Subject	Advanced Organic Chemistry				
Course Numbering	Y MP PHA 5 21 J Y LP PHA 5 21 J	Categories	Elective		
Preferable Participants	MC 1st	Schedule	Thursday 9:00-12:00	Credits	2
Instructor	Yoshiharu Iwabuchi, Takayuki Doi, Naohiko Yoshikai, Shino Manabe, Masanori Shigeno, Atsushi Tahara				
Practical business					
Objectives and summary of class	This lecture course will illustrate some of the essential concepts and mechanisms of organic reactions and synthetic methodology for the efficient construction of drug candidate molecules. Practices of these subjects will help students' better understanding of organic chemistry and its relevance to pharmaceutical sciences.				
Goal of study					
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	June 1	Masanori Shigeno	Selective functionalization of aromatic and heteroaromatic compounds	Aromatic and heteroaromatic compounds are very important structural units in medicinal chemistry. In this lecture, students will learn various methodologies to functionalize aromatic and heteroaromatic compounds selectively.
2			Practice	Practice of using various methods for construction of poly functionalized aromatic and heteroaromatic compounds.
3	June 8	Naohiko Yoshikai	Transition metal catalysis	Structure, bonding, and reactivity of transition metal complexes and their applications as catalysts for organic transformations, especially those relevant to the synthesis of bioactive compounds and pharmaceuticals.
4			Practice	To improve analytical and problem-solving skills through practice on mechanisms and applications of transition metal-catalyzed reactions.
5	June 15	Naohiko Yoshikai	Heterocycle synthesis	Methods for the construction of pharmaceutically relevant heterocyclic compounds from readily available starting materials, including classical condensation reactions as well as modern catalytic reactions.
6			Practice	To improve analytical and problem-solving skills through practice on mechanisms and applications of heterocycle-forming reactions.
7	June 22	Masanori Shigeno	Functionalization of unreactive chemical bonds	Direct functionalization of C-H and C-C bonds is important because it enables a straightforward synthetic route from readily available substances to target products, which will be explained in this lecture.
8			Practice	Practice of understanding various methodologies utilizing unreactive chemical bonds.

9	June 29	Takayuki Doi Atsushi Tahara	Introduction to theoretical calculations	Theoretical calculations play important role for designing and analyzing new drugs. In this lecture, students will learn and understand fundamental theory of molecular force field calculation and molecular orbital calculation. Students will also learn minimization of energy of compound by structural optimization and conformational analysis.
10			Practice	The practice using SPARTAN aims to improve students' understanding of the above issues.
11	July 6	Takayuki Doi Atsushi Tahara	Application of theoretical calculations	In this lecture, students will learn frontier orbitals (HOMO and LUMO) by using molecular orbital calculations and their visualization. In addition, students will understand analysis of transition state structure.
12			Practice	The practice using SPARTAN aims to improve students' understanding the above issues.
13	July 13	Yoshiharu Iwabuchi	Stereoelectronic effect	The concept of stereoelectronic effects exerting on organic molecular conformation, reactivity, and selectivity will be explained.
14			Practice	The practice of understanding and predicting chemo, regio-, and diastereoselecitive reactions to improve students' skills.
15	July 20	Shino Manabe	Glycochemistry	Glycosides and glycoconjugates play important roles in biological events. Structure and chemical synthesis of glycosides/glycoconjugates are explained. In addition, medicines based on glycosides will be shown.
16			Practice	The practice of synthetic strategy of glycosides and structural analyses will be conducted.

Record and evaluation method	Evaluated by final examination (80%) and class performance including exercise (20%).
Textbook/ Reference	Each lecturer will introduce the textbook and/or references for the content of his/her lecture.
Preparation and Review	Students should try to gain relevant basic knowledge about the content of the lecture beforehand. After each lecture, students are encouraged to study further to deepen and strengthen their understanding of the content.
Language Used in Course	Japanese
In addition	

Subject	Advanced Clinical Pharmacy/ Special Lecture in Pharmacy I*				
Course Numbering	Y MP PHA 5 61 J Y LP PHA 5 61 J Y PH PHA 7 11 J*	Categories	Elective/ Required*		
Preferable Participants	MC 1st /DC 1st*	Schedule	Monday 9:00-12:00	Credits	3 /2*
Instructor	Yoshihisa Tomioka, Masahiro Hiratsuka, Nariyasu Mano, Nobuyuki Takahashi, Yuriko Murai, Noriyasu Hirasawa, Toshihide Saga, Shoji Takamatsu, Fumiyoshi Ojima, Norio Takahashi, Yotaro Matsumoto, Hiroaki Yamaguchi				
Practical business	○				
Objectives and summary of class	In this course, students learn pathology, practical pharmacotherapy planning and outcome evaluation, contribution based on pathological knowledge to drug discovery, post-marketing evaluation, evaluation for drug information, proper medication use and, practice of medical care and disease management.				
Goal of study	The purpose of this course is to help students explain the basic roles of medical practitioner as a leading pharmacist candidate.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	10/2	Yotaro Matsumoto	Organic chemistry and pharmacy practice	Students learn the importance of the thinking and idea for organic chemistry to understand pharmacy practice and medicine widely.
2			Its exercise and practice	In order to improve scientific understanding and thinking, carry out group discussion about when the organic chemistry will be important during pharmacy practice.
3	10/16	Fumiyoshi Ojima	Outcome evaluation for pharmacotherapy and clinical research	Students can deepen understanding of the importance of the evaluation for a patient's vital signs in order to find drug therapy problems such as side effects.
4			Its exercise and practice	Actually carry out the measurement of vital signs. Learn the correct procedure them. To understand how to evaluate them as a pharmacist.
5	10/23	Nariyasu Mano	Latest chemical diagnosis	Students can deepen their understanding of the latest developments for advances in chemical diagnostics of various diseases using mass spectrometry, practice of TDM, and biomarker reseach and developments.
6			Its exercise and practice	In order to improve understanding power and expression power, carry out something practices in a variety of ways in chemical diagnostics.
7	10/30	undecided	From drug development to post-marketing safety measures	Students can outline the example of the approval and post-marketing safety measures based on recent pharmaceutical administration and regulations in Japan and international trends.
8			Its exercise and practice	In order to improve understanding power and expression power, carry out something practices in a variety of ways in chemical diagnostics.
9	11/6	Yuriko Murai	Analysis, evaluation and the use of drug information	The course provides explanations of the proper use of medicine from a drug informational point of view to deepen understanding of the medical care, and also refers to the medical risk communication and drug information specialist pharmacist.

