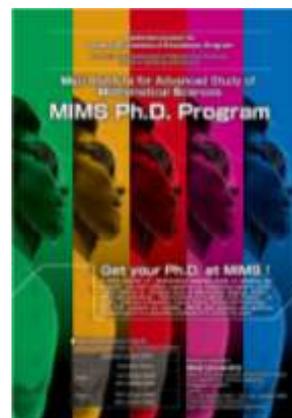


## 4. Activities in FY 2008

### 1) Overview

Please see the record of our activities in FY 2008 as follows:

Activities of our project base Meiji University include: the development of infrastructure for successfully implementing our plan (the renovation of Annex 3 of Bldg. 2 at the Ikuta campus, Meiji University); the recruitment of students for the MIMS Ph.D. program (positions offered: 5; actual enrollments: 6); the employment of young researchers (2 GCOE PDs, January–March 2009; 1 SPD and 3 PDs, April– 2009); the acceptance of applications for the Mathematical Modeling and Analysis Project for Young Researchers (places offered: 2; actual adoption: 1), and the allocation of research funding for GCOE PDs (0.5 million yen  $\times$  2). Additional activities are: the coordination and implementation of the “Project-based Analysis and Research Cluster” course (4 subjects) of the Inter-departmental Curriculum for the Doctoral course; the development of computer equipment for graduate schools; the establishment of the website as a central PR function; the issuance of pamphlets; the issuance of technical reports; the holding of colloquiums and kick-off forums; the signing of university-wide agreements with two domestic institutions (Hiroshima University and Ryukoku University); the signing of memorandums with three overseas institutions (Istituto per le Applicazioni del Calcolo “Mauro Picone,” Institute of Mathematical Modeling and Scientific Computing, National Chiao Tung University; and Instituto de Matemática Interdisciplinar, Universidad Complutense de Madrid). Thus, we have completed the infrastructure for full-scale COE initiatives from FY 2009 onward while steadily advancing our education and research activities.



Moreover, to promote graduate education attractive to talented students inside and outside Japan for the Doctoral course (students participating in the MIMS Ph.D. program) and to ensure the environment in which they can concentrate on their research, we have introduced a tuition waiver program (scholarship system) and the Global COE program student researcher system.

On the occasion of various workshops and colloquiums, we have invited leading domestic and overseas researchers in the Mathematical Modeling and Analysis field to inform graduate students and young researchers of the latest research trends. Equipment infrastructure was also developed, including the TV conference system for use in meetings with partner universities such as Hiroshima University, and a variety of electronic devices (cluster simulators, PCs, graphic servers, etc.) necessary for the advancement of Mathematical Sciences Based on Modeling and Analysis.

One of our future challenges is the establishment of the Graduate School of Advanced Mathematical Sciences (tentative name), a source of young researchers (students in the Doctoral course) who can serve as a bridge between phenomena and mathematical sciences. We are working to establish it in 2011.

The Department of Mathematical and Life Sciences, Graduate School of Science, Hiroshima University has started COE activities for the “Formation and Development of Mathematical Sciences Based on Modeling and Analysis” centered around its mission as the program’s sub-base: understanding and depicting life phenomena. To that end, each program promoter has started working to enhance and deepen previous research and education efforts, and to newly develop the environment and system for research and education. Measures taken to build the sub-base’s environment and system in FY 2008 are as follows:

We have recruited two PDs for Mathematical Modeling and Analysis related to nonlinear non-equilibrium sciences as a core for not only promoting this Global COE Program but also combining mathematical sciences and life sciences at the Department of Mathematical and Life Sciences as a whole. The recruitment took place in the late fiscal year, and specific research results have yet to be published. In cooperation with program members and other staff, however, these PDs have embarked on the experimental research on the collective motion of euglenas and the relationship between neurotransmission and noises, as well as the building of mathematical scientific models for ameboid movement of phagocytic cells.

