

Welcome to Graduate School of Science and School of Science, Osaka University



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Welcome to the School of Science and the Graduate School of Science, Osaka University, and thank you for your interest in our university. The research conducted in our departments is pure fundamental science, which has formed the basis of our civilization. Humankind appeared on this planet at some time in the long history of our universe, and we have prospered owing to the fruits of basic scientific research, which are the crystallization of humanity's knowledge and wisdom. Our endeavors started from a keen curiosity about the world around us, and the scientific discoveries that lead us to sustained prosperity can often be traced back to simply asking "why?" about the phenomena that take place in nature. The greatest scientific discoveries are often made when people follow their own curiosity, and do not look for profit or a return.

The results of fundamental scientific research can be applied to technological developments, which make our life easier and more comfortable. However, these technological developments sometimes create novel and more complex problems. Highly advanced knowledges and skills are required to solve them, and in many cases solutions cannot be found by simply applying formulae established then. Instead, one needs to go back to the basic principles of science, and carefully analyze the situation. For such problem-solving processes, it is essential to acquire the knowledges and skills through basic research at universities. Our fundamental research does not look for understanding that can be immediately applied in our daily lives; we learn how to seek answers to questions that are driven by pure curiosity. Maintaining this effort will certainly advance our understanding of nature as we cultivate new scientific fields that may later turn out to have great profit.

The School of Science was established in 1931 with the goal of promoting fundamental science. Dr. Hantaro Nagaoka, the first president of Osaka University, was the first to advocate the Saturnian model of the atom. His motto was "Originality and Inspiration," which is still inherent at Osaka University. The field of basic science continues to gradually expand. The School of Science started with three departments, and now has four (Mathematics, Physics, Chemistry, and Biological Sciences). In these departments, we offer six majors (Mathematics; Physics; Chemistry; Biological Sciences; Macromolecular Science; and Earth and Space Science). Our faculty members actively pursue their own research goals, and work hard on education and research. Our departments are open to other fields, and we value frequent interactions and promote interdisciplinary science.

In this booklet, we would like to introduce our graduate school and provide further information and descriptions of individual departments and majors. We hope it will help you, and you will join us in future in our quest for scientific truths. Let us together pursue fundamental science with keen curiosity and inquiring minds.



History of the Graduate School of Science and the School of Science

The history of the School of Science of Osaka University dates back to 1931, when it was established together with the School of Medicine upon the foundation of Osaka Imperial University. At that time, Osaka was the commercial capital of Japan, and played a pivotal role in industrial development. The city became increasingly convinced that Japan should no longer rely on industrial technologies copied from the West, and should endeavor to create new technologies from original, fundamental studies. Accordingly, business leaders in Osaka came to recognize the need for an educational and research institution in Osaka to study basic science for the future, which coupled with the support of local citizens, led to the establishment of the School of Science. Reportedly, local citizens covered all the expenses of the School of Science for the first three years, including the funds for its establishment, without receiving any aid from the government. This demonstrates the future-oriented mindset and enterprising spirit inherent in the people of Osaka, which also actuated the establishment of two renowned private schools, Kaitoku-do and Teki-jyuku, in Osaka in the Edo period (1603–1868).

Characteristically, from its onset, the School of Science of Osaka University focused on industrial application of technologies, while pursuing fundamental scientific principles. By placing equal importance on applied research and fundamental research, the School of Science aimed to always meet the needs of society. This attitude has become a traditional principle of the School of Science and is very much alive still today.

The Graduate School of Science began accepting graduate students from universities under the old school system and

started education and research guidance at the Department of Mathematics, the Department of Physics and the Department of Chemistry in 1933, and at the Department of Biology in 1952. In 1953, the Graduate School of Science was reestablished under a new school system with eight departments: one for mathematics, three for physics, two for chemistry and two for biology. The first master's students and doctoral students entered the Graduate School of Science in 1953 and 1955, respectively. The Department of Macromolecular Science was added to the Graduate School of Science in 1963, the three departments for physics were integrated into the Department of Physics in 1964, and the Department Earth and Space Science was established in 1995.

Following a reform to place greater emphasis on graduate education implemented between 1995 and 1996, the Graduate School of Science was reorganized and has since then comprised of six departments: Mathematics; Physics; Chemistry; Biological Sciences; Macromolecular Science; and Earth and Space Science. Additionally, affiliated institutes of the Graduate School of Science, the Research Center for Structural Thermodynamics and the Project Research Center for Fundamental Sciences, conduct education and research together with the Graduate School of Science.

More recently, on April 1, 2014, the Center for Advanced High Magnetic Field Science was opened.



Characteristics

Characteristics of the Graduate School of Science

Inheriting the founding spirit and tradition of the School of Science of Osaka University, which celebrated its 80th anniversary in 2011, the Graduate School of Science has maintained its research-first principle, which places importance on a liberal, lively spirit and creativity unencumbered by old conventions. It is very important for the progress of science to be in an environment where basic studies are highly valued even if they are seemingly useless at present. For instance, nobody pointed out the importance of the structure of a gene when it was revealed in 1950s. However, as a result of the progress of science in other fields, the structure of a gene is now applied to many different technologies. There are so many examples similar to this case. This means that behind the progress of technologies, there is a culture created by scientific studies. If a country is to produce a unique, revolutionary technology, the country should have a well-established scientific culture.



