

PROSPECTUS for DOCTORAL COURSE

Graduate School of Science, Kobe University

Term 2 2025

(Starting in October, 2025)

The Graduate School of Science, Kobe University, was established as a result of the reorganization of the Graduate School of Science and Technology in April 2007. The Graduate School of Science has five departments offering both Master's and Doctoral Programs: Mathematics, Physics, Chemistry, Biology, and Planetology.

A Master's Degree of Science will be granted upon completion of the Master's Program, and a Doctoral Degree, either a Dr. of Science or a PhD, will be granted upon completion of the Doctoral Program.

For inquiries, please contact:

Kyomu-gakusei-kakari (Section of Academic Affairs)

Graduate School of Science, Kobe University, 1-1, Rokkodai-cho, Nada-ku, Kobe 657-8501

Tel: +81(0)78-803-5767 e-mail: sci-kyomu@office.kobe-u.ac.jp

<http://www.sci.kobe-u.ac.jp/english> (Web page of the Graduate School of Science, Kobe University)

<http://www.math.sci.kobe-u.ac.jp/index.html> (Department of Mathematics)

http://www.phys.sci.kobe-u.ac.jp/index_e.html (Department of Physics)

<http://www.chem.sci.kobe-u.ac.jp/en/> (Department of Chemistry)

https://www.edu.kobe-u.ac.jp/fsci-biol/index_en.html (Department of Biology)

http://www.planet.sci.kobe-u.ac.jp/index_e.html (Department of Planetology)

The Graduate School of Science provides information regarding the entrance examination on the "Admission" page of our website (<http://www.sci.kobe-u.ac.jp/>). Updates on current admission details, such as postponements and change of examination contents, will be made available, depending on and possibly other factors, such as weather conditions. Please check this website and Kobe University's official "X" account (@kobeU_sci) for updates.

1. Number of Students to Be Admitted

Department	Number of students to be admitted
Mathematics	A few persons
Physics	A few persons
Chemistry	A few persons
Biology	A few persons
Planetology	A few persons

Notes: These numbers include foreign students, applicants who are expected to complete the Master's course of Kobe University in September 2025, and those who have work experience.

2. Eligibility for Application

1. Those who are expected to hold a Master's degree or a professional degree on or before September 30, 2025, or already hold a Master's degree or a professional degree, awarded in Japan.
2. Those who are expected to hold an equivalent degree on or before September 30, 2025 or already hold an equivalent degree, awarded from a university or college overseas.
3. Those who took classes in Japan through a correspondence course provided by a foreign school and are expected to hold an equivalent degree on or before September 30, 2025, or already hold an equivalent degree.
4. Those who have been enrolled in a graduate school in Japan of an overseas-based educational institution approved by the Minister of Education, Culture, Sports, Science and Technology, and are expected to hold a Master's degree or a professional degree studies on or before September 30, 2025, or already hold a Master's degree or professional degree.
5. Those who have held a degree equivalent to Master's degree after completing the course at United Nations University established according to the United Nations General Assembly Resolution of December 11, 1972 detailed in Article 1, paragraph 2 of the Act on Special Measures incidental to the enforcement of the Agreement between the United Nations and Japan regarding the Headquarters of the United Nations University (Act No. 72 of 1976).
6. Those who have taken courses in an educational curriculum at an overseas school, an educational institution specified in item 4 above, or at United Nations University, have passed examinations corresponding to those provided in Article 16-2 of the Graduate School Establishment Standards (Ordinance No. 28 of the Ministry of Education of 1974), and are recognized as having academic ability equivalent to or above those holding a Master's degree.
7. Those who were qualified by the Japanese Minister of Education, Culture, Sports, Science and Technology (i.e. those who were engaged in a post-graduate research for at least two years at a university or institution after graduating from a university/college or after completing 16 years of higher education overseas, whose academic records were approved by the Graduate School to be equivalent to, or higher than, those holding a Master's degree).
8. Those who received a separate qualification screening and were approved by the Graduate School to be equivalent to, or higher than, those holding a Master's degree or a professional degree. In this case, the candidate must have reached the age of 24 at the day of September 30, 2025.

(Applicants who correspond to one of 7 and 8 should refer to Section 9.)

3. Application Period

From January 8, 2025 through January 10, 2025 (Office hours: 9:00-12:00 and 13:00-17:00 JST, Monday-Friday). If sent by mail, the application must be received by the office within this prescribed period.

4. Application Procedure

(1) Application Documents

1. Application Form: Fill in Form No. 1.
2. Curriculum Vitae: Fill in Form No. 2.
3. ID for the Examination: Fill in Form No. 3.
4. The certificate of payment card: Fill in Form No. 4.
5. Entrance Examination Fee: 30,000 yen. Follow the Form No. 5. Payment of the examination fee should be made with a payment form at a post office. After paying the entrance

examination fee, a certificate of payment should be pasted on the certificate of payment card (Form No. 4) and submitted with the other application documents.

1. For applicants residing outside Japan

Please refer to “11. Application fee payment method (Only when paying from overseas)”.