10			Its exercise and practice	In order to improve understanding power and expression power, carry out something practices in a variety of ways such as group discussion, role playing in the drug information analysis, evaluation and the use.
11	11/13	Masahiro Hiratsuka	Individualized drug therapy with genetic polymorphism diagnosis	Students can understand several clinical examples for individualized drug therapy related to drug selection, dose planning and side effect avoidance through genetic polymorphism diagnosis for drug metabolizing enzyme and/or drug transporter.
12			Its exercise and practice	In order to improve understanding power and expression power, carry out something practices in a variety of ways in the individualized drug therapy with genetic polymorphism diagnosis .
13	11/20	Toshihide Saga	Theory and practice of risk management and disaster pharmacy	Students can learn the basic idea of the medical safety, and deepen their understanding of the importance of risk management as a pharmacist participating to the highly advanced medical care/technology.
14			Its exercise and practice	Based on the real incident example, students will analyze the factors and plan the measures.
15	11/27	Nobuyuki Takahashi	Pathophysiology and treatment of pregnancy-induced hypertension	Students learn definition, classification and pathophysiology of gestational hypertension. They also discuss the problems and future perspectives of gestational hypertension.
16			Its exercise and practice	Students learn variety of ways to develop novel drug therapies of pregnancy-induced hypertension.
17	12/4	Noriyasu Hirasawa	Advances in pharmacotherapy of diabetes	This lecture provides overview about pathological conditions of diabetes and mode of actions of anti-diabetic drugs. Recent development of new types of anti-diabetic drugs caused the change of strategy of pharmacotherapy. This lecture helps the student better understand the most up-to-date pharmacotherapy of diabetes.
18			Its exercise and practice	Students understand the most up-to-date pharmacotherapy of diabetes and describe it in their own words.
19	12/11	Hiroaki Yamaguchi	Toxidorome and drug test	Students understand the concept of toxidrome in the treatment of acute poisoning, and learn how to test for substances that cause poisoning.
20			Its exercise and practice	In order to improve understanding power, carry out something practices in a variety of ways in toxidrome and drug test
21	12/18	Norio Takahashi	Theory and practice of medical economy	Students can understand the theory and practice related to pharmacoenomical approach from the point of view of hospital management and patient benefit. They also understand the position of the generic medicine and biosimilar pharmaceutical.
22			Its exercise and practice	Students can deepen understanding from the concrete examples of pharmacoeconomics.
23	12/25	Yoshihisa Tomioka	The role and responsibility of oncology pharmacists	Students understand the role and responsibility of oncology pharmacist. They also understand the need and importance for research to be more safe and effective pharmacotherapy for the next generation.
24			Its exercise and practice	In order to improve understanding power and expression power, carry out something practices in a variety of ways in the desing of prescription, side effect monitoring and avoidance to be serious progress.
25	unfixed	Yoshihisa Tomioka Masahiro Hiratsuka Nariyasu Mano	Course special lecture	Students select a special lecture interested, and deepen understanding of the latest findings in the medical pharmaceutics.

26		Nobuyuki Takahashi Noriyasu Hirasawa Yotaro Matsumoto	Its exercise and practice	In order to improve their knowledge precisely and writing skill such as reports, students summarized the contents of a selected special lecture and read some related review and/or original articles.
Record and evaluation method	Presentations and class participation, and submitted reports, attendance and so on are evaluated.			
Textbook/ Reference	Specify in each lecture.			
Preparation and Review	Preparation: Participants will read and evaluate an original paper related to each lecture. Review: Participants will read and evaluate a review article related to each lecture and practice.			
Language Used in Course	Japanese			
Office hours	Please make an appointment by e-mail etc. before visiting. E-mail: yotaro.matsumoto.a5@tohoku.ac.jp TEL: 022-717-8746			
In addition	*DC (Pharmacy)			

Subject	Advanced Applied Bio-pharmaceutical Sciences / Special Lecture in Pharmacy II*				
Course Numbering	Y MP PHA 5 62 J Y LP PHA 5 62 J Y PH PHA 7 12 J*	Categories	Elective/ Required*		
Preferable Participants	MC 1st /DC 1st*	Schedule	Thursday 18:00-19:30	Credits	3 /2*
Instructor	Takahashi Nobuyuki, Hirasawa Noriyasu, Doi Takayuki, Furumoto Shozo, Tomioka Yoshihisa, Ikeda Kouji, Tashiro Shimon, Goto Takaaki, Matsui Naoko, Obara Taku, Kikuchi Masafumi, Suzuki Hiroyuki, Yamaguchi Takuhiro, Baba Hiroaki, Takayama Makoto				
Practical business	○				
Objectives and summary of class	In this course, students will understand ethics, basic knowledge and technique that are required to carry out clinical research and clinical trial.				
Goal of study	Students understand the significance and the strategy of clinical study and trial in human.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	4/13	Hirasawa	Animal model and assessment of drug efficacy	To develop a new drug, the assessment of the efficacy in animal experimental model is important. In this lecture, you can learn application examples of various animal models and their limitation.
2	4/20	Doi	Organic Chemistry & Medicinal Chemistry	Organic compounds are often included in pharmaceutical products. This lecture features basic organic chemistry from the point of view of medicinal chemistry, and drug discovery based on molecular structures.
3	4/27	Furumoto	Development of PET radiopharmaceuticals for clinical use	Positron emission tomography, PET, which uses a radiopharmaceutical labeled with a positron emitter, is a useful in vivo imaging technology with high quantitative sensitivity and is available for both small animal and human imaging studies. To develop a new PET radiopharmaceutical is helpful to advance development of imaging diagnosis, pharmacokinetic and pharmacodynamics studies, and proof of mechanism of action. In this class, students learn about a development process of PET radiopharmaceuticals including a molecular design, preclinical evaluation, safety tests, and actual clinical usage.
4	5/11	Tomioka	OMICS research in the field of pharmaceutical health care and sciences	OMICS is expected to be applied in various fields, but it is particularly applicable to the personalized medicine by biomarker search and pathological evaluation. In this lecture, I will focus on metabolome analysis and outline the usefulness of comprehensive metabolite analysis in blood, urine, and tissues.
5	5/18	Ikeda	Overview of Drug and medical device development	To be used in clinical practice, newly developed pharmaceuticals and medical devices need to be approved by Ministry for Health, Labour and Welfare.

