List of lectures: Master's Program in Life Science Innovation
ライフイノベーション学位プログラム　博士前期課程　科目表

Required Common Subjects 基礎科目（必修）

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC001	Introduction to Medicine 医学概論	1	1.0	1	SprA	Fri	Innovative Medical Reseach Institute 511	Nobuhiro Ohkohchi, Tatsuya Oda,Kazutaka Aonuma, Nobuyuki Hizawa, Junichi Shoda, Masashi Yamazaki, Tsuyoshi Enomoto, Tetsuya Yamamoto	Malignant neoplasm, cardiovascular disease, and cerebrovascular disease have been major causes of death in Japan. Additionally, orthopedic disorder and trauma by athletics are common. This course will provie students with an overview of current states on pathological conditions, treatments, outcomes, and clinical problems about the diseases. In addition, the progress of research associated with the diseases will be reviewd. 悪性新生物，心疾患，脳血管疾患は日本人の死因の上位を占める疾患である．また，整形外科疾患および外傷（スポーツ外傷も含む）は日常的に遭遇することの多い疾患である．これらの疾患について，主に臨床医学の側面からその病態，治療法，治療成績，ならびに解決すべき課題について概説し，関連する研究分野の世界的な動向について学ぶ．様々な疾患における病態、治療法とその成績、ならびに解決すべき課題について概説し、関連する研究分野の世界の動向について学ぶ。	This class is held on Friday but the period will vary. The period of each class will be put on syllabus. Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC002	Introduction to Drug Discovery 創薬概論	4	1.0	1	SprB	Fri1,2	Innovative Medical Reseach Institute 511	Yoshinori Ikeura, Daikichi Fukushima, Masato Chiba, Hiraku Itadani, Yasuhiro Yasutomi, (Tadayoshi Hayata)	Student will study what kind of processes each pharmaceautical company goes through to place new drugs on the market and their original drug discovery strategy. Students will also study development and practical application of vaccines against infectious disease. 各製薬企業が新薬を上市するまでにどのようなプロセスを経る必要があるのか、また各社に特徴的な創薬戦略について学習する。また、感染症に対するワクチンの開発と実用化について理解を深める。	Lectures are conducted in English. This course includes a trip to Takeda Shonan Research Institute (Fujisawa City). Lectures are conducted in English.
01RC003	Introduction to Food Science 食品科学概論	1	1.0	1	FallA	Fri1,2	Innovative Medical Reseach Institute 511	Mitsutoshi Nakajima, Hiroko Isoda, Sosaku Ichikawa, Kazuichi Sakamoto, Marcos Neves	In this course, students will learn about food science, based on physical, chemical, biochemical, biological, and engineering approach from fundamental level to cutting-edge applied science technology.　本講義では、食品科学技術に関して、物理的、化学的、生物学的、生化学的、工学的アプローチに基づき、基礎から先端応用まで概説する。	Lectures are conducted in English
01RC004	Introduction to BioResource バイオリソース概論	1	1.0	1	FallB	Fri1,2	Innovative Medical Reseach Institute 511	Moriya Ohkuma, Masatomo Kobayashi, Yukio Nakamura, Atsushi Yoshiki, Kuniya Abe (Tadayoshi Hayata)	Students are expected to deeply understand the importance of bioresources and roles of resource centers in promoting life science innovation. In order to achieve the aim, professors who are responsible for experimental animal, experimental plant, cell bank and microorganisms in RIKEN BRC will give lectures on their resources including technologies and related information. 本講義ではライフサイエンスイノベーションの推進におけるバイオリソースの重要性とバイオリソースセンターの役割について理解を深めることを目指す。そのために動植物個体、細胞、微生物リソース、及び関連技術、付随情報について、それぞれの責任者による講義を受ける。	Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC005	Introduction to Natural History 自然史概論	5	1.0	1	SprC	By appointment	National Museum of Nature and Science, Tsukuba	Toshiaki Kuramochi, Tsukasa Iwashina (Mitsuteru Irie)	To introduce investigations on Natural History, several zoological and botanical rsearches will be reviewed. Taxonomy and diversity of parasitic helminth will be lectured and precticed, and lectures on the properties and distribution of flavonoid compounds in plants will also be given. 自然史研究について概観するために、動物学と植物学における研究例のいくつかを紹介する。動物学分野では、寄生蠕虫類の分類と多様性について講義と実習、植物学においては植物におけるフラボノイド化合物の特性と分布について講義を行う。	This curse is performed at Tsukuba Research Institute, National Museum of Nature and Science. Lectures are conducted in English.