2. The grantees of Japanese Government scholarship are exempted from paying the examination fee. If applicants are students with Japanese Government scholarship at other universities than Kobe University, they should submit a certificate of Japanese Government scholarship student.

3. Those who are expected to complete a master's degree at Kobe University in September 2025 are not required to pay.

6 Photograph: Two photographs (4 cm x 3 cm), taken within the past three months, should be pasted on the application form and the ID for the examination.

7 A copy of a Master's degree diploma or a letter that certifies the anticipated graduation.

8 Academic Records:

1. Undergraduate level: The record must be certified by the dean or the president of the applicant's university.

2. Master's level: The record must be certified by the dean or the president of the applicant's graduate school.

9 Master's Thesis:

(a) Applicants who have completed a Master's course: i) A copy of the Master's thesis, or published manuscript(s) equivalent to the thesis. ii) A copy of the summary of the Master's thesis in English (about 1,200 words). Use A4 size paper and attach a cover sheet (Form No. 6).

(b) Applicants who anticipate a Master's degree: A copy of the summary of the research program in the Master's course in English (about 1,200 words). Use A4 size paper and attach a cover sheet (Form No. 6).

(c) Copies of published manuscript(s), if any.

10 Research Plan: Describe your research proposal (goal, objectives, and experimental designs) in English (about 1,200 words). Use A4 size paper and attach a cover sheet (Form No.7).

11 Certificate of Foreigner Registration: An applicant who resides in Japan must submit a copy of the "Certificate of Foreigner Registration" issued by a local administration office in Japan or copies of both sides of the “Certificate of Alien Registration” issued by a Municipal office.

12 Self-addressed Forms: Fill in your address and name. (Form No. 8)

(2) Submission by mail

When submitting the forms by mail, be sure to send them by registered special delivery mail, and do not forget to indicate "Application Forms for Doctoral Course" in red on the envelope and enclose a self-addressed Envelope (23.5cm x 12cm) with 344410 yen-stamps.

(3) Only for those residing in a foreign country, the documents necessary for application, such as the admission application forms for admission, will be sent electronically, so please send a request by email to the Section of Academic Affairs of the Graduate School of Science. At that time, please use the subject line as "Request for Application Forms for Doctoral Course". Please note that we will contact you separately via email regarding how to submit your application documents.

(4) Submission address

Kyomu-gakusei-kakari (Section of Academic Affairs), Graduate School of Science, Kobe University, 1-1, Rokkodai-cho, Nada-ku, Kobe, Japan 657-8501, Japan, Tel: +81(0)78-803-5767

e-mail: sci-kyomu@office.kobe-u.ac.jp

[Notes]

(1) Applicants cannot make any changes to the documentation after submitting their application documents. The entrance examination fee is not refundable after application, except for the case that the application is not accepted.

(2) Regarding any certificates written in other foreign languages than English, applicants must attach Japanese translations, with a certification issued by such public organizations as the Japanese government or the overseas mission of a foreign government.

(3) Applicants should select a professor as a supervisor from the annexed "List of Departments and Divisions" and contact the professor in advance, when preparing the Research Plan. Application documents will not be accepted without nominating a professor.

[Notes]

RIKEN—Kobe University International School will support foreign students who will conduct Ph.D. project under supervision of BDR (Center for Biosystems Dynamics Research) scientists who hold positions as visiting faculty at Kobe University.

RIKEN will partially provide students' living costs under the International Program Associate (IPA) program. Details will be available from the web site of BDR (<http://www.bdr.riken.jp/en/index.html>) and of RIKEN (<http://www.riken.jp/en/careers/programs/ipa>).

5. Examination Procedures

Applicants will be selected based on the evaluation of the oral examination and the submitted documents. The oral examination is evaluated by focusing on the following points;

- (1) The contents of the Master's thesis or research program: Basic knowledge and capability for taking the course will be examined.
- (2) Language ability (For foreign applicants who graduated from a foreign university, ability in both the English and Japanese languages): Language ability for taking the course will be qualified.
- (3) The contents of the Research Plan: It will be evaluated if the quality of the Research Plan is sufficient for granting the degree.

6. Date and Place of Oral Examination

Department	Date
Mathematics	February 5 ,2025
Physics	February 14 ,2025
Chemistry	February 6 ,2025
Biology	February 5 ,2025
Planetology	February 7 ,2025

Place: Graduate School of Science, Kobe University.

*Time and place of each presentation will be announced later.

*In case of emergency, please check our website (<http://www.sci.kobe-u.ac.jp/english/>) or our "X" account (@kobeU_sci).

Take Kobe City Bus bound for "Tsurukabuto Danchi" (Line No. 36) from "Rokko" station (Hankyu Railway), "Rokko-Michi" station (JR), or "Mikage" station (Hanshin Railway). Get off at "Shindai Bunrinogakubu Mae" and walk about 3 minutes southward.

7. Examination Results

Accepted applicants will be notified by mail. In addition, the names of the accepted applicants will be announced on the homepage ([http:// http://www.sci.kobe-u.ac.jp/exam/index.htm](http://http://www.sci.kobe-u.ac.jp/exam/index.htm)) of Graduate School of Science at 10:00 JST on March 7, 2025 No telephone inquiries will be accepted.