				The aim of this course is to give an outline of the way of thinking about securing efficacy and safety which are required for application for approval.
6	5/25	Tashiro	Ethics of clinical trials	Well-designed clinical trials are essential for drug development, but the methodology of clinical trials creates its own ethical challenges. This lecture provides an overview of the international debate on ethics of randomized controlled trials.
7	6/1	Goto	Organizational efforts to support proper implementation of clinical research	Clinical research is necessary to realize better medical care in the future, and its proper implementation is strongly required. This lecture will outline the management system and efforts that systematically support the proper implementation of clinical research.
8	6/8	Takahashi	Pathogenesis and Pharmaceutical Treatment of Preeclampsia	Preeclampsia (PE) is a severe form of Hypertensive Disorders of Pregnancy (HDP), and is one of the leading causes of pregnancy-related maternal and fetal death. This course discusses pathogenesis and treatment of PE.
9	6/15	Matsui	Support of clinical research and clinical trial: Roles of CRC	The cooperation of clinical research coordinator (CRC) and other supporting staff is essential for conducting high-quality clinical research and trial. In this lecture, students will learn about the role and responsibilities of the CRC. In addition, we will introduce our support experience of investigator initiated registration-directed clinical trial which is planned and conducted by physicians themselves targeting pharmaceuticals especially with high medical needs.
10	6/22	Obara	Pharmacoepidemiological Study and Clinical Trial in a Digital Society	The Digital Agency was inaugurated in September 2021, and a priority plan for the realization of a Digital Society was announced in December 2021. We would like to discuss how the safety evaluation of post-marketing drug gs and drug development will change as the shift to Dx is further accelerated, using actual examples.
11	6/29	Kikuchi	To provide a more effective and safe pharmacotherapy	Maximizing the therapeutic effect of a drug is extremely important. In a lecture, the examples of therapeutic drug monitoring (TDM) of immunosuppressive agents and molecular targeted anticancer drugs in Tohoku University Hospital will be introduced.
12	7/6	Suzuki	History and next generation of cancer therapy	The class will focus on the history of anti-tumor drug development and the new modality for cancer therapy including antibody and peptide drugs.
13	7/13	Yamaguchi	Statistical thinking and interpretation in evidence-based medicine	In this lecture, students will understand the role of statistics in design, conduct, analysis, interpretation and reporting of medical research, and recognize the importance in creation of evidence.
14	7/20	Baba	Basics on antibiotics	Even now when the medicine has advanced, infectious diseases are big problems in public health. We treat infectious disease with antibiotics. Although the drugs are widely used, therefore, sometimes inappropriately. Pharmacokinetics and pharmacodynamics of antibiotics are established and which make it possible efficient administration of antibiotics. Based on these findings, we discuss appropriate antibiotic use anew.

15	8/3	Takayama	Evidence of traditional Japanese Kampo medicine	Kampo medicine has been widely used in the clinical settings. Clinical and pharmacological evidence of Kampo has been constructed in the last decade. In this lecture, we learn the application and evidence of Kampo medicine.
16	Unfixed	Hirasawa, Doi, Tomioka Takahashi	Topics in Applied Bio-pharmaceutical Sciences	Students will deepen understanding of the topics in Applied Bio-pharmaceutical Sciences and describe their consideration in their own words.
17				
18				
19				
Record and evaluation method		Evaluate submitted report, attendance and so on.		
Textbook/ Reference				
Preparation and Review				
Language Used in Course		Japanese		
Office hours				
In addition		*DC (Pharmacy)		

Subject	Advanced Biochemistry I				
Course Numbering	YMP-PHA541J YLP-PHA541J	Categories	elective		
Preferable Participants	MC 1st	Schedule	Wednesday 9:00-12:00	Credits	3
Instructor	Tohoku University Graduate School Faculty Members				
Practical business	×				
Objectives and summary of class	In Applied Biochemistry I, students will learn the progress of the most cutting-edge biochemical research. It is a joint lecture for the doctoral program (first term) of the Graduate School of Pharmaceutical Sciences, Graduate School of Science, Graduate School of Engineering, Graduate School of Agriculture, Graduate School of Life Sciences, Graduate School of Environmental Science, and students of Doctoral Course of Graduate School of Medicine, Graduate School of Dentistry Doctoral Student. Studends will receive the credits by attending Tohoku University Graduate Student Chemistry Lecture (from April to July; from the 1st to the 12th lecture) to be held at Graduate School of Agriculture and submitting reports.				
Goal of study	This course aims to acquire the latest knowledge on research promotion methods and techniques by learning state-of-the-art research in the field of biochemistry.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				
Term, Date, Lecturer, Theme and Contents	The schedule of the lectures from April to July will be announced separately.				
Record and evaluation method	Students are evaluated on their report of the special lecture. Check with instructor for more information.				
Textbook/ Reference	As the content is diverse, textbooks are not specifically set up.				
Preparation and Review					
Language Used in Course	Japanese				
Office hours					
In addition					

Subject	Advanced Biochemistry II				
Course Numbering	YMP-PHA641 YLP-PHA641	Categories	elective		
Preferable Participants	MC 1st	Schedule	Wednesday 9:00-12:00	Credits	3
Instructor	Tohoku University Graduate School Faculty Members				
Practical business	×				
Objectives and summary of class	In Applied Biochemistry II, students will learn the progress of the most cutting-edge biochemical research. It is a joint lecture for the doctoral program (first term) of the Graduate School of Pharmaceutical Sciences, Graduate School of Science, Graduate School of Engineering, Graduate School of Agriculture, Graduate School of Life Sciences, Graduate School of Environmental Science, and students of Doctoral Course of Graduate School of Medicine, Graduate School of Dentistry Doctoral Student. Studends will receive the credits by attending Tohoku University Graduate Student Chemistry Lecture (from July to December; from the 13th to the 24th lecture) to be held at Graduate School of Agriculture and submitting reports.				
Goal of study	This course aims to acquire the latest knowledge on research promotion methods and techniques by learning state-of-the-art research in the field of biochemistry.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				
Term, Date, Lecturer, Theme and Contents	The schedule of the lectures from July to December will be announced separately.				
Record and evaluation method	Students are evaluated on their report of the special lecture. Check with instructor for more information.				
Textbook/ Reference	As the content is diverse, textbooks are not specifically set up.				
Preparation and Review					
Language Used in Course	Japanese				
Office hours					
In addition					