01RC006	Bioinfomatics バイオインフォマティクス	5	1.0	1	SprA,B	Fri3	Innovative Medical Reseach Institute 511 and etc.	Tetsuya Sakurai, Yasunori Futamura	In this course, students learn basic concepts and techniques in bioinformatics. Excersizes using a computer will be provided to help understanding basic theories and learning practical skills. この講義では、バイオインフォマティクスに関する基本的な事項を学ぶ。計算機を利用した演習を通して、基礎理論や実践的手法の理解を深める。	Lectures are conducted in English.
01RC007	Management in Pharmaceuticals and Food 医薬品・食品マネジメント学	1	1.0	2	SprA	Fri1,2	Innovative Medical Reseach Institute	Hiroshi AKIMOTO, Kaoru Watanabe, Yoshiki SASAKI	This course will provide students with an overview of current states on the intellectural property, management and investment on the business management on pharmaceutical, functional food and cosmetic industry concretely. 医薬品・食品ビジネスマネジメントに関わる知財管理、運用、投資について、創薬・機能性食品・薬用化粧品開発の実例を提示し、理解を深める。	Lectures are conducted in English. This course will be held in 2017.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC008	Reguratory Science レギュラトリーサイエンス	1	1.0	2	SprB	Mon6,7	Innovative Medical Reseach Institute	Tamotsu Tokunaga, Hajime Kamiyama, Cécile Le Gal-Fontès, Virginie Rage-Andrieu, (Tadayoshi Hayata)	Explains the general principles and requirements of food law and the legislative and regulatory system for food safety and food quality in Japan, the USA, and the EU. Introduces the method of risk analysis for food safety and examines the existing administrative systems and public policy concerning food safety. 本講義では、食品の安全性に関わる法律について解説する。そして、食品安全に関するリスク分析法について解説し、食品安全行政および食品安全をめぐる公共政策の在り方について講義する。	Lectures are conducted in English. This course will be held in 2017.
01RC009	Practice in Life Science Innovation ライフイノベーション実習	5	1.5	1	SprC	By appointment		Hiroko Isoda	This course provides students with the opportunities to visit national and indutrial research institutes in a field of life sciences. Students will learn about the original approach of each institute to research. Students will make the best use of what they learn for thier own research and thier career path after completion of this graduate program. ライフサイエンス分野の国立研究開発法人や製薬企業の研究所を見学する機会を提供する。学生は、各研究所の研究への独自の取り組み方を学習する。学んだことを自らの研究に活かし、大学院修了後のキャリアパスを考える材料とする。	Lectures are conducted in English.Thi course includes a total of 11 trips to national and indutrial research institutes.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC010	Team Learning in Life Science Innvoation ライフイノベーションチーム型演習	2	1.5	1	Annual	By appointment	Innovative Medical Reseach Institute and etc.	Mitsuteru Irie, Hiroko Isoda, Tadayoshi Hayata, Myra O. Villareal, Yasunori Futamura	Students joining this class will try to find a project which is possible to approach with the knowledge of Life Sciences and suggest a solution with collaborative works with the students in the different fields of the program. Through these works, the students are expected to obtain the sense of grasping substential needs of Life Sciences in society and cooperation with experts in different fields which are required for innovation. 本講義ではライフサイエンスに基づいてアプローチ可能な実社会の中の問題を見つけ出し、プログラム内の異分野の研究を行う学生との協働作業により解決策を提案する。これらの作業を通してイノベーションに必要とされる社会的ニーズの的確な把握と、関連する他分野の専門家との共同作業を行うための能力を養成する。	Lectures are conducted in English.
01RC011	CITI: Responsible Conduct of Research CITI：責任ある研究行為：基盤編(e-learning)	0	1.0	1	Annual	By request		Online	This course is CITI JAPAN e-larning will be provided on line. Students will learn responsible conduct of research and rule of research. 本コースは、CITI JAPANのe-ラーニングである。本コースを受講することにより、学生は責任ある研究とはどういうことか、研究のルールを学習することができる。	Online e-learning
01RC012	Master's Internship 博士前期インターンシップ	0	1.0	1	Annual	By appointment		Each Faculty	Students will experience employment and lean practical skills as a member of society in national or industrial research institutes, companies, ministries and agencies, and laboratories in this academic program. 就業体験をし、国立や企業の研究所、会社、省庁、本学位プログラムの研究室で、社会人としての実践力を修得する。	By appointment