8. Enrollment Procedures

- (1) Date: Mid-September 2025. (As planned) Detailed date and the documents for admission will be sent by postal mail to each applicant with the examination result at the beginning of September 2025.
- (2) Place: Kyomu-gakusei-kakari (Section of Academic Affairs), Graduate School of Science, Kobe University
- (3) Admission Expenses:
 - (A) Entrance fee: 282,000 yen. (As planned)
 - (B) Tuition fee: 267,900 yen for the first semester, 535,800 yen per year. (as planned)
 Please confirm how to pay the tuition for the first semester by the documents which will be sent at the mid-September, 2025. If the tuition fee is revised during enrollment, the revised tuition fee will apply.

[Notes]

- (1) The entrance fee is not refundable.
- (2) An applicant will be deprived of entrance under the following cases:
 - (A) False statements on the documents.
 - (B) Failure to complete the enrollment procedures.
 - (C) Failure to obtain a Master's degree by September 30, 2025.
- (3) Foreign students with a Japanese Government scholarship are exempted from paying the entrance and tuition fees.

9. Examination of Qualifications for Application

Those who are qualified under items 7 and 8 in the Section 2 will be examined for their qualifications in applying.

(1) Application Documents

- ① Application Form for Examination of Qualification (Form No. 9)
- ② A copy of a Bachelor's degree diploma, or a letter that certifies the anticipated graduation. : The record must be certified by the dean or the president of the applicant's university.
- ③ Curriculum Vitae (Form No. 2)
- ④ History or Research (Form No. 10): History of research needs to be certified by the deans or the directors of the institutions where the applicant has worked and work. The history of research written by the applicant may be accepted, if it can not be certified at the corresponding institution(s).
- ⑤ Research Experience (Form No. 11): A copy of the summary of the thesis equivalent to the Master's thesis (about 1,200 words). Use A4 size paper and attach a cover sheet (Form No. 11).
- ⑥ Publication: Submit the list and reprints (copies) of significant publications. If an applicant is a co-author or one of several co-authors for any significant publication(s), specify your role and work.
- ⑦ Research Plan: Describe your research proposal (goal, objectives, and experimental designs) in English (about 1,200 words). Use A4 size paper and attach a cover sheet (Form No. 7).
Submissions of ④, ⑤ and ⑥ are not obligatory, if an applicant graduated or expected to graduate by September 30, 2025 from the Medical school, Dental school, Pharmaceutical school, or the 6-year course of Veterinary Medical school.

(2) Application Period and Place

Application documents will be accepted by December 25, 2024 at Kyomu-gakusei-kakari (Section of Academic Affairs), Graduate School of Science. (Office hours: 9:00-12:00 and 13:00-17:00 JST, Monday-Friday). When application forms are sent by mail, they must arrive within this prescribed period. When submitting the forms by mail, be sure to send them by registered special delivery, and do not forget to indicate "Application Forms for Examination for Qualification" in red on the envelope.

(3) Notification to Candidates

Each candidate will be notified before January 7, 2025.

10. Others

1. Exemption of Payment of Entrance Fee

Those who meet one of the following special requirements and have remarkable difficulties to pay the entrance fee, based on application and through a selection process, may receive a full or half exemption of entrance fee.

- (1) The person who was to pay for the applicant's school expenses died, or was involved in natural disasters such as wind and flood damage within a year of the applicant's enrollment.
- (2) Financial reason as well as having achieved excellent academic performance.

2. Postponement of Payment of Entrance Fee

Those who meet one of the following requirements and have difficulties to pay entrance fee by the designated date, based on application and through a selection process, may be given fixed time to prepare for paying the entrance fee.

- (1) The person who was to pay for the applicant's school expenses died, or was involved in natural disasters such as wind and flood damage within a year of the applicant's enrollment.
- (2) Financial reason as well as having achieved excellent academic performance.

3. Exemption of Payment of Tuition

Those who meet one of the following requirements and have difficulties to pay the tuition fee, based on application and through a selection process, may receive a full or half exemption of tuition fee.

- (1) The person who was to pay for the applicant's school expenses died, or was involved in natural disasters such as wind and flood damage within a year of the applicant's enrollment.
- (2) Financial reason as well as having achieved excellent academic performance.

4. Scholarship

Besides of the honor scholarship of Japan Student Service Organization, there are various scholarships. Details are announced separately.

5. Research Assistant Program

Our graduate school offers a Research Assistant Program for newly entering students (for those who paid the entrance fee only). Accepted applicants for this program can work as research assistants and receive an allowance (a maximum amount: approximately 282,000 yen). The program aims to support the students financially within 1 year after the enrollment and promote the research and study for Doctoral degree.

