals and Response
- Laboratory of Applied Molecular Microbiology
- Laboratory of Molecular Biology of Bioresponse
- Laboratory of Plant Developmental Biology
- Laboratory of Science Communication and Bioethics

Faculty of Agriculture (Main Bldg.)
- Laboratory of Molecular and Cellular Biology of Totipotency

Faculty of Science (Bldg. No.2)
- Laboratory of Signal Transduction





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Contact

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URL http://www.lif.kyoto-u.ac.jp/Global_frontier_in_life_science/index.html

Other inquiries

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URL http://www.lif.kyoto-u.ac.jp/e/

BIOSTUDIES