Subject	Advanced Molecular and Structural Analysis				
Course Numbering	Y MP PHA 5 11 J Y LP PHA 5 11 J	Categories	elective		
Preferable Participants	MC 1st	Schedule	Thursday 9:00-12:00	Credits	3
Instructor	Tomoyuki Oe, Takakazu Nakabayashi, Shozo Furumoto, Tomohiro Konno, Shinji Kajimoto				
Practical business	×				
Objectives and summary of class	This course is designed to help students understand the research methodology which provides insights and understanding to biological functions of proteins, DNA, biopolymers, biomaterials, and soft matters on the basis of the principles of physical chemistry. Students will also understand how the methods of physical chemistry are applied to clarify the structures of biomolecules and to perform quantitative analyses of pharmaceutical products.				
Goal of study	Students will be familiar with the fundamentals of the following topics: biomaterials, soft-matters, statistical analyses of observed spectra, structural analyses using fluorescence spectroscopy, structures and functions of antibodies, biomolecular analyses using mass spectrometry, bio-imaging using radiation rays, surface analyses of biomaterials, mechanical properties of soft-matters, bio-imaging using super-resolution microscopy techniques. Students will also improve their ability to read and understand the papers related to the topics and summarize them as a report.				
Method of class	[Lecture] ・ [Practice] ・ Training ・ On-site training ・ SGD ・ PBL ・ Roleplay ・ e-learning ・ Others( )				

Term	Date	Lecturer	Theme	Contents
1	5/11	Tomohiro Konno	Surface analyses of biomaterials	This lecture provides the surface analysis of biomaterials from viewing point of molecular-designing of polymeric materials. Students can learn the interaction between biomaterials and biomolecules.
2			Exercises	Students are asked to answer several related questions for deeper understanding.
3	5/18	Tomohiro Konno	Mechanical properties of soft-matters	This lecture provides the mechanical properties of colloidal biomaterials, hydrogels, nanoparticles, polymer aggregatesm and so on. Students can learn the interaction between soft-matters and living organisms.
4			Exercises	Students are asked to answer several related questions for deeper understanding.
5	5/25	Shinji Kajimoto	Super-resolution microscopy and its application to biology	This lecture provides the basic principle of super-resolution microscopy and its application to bio-imaging.
6			Exercises	Students will improve their ability to comprehension and expression of the basis of super-resolution microscopy throurh various excersises.

7	6/1	Takakazu Nakabayashi	Fluorescence spectroscopy in biological research	This lecture provides the basic concepts of high sensitive detection of molecules, proteins, and intracellular environments using fluorescence spectroscopic techniques.
8			Exercises	Students will improve their ability to comprehension and expression of the basis of fluorescence and bioscience throurh various excersises.
9	6/8	Tomoyuki Oe	Mass spectrometry of bioactive low molecular weight compounds	This lecture focuses on how mass spectrometry can be used to qualify/quantify small molecules, such as drugs, lipids, steroids, etc. The typical ionization, mass separation, and scanning methods are introduced to understand each principle and characteristics. Students can learn the practical knowledge of mass spectrometric analysis for biomolecules with various examples.
10			Exercises	Students will calculate several data using the linear / nonlinear least squares method. Also students will improve their understanding of the principle of principal component analysis and the relashinship between principal component analysis and least squares method.
11	6/15	Tomoyuki Oe	Mass spectrometry of biomacromolecules	This lecture focuses on how mass spectrometry can be used to qualify/quantify macromolecules, especially proteins. The specific strategies in protein analysis are introduced in terms of ionization, mass separation, database search, etc. Students can learn recent strategy of protein analysis for identification, quantification, and screening of post-translational modifications including chemical modifications.
12			Exercises	Students are asked to answer several related questions for deeper understanding.
13	6/22	Shozo Furumoto	PET radiopharmaceuticals and diagnostic imaging	PET is a highly quantitative technology for analyzing pharmacokinetics in vivo by imaging with a radiolabeled compound. The utility of PET imaging is well known as a molecular imaging method which is applicable to human and useful for medical diagnosis and drug development. This class provides basic and state-of-the-art knowledge of PET probes and clinical diagnosis.
14			Exercises	Students will improve their ability to comprehension and expression of the basis of diagnostic imaging and related radiopharmaceuticals through various exercises.
15	unde cided	Tomoyuki Oe, Takakazu Nakabayashi, Shozo Furumoto, Tomohiro Konno, Shinji Kajimoto	Special lecture for advanced course	Students select one of the lectures and learn about the latest topics in biomolecular analyses.
16				
17			Exercises	Students will deepen their understanding of the special lecture by reading the related reviews and papers. Students will also improve their writing ability by summarizing the contents and expressing their opinions of the special lecture as a report.
18				

Record and evaluation method	Evaluation is performed comprehensively based on attendance, submitted report, and a questions and answers session in exercises.
Textbook/ Reference	The textbook and reference materials will be designated at the beginning of each lecture.
Preparation and Review	It is important for students to acquire preliminary knowledge to prepare for class by reading relevant information and documents that are commonly available.
Language Used in	Japanese