6. Privacy Statement

- (1) With regard to personal data possessed by this University, laws including the Law Concerning the Protection of Personal Information by Independent Administrative Institutions are observed, and every possible measure is taken to protect it based on the Personal Data Management Rules of Kobe University.
- (2) Personal data provided to this University for application are used for the selection of students, the announcement of accepted applicants, admission procedures, research into selection methods of students.
- (3) The personal data of accepted applicants provided to this University for application is used after admission for student support (health management, scholarship application, etc.), educational purposes (student registration, academic guidance, etc.), and services related to tuition.
- (4) With regard to the use of personal data for various services, some of the services may be entrusted by this University to outside operators (hereinafter referred to as "entrusted operators"). In such cases, all or part of the personal data provided to this University may be provided to the operators imposing the confidentiality of data, to the extent necessary to implement the entrusted services.

11. Application fee payment method (Only when paying from overseas)

Please access the Application Fee Payment System of Kobe University from the URL shown below or the QR code, and pay with a credit card or Alipay. The credit card holder does not have to be the applicant, but please be sure to enter the applicant's information in the Customer information field. Please print the Incoming email of payment completion and attach it to the application form.

Student type	Faculty/Graduate	Amount of money	URL	QR code
Doctoral Program	Graduate School Of Science	¥30,660	https://tinyurl.com/y5gs7og8	

items
 ¥30,000 {Application fee}
 ¥660 {Remittance fee}

[Handling credit cards, etc. at the payment system of Kobe University]



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Tel: +81(0)78-803-5767

e-mail: sci-kyomu@office.kobe-u.ac.jp

Preventive measures against measles, rubella, epidemic parotiditis, and chickenpox

(1) Submission of a certificate demonstrating inoculation and an antibody test against measles and rubella:

Kobe University has implemented the *Measles and Rubella Registration Policy*, and all newly enrolled Kobe University students must submit one of the following three certificates (①, ②, or ③) to prevent a possible outbreak of measles and rubella on campus.

Please note that students admitted to the following schools are required to submit either ① or ③:

School of Medicine (Faculty of Medicine and Faculty of Health Sciences).

the Graduate School of Medicine, or the Graduate School of Health Sciences.

- ① A vaccination certificate to prove that you have received two doses each of the measles and rubella vaccine after turning one year old (recommended)
- ② A vaccination certificate to prove that you were inoculated with measles and rubella vaccines each within the last five years (since April 2020).
- ③ An antibody certificate to prove that you have sufficient antibody titer in your blood (refer to the chart next page) to prevent the development of measles and rubella, based on the results of an antibody test performed within the last five years (since April 2020)
 - * For ① and ②, a combined vaccine against measles and rubella (e.g., MR vaccine) is permissible.
 - * For ① and ②, the certificate must be issued by an accredited medical institution and state the type of vaccine and the date of inoculation.
 - * If you have a history of measles or rubella, please submit ③ or receive a vaccination and submit ① or ②.
 - * For ③, the certificate must specify the measuring method and the measured values of antibody titer in your blood (refer to the next page), and it must satisfy the judging standard listed in the chart. A blood test report sheet itself can be accepted for submission.
 - If the antibody titer in your blood is insufficient, you must receive the necessary vaccination, and submit either ① or ②.
- * You may submit a combination of ①, ②, and ③ (e.g., ① for measles and ③ for rubella).
- * If your antibody titer level is below the threshold, yet you are unable to receive the vaccinations due to certain circumstances (such as illness or specific body conditions), please provide an official document (like a medical certificate) that explains the reason.

Procedure, deadline, and location for submission

- All successful undergraduate and graduate applicants enrolling in April (except the Graduate School of Medicine, the Graduate School of Health Sciences and the Graduate School of Maritime Sciences):
Please submit at the time of the medical checkup for new students scheduled in April.
- All successful graduate applicants enrolling in April (the Graduate School of Medicine, the Graduate School of Health Sciences, and the Graduate School of Maritime Sciences):
Submit the certificate to the following institution by the designated date:
 - Students of the Graduate School of Medicine should submit directly to the Medical Center for Student Health, Kusunoki Branch, by April 21.
 - Students of the Graduate School of Health Sciences should submit directly to the Physical and Mental Health Consultation Office (Myodani Campus), by April 21.
 - Students of the Graduate School of Maritime Sciences should submit the form at the medical examination site on the day of the medical check-up for maritime sciences students.
- Successful applicants enrolling in October:

Please submit the form at the time of the medical check-up for students entering in October.

(2) Submission of a certificate demonstrating inoculation and an antibody test against epidemic parotiditis and chickenpox (only for successful applicants enrolling in the School of Medicine including both the Faculty of Medicine and the Faculty of Health Sciences; the Graduate School of Medicine; and the Graduate School of Health Sciences):

In addition to the measles and rubella certificate, successful applicants enrolling in the School of Medicine (the Faculty of Medicine and the Faculty of Health Sciences), the Graduate School of Medicine, and the Graduate School of Health Sciences, are also required to submit a certificate regarding epidemic parotiditis and chickenpox. A designated form for the certificate is available at the Academic Affairs Section.

The certificate must state that either you were inoculated against epidemic parotiditis and chickenpox (twice each after one year of age), or verify that you have sufficient antibody titer in your blood to prevent the development of epidemic parotiditis and chickenpox based on an antibody test performed within the last five years (since April 2020).

