

## 2025 年度シラバス

科目分類/Subject Categories			
学部等/Faculty	/大学院工芸科学研究科（博士前期課程）： /Graduate School of Science and Technology (Master's Programs)	今年度開講/Availability	/有：/Available
学域等/Field	/物質・材料科学域：/Academic Field of Materials Science	年次/Year	/1～2年次：/1st through 2nd Year
課程等/Program	/機能物質化学専攻：/Master's Program of Functional Chemistry	学期/Semester	/春学期：/Spring term
分類/Category	/授業科目：/Courses	曜日時限/Day & Period	/：/

科目情報/Course Information				
時間割番号 /Timetable Number				
科目番号 /Course Number	61960019			
単位数/Credits	2			
授業形態 /Course Type	講義：Lecture			
クラス/Class				
授業科目名 /Course Title	Biomacromolecular Engineering : Biomacromolecular Engineering			
担当教員名 / Instructor(s)	/機能物質化学専攻関係教員：Related teacher of the Master's Program of Functional Chemistry			
その他/Other	インターンシップ実施科目 Internship	国際科学技術コース提供科目 IGP	PBL 実施科目 Project Based Learning	DX 活用科目 ICT Usage in Learning
	実務経験のある教員による科目 Practical Teacher			
科目ナンバリング /Numbering Code				

授業の目的・概要 Objectives and Outline of the Course	
日	
英	This teaching is one of the basic training activities of the degree course in Science and Technology of Bio and Nanomaterials. The major goal of this teaching, which includes both theoretical lessons and laboratory sessions, is to introduce the students to biomolecular engineering, an emerging and highly interdisciplinary discipline that includes molecular biology, biological chemistry and bioengineering. Particular attention will be dedicated to the principles and methodologies used to modify the properties of genetically encoded macromolecules such as nucleic acids, peptides and proteins, and their applications as therapeutics, diagnostics, biosensors and biocatalysts.

学習の到達目標 Learning Objectives	
日	
英	<p>to encourage and stimulate the use of a logical and deductive thinking necessary to understand and modify the structure and function of complex macromolecules such as DNA, RNA, peptides and proteins</p> <p>to learn advanced methodologies and technologies for the synthesis, modification and characterization of the major biological macromolecules</p> <p>to favour an adequate and critical experimental approach that is indispensable for reading and understanding scientific articles</p> <p>to develop familiarity and independence in the preparation of PowerPoint slides in order to be able to present and explain an</p>

	assigned scientific article in front of the classroom to develop practical skills and expertise in the production, purification and characterisation of some biological macromolecules, either alone or as part of small work units to develop the ability to expose scientific concepts in a formal manner and using a proper scientific language
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学習目標の達成度の評価基準 / Fulfillment of Course Goals (JABEE 関連科目のみ)	
日	
英	

授業計画項目 Course Plan			
No.		項目 Topics	内容 Content
1	日 英	Theoretical lessons (1)	Properties of the major functional groups present in the biomolecules and non-covalent interactions in the aqueous systems
2	日 英	Theoretical lessons (2)	Structure and function of the nucleic acids DNA and RNA; Structure and function of peptides and proteins
3	日 英	Theoretical lessons (3)	Description of properties and functions of biological macromolecules that can be engineered; Methods for generating genetic diversity: focused and random mutagenesis
4	日 英	Theoretical lessons (4)	Rational design of novel biological macromolecules; Directed evolution technologies: in vivo, in vitro and ex vivo selection strategies;
5	日 英	Theoretical lessons (5)	Theoretical lessons (5)
6	日 英	Theoretical lessons (6)	Applications of engineered macromolecules to bio and nanotechnologies
7	日 英	Laboratory sessions (1)	Techniques for the production, purification and modification of nucleic acids and proteins. Isolation and purification of DNA and RNA. Cloning of DNA molecules: amplification, digestion and ligation.
8	日 英	Laboratory sessions (2)	Mutagenesis methods. Bioconjugation of DNA and RNA. Methods for the determination of protein concentration.
9	日 英	Laboratory sessions (3)	Methods for the production and extraction of recombinant proteins.
10	日 英	Laboratory sessions (4)	Liquid chromatography techniques for protein purification. Bioconjugation of proteins.
11	日 英	Laboratory sessions (5)	The cloning, production, purification and concentration of a recombinant protein,
12	日 英	Laboratory sessions (6)	Bioconjugation of a fluorophore to a protein and its characterization by spectroscopic techniques (UV/Vis, fluorescence).
13	日 英	Discussion and presentation	The discussion and presentation of a scientific articles pertaining to the course and selected among six articles assigned by the teacher.
14	日 英	Oral exam (1)	A series of questions concerning theoretical part of the program reported in the "Contents" section, including the practical laboratory experiences
15	日 英	Oral exam (2)	A series of questions concerning laboratory sessions part of the program reported in

		the "Contents" section, including the practical laboratory experiences
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履修条件 Prerequisite(s)	
日	
英	

授業時間外学習（予習・復習等） Required study time, Preparation and review	
日	
英	To have reached the educational objectives of physic, general and organic chemistry, molecular biology, biochemistry, cellular biology and microbiology, possibly (but not necessarily) having passed the final exams of these courses.

教科書／参考書 Textbooks/Reference Books	
日	
英	As a support to the study, in addition to the lecture notes and a series of scientific publications provided by the teacher, the following textbook is suggested: D. Van Vranken, G. Weiss: Introduction to Bioorganic Chemistry and Chemical Biology, Garland

成績評価の方法及び基準 Grading Policy	
日	
英	The assessment of learning takes place by means of an oral exam lasting about one hour. The degree of accuracy of the answers and the ownership of the scientific language used will be evaluated. The constant and active participation to the lessons will be

留意事項等 Point to consider	
日	
英	