Course	
Office hours	
In addition	

Subject	Advanced Pharmacology				
Course Numbering	Y MP PHA 5 51 J Y LP PHA 5 51 J	Categories	Elective		
Preferable Participants	MC 1st	Schedule	Monday 9:00-12:00	Credits	3
Instructor	Atsushi Matsuzawa, Takuya Sasaki, Hidetaka Akita, Takuya Noguchi, Nariko Arimura, Yu Sakurai				
Practical business	×				
Objectives and summary of class	In this course, students understand the importance of stress-responsive signaling as drug targets, drug discovery research based on molecular mechanisms of cell death and inflammation, mechanisms underlying neurodegenerative disease and neuropsychiatric disorder and the significance of drug discovery research targeting the neuronal circuit, the drug delivery systems and pharmacokinetics/pharmacodynamics for the drug development.				
Goal of study	The purpose of this course is to help students understand and explain basic important points of chemical pharmacology and the importance of its application to drug discovery and clinical pharmacy.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	4/10	Atsushi Matsuzawa, Takuya Noguchi	Stress-responsive signaling as drug targets	Organisms are always exposed to various types of stress, such as oxygen radicals, ultraviolet rays, and pathogen infection, and therefore sense the stress and maintain homeostasis by appropriate responses to the stress through stress-responsive signaling. Disregulation of the signaling leads to various diseases. This lecture provides explanations of drug discovery research targeting stress-responsive signaling molecules.
2			Practice	The practice of drug discovery research targeting stress-responsive signaling molecules in various methods improves students' skill of discovery and development research of new drugs.
3	4/17	Atsushi Matsuzawa, Takuya Noguchi	Drug discovery research based on molecular mechanisms of cell death and inflammation	In recent years, it has become clear that a reduced ability to induce cell death and excessive inflammation lead to various diseases. Therefore, signaling molecules involved in the induction of cell death and inflammatory responses are considered as attractive targets for drug discovery. This lecture provides explanations of drug discovery research based on molecular mechanisms of cell death and inflammation.

4			Practice	The practice of drug discovery research based on molecular mechanisms of cell death and inflammation in various methods improves students' skill of discovery and development research of new drugs.
5	4/24	Takuya Sasaki	Memory in the brain and neurodegenerative disease	The brain circuits play crucial roles in learning and memory. Dysregulation of these functions leads to neurodegenerative disease. The lecture focuses on drug development for neurodegenerative disease based on the dynamics of neurnoanl circuits.
6			Practice	The students should learn the skill for drug development targeting for neuronal circuits in neurodegenerative disorders.
7	5/1	Nariko Arimura	Emotion in the brain and neuropsychiatric disease	The brain circuits play crucial roles in emotion. Imbalance of excitation/inhibition of neurons leads to neuropsychiatric disease. The lecture focuses on drug development for neuropsychiatric disease based on the development of neuronal circuit and its molecular mechanisms.
8			Practice	The students should learn the skill for drug development targeting for neuronal circuits in neuropsychiatric disorders.
9	5/8	Hidetaka Akita	DDS technology for gene/nucleotide-based drug development	In parallel with a progress in "-omics" technologies, Genes (i.e. DNA and RNA) for protein complementation and nucleic acids for protein knockdown are now recognized as an attractive molecule for delivering personalized medication. We will explain the current state of medical technology using genes and nucleic acids. Also, the DDS technologies those are important for realizing this medical modaliry will be explained.
10			Practice	To get deep understanding of DDS for gene and nucleic acids, several practical examples will be demonstrated.

11	5/15	Yu Sakurai	DDS Technology in Cancer Therapy	The development of DDS technology for cancer is the most studied area of DDS technology. The characteristic structure of cancer tissue that enables cancer-selective drug delivery and current issues will be discussed.
12			Practice	To get deep understanding of advanced DDS Technology in Cancer Therapy, several practical examples will be demonstrated.
13	(Undecided)	Atsushi Matsuzawa, Takuya Sasaki, Hidetaka Akita, Takuya Noguchi, Nariko Arimura, Yasuo Uchida	Special lecture	The latest findings of chemical pharmacology are introduced. Students select interesting one among several special lectures.
14				
15			Practice	Students arrange the contents of the special lecture and deepen their understanding of it by reading of the related reviews and articles in order to make their knowledge more accurate. Furthermore, students improve their ability to write sentences by training to summarize the contents and their knowledge in a report.
16				
17				
18				

Record and evaluation method	Evaluation is performed comprehensively based on discussion, presentation, submitted report and so on, in the practice.
Textbook/ Reference	Each instructor introduces reference books and scientific literature as required.
Preparation and Review	Students are required to prepare and review for class according to the goal and contents of each class.
Language Used in Course	Japanese
Office hours	
In addition	On-line (On-demand) lectures will be provided.

Subject	Advanced Biological Sciences				
Course Numbering	Y MP PHA 5 42 J Y LP PHA 5 42 J	Categories	elective		
Preferable Participants	MC 1st	Schedule	Monday 9:00-12:00	Credits	3
Instructor	Shoichiro Kurata, Yoshiro Saito, Asuka Inoue, Tamaki Yano				
Practical business	×				
Objectives and summary of class	In this course, students will learn the progress of the latest research on the molecular basis of biological phenomenon, and understand the direction of the future research in drug development and biological chemistry. Students can deepen their understanding of the biological chemistry by practice.				
Goal of study	This course aims to improve the student's ability to understand and explain the molecular basis of biological phenomenon, that is required for researchers in in drug development and biological chemistry.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	6/5	Asuka Inoue	GPCR and drug development	G-protein-coupled receptors (GPCRs) represent the most important and successful class for drug targets. Over a decade, structural and dynamics understanding of a ligand-GPCR-effector activation mechanism has been advanced. In this course, such advancement of GPCR structural works will be lecutured. In addition, a new pharmacological mode known as biased ligand will be explained and its application to development of a safer drug will be presented.
2			Exercises	This exercises aims to improve student's ability to understand structure and signal transduction of GPCRs and drugs.
3	6/12	Asuka Inoue	Bioinformatics	Recent progresses in omics (e.g, genomics, trancritomics and interactomics) provides a wealth of deposited information in databases. Nowadays, researchers routinely use these databases and understanding of access to the database becomes increasingly important for research progress. In this course, gene searching and sgRNA design for genome editing will be explained. In addition, cancer-related signal transduction that was revealed by bioinformatics approaches will be lectured.
4			Exercises	This exercises aims to improve student's ability to search databases and design sgRNA sequences for CRISPR-Cas9 genome editing.