If the antibody titer in your blood is insufficient, you must receive the necessary vaccination (twice each), by the due date for the certificate submission. (The two vaccinations must be given at least 4 weeks apart.)

- * If your antibody titer level is below the threshold, yet you are unable to receive the vaccinations due to certain circumstances (such as illness or specific body conditions), please provide an official document (like a medical certificate) that explains the reason.

Procedure, deadline, and location for submission>

- Successful undergraduate and graduate applicants enrolling in April

(Only for the School of Medicine including the Faculty of Medicine and the Faculty of Health Sciences; the Graduate School of Medicine, and the Graduate School of Health Sciences):

By the end of June of your first year, submit the certificate to the following:

- Students of the School of Medicine (both the Faculty of Medicine and the Faculty of Health Sciences) should submit directly to the Medical Center for Student Health (Rokkodai).
- Students of the Graduate School of Medicine should submit directly to the Medical Center for Student Health, Kusunoki Branch.
- Students of the Graduate School of Health Sciences should submit directly to the Physical and Mental Health Consultation Office (Myodani Campus).

- ☆ Attention: For those who are enrolled in the School of Medicine but miss the submission deadline, you may not be able to participate in the initial on-site clinical training program etc.

- Successful graduate applicants enrolling in October

(Only for the Graduate School of Medicine and the Graduate School of Health Sciences):

Submit the certificate by end of December of your first year to the following:

- Students of the Graduate School of Medicine should submit directly to the Medical Center for Student Health, Kusunoki Branch.
- Students of the Graduate School of Health Sciences should submit directly to the Physical and Mental Health Consultation Office (Myodani Campus).

Measuring methods and judging standards for blood antibody titers

	Measuring Method	Judging Standard	Remarks
Measles	IgG — EIA method PA method NT method	$8.0 \leq$ positive $(16.0 \leq)$ * $256x \leq$ positive $(256x \leq)$ * $4.0x \leq$ positive $(8x \leq)$ *	Positive result by one of these three methods. * For the School of Medicine (both the Faculty of Medicine and the Faculty of Health Sciences), the Graduate School of Medicine, and the Graduate School of Health Sciences: Positive result by one of these three methods, and must achieve values shown in brackets.
Rubella	HI method IgG—EIA method	$32x \leq$ positive $8.0 \leq$ positive	Positive result by one of these two methods. (HI method is recommended)
Epidemic parotiditis (mumps)	IgG—EIA method	$4.0 \leq$ positive	Only for the following schools: School of Medicine (Faculty of Medicine, Faculty of Health Sciences), Graduate School of Medicine, and Graduate School of Health Sciences
Chickenpox	IgG—EIA method IAHA method NT method	$4.0 \leq$ positive $4\text{-fold} \leq$ positive $4\text{-fold} \leq$ positive	Only for the following schools: School of Medicine (Faculty of Medicine, Faculty of Health Sciences), Graduate School of Medicine, Graduate School of Health Sciences Positive result by one of these three methods (IgG—EIA method is recommended)

* Antibody testing is not required if the vaccination history meets the requirements or if additional vaccinations are given.

* Make sure the above methods are followed when the antibody titer is measured in your blood.

* The protective antibody value differs according to the measuring method used. Please note that **the judging standards are higher than the usual standards used at medical institutions.**

Students who wish to enter the School of Medicine (the Faculty of Medicine and the Faculty of Health Sciences), the Graduate School of Medicine, and the Graduate School of Health Sciences should note that they are required to have a higher level of protective antibodies against measles, as indicated in brackets.

* Before visiting a medical institution, please confirm in advance whether you can receive the necessary antibody tests and/or the vaccinations.

When you visit a doctor at a medical institution, make sure to present this document to obtain the necessary certificate(s). (In particular, when taking an antibody test, please ensure the measurement methods meet the above criteria.)

* Points to consider when submitting a certificate:

- ① Please bring the original certificate along with one copy (A4 size).
- ② If the certificate is written in a language other than Japanese or English, please attach a document showing the Japanese or English translation.

For further information, please refer to:

Medical Center for Student Health, Kobe University Tel: 078-803-5245

Student Support Division, Student Affairs Department, Kobe University Tel: 078-803-5219

Graduate School of Science, Kobe University

Department of Mathematics

I. Division of Analysis

This subject is aimed at the mathematical structures of changes occurring in phenomena. Included are the fields of functional equations, functional analysis, complex analysis, harmonic analysis, algebraic analysis and differential equations.

(1) Functional Equations

Mathematical analysis of nonlinear partial differential equations; methods of functional and harmonic analysis. (Y. Ohta***, M. Higaki)

(2) Functional Analysis

Fourier analysis; Functional analytic methods for partial differential equations. (H. Takaoka)

(3) Complex Analysis

Complex analytic functions and special functions, such as elliptic functions and solutions of differential equations; Riemann surfaces; use of analytic and algebraic and geometric methods. (Y. Yamada**)

II. Division of Algebra and Geometry

This subject is aimed at elucidating the essential properties behind the continuity and symmetry in structures related to equations and spaces. Included are the fields of number theory, automorphic forms, algebraic geometry, differential geometry and topology.