We have secured laboratory space in the Graduate School of Science, Hiroshima University, and set up the equipment for the above-mentioned experiments. This space is next to the room secured to promote the MEXT’s Support Program for Improving Graduate School Education “Formation of Consortium for Education Integrating Mathematics and Life Sciences,” which was launched in FY 2007 in collaboration with Meiji University. So an environment is in place where students, PDs and other staff from both programs can hold discussions, conduct and observe experiments, and make trials and errors in Mathematical Modeling and Analysis.

## 2) Results of activities

### (1) Infrastructure development

In FY 2008, infrastructure development was centered at this Center, which is Meiji University’s first Global COE Program base.

First, the renovation of Annex 3 of Bldg. 2 at the Ikuta campus, Meiji University (the “Center”) (605.2 m<sup>2</sup>) was done using the university’s budget to secure the project leader’s room, visiting researchers’ rooms, common laboratories used by graduate



students and post-doctors , and meeting rooms for program members.

Second, the Office of the Global COE Program was newly established under the Teaching and Study Planning Division to provide administrative support for this Global COE Program (full-time staff: 5; temporary staff: 3).

Third, the Promoting Committee for the Meiji University Global COE Program was established under the President to help promote and manage the Global COE Program, and was held four times during the half-year period. This committee is joined by Professor Ryo KOBAYASHI at Hiroshima University, a sub-leader of the Program. The MIMS Ph.D. Program Entrance Exam Committee was established to conduct the entrance examination of the MIMS Ph.D. program rigorously and smoothly. Meiji University and Hiroshima University strengthened their partnership by exchanging opinions on research meetings and progress, policy for developing young researchers, and COE formation, such as by making effective use of the TV conference system.

These quick actions helped complete the infrastructure for full-scale COE initiatives from FY 2009 onward by creating an environment where the entrance examination of the MIMS Ph.D. program and various Global COE Program-related projects (to be mentioned later) can be implemented, and the MIMS Ph.D. program's students, young researchers, Global COE Program's members and visiting researchers can get together. In addition, a set of devices, including cluster simulators, was introduced to allow for simulation, which is critical in Mathematical Modeling and Analysis. Even available to external users, these devices can also be utilized for joint research activities with partner institutions that will be detailed later.



Furthermore, the open “lounge” was created in the Center so that graduate students and young researchers (including post-doctors) can meet and come up with new research themes. In this way, we are working to build an environment in which researchers engaging in different academic fields contribute to the new development of Mathematical Sciences Based on Modeling and Analysis by interacting with each other and encouraging mutual insights.

Elsewhere, Library in the Center was equipped with books and DVDs on Mathematical Modeling and Analysis as well as a large printer that can support young researchers in their presentations.

The purpose of this Global COE Program “Formation and Development of Mathematical Sciences Based on Modeling and Analysis” is to build extraction models for detecting and understanding the essence of phenomena while focusing on elucidating complex systems observed in society, nature and biological phenomena. This Program



comprises experienced educators and researchers with flexible and multifaceted perspectives that enable them to have a wider understanding of phenomena and mathematical sciences. It aims to not only form a base for Mathematical Modeling and Analysis, but also to cultivate and deliver young researchers who have high-level broad mathematical knowledge and mathematical and scientific ability to grasp the essence of complex phenomena. To that end, it is necessary to establish an appropriate research system through the partnership with university bodies whose approach to phenomena is based on mathematical sciences. One of such partner bodies is the Department of Mathematical and Life Sciences, Graduate School of Science, Hiroshima University. To expand our research scope into the department’s specialty field that combines



mathematical sciences and life sciences, and secure a substantive system for teaching students, we have entered into a university-wide agreement on the interaction with Hiroshima University. In addition, we have also concluded a comprehensive agreement with Ryukoku University that employs Japan’s leading researchers in nonlinear analysis, which is indispensable for Mathematical Modeling and Analysis. With credit transfer available to doctoral students of the affiliated universities, these agreements will significantly help develop young researchers in Mathematical Modeling and Analysis that requires the

mastering of multifaceted perspectives. Also, in view of the worldwide rollout, we have established an international network by signing memorandums of understanding on research exchange with three overseas institutes: Istituto per le Applicazioni del Calcolo “Mauro Picone,” Institute of Mathematical Modeling and Scientific Computing, National Chiao Tung University; and Instituto de Matemática Interdisciplinar, Universidad Complutense de Madrid.