5	6/19	Tamaki Yano	Physiological function of autophagy	Autophagy is a fundamental process involved in the turnover of molecules and organelles in the cell cytoplasm to maintain cellular homeostasis. This lecture provides an overview of molecular mechanism and the physiological function of autophagy, with the focus on its role on immunity, neurodegenerative diseases, and tissue homeostasis.
6			Related practice	Aiming to improve students' ability to review and describe on cellular homeostasis and physiological function of autopthagy.
7	6/26	Shoichiro Kurata	Molecular mechanism of recognition and elimination of pathgens in innate immunity	Innate immunity is evolutionarily conserved host defense system independent of the gene rearrangement. This lecture provides an overview of molecular mechanism of recognition and elimination of various pathogens in innate immunity.
8			Related practice	This course aims to improve students' ability to comprehension and expression by the exercises on the molecular mechanisms of innate immunity.
9	7/4 (Tue)	Yoshiro Saito	Metabolism of essential trace elements and related diseases	The amount of essential trace elements is small, but its decrease and increase have a great impact on homeostasis. This lecture provides an overview of the physiological role of selenium and diseases related to its metabolism disorder.
10			Related practice	This practice aims to improve students' ability to comprehend and express the physiological role of essential trace elements and the molecular mechanisms of its regulation.
11	7/10	Yoshiro Saito	Toxicity of environmental pollutants and biological defense system	Environmental pollutants cause various health problems on living organisms, while there is a system that acts defensively against the toxicity of these pollutants. This lecture provides an overview of the environmental pollutants and defense systems against these.
12			Related practice	This practice aims to improve students' ability to comprehend and express about the environmental pollutants and defense systems against these.
13		Shoichiro Kurata, Yoshiro Saito, Asuka Inoue Tamaki Yano,	Special lecture	To introduce the latest knowledge in biological chemistry. Select interested one from the special lectures.
14				
15				
16			Related practice	This practice aims to help students understand the knowledge of the special lecture through study of the related reviews and papers, and to further improve students' ability to write reports.
17				
18				
Record and evaluation method		Students are evaluated on their discussion, presentation, and report in the lecture and the related practice and their report of the special lecture.		

Textbook/ Reference	Lecturers introduce related textbooks and papers in their lecture.
Preparation and Review	Understanding of the lectures and development of the practices by reference books and literatures introduced by each lecturers
Language Used in Course	Japanese
Office hours	
In addition	

Subject	Advanced Medicinal Chemistry				
Course Numbering	Y MP PHA 5 31 J Y LP PHA 5 31 J	Categories	Elective		
Preferable Participants	MC 1st	Schedule	Thursday 9:00-12:00	Credits	2
Instructor	Hidetoshi Tokuyama, Teigo Asai, Naoki Kanoh, Shino Manabe, Masaatsu Adachi, Hirofumi Ueda, Yusuke Sasano				
Practical business	Not applicable				
Objectives and summary of class	This lecture course will explain molecules having potential as a new drug from various point of view including organometallic chemistry, biogenesis, synthetic organic chemistry, and carbohydrate chemistry, and antibody drug to understand approaches to creat new drugs such as exploration of new drug candicates from the nature, exploration of new drug target, transformation and construction of organic molecules, and designing new molecules. Practices of these subjects help students' better understanding of medicinal chemistry.				
Goal of study	Goal of course will to acquire expertise and understanding of latest methodologies and judgment skill as a researcher, which is required in the future research and drug development.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	Oct. 5	Yusuke Sasano	Bioorganometallic chemistry	Many metal elements play important roles to retain homeostasis. In this lecture, students will learn basic coordination chemistry and chemistry of redox metal enzymes.
2			Practice	The practice of designing of model complexes for metal enzymes aims to improve students' understanding and presentation skills.
3	Oct. 12	Taro Ozaki	Enzymatic reactions in biosynthesis	Enzymes catalize a variety of reactions and are responsible for a diversity of skeletal formations and structure modifications of natural products. This lecture aimes to understand various enzymatic reactions in natural product biosynthesis from organic chemistry and structural biology point of view.
4			Practice	The practice for understanding of various reaction mechanisms of enzymatic reactions to improve students' skills.
5	Oct. 19	Teigo Asai	Biosynthesis and synthetic biology of natural product	Natural product is an attractive source for drug discovery. Understanding natural product biosynthetic machinery enables us to produce not only valuable natural products but also novel natural products. This lecture will introduce representative natural product biosynthetic machinery and recent examples of natural product synthetic biology.
6			Practice	The practice of mining famous natural product biosynthetic gene clusters and their related clusters aimes to improve students' understanding and reserche skills.

7	Oct. 26	Naoki Kanoh	Target identification of biologically active small molecules by using chemical proteomics approaches	Identification of molecular targets is an important step for understanding mode-of-action of biologically active small molecules. This lecture will introduce recent methods and protocols for identifying molecular targets for bioactive natural and sythetic small molecules by using chemical proteomic approaches.
8			Practice	he practice of planning methods for target identification of several bioactive small molecules aims to improve students' understanding and presentation skills.
9	Nov. 2	Hirofumi Ueda	Efficient synthesis of biologically active compounds	This lecure will pick-up biologically active compounds, which has a potential of new drug lead compounds, and expain efficient synthesis of target molecules based on the latest organic synthetic strategies including C-H functionalization.
10			Practice	The practice of planning synthetic route of biologically active compounds in several ways aims to improve students' understanding and presentation skills.
11	Nov. 9	Hidetoshi Tokuyama	Efficient synthesis of nitrogen containing heterocylic compounds	Nitrogen-containing heterocycles are fundamental skeleton in biologically acitive compounds. Lecture will deal with representative synthesis of nitrogen-containing heterocycles and their applications to total syntheses of biologically active compounds.
12			Practice	The practice of planning synthetic route of biologically active compounds using construction of N-heterocycles aims to improve students' understanding and presentation skills.
13	Nov. 16	Masaatsu Adachi	Synthetic strategy of biologically active compounds containing carbohydrates	Carbohydrates in biologically active compounds play important roles in expression of biological activity. This lecture will pick-up methodologies based on *C*-Glycosylation and their applications to chemical synthesis of carbohydrates.
14			Practice	The practice using various methods for introduction of carbohydrates by *C*-Glycosylation to improve students' understanding and presentation skills.
15	Nov. 30	Shino Manabe	Design of antibody-drug conjugates	Antibody-drug conjugate is expected as next-generation therapeutic antibody. Payload conjugateion methodology and design of payload release will be explained from organic chemisty view.
16			Practice	The practice of design of ADC will be held in order to improve students' understanding and presentation skills.
Record and evaluation method	Evaluated by final examination (80%) and class performance including exercise (20%).			