(1) Algebra

Structure and theory of algebraic manifolds, moduli theory, automorphic forms, automorphic representations, number theory. (K. Yoshioka, T. Taniguchi, K. Morimoto, T. Sano)

(2) Geometry

Differential geometry and topology; differentiable manifolds; theory of knots and links; minimal and constant mean curvature surfaces; singularities on Riemannian manifolds; hyperbolic space and low dimensional topology. (W. Rossman, S. Satoh, K. Saji)

III. Division of Applied Mathematics

This subject is aimed at the fields of probability, combinatorics, automorphic forms, number theory, computational mathematics, information science and mathematical physics, with applications to such things as science, engineering, computer science and economics in mind.

(1) Probability

Applications of probability theory to random motions, fluctuations and random phenomena of mathematical objects. (K. Fukuyama)

(2) Computational Mathematics

Computational methods in the mathematical sciences; efficient implementation on computers and development of computer algebra systems; applications to algebra, algebraic analysis and mathematical physics. (N. Takayama*, S. Aoki, T. Yaguchi, N. Shutoh)

Those staff members indicated by * are scheduled to retire at the end of March 2025.

Those staff members indicated by ** are scheduled to retire at the end of March 2026.

Those staff members indicated by *** are scheduled to retire at the end of March 2027.

Department of Physics

I. Division of Theoretical Physics

The aim of this division is to study theoretically on elementary particles, the most fundamental constituents of the universe, and various physical properties of condensed matter systems.

(1) Elementary Particle Physics and Cosmology

The properties of elementary particles and physics beyond the standard model and quantum gravity are studied theoretically. The origin of the spacetime and matter in the universe is investigated. (J. Soda)

(2) Condensed Matter Theory

Mechanisms of superconductivity and magnetism in various systems are studied using analytical and numerical methods with emphasis on the view point of spontaneous symmetry breaking and quantum information. (K. Kuboki**, T. Nishino)

(3) Quantum Solid State Physics

Electronic properties of solid states are theoretically investigated to understand the macroscopic quantum phenomena in strongly correlated electron systems such as heavy electron systems. (Y. Fuseya)

II. Division of Particle Physics

The aim of this division is to experimentally study the properties of elementary particles and the interactions between them, and to answer questions about the early universe.

(1) Particle Physics

We work on experiments, using the most advanced experimental facilities, such as high-energy hadron collider experiment (LHC • ATLAS), neutrino experiments (Super-Kamiokande, Hyper-Kamiokande, T2K), and direct dark matter search experiments (XENON, NEWAGE). (H. Kurashige**, Y. Takeuchi, Y. Yamazaki, K. Miuchi, J. Maeda)

III. Division of Condensed Matter Physics

The aim of this division is to experimentally study on the magnetic, electric, and thermal properties of condensed matter systems such as magnetic material, superconductor, and semiconductor.

(1) Extreme Condition Condensed Matter Physics

Quantum phenomena are studied by electron spin resonance and nano-scale magnetometry under extreme conditions, such as low temperature, high magnetic field, and high pressure. (E. Ohmichi, S. Okubo)

(2) Low Temperature Condensed Matter Physics

Quantum phenomena, such as superconductivity, magnetism, and multipole order, are studied by nuclear magnetic resonance and macroscopic measurements under complex conditions such as low-temperature, high-magnetic field and high pressure. (H. Tou, H. Kotegawa)

(3) Correlated Electron Physics

Our study is focused on the crystal growth and low temperature measurements in highly correlated electron systems to explore new quantum phenomena, such as unconventional superconductivity and magnetism. (H. Sugawara, E. Matsuoka)

Those staff members indicated by ** are scheduled to retire at the end of March 2026.

Department of Chemistry

I. Division of Physical Chemistry

Research and education are directed toward understanding structures and dynamics of molecules, clusters, and solid surfaces using various laser spectroscopic and quantum chemical methods. The structures are investigated by high-resolution spectroscopy, resonant enhanced multi-photon spectroscopy, and scanning micro probe. The excited states and reaction dynamics are studied by time-resolved nonlinear spectroscopy, scanning micro probe, and pulse shaping method. Physicochemical understanding of chemical reaction mechanism is learned through the experimental studies.

(1) Molecular Structure and Dynamics

Research and education are aimed to understand molecular structure and control dynamics and chemical reaction on the basis of laser spectroscopy and quantum theory.

(A. Wada^{***}, S. Kasahara)

(2) Material Physical Chemistry

Chemistry at buried interfaces is studied with advanced scanning probe microscopy and optical spectroscopy. Brand-new methods for characterizing nanometer-sized materials are being developed. New solid compounds are synthesized. (H. Onishi, K. Kimura, K. Eda*)

(3) Chemical Reaction Dynamics

Research and education focus on structure and electronic interaction of intermediate species in photoactive proteins and in solar cells by using time resolved electron paramagnetic resonance spectroscopy. Our main scope is elucidations of molecular function for novel light-energy conversion processes. (Y. Kobori, T. Tachikawa)

II. Division of Inorganic Chemistry

Research and education focus on coordination chemistry, inorganic materials chemistry, analytical chemistry, electrochemistry, and reaction chemistry: development of functional materials including organometallic compounds, metal oxides, and polyoxometalate compounds, and analysis of electrochemical reactions, electron transfer reactions, and chemical dynamics in condensed matter.