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC013	Master's Life Science Innovation Seminar 博士前期ライフイノベーションセミナー	1	1.0	1・2	Annual	By appointment	Innovative Medical Reseach Institute 511	Hiroko Isoda	Faculty from abraod associated with this program provide studenst with research topics in life sciences from basic to forefront. Students will acquire qualities of a researcher and the skills of presentation, discussion and communication by intearcting with the lecturers. 本授業では、海外の協力教員が、ライフサイエンスにおける基礎から最先端の研究トピックを提供する。また、このセミナーを通じて、講師と相互作用することにより、研究者の資質、研究者に必要なプレゼンテーション、ディスカッション、コミュニケーション能力などを獲得する。	Lectures are conducted in English.

Specialized Subjects in Disease Mechanism course

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01EQ052 01RC105	Prominent Discoveries in Neuroscience 神経科学特論	1	1.0	1	SprA	Tue7,Thr7		Masashi Yanagisawa, Hiroshi Nagase, Masanori Sakaguchi, Michael Lazarus, Hiromasa Funato, Qinghua Liu, Yoshihiro Urade	The goal of this omnibus course is to learn advanced principles in neuroscience, by reading “landmark” papers of historical significance in the broad area of neurobiology chosen by each instructor. 神経科学分野において重要な論文を読み、内容を深く理解することで、基礎から応用までの幅広い知識を養う。	This course is a code-share subject provided by Master's Program in Medical Sciences. Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC101	Molecular and Cellular Biology of Disease I 疾患の分子細胞生物学I	1	1.0	1	Spring	By appointment	Innovative Medical Reseach Institute 511	Colin Goding, Panagis Filippakopoulos, Lionel Larue, Eirikur Steingrimsson, Jane Mellor (Myra Villareal)	This course provides an introduction to the principles of molecular and cellular biology and their connections to disease control. Lectures range transcription regulation to models of diseases (in vivo) and provide insights into biological processes and how biological mechanisms underlie human disease (e.g. cancer) and physiology. 本講義では、分子細胞生物学の基本原理とそれらの疾患制御との関わりに関する概論を提供する。講義は、転写調節からin vivo疾患モデルまで取り扱い、生物学的過程への洞察と生物学的メカニズムがどのようにヒト疾患（例：がん）や生理学の基礎となるかについて提供する。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.
01RC102	Molecular and Cellular Biology of Disease II 疾患の分子細胞生物学II	1	1.0	1	Spring	By appointment	Innovative Medical Reseach Institute 511	Colin Goding, Panagis Filippakopoulos, Eric O'neill, Mads Gyrrd-Hansen, Custodia Jimenez Garcia (Myra Villareal)	This course complements Molecular and Cellular Biology of Disease I. Lectures range from cancer cell biology to relationship between deregulation of metabolism and cancer and provides current information in these fields of research. 本講義は、疾患の分子細胞生物学Iと相補的である。講義は、がんの細胞生物学から代謝異常とがんの関係性まで取り扱い、これらの領域における研究の最新の知見を提供する。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.
01RC103	Advances in Cellular Regulation 細胞制御論	1	1.0	1	SprA	Mon1,2	Innovative Medical Reseach Institute 511	Akira Kurisaki, Yuzuru Ito, Tomoko Kuwabara, Renu Wadhwa, Yunwen Zheng, (Tadayoshi Hayata)	Students will study the state-of-the-art research topics in regenerative medicine, developmental biology, stem cell biology and cancer biology as well as therapy against disease and application to drug discovery. 再生医療、発生生物学、幹細胞生物学、がん生物学に関する最先端の研究内容を取り上げ、疾患への治療と創薬への応用について学習する。	Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC104	Basic Bone Biology 基礎骨生物学	1	1.0	1	SprB	Mon1,2	Innovative Medical Reseach Institute 511	Tadayoshi Hayata	Bone is multifunctional organ that plays critical roles for locomotrium, protection for internal organs, storage for calcium and phosphorus, hematopoiesis as well as endocrine function. This course provides students with wide range of bone biology from bone structure and fucntion to bone diseases and their pharmaceautical treatment. Finally, current topics in bone and mineral research will be introcuded and discussed. 骨は、運動器官、内臓の保護、リンとカルシウムの貯蔵庫、造血だけではなく,内分泌器官としても機能する多機能器官である。本講義では、骨の構造、機能から骨疾患とその治療法まで幅広い骨生物学を網羅する。最後に、最新の骨ミネラル研究について紹介し、討論を行う。	Lectures are conducted in English.