Textbook/ Reference	The text book or the reference will be designated at the beginning of each of lecture.
Preparation and Review	Students should prepare related preliminary knowledge beforehand about the content of the lecture. After lecture, understanding will be deepened by further studying on the contents of the lecture.
Language Used in Course	Japanese
In addition	

授業科目名	Food & Agriculture	科目ナンバリング	YMP-PHA544（分子薬科学専攻） YLP-PHA544（生命薬科学専攻）	科目区分	elective
配当学年	MC1st	開講時間	Friday, 14:40 – 16:10	単位数	2
担当教員	Faculties in CFAI, Graduate School of Agricultural Science, Tohoku University, and Faculties in Tohoku University School of Medicine, Tohoku University Graduate School of Dentistry and Graduate School of Pharmaceutical Sciences, Tohoku University, and Faculties in foreign institutions.				
実務・実践的授業	×	使用言語	English		
授業概要	This class aims to study the basic concepts of food and agricultural immunology and their application for drug-independent cultivation and food production. Each unit professor of the center and collaborative professor in Tohoku University will give the lectures to introduce their specific research relating to immunology field. This lecture is opened using ISTU (Internet School of Tohoku University). Students can view the video after registration.				
到達目標	To understand the new study field of food and agricultural immunology and how to apply the concept for drug-independent cultivation and food production.				
授業方法	Lecture・Practice・Training・On-site training・ SGD・PBL・Roleplay・e-learning・ Others（ISTU）				
授業内容・方法と進度予定	1. Overview of food & agricultural immunology. (Dr. Haruki Kitazawa) 2. Overview of microbial ecology in animals, plants, and fish. (Dr. Wakako Ikeda-Ohtsubo) 3. Recognition and exclusion of pathogens in innate immunity.(Dr. Shoichiro Kurata) 4. Overview of innate immune system of mollusks and crustaceans. (Dr. Keisuke Takahashi) 5. Overview of immune system of fish and disease prevention study. (Dr. Toshiki Nakano) 6. Overview of plant immune system (Dr. Sugihiro Ando) 7. Overview of insect control system by plant immune system. (Dr. Masatoshi Hori) 8. Overview of functional food evaluation. (Dr. Hitoshi Shirakawa) 9. Overview of effects on human health relating to epigenetics. (Dr. Masahiko Harata) 10. Overview of plant response to environmental cues. (Dr. Yukihiro Ito) 11. Introduction of Immunology. (Dr. Naoto Ishii) 12. Mucosal Immunity from mouth to gut. (Dr. Shunji Sugawara) 13. Overview of mucosal immune system. (Dr. Tomonori Nochi) 14. Emerging Infectious Diseases. (Dr. Hitoshi Oshitani)				

	15. Food Safety and Society. (Dr. Katsuhito Fuyuki)
成績評価法	Participation(30%), Reports(70%)
準備学修等	Participate in the International Food & Agricultural Immunology Lecture is highly recommended.
教科書・参考書	Textbook and references will be introduced by each professor. Video materials are also available.
時間外学修	It is important for students to acquire preliminary knowledge to prepare for class by reading relevant information and documents that are commonly available.
備考	This class is opened by ISTU. Information about the lecture also will be sent from the google classroom. Important! Student who want to use financial aid for study abroad from CFAI have to take this credit. Please check CFAI homepage carefully. http://www.agri.tohoku.ac.jp/cfai/ Instructors: Faculties in CFAI, Graduate School of Agricultural Science, Tohoku University, and Faculties in Tohoku University School of Medicine, Tohoku University Graduate School of Dentistry and Graduate School of Pharmaceutical Sciences, Tohoku University, and Faculties in foreign institutions. Office hours: The time of day is not specified. Please make an appointment in advance by email. E-mail: sugihiro.ando.a2◎tohoku.ac.jp Please change "◎" to "@".

Subject	Advanced Oraganic Chemistry A				
Course Numbering	YMPPHA522J	Categories	Elective		
Preferable Participants	MC 1st	Schedule	Friday 13:00-14:30	Credits	2
Instructor	Iwamoto, Takeaki (Sci), Sasaki, Makoto (Life Sci), Takimiya, Kazuo (Sci), Mitsuishi, Masaya (Eng), Ishikawa, Minoru (Life Sci), Arimoto, Hirokazu (Life Sci), Doi, Takayuki (Pharm Sci)				
Practical business	Not applicable				
Objectives and summary of class	You will learn modern organic chemistry from the basics of organic chemistry and acquire the basic knowledge for conducting advanced research.				
Goal of study	Understanding the molecular structure and chemical reactions of organic molecules based on the molecular orbital method. Understanding the structure of organometallic molecules and the mechanism of chemical reactions				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1 2 3	4/14 4/21 4/28	Iwamoto	Chemistry of main group elements I-7 , I-8	The structure of organic element compounds will be explained, and organic typical element chemistry will be presented.
4 5 6	5/12 5/19 5/26	Takimiya	Organic reaction I I-6：6.1,6.6	The polar reaction and the pericyclic reaction will be presented.
7 8 9	6/2 6/9 6/16	Sasaki	Organic reaction II I-5：5.3,5.4, I-6：6.2～6.4	Radicals and carbene intermediates are outlined, and radical reactions, carbene reactions, and photochemical reactions are presented.
10 11 12	6/23 6/30 7/7	Ishikawa Arimoto	Structure, bonding, and reaction of transition metal organic complexes I-9 , I-10	The structure and bond of the complex are outlined, and the reaction of the organic transition metal complex is presented.
13 14 15	7/14 7/21 7/28	Mitsuishi	Skeleton formation reaction I II-2：2.1～2.2	The addition reaction to the C = X type bond and the addition reaction to the C = C bond will be presented.
	8/4	Toyota	Examination	

Record and evaluation method	Evaluated by final examination (100%)
Textbook/ Reference	大学院講義 有機化学 第２版、I. 分子構造と反応・有機金属化学、および II. 有機合成化学・生物有機化学、野依良治編集、東京化学同人
Preparation and Review	Read a textbook and prepare for the content of the lecture. After the lecture, deepen your understanding of the content of the lecture by further learning on your own.
Language Used in Course	Japanese
Office hours	You may ask questions to the instructor after the lecture, or by email. If you do not know the contact information, please contact Prof. Doi Email: doi_taka@mail.pharm.tohoku.ac.jp
In addition	