(1) Solid State Chemistry

Research and education focus on synthesis and characterization of functional inorganic materials including coordination compounds and metal oxides in crystalline or non-crystalline forms. (T. Mochida, T. Uchino, K. Takahashi)

(2) Solution Chemistry

Development of novel spectroscopic methods using ultrashort pulsed lasers and their application to the study of intermolecular interactions and dynamical structure and reaction dynamics in condensed phases (molecular crystals, solutions/liquids, polymers, etc.).

(K. Tominaga)

(3) Physical Inorganic Chemistry

Excitation dynamics of biomolecules, including their relaxation, energy transfer, and electron transfer, are studied in solutions and in photosynthetic pigment-protein complexes. (S. Akimoto)

III. Division Organic Chemistry

Fundamental researches on organic chemistry and biochemistry, in particular, investigations of new synthetic methodologies and molecular design based on supramolecular

chemistry and protein science are executed.

(1) Organic Reaction Chemistry

Research and education are conducted on development of new methodologies for selective organic synthesis, investigation of general and highly efficient catalytic routes yielding useful compounds for life science and material science. (M. Hayashi**, R. Matsubara)

(2) Organic Molecular Structure and Function

Research and education focus on molecular structure and functions based on organic chemistry and material science; design, synthesis, and structural analysis of supramolecular architectures composed of p-conjugated macrocycles and cage compounds. (A. Tsuda)

(3) Biomolecular Science

Research and education focusing on folding and structural formation of proteins and enzymes, their dynamical functions in solutions and in biomembranes, and conversion of their functions by biotechnological methods. (A. Tamura, E. Chatani, T. Kimura)

IV. Visiting Academic Staff for Cooperative Division (Japan Synchrotron Radiation Research Institute)

(1) Materials Structure Science

Research and education are conducted with a focus on the structural analysis of crystalline materials with synchrotron radiation, dynamic structural analysis, and the use of diffraction techniques and biological macromolecules using X-ray scattering techniques and fluid structure analysis. (T. Koganezawa, K. Uesugi)

V. Visiting Academic Staff for Cooperative Division (Institute of Physical and Chemical Research)

(1) Theoretical Biochemistry

We aim to understand chemical reactions, properties, and functions of large molecular systems such as biomolecules and biodegradable polymers by quantum chemical calculations using supercomputers. (T. Nakajima)

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Department of Biology

I. Division of Biomolecular Organization

This division conducts education and research on the cell structure and functions in levels of molecules, cells, tissues, and individuals.

(1) Molecular Physiology

Animals receive various external signals as stimuli through their sensory organs. The sensory information is integrated and processed in the brain to express adaptive behavior according to the circumstance. Our education and research focus on functioning of molecular mechanisms within cells at various levels, such as intercellular communication and interactions between individuals, to understand the mechanisms underlying the expression of adaptive behavior. (H. Aonuma, M. Sakura)

(2) Cell Function

Plants do not have to move from where they live by conducting photosynthesis. Instead, they have abilities to change their cell function, organ growth, and developmental program in response to environmental changes. We educate and research on the mechanisms and their evolution of various plant physiological/morphological responses to environment based on the molecular and cell biology. (H. Fukaki, K. Ishizaki)

(3) Bioinformation

Aiming to explore information processing in biological systems, our education and research focus on signal transductions underlying "brain function" and "membrane traffic and cellular morphology in model organisms". (M. Miyamoto***, M. Morita, H. Tsukamoto)

II. Division of Biosignal Transduction

This division conducts education and research on the mechanisms of gene expression and the regulation of biological responses through the intracellular signal transduction.

(1) Gene Expression

We educate and research on the mechanisms of gene expression and the related developmental processes; germ cell formation and pigment cell differentiation in zebrafish, gene regulatory mechanism of cell fate specification in cardiac neural crest of chicken embryo, and the regulatory mechanisms of gene expression and their evolutionary dynamics in tissue regeneration using amphibians and zebrafish.

(K. Inoue, H. Ochi[scheduled to be assigned], S. Matsuhana)

(2) Genetic Information

We educate and research on the molecular mechanisms underlying maintenance and diversification of genetic information, and also on the intracellular signal transduction pathways by the post-translational modifications of proteins that regulate biological responses to genotoxic stresses caused by various endogenous as well as environmental agents.

(K. Sugasawa***, M. Yokoi)

(3) Gene Function

We educate and research on the functions of genes involved in the regulation of cellular transformation, apoptosis, and senescence, and also in the processes of morphogenesis. Studies are focused on the molecular mechanisms of cell fate decision between apoptosis and senescence induced by cellular stresses, and the functions of long noncoding RNA and small peptide genes in *Drosophila* development. (S. Kamada*, Y. Kageyama)

III. Division of Biodiversity

This division conducts research and educational program on ecology and systematic biology for elucidating origin and sustenance mechanism of biodiversity of various biota inhabiting both terrestrial and marine environments.