Experiment in chemistry

These days, science and technology are becoming more advanced and specialized, covering a wider range of fields. However, the original missions of the Graduate School of Science have remained unchanged, which include creating new culture based on the tradition of basic science, as well as educating researchers capable of contributing to this purpose. On the other hand, it is important to have a good understanding of how science and technology can affect our society, such



Discussion in macromolecular science



Lecture in mathematics course

as through energy and environmental problems, and it is necessary to foster a willingness to work for the wellbeing of humans from a global perspective. Researchers should have a global mindset and the ability to produce more creative, revolutionary results to contribute to the development and happiness of humans. In this light, graduate education is now expected to not only educate students through conventional basic studies, but also develop professionals who can cater to various industrial needs. In other words, graduate schools are required to take on two important roles: one is education in individual, highly specialized fields of study; the other is a synthetically balanced education which integrates and organizes these fields of study.



Experiment in biology

In order to meet the needs of the times by successfully playing these roles, the Graduate School of Science pursues the following two goals in its educational and research activities: (1) to maintain a liberal, creative, research-first principle as its academic culture, and educate high-caliber researchers capable of conducting research on their own in their respective fields of study; and (2) to train highly specialized professionals who have expertise across a broad range of natural science disciplines by providing education and research guidance on basic science, which is fundamental for all scientific skills



Library of the department of Mathematics

and technologies. In order to achieve these two purposes, the Graduate School of Science has accepted a significant number of academic staff from external organizations and launched new educational and research programs of science, with a view to promoting advanced, interdisciplinary research on a global scale. The Graduate School of Science also offers courses jointly with other organizations within the university; namely, the Graduate School of Information Science and Technology; the Graduate School of Frontier Biosciences; the Graduate School of Engineering Science; the Research Institute for Microbial Diseases; the Institute of Scientific and Industrial Research; the Institute for Protein Research; the Research Center for Nuclear Physics; the Institute of Laser Engineering; the Radioisotope Research Center; the Center for Education in Liberal Arts and Sciences; the Cybermedia Center; the Department of Safety and Hygiene; and the Museum of



Seminar

Osaka University. Many academic staff members of these organizations have joined the Graduate School of Science to teach courses related to their fields of study. Moreover, a number of outside researchers have participated in research studies at the Graduate School of Science as collaborative and guest instructors. These instructors are from the Graduate School of Science and Technology of Keio University; the Institute of Physical and Chemical Research (RIKEN);

the National Institute of Advanced Industrial Science and Technology (AIST); the National Institute of Information and Communications Technology (NICT); the Peptide Institute Inc.; Suntory Foundation for Life Sciences, Bioorganic Research Institute; and JT Biohistory Research Hall. With so many leading instructors with diverse specialties, the Graduate School of Science provides a wide range of educational and research programs covering various areas from basic science to applied research.



Experiment in earth and space science

While science and technology made remarkable progress during the 20th century, the pace of progress will further accelerate during this century. The advancement of science and technology has enabled humans to enjoy affluent, comfortable lives, as well as increased longevity, which no previous generation has experienced before. On the other hand, the continuous pursuit of affluence and efficiency has resulted in serious environmental problems such as a depletion of energy resources and destruction of the global environment. These problems have surfaced within a fairly short period of time, hardly a blink of an eye in light of long human history that spans tens of thousands of years. Therefore, humans in the 21st century should be wise enough to have a sober understanding of science and technology from the perspective of human history. Humans will be inevitably led to extinction unless we achieve revolutionary breakthroughs in science and technology that will help us find fundamental solutions to various problems related to energy, the environment, food supplies, and overpopulation. In this sense, our generation has an obligation to pass on basic science that can lead to the development of technologies for coping with these problems to the next generation as a cultural heritage.

With this in mind, researchers at the Graduate School of Science devote their passion and energy to educational and research activities in an open and stimulating environment to achieve their own individual goals.

Organization of Graduate School of Science and School of Science

Graduate School of Science / School of Science

Department of Mathematics (Graduate Course / Undergraduate Course)

Graduate School of Information Science and Technology
Center for Education in Liberal Arts and Sciences
Cybermedia Center
Keio University Graduate School of Science and Technology

Department of Physics (Graduate Course / Undergraduate Course)

Graduate School of Frontier Biosciences
Institute of Scientific and Industrial Research
Research Center for Nuclear Physics
Radioisotope Research Center
Center for Education in Liberal Arts and Sciences
Low Temperature Center
Institute of Laser Engineering
Cybermedia Center
Cooperation with the Institute of Physical and Chemical Research (RIKEN)

Department of Chemistry (Graduate Course / Undergraduate Course)

Institute for Protein Research
Institute of Scientific and Industrial Research
Radioisotope Research Center
Museum of Osaka University
Center for Education in Liberal Arts and Sciences
Cooperation with National Institute of Advanced Industrial Science and Technology, KANSAI
Collaboration with Peptide Institute, Inc.
Cooperation with Suntory Foundation for Life Sciences, Bioorganic Research Institute

Department of Biological Sciences (Graduate Course / Undergraduate Course)

Graduate School of Frontier Biosciences
Research Institute for Microbial Diseases
Institute of Scientific and Industrial Research
Institute for Protein Research
Genome Information Research Center
Cooperation with Biohistory Research Hall, Inc.
Cooperation with Kansai Advanced Research Center, Advanced ICT Research Institute National Information and Communications Technology
Cooperation with RIKEN Spring-8 Center (HARIMA)
Cooperation with RIKEN Center for Developmental Biology (KOBE)

Department of Macromolecular Science (Graduate Course)

Institute for Protein Research
Department of Safety and Hygiene

Department of Earth and Space Science (Graduate Course)

Institute of Laser Engineering

Project Research Center for Fundamental Sciences

Research Center for Structural Thermodynamics

Center for Advanced High Magnetic Field Science

Administrative Office

General Affairs Section
Personnel Section
Academic Affairs
Graduate Students Section
Accounting Section
Contract Section
University-Industry Collaboration Section
Research Support Section