## (2) Development of young researchers at the Program

### i) Recruitment of young researchers

The need to make more students aware of Mathematical Modeling and Analysis and to attract talented students for the Doctoral course inside and outside Japan was pointed out at the time of the adoption of the program. In this regard, the following efforts were made.



- Launch an active PR campaign, including the posting on recruitment information sites, announcement on our website, distribution of posters, and advertising on magazines.
- Provide the Project-based Analysis and Research Cluster course of the Inter-departmental Curriculum for the Doctoral course by inviting the MIMS staff/researchers and domestic and overseas lecturers. Comprising four subjects of Advanced Study of Mathematical Sciences I and II and Advanced Mathematical Sciences I and II (in English), this course is designed to incorporate current research results achieved at the MIMS into education, and provides an opportunity to study “the latest Mathematical Modeling and Analysis.”
- Make the Project-based Analysis and Research Cluster course open to young researchers to make more students aware of Mathematical Modeling and Analysis. Provide support for travel expenses using the university’s budget so that students from remote places can participate.
- Provide students for the Doctoral course (students participating in the MIMS Ph.D. Program) with economic assistance by introducing a tuition waiver program (scholarship system) and the Global COE Student Researcher system.
- Offer two types of the entrance examination for the Doctoral course: examination type A for those living in Japan (documentary screening, presentation of a research plan, and interview), and examination type B for those living abroad (documentary screening only).
- Establish the MIMS Ph.D. Program Entrance Exam Committee to conduct the entrance examination smoothly.

These efforts have resulted in an enrollment of six students (one from abroad), which exceed the planned capacity of five. A total of seven students (from Hokkaido University, Kyoto University, Kyushu University, Kwansei Gakuin University, etc.) used the travel expense support system for the Project-based Analysis and Research Cluster course of the Inter-departmental Curriculum for the Doctoral course.

## ii) Program for developing young researchers

We publicly sought distinguished young researchers. Through strict examinations, Meiji University employed two GCOE PDs for January–March 2009 and one SPD and



three PDs for April– 2009, and Hiroshima University employed one researcher in January 2009 and another in February 2009. Within the Center, enough space is provided for young researchers and students. Young researchers can also receive research funds upon request. Thus, we have

created an environment where independent research can be pursued. We have also accepted applications for the Mathematical Modeling and Analysis Project for Young Researchers in support of their spontaneous and aggressive research that can strengthen the link with other academic fields. The following was adopted as a result:

### Research on the mechanism of how the Turing pattern arises on a sphere

Representative: Yuki TANIGUCHI (MIMS researcher)

Young joint researcher: Hitoshi MAHARA (MIMS researcher)

Advisers: Tomohiko YAMAGUCHI

(New Energy and Industrial Technology Development Organization)

Daishin UEYAMA (Meiji University, GCOE program member)

## iii) School for young researchers

The Project-based Analysis and Research Cluster course (four subjects) of the Inter-departmental Curriculum for the Doctoral course was implemented. It was open to the public, and the university's budget was used to support students from other graduate schools in their travel expenses. So the course functioned as a school for Mathematical Modeling and Analysis.

### • Project-based Analysis and Research Cluster courses (MIMS course)

#### 1. Advanced Study of Mathematical Sciences I

“Mathematical Sciences in Arts” (in Japanese):

September 9–11, 2008

#### 2. Advanced Study of Mathematical Sciences II “Emotion and Information” (in Japanese): January 20, 22 and 26, 2009

#### 3. Advanced Mathematical Sciences I “Nonlinear Dynamics and Pattern Formation” (in English): November 25–28, 2008

#### 4. Advanced Mathematical Sciences II “Modeling and Simulation of Complex Systems” (in English): February 17–20, 2009



### (3) Research promotion activities at the Center

In FY 2008, the following activities were carried out to promote research at the Center.