Specialized Subjects in Drug Discovery course

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC201	Organic Chemistry / Chemical Biology 有機化学/ケミカルバイオロジー	1	1.0	1	FallA	Mon1,2	Innovative Medical Reseach Institute 511	Noriki Kutsumura, Masaki Kita, Naoshi Yamamoto, Takayuki Ohyoshi,Tsuyoshi Saito, Yoko Nagumo	This course provides the basic organic chemistry required for learning about medicinal chemistry and chemical biology. Mini-exam and report (homework) will promote greater understanding of organic synthetic chemistry. Topics in chemical biology such as target identification and protein labeling will be also discussed. 創薬やケミカルバイオロジーを学ぶために必要な有機化学の基礎を講義する。小テストやレポートによる演習問題を行い、有機合成化学について一層の理解を深める。また標的同定やタンパクラベリングなどケミカルバイオロジーのトピックスについてもふれる。	Lectures are conducted in English. This lecture will not be held in 2015.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC202	Medicinal Chemistry / Pharmacology 創薬化学/薬理学	1	1.0	1	FallB	Mon1,2	Innovative Medical Reseach Institute 511	Hiroshi Nagase, Setsu Endoh, Yasuyuki Nagumo	This course provides the opportunities for students to learn characteristics of a living body, nature of water, the nature and role of the membrane, pharmacophore binding theory for drug design from the selection of drug targets, enzymes, the basis of receptor binding, how to discover new drugs, structure-activity relationship theory as well as application to drug development based on these.This course also provides the pharmacology required for drug discovery. Students will learn mode of action and mechanism of action of the drug, and the basis of the pharmacology from in vitro to in vivo. Furthermore, students will learn the effect of the physiologically active substance on the biological function in central nervous system, cardiovascular, immune/inflammatory system as well as chemotherapy. 生体の特徴、水の性質、膜の性質と役割、創薬ターゲットの選定から薬物設計のためのファーマコフォア結合の理論、酵素、受容体結合の基礎、新薬を発見する方法、構造活性相関の理論等を説明し、これらに基づく新薬開発への応用も解説する。 創薬に必要な薬理学について講義する。薬物の作用様式と作用機序、in vitroからin vivo薬理の基礎を解説する。さらに、生理活性物質の生体機能への作用を中枢神経系、循環器、免疫・炎症系に分けて解説し、また、化学療法についても説明する。	Lectures are conducted in English. This lecture will not be held in 2015.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC203	Translational Science in Drug Discovery 創薬トランスレーショナルサイエンス	5	1.0	1	SprA	Wed1,2	Innovative Medical Reseach Institute 511	Sosuke Miyoshi, Keiji Miyata, Akihiro Noda, (Tadayoshi Hayata)	Translational Science has been of more importance to bridge basic research in the preclinical stage and patient care in the clinical stage. From drug discovery research point of view, it can enhance our understanding and confidence in targets, bringing potential compounds and biologics up to Proof of Concept earlier. Bio-imaging is a translatable tool from preclinical study to clinical study with same methodology such as PET MRI CT, to investigate pharmacokinetics, pharmacodynamics and efficacy especially in target organs with more minimally invasive. 創薬の過程において、非臨床段階で得られた知見を効率良く、迅速に臨床段階へ橋渡しするトランスレーショナルサイエンス概論の授業を実施する。PET、CT、MRI等のバイオイメージング手法は、動物とヒトで試験プロトコールが類似していること、同一個体において長期的試験が可能なこと、生体において視覚的・定量的なデータが得られること、非侵襲的技術であることなど、トランスレーショナルサイエンスの推進において強力なツールである。創薬の現場での経験を生かし、本授業を通じて創薬の魅力を伝える。	Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC204	Drug Discovery Research & Project Management 創薬研究・プロジェクトマネジメント	1	1.0	1	SprB	Wed1,2	Innovative Medical Reseach Institute 511	Kentaro Yoshimatsu (Tadayoshi Hayata)	Promote an understanding of key elements/process of drug discovery research (selection of drug target, assay development, disease-model, lead compound finding, translational research, drug delivery, clinical development etc.) and project management, and provide the examples of specific drug discovery projects in Alzheimer's disease and cancer. 創薬研究の重要なプロセス（創薬標的の選定、アッセイ系の確立、病態モデル、リード化合物の創出、トランスレーショナルリサーチ、drug delivery、臨床開発等）と創薬研究プロジェクトのマネージメントに関する理解を促すとともに、アルツハイマー病およびがんにおける具体的な創薬研究プロジェクトでの例を提示する。	Lectures are conducted in English.
01RC205	Drug Design Engineering 薬剤設計工学	1	1.0	2	SprA	Wed1,2	Innovative Medical Reseach Institute 511	Sosaku Ichikawa, Guoping Chen, Tetsushi Taguchi, Shinji Sugiura	In this course, students will learn about physicalchemistry and material science for the basis of phermaceutical design and engineering. In addition, pharmacokinetics and pharmaceutical assay required for pharmaceutical design will be lectured. We will also provide advanced research topics and cutting-edge technologies in the related fields. 薬剤設計工学の基礎となる物理化学と材料科学について学ぶ。また、薬剤設計に必要な薬物動態と薬剤アッセイ法について講義する。さらに、関連分野の先進的な研究や最先端技術を紹介する。	Lectures are conducted in English. This course will be held in 2017.