(1) Ecology and speciation

This course covers studies on ecological aspects of biodiversity and its conservation, with particular interests in revealing mechanisms of species interactions, evolutionary change, speciation and diversity of aquatic plants and animals. (N. Okuda, K. Suetsugu)

(2) Evolution and phylogeny

We focus on the researches and education of the evolutionary aspects of biodiversity, systematics, metabolic physiology, cell structures and ecology of diverse algae, and apply the results for the conservation and improvement of the aquatic ecosystems.

(S. Uwai, H. Sakayama)

IV. Division of Developmental Biology

This program provides basic knowledge on mammalian developmental biology, tissue regeneration and active hypometabolism such as hibernation.

(1) Developmental Biology****

Research and education in this division cover fundamental problems in developmental biology and tissue regeneration in respiratory/circulatory system in mouse, and active hypometabolism such as hibernation. We also provide research opportunities using cutting edge technologies in bioimaging, stem cell biology, gene expression and organ regeneration.

(S. Hayashi*, M. Morimoto)

V. Division of Bioregulatory Science

This division reviews the discovery research for bioactive compounds and the study of their mode of action, translocation and metabolism in organisms such as insects, fungi and plants.

(1) Bioregulatory Science****

Research and education in this division are conducted to clarify the interaction between the organisms and bioactive compounds integrating a variety of technologies.

(F. Iwahashi)

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Those staff members indicated by *** are scheduled to retire at the end of March 2027.

For retirement schedule of the staff members in the research fields indicated by ****, please directly contact each staff member.

If you wish to apply for the research fields indicated by ****, you need permission from the staff members in advance.

Department of Planetology

Why is this planet to be the Earth? In order to answer this fundamental question, we are aiming at comprehensive understanding of the evolution of the earth, planetary and solar systems by analyzing various processes occurring at spaces from the center of the Earth to the edge of the solar system with multidisciplinary approaches.

I. Division of Fundamental Planetology

This division aims at cultivating discerning persons leading society and /or academic communities by logical analyses and considerations of variable phenomena in planetary and Earth systems.

(1) Geology

We examine surficial materials and geologic structures of the Earth. Our main targets include the various geologic phenomena associated with plate subduction characterizing “planet Earth”, environments and life evolution, and tectonics. (Y. Yamamoto, K. Yamasaki)

(2) Petrology and Mineralogy

We examine various kinds of Earth and planetary materials to elucidate their origin and evolution by using various methods such as electron microscopy, chemical analyses, synchrotron radiation, experimental reproductions, field works, and so on. (K. Kaneko)

(3) Solid Geophysics

We study source processes of large earthquakes and slow earthquakes, seismic wave propagation, tsunami generation and propagation processes, and dynamics associated with subduction of oceanic plates such as slab deformation, temperature and flow fields. (S. Yoshioka)

(4) Fluid Geophysics

We investigate, by the use of theoretical and numerical methods, the structures and the evolutions of fluid spheres, mainly the atmospheres, of the planets in our solar and exosolar systems in general, and we are trying to argue the problem by understanding Earth's fluid sphere as one of the realization of those general features. (Y. Takahashi, H. Kashimura)

(5) Planetary Astrophysics

The major goal of our group is to advance our understanding of the origin and evolution of ring-satellite systems, small solar system bodies, and planetary systems including those outside our solar system, mainly by theoretical research and analysis of data obtained by telescopes and spacecraft observations. (K. Ohtsuki, A. M. Nakamura)

II. Division of Frontier Planetology

This division aims at cultivating aspirational persons pioneering frontier researches in planetology in collaboration with national institutes of planetary and earth sciences.

(1) Experimental Planetary Science

We study the origin and evolution of planetary bodies by means of laboratory experiments and planetary explorations. Our research interests are the effects of planetary collisions on the variety of solar system bodies and the tectonics of icy satellites and cometary nuclei. (M. Arakawa, M. Yasui)

(2) Marine Geodynamics

We conduct researches on the structure and evolution of the solid Earth using marine geophysical methods. (N. Shima**, H. Sugioka, H. Hirose)

(3) Computational Planetology

We mainly study the formation and evolution of astronomical objects from the large scale structure of the universe for planets by means of theoretical and computational approaches. We also work on the research and development of numerical algorithms, software, and hardware. (J. Makino, T. Saitoh)

III. Cooperative Division

(1) Evolutionary History of the Planets and the Earth****

We carry out observational studies on cosmology and galaxy formation (NAOJ), and study the history of the Japanese Islands related to global evolution of the Earth (JAMSTEC). (M. Obayashi, S. Miyazaki)

(2) Applied Planetology****

Japan has experienced natural disaster conditions brought by torrential rain, typhoons, and so on. The global warming is also an urgent issue. Thus, meteorology is an increasingly important branch of the planetary science. By making use of various facilities of the Meteorological Research Institute, we study the atmosphere close to the earth's surface and the data assimilation and predictions of local heavy rainfalls. (T. Kawabata)

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