#### i) Japan-France Cooperative Research Project (LIA 197)

The Meiji Institute for Advanced Study of Mathematical Sciences (MIMS), the parent organization of this program, has launched ReaDiLab as a cooperative research project (LIA 197) with the Centre National de la Recherche Scientifique (CNRS). Joined by French institutes (Paris-Sud 11 University, the Institut Polytechnique, and Grenoble's Joseph Fourier University) and Japanese institutes (MIMS and the Graduate School of Mathematical Sciences, the University of Tokyo), ReaDiLab aims to develop a better understanding of complex phenomena based on Mathematical Modeling and Analysis. MIMS is the representative institute of the Japanese side. Coordinated by our GCOE program leader Masayasu MIMURA and Danielle HILHORST (CNRS), ReaDiLab consists of 20 Japanese researchers and 19 French researchers. As part of this project, a seminar titled "Mathematical Understanding of Complex Systems Arising in Biology and Medicine" was held in October 2008 at the Surugadai campus of Meiji University.



#### ii) Study group for "Science of Hierarchical Structures + Mathematical Modeling and Analysis"

A hierarchical structure is universally observed in a wide range of phenomena including nature, engineering, society and economy. Efforts to comprehensively understand rules of various phenomena by grasping the essence of hierarchical structures would provide an important guide as a new scientific perspective. A seminar camp designed for interdisciplinary research on hierarchical structures was jointly hosted by the study group for Science of Hierarchical Structures in the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and the study group for Meiji University's Global COE Program "Formation and Development of Mathematical Sciences Based on Modeling and Analysis."



Dates: November 30 and December 1, 2008

Facilitators : Kanya KUSANO (JAMSTEC, GCOE Program member)

Masayasu MIMURA (GCOE Program leader)

#### iii) Research activity centered the understanding and depiction of life phenomena

At our sub-base (the Department of Mathematical and Life Sciences, Graduate School of Science, Hiroshima University), we derived mathematical sciences-based models from experiments and observations, made an analysis of them, and gained initial results, regarding the movement of individual creatures and the dynamics of gene networks in cells. Other mathematical sciences-based models were also

developed in relation to the movement of dunes, although this nonlinear non-equilibrium phenomenon is not a life phenomenon.

#### **(4) Broad introduction of Mathematical Modeling and Analysis by the project leader (outreach activities)**

In FY 2008, the first year of the project, we actively engaged in the introduction of Mathematical Modeling and Analysis and Meiji University's Global COE Program "Formation and Development of Mathematical Sciences Based on Modeling and Analysis," and provided workshops.

##### **i) Overseas activities**

- "Traveling waves in smoldering combustion under micro-gravity" Workshop on PDE approximations in fast reaction-slow diffusion scenario, Lorentz Center, the Netherlands. November 10, 2008.
- "Transient self-organized patterns in biological and chemical systems" International Workshop on Mathematical Biology, National Taiwan Normal University, Taiwan. December 15, 2008.
- "The importance of Mathematical Modeling and Analysis, and the need to build networks in Asia" Mathematical Society of the Republic of China, December 19, 2008.
- "Reaction-diffusion equations and Applications, Analysis seminar" Institute of Mathematics, Academia Sinica, Taiwan, December 20, 2008.
- "Pattern formation and reaction-diffusion systems" Advanced Course on Mathematical Biology: Modeling and Differential Equations, Centre de Recerca Matemàtica, Spain, February 2 to 6, 2009.
- "Free Boundary Problems related to Contact Inhibition" Winter school : Mathematical Analysis and simulation in Medicine and Biology, CIRM, February 23 to 27, 2009.