Specialized Subjects in Food Innovation course

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC301	Food Process Engineering 食品プロセス工学	1	1.0	1	FallA	Tue6,7	Institutes of Biological and Agricultural Sciences F Building 406	Mitsutoshi Nakajima, Marcos Antonio das Neves, Remko Boom	In this course, students will learn about food process engineering, such as heating, freezing, and separaton as well as baisic principles of mass and heat transfer, reaction and food rhelogy.　本講義では、食品プロセス工学、具体的には、加熱、冷凍、分離プロセス、熱・」物質移動、レオロジーについて解説する。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.
01RC302	Food Functionality 食品機能学	1	1.0	1	FallB	Tue1,2	Innovative Medical Reseach Institute 511	Hiroko Isoda, Mari Maeda-Yamamoto, Myra Villareal, Michel Larroque, Pierre Trifilieff	Functional Foods are foods that have, in addition to their nutritive value, beneficial effect on health. This course discusses functional foods and their bioactive components, specifically their effect on cancer, allergy, neuronal regulation, regulation of metabolism including the mechanism of their effects. 機能性食品は、栄養的価値に加えて、健康に有益な効果をもつ食品である。本授業においては、特に、がん、アレルギー、神経調節、代謝調節およびそれらの作用機序に関して、機能性食品と生理活性物質について議論する。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.
01RC303	Food Safety 食品安全学	1	1.0	1	SprA	Thr1,2	Innovative Medical Reseach Institute 511	Motoo Utsumi, Kazutaka Yamamoto, Hitoshi Nagashima	Learn the basic elements of food safety: risk and hazard, chemical, biological, and physical hazards, toxicology, pasteurization/sterilization, and food safety standards. リスクとハザード、生物的・化学的・物理的危害因子、毒性学、殺菌/滅菌、食品安全規格等、食品安全性の基礎を学ぶ。	Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC304	Food Business 食品ビジネス学	1	1.0	2	SprA	Thr1,2	Innovative Medical Reseach Institute	Kenichi Kashiwagi, Maki Iwasaki, Takayasu Hirosawa	This lecture explores the extention of food business from the point of technology, economic and religious view, and discuss the development and innovation of food industry. (i) After an review of current status of technology among food idustries, the strategic approach toward the smooth implementaion of newly developed technology for establishing the innovative food industry. (ii) Reviewing producer's and comsumer's behaviour and market mechanism in agro-food value chain and discuss the way to develop a new market of agro-food sector. (iii) Many religions have their own rules or laws such as "halal" in Islam, "Kosher"in Judaism, etc and they are deeply related with food business in certain regions. In this lecture, we focus on food and eating habits from the point of religious perspective. The lecture also talks about dietary culture based on the lecturer's fieldworks in Egypt, Tunisia, Turkey, France, Canada, etc. 本講義は、技術、経済および宗教の3つのアプローチから食品ビジネスの展開について概説し、食品産業の発展とイノベーションについて議論するものである。①実学としての食品関連技術開発を如何に、産業活動に結び付けて行くかについて、食品産業の現状を概観した上で、基本的な考え方について考える。②消費者と生産者の行動及び市場メカニズムについて学び、食品産業における新市場を開拓する方途について議論する。③ハラール（イスラーム的に許されたものの意）やコーシェル（ユダヤ教の食事規定）のように、多くの宗教は食に関する重要な戒律が存在し、それらは、一部の地域では食品ビジネスと密接なかかわりを持っている。本講義では、宗教という観点から食について考察するとともに、エジプト、チュニジア、トルコ、フランス、カナダなどでの現地調査に基づき世界の人々の食文化についても焦点をあてる。	Lectures are conducted in English. This course will be held in 2017.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC305	Nutrigenomics 遺伝子栄養学	1	1.0	1	SprB	Thr1,2	Innovative Medical Reseach Institute 511	Kazuichi Sakamoto	Phytochemicals are critically involved in the regulation of a variety of signaling cascades and their essential gene expression, resulting in the protection of metabolic syndromes and anti-aging. In this class, students will learn about the physiological roles and their related-signaling cascade caused by phytochemicals in lipid metabolism, bone metabolism, melanogenesis, and inflammation, etc. ファイトケミカルは種々のシグナル経路や遺伝子発現を介して病気の予防や抗老化に作用する。本講義では、脂質代謝、骨代謝、色素代謝、炎症などに対するファイトケミカルの働きと制御機構を分子生物学的視点から解説する。	Lectures are conducted in English.