Subject	Advanced Oraganic Chemistry B				
Course Numbering	YMPPHA523J	Categories	Elective		
Preferable Participants	MC 1st	Schedule	Friday 13:00-14:30	Credits	2
Instructor	Hayashi, Yujiro (Sci), Doi, Takayuki (Pharm Sci), Yoshikai, Naohiko (Pharm Sci), Terada, Masahiro (Sci), Kuwahara, Shigefumi (Agr Sci),				
Practical business	Not applicable				
Objectives and summary of class	You will learn up to date synthetic reactions, functional group transformation, asymmetric reactions, and multi-step synthesis.				
Goal of study	Understanding modern organic molecule construction methods learining from the basics to the latest synthetic reactions. You will be able to design multi-step synthesis by combining them.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1 2 3	10/6 10/13 10/20	Hayashi	Skeleton formation reaction II II- 2 : 2.3～2.5	Substitution reactions on an sp^3 carbon, cross-coupling reactions, and metathesis reactions competitive reactions of π-electron systems are explained.
4 5 6	11/10 11/17 11/24	Doi	Skeleton formation reaction III II- 2 : 2.6～2.8	Concerted reactions on π-electron systems, rearrangment, elimination, bond cleavage, photochemical reactions, and heterocyclic reactions are explained.
7 8 9	12/1 12/8 12/15	Yoshikai	Functional group transformation II-3	Reduction and oxidation are explained.
10 11 12	12/22 12/27* 1/5	Terada	Stereochemical control of organic reactions II-1, II-4	The selectivity in the organic synthetic reactions is explained, and the asymmetric synthesis is presented.
13 14 15	1/19 1/26 2/2	Enomoto	Design for multistep synthesis II-5	Retrosynthetic analysis, functional group transformation, functional group addition, functional group migration, skeletal rearrangement, and cascade reaction are explained. Protecting groups are also presented.
	2/9	Toyota	Examination	

Record and evaluation method	Evaluated by final examination (100%)
Textbook/ Reference	大学院講義 有機化学 第２版、I. 分子構造と反応・有機金属化学、および II. 有機合成化学・生物有機化学、野依良治編集、東京化学同人
Preparation and Review	Read a textbook and prepare for the content of the lecture. After the lecture, deepen your understanding of the content of the lecture by further learning on your own.
Language Used in Course	Japanese
Office hours	You may ask questions to the instructor after the lecture, or by email. If you do not know the contact information, please contact Prof. Tokuyama. Email: tokuyama@mail.pharm.tohoku.ac.jp
In addition	It is recommended that students have mastered Advanced Organic Chemistry A.

Subject	Medical Omics				
Course Numbering	YMP-PHA591J / YLP-PHA591J / YPH-PHA791J	Categories	elective		
Preferable Participants	MC 1st /DC 1st*	Schedule	Friday, 17:30-19:00	Credits	1
Instructor	Nariyasu Mano, Nobuo Fuse, Daisuke Saigusa, Yasushi Ishihama, Masahiro Hiratsuka, Yuichi Aoki, Masamitsu Maekawa, Yoshihide Kawasaki				
Practical business	○				
Objectives and summary of class	This lecture provides methods and practical examples necessary for analysis of Biomolecules.				
Goal of study	This course is designed to help students understand the linkage of their own research and Biomolecular analysis.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				

Term	Date	Lecturer	Theme	Contents
1	10/13	Nariyasu Mano	Basic technologies in biomolecular analysis	In this lecture, you will learn the basics of separation and detection techniques for genes, proteins, bioactive small molecules, etc.
2	10/20	Nobuo Fuse	Genome analysis research	This lecture outlines genome analysis research such as whole genome analysis, SNP analysis, and GWAS analysis.
3	11/10	Daisuke Saigusa	Global metabolomics and lipidomics	This lecture outlines comprehensive analysis of metabolome and lipid analysis research related to diseases.
4	11/17	Yasushi Ishihama	Disease proeomics	This lecture outlines proteome analysis, which is indispensable for today's medical research.
5	11/24	Masahiro Hiratsuka	Pharmacogenomics	This lecture outlines pharmacogenomics, which is indispensable for promoting personalized medicine and precision medicine.
6	12/1	Yuichi Aoki	Bioinformatics	This lecture outlines integrated analysis of information obtained from analysis of DNA, RNA, proteins, small molecules, etc.
7	12/8	Masamitsu Maekawa	Clinical chemistry research by target metabolomics	This lecture outlines exploratory research on diagnostic markers by analyzing the behavior of molecules in the body in various diseases.
8	12/15	Yoshihide Kawasaki	Disease omics research and its clinical application	This lecture introduces examples of application of disease omics analysis to clinical practice.

Record and evaluation method	Evaluation reports submitted just after each class, attendance and so on.
Textbook/ Reference	No textbooks will be used. Lecturers will introduce books and literatures as needed.

Preparation and Review	Self-directed learning such as a review is important to gain a better understanding of content of lectures.
Language Used in Course	Japanese
Office hours	
In addition	This class is an omnibus lecture series. *DC (Pharmacy)

Subject	Special Lecture in Organic Chemistry				
Course Numbering	YMPPHA525 YLPPHA525	Categories	elective		
Preferable Participants	MC 1st	Schedule		Credits	2
Instructor	Teigo Asai				
Objectives and summary of class	Students will attend lectures on the latest research on organic chemistry and learn about the progress and future direction of the research on organic chemistry.				
Goal of study	This course aims to deepen knowledge and understanding on the latest lectures on organic chemistry by summarizing the lecture and provide their thoughts as a report.				
Method of class	Lecture・Practice・Training・On-site training・SGD・PBL・Roleplay・e-learning・Others( )				
Term, Date, Lecturer, Theme and Contents					
Record and evaluation method	Students are evaluated on their report.				
Textbook/ Reference	As the content is diverse, textbooks are not specifically set up.				
Preparation and Review					
Language Used in Course	Japanese				
Office hours					
In addition					