##### **ii) Domestic activities**

- "Further advancement of education and research through the adoption of the Global COE Program" (Interview with President Hiromi NAYA) AERA, September 29, 2008 (No. 43), Asahi Shimbun Publications.
- "University/junior college guide 2008—campus garage" "Elucidating social complex phenomena using mathematical sciences methods" Gifu Shimbun, November 16, 2008, Gifu Shimbunsha.
- "Mystery of creatures—mathematical elucidation" The 2nd lecture of Gyokusui Global Academy (GGA) in FY 2008, gym of Takamatsu High School, November 27, 2008.

- “Seeking mathematics observed in nature” The 14th Shonan Mathematics Seminar, Shonan Village Center, January 5 and 6, 2008.
- “Looking at the world with eyes of mathematical sciences” Mathematical Modeling and Analysis: winter school, Shikon-kan at Surugadai Campus of Meiji University, January 7 to 9, 2009. Organization committee members: Ryo KOBAYASHI, Daishin UHEYAMA, and Toru WAKASA.
- “Mystery of creatures—mathematical elucidation” SSH lecture at Kaiho Senior High School, Okinawa Prefecture, January 8, 2009.
- “Leopards’ patterns appear on zebras?—Let’s find out about it through mathematics” Open college for the introduction to modern mathematics, Shonan Village Center, January 11, 2009.
- “Let’s find mathematics in nature” SSH lecture at Hiroshima University High School, Training Room 1, January 13, 2009.
- MEXT University Education Reform Program Joint Forum ( participated in the poster session), Pacifico Yokohama, January 12 and 13, 2009.

### **iii) Activities held in or hosted by Meiji University**

- Alumni Meeting in Akita, Meiji University (participated in the booth and through materials), Akita Castle Hotel, September 14, 2008.
- “Intellectual base communicating to the world—New development of education and research at Meiji University through the adoption of the Global COE Program” Posted on Meiji magazine, October 2008 (vol. 40).
- “Feature story: Introduction of “Formation and Development of Mathematical Sciences Based on Modeling and Analysis,” the MEXT’s Global COE Program for FY 2008” Posted on Meiji University News, January 2008 (vol. 598).
- The 11th Meiji University Home Coming Day (participated in the booth and through materials), Surugadai Campus of Meiji University, October 19, 2008.
- Media exchange meeting (panel exhibit), Surugadai Campus of Meiji University, January 30, 2009.
- Kick-off forum of the Global COE Program “Formation and Development of Mathematical Sciences Based on Modeling and Analysis”—In Search of New Development of Mathematical Sciences Based on Modeling and Analysis (lecture), Surugadai Campus of Meiji University, March 6, 2009.

### **(5) PR of the Program**

The following PR activities were conducted to make people aware of the Program.

- Opening of the Program’s website (in Japanese and in English)

<http://gcoe.mims.meiji.ac.jp/> (in Japanese)

<http://gcoe.mims.meiji.ac.jp/index-e.html> (in English)

- Preparation of the system for collecting GCOE-related events on the web (in Japanese and in English)

<http://gcoe.mims.meiji.ac.jp/jpn/events/index.html>(in Japanese)

<http://gcoe.mims.meiji.ac.jp/eng/schedule/index.html>  
(in English)



- Preparation and distribution of pamphlets outlining GCOE activities
- MEXT “Support Program for improving Graduate School Education” Joint Forum, (participated in the poster session)  
Dates: January 12 and 13, 2009  
Venue: Pacifico Yokohama
- Kick-off forum “In Search of New Development of Mathematical Sciences Based on Modeling and Analysis” to introduce GCOE activities (simultaneous interpretation by Simul International)  
Attended by about 200 people, including the general public.  
Dates: March 6 and 7, 2009  
Venue: Shikon-kan, Surugadai Campus, Meiji University
- GCOE activity reports were planned to be publicized on the web in a newsletter format, but preparations were not completed. In FY 2009, a print version as well as a web version will be broadly available.