Specialized Subjects in Environmental Management course

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
02AF311 01RC404	Environmental Algology 環境藻類学	1	1.0	1	SprA,B	Tue3		Ken-ichiro Ishida, Takeshi Nakayama, Masanobu Kawachi, Masaki Yoshida	Evolution, phylogeny and ecology of the algae will be explained from view of basic biology and environmental sciences. 藻類の進化、系統、生態について、基礎生物学および環境科学の視点から解説する。	This course is a code-share subject provided by Doctoral Program in Integrative Environment and Biomass Sciences. Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC401	Habitat and Functional Compound 生育環境と機能性成分	1	1.0	1	FallA	Wed1,2	Innovative Medical Reseach Institute 511	Nobuo Kawahara, Kayo Yoshimatsu, Hiroyuki Fuchino, Chedly Abdelly, Kenji Tamura, Myra Villareal	Finding medicinal plants which contain functional compounds and culturing them are the important issues in drug discovery and industrial production from natural products. In addition, environmental parameters such as soil condition and aridity define the content of functional compound. Lecture will cover the topics related to Natural product chemistry of medicinal plants, Screening of bioactive component from medicinal plants, Relation between soil condition and functinal compound, Quality control of crude drugs, Drug discovery for tropical diseases from medicinal plants, Micropropagation of medicinal plants through tissue culture, Transformation of medicinal plants, Production of medicinal plants in plant factory and examples of applications. 有用成分を含む薬用植物の発見とその栽培は、天然物質由来の創薬と産業化において重要な課題である。また、土壌、乾燥度などの環境条件は機能性成分含有量の決定因子ともなる。 本授業では薬用植物中の天然物化学、生物活性物質の探索、土壌環境と機能性成分の関係、生薬の品質評価、熱帯感染症治療薬の探索、薬用植物の細胞培養、植物工場における栽培、およびそれらの実例について紹介する。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC402	Biomass Science バイオマス科学	1	1.0	1	FallB	Wed1,2	Innovative Medical Reseach Institute 511	Makoto Watanabe, Gen Inoue, Fred Tennant, Mikihide Demura	Focused on algae biomass, useful functions and coumpounds are introduced from the viewpoints of energy, food, health and life securities, then current status and future porospect of their business are shown and discussed. 藻類バイオマスに焦点をあてて、有用な機能・成分がｴﾈﾙｷﾞｰ、食料、健康および生活保障にどう活用される可能性があるのか、さらにこれらの機能・成分のビジネスの現状と将来展望が議論される。	Lectures are conducted in English. Lectures by foreign teachers are held according to their visiting schedule.
02RA124 01RC405	Environmental Medicine 環境医学	1	1.0	1・2	SprA,B,C	Wed4	Health and Medical Innovation Laboratory, Room 301-2	Yoshito Kumagai	This course aims to lead the students to acquire 1) better understanding of the condition of environmental substances existing in the air, water, soil and food products, and their biological effects on organisms and 2) skills for discussing the mechanism of related adverse reactions. 本講義では、1)空気、水、土壌、食品に存在する環境物質の状態と生体に対する生物学的影響の理解を深め、2)関連する有害反応の機構について議論する能力を獲得する。	This course is a code-share subject provided by Ph.D Program in Human Biology. Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC403	Water Environment and Life Science 水環境と生命科学	1	1.0	1	SprB	Tue1,2	Innovative Medical Reseach Institute 511	Mitsuteru Irie, Maki Tsujimura, Ryoji Okawara, Benjamin Piña	Water is one of the most important medium that determines the conditions of life and Water is cycling on earth, so that the dynamics of water environment is one of the key issues for controlling bioresource. On the other hand, bioligical method to quantify the hazardous contaminants such as endocrine disrupters that define the availability of water resource have been developed recent decades. Lecture will cover the topics related to dynamics of natural water environment; water cycle, climate change, diffusion of substances, hydraulics in stratified water body, material transportation and environmental risk assessment of endocrine disrupter, theoriticaly and practically. 水は生命の生存条件を決定する要素の一つであり、地球上を循環している。したがって、水環境の動的理解は生物資源を制御する上で重要な課題の一つである。また、環境ホルモンなど水資源の安全性を脅かす物質によるリスク評価の生物学的手法が注目を集めている。本講義は水循環、気候変動、物質拡散、成層水塊の水理、物質輸送などの自然の水環境の動態解析、および環境ホルモンとその生物学的評価手法に関する理論および実践に関わる話題を取り扱う。	Lectures are conducted in English.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks

Common Specialized Subjects

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC501	Life Science Innovation Master’s Special Seminar I ライフイノベーション博士前期演習I	2	2.0	1	Annual	By request		Each Faculty	Students will participate journal club in their laboratories, perform scientific presentation and discussion about the journal topics. Student will also take the obtained results into thier own research. 各自の所属研究室において、最新の研究論文の抄読会に参加し、論文の内容について、科学的なプレゼンテーションやディスカッションを行い、また、得られた成果を自らの研究に取り入れる。	Required subject.
01RC502	Life Science Innovation Master’s Special Seminar IIライフイノベーション博士前期演習II	2	2.0	2	Annual	By request		Each Faculty	Students will participate journal club in their laboratories, perform scientific presentation and discussion about the journal topics. Student will also take the obtained results into thier own research. 各自の所属研究室において、最新の研究論文の抄読会に参加し、論文の内容について、科学的なプレゼンテーションやディスカッションを行い、また、得られた成果を自らの研究に取り入れる。	Required subject

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks
01RC503	Life Science Innovation Master's Special Research I ライフイノベーション博士前期研究I	8	4.0	1	Annual	By request		Each Faculty	Students will propose research projects and conduct research activities. Students will perfom presentation about their research progress, deepen the discussion and correct the course of the research. Students will perform presentation at academic meetings and publish the result of their research and finally complete a master thesis or a report on specific subject research. 各自の所属研究室において、研究計画を立案し、研究活動を行う。研究の進捗状況を随時プレゼンテーションし、議論を深めることにより、研究の軌道修正を行う。得られた研究成果を学会や論文として発表し、最終的には修士論文または特定課題研究報告書を完成する。	Required subject
01RC504	Life Science Innovation Master's Special Research II ライフイノベーション博士前期研究II	8	4.0	2	Annual	By request		Each Faculty	Students will propose research projects and conduct research activities. Students will perfom presentation about their research progress, deepen the discussion and correct the course of the research. Students will perform presentation at academic meetings and publish the result of their research and finally complete a master thesis or a report on specific subject research. 各自の所属研究室において、研究計画を立案し、研究活動を行う。研究の進捗状況を随時プレゼンテーションし、議論を深めることにより、研究の軌道修正を行う。得られた研究成果を学会や論文として発表し、最終的には修士論文または特定課題研究報告書を完成する。	Required subject
01RC505	博士前期海外インターンシップ Master's Internship Abroad	0	1.0	1・2	Annual	By appointment		Each Faculty	Students will perform research activity or internship in overseas laboratories and compnies and develop ability to act in a global manner. 海外の研究室や企業等で、研究活動や就業体験を行い、グローバルな活動能力を養う。	Elective subject.

Course Number	Course Name	Course Type	Credits	Standard Academic Year	Course Offering Term	Weeday and Period	Classroom	Instructor	Course Overview	Remarks