



浙江理工大学  
ZHEJIANG SCI-TECH UNIVERSITY

# 生物技术专业 (全英文授课班) 课程教学大纲

TEACHING SYLLABI OF  
BIOTECHNOLOGY MAJOR

生命科学与医药学院  
COLLEGE OF LIFE SCIENCES AND MEDICINE

教务处  
DIVISION OF ACADEMIC AFFAIRS

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厚德致远

博学敦行



浙江理工大学  
ZHEJIANG SCI-TECH UNIVERSITY

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Zhejiang Sci-Tech University  
**Teaching Syllabi of Biotechnology  
Major**

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## Foreword

Syllabus serves not only as the basis for textbook compiling and teaching, but also as the important standard for the evaluation of students' academic achievements and teachers' teaching quality. This new round of syllabus revision is organized by the Academic Affairs Office and supported by all Schools and Departments of Zhejiang Sci-Tech University (ZSTU). The aim is to thoroughly carry forward the spirit of the National Education Conference and implement *The Outline on Ideological and Political Construction of University Curriculum* issued by the Ministry of Education. It is also an effort to carry out the requirements for courses set by both major accreditation (evaluation) and national standards for teaching quality of different majors. The revised syllabi are expected to ensure the successful implementation of the 2020 edition of *the ZSTU Undergraduate Students Cultivation Plan* and to promote the construction of the first-class majors and the first-class courses.

After revision, each volume of the syllabi is centered on one major, including its general education courses, basic courses, core courses and practice courses. The syllabi of all the non-major general education courses are compiled into a separate volume.

The syllabi was revised based on the 2020 edition of the ZSTU Undergraduate Students Cultivation Plan. Some obsolete courses and content are deleted. New additions include: (1) The ideological and political education is incorporated into the course design, teaching content and seminars. (2) Three criteria for a gold course are emphasized by highlighting the integration of knowledge, ability and quality. (3) Quality textbooks are selected; in particular, mandatory textbooks listed by the Marxist Theory Research and Development Project are designated as the only textbooks for some specific majors as required.

The revision and compilation is finished by the joint efforts of the deans and head teachers in charge of teaching in all the Schools and Departments. Participation of many teachers and support from the leaders of the University guarantee its successful completion. Their efforts and support are hereby acknowledged.

It is our sincere hope that teachers will follow the revised syllabi, exploring new teaching contents and models to develop more first-class courses.

Syllabus revision is like a systematic project, involving many factors. Although we have tried our best, there might still exist some errors. Please do not spare your comments to help us make constant improvements, so that a solid foundation is laid to push the education and teaching quality of our university to a higher level.

Academic Affairs Office  
June 2021

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# Syllabus of Fermentation Engineering

**Course Name/Title:** Fermentation Engineering      **Course code:** 86904

**Course Type:** Basic Course (Optional Course)

**Total Teaching Hours:** 32    (32 Classroom Hour)

**Course Credit:** 2

## I Course Introduction

Fermentation engineering is one of the main and important courses for students whose majority is biotechnology. Learning this course let students master the basic knowledge of strain improving, fermentation techniques, master practical skills of fermentation in the field of theory and production, and develops students' abilities of acquisition of knowledge, application of knowledge, and innovation. Through the integration of critical thinking, students' materialistic world outlook, scientific spirit and innovative thinking are cultivated, and students' homeland feelings, pride and sense of mission are stimulated by explaining the development history of fermentation engineering and the research results of Chinese scholars.

## II. Course objective

### 1. Ideological and political objective

**Course objective 1:** Through the integration of critical thinking, students' materialistic world outlook, scientific spirit and innovative thinking are cultivated, and students' homeland feelings, pride and sense of mission are stimulated by explaining the development history of fermentation engineering and the research results of Chinese scholars.

### 2. Knowledge objective

**Course objective 2:** Master the basic knowledge of strain improving, strain preservation, fermentation equipments and techniques;

**Course objective 3:** Master the practical skills of fermentation in the field of theory and industrial production.

### 3. Ability objective

**Course objective 4:** Develop students' abilities of acquisition of knowledge, application of knowledge, and innovation.

### 4. Quality objectives

**Course objective 5:** Possess the abilities of dialectical thinking, realistic attitude, innovation

spirit and good professional ethics.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Could understand the biological science and biological technology, mathematical statistics and biological engineering principle and other basic theory; understand the biological industry theory, possess the ability of analyzing problems.	Course Objective 1,2,3,4,5
Graduation Requirement 5	Have the biotechnology engineering practice and the basic technological innovation ability by using the knowledge of gene engineering, microbiological engineering and fermentation engineering methods and tools. By the integrated application of the theoretical knowledge and skills, possess the ability of designing downstream product of biotechnology and related fields research.	Course Objective 1,2,3,4,5

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Overview 1. The concepts, such as fermentation and fermentation engineering; 2. The history and future of fermentation engineering; 3. The types and process of fermentation engineering, the industrial fields as concerned and the industrial production process; Teaching objects and study methods.	1. Understand the concepts of fermentation and fermentation engineering; 2. Understand the history and future of fermentation engineering; 3. Master the types and process of fermentation engineering. 4. Cultivate students'	2	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		materialistic world outlook, scientific spirit and innovative thinking.			
2	<p>Strains of Fermentation Industry</p> <p>1. Introduction to the common microorganisms and the corresponding requirements in fermentation industry.</p> <p>2. Methods for the isolation and selection of industrial microorganisms.</p> <p>3. Methods for preventing industrial microorganisms from degeneration and for rejuvenation of degenerated microorganisms.</p> <p>4. Theory and practice for the preservation of industrial microorganisms.</p>	<p>1. Understand the introduction of common microorganisms and the corresponding requirements in fermentation industry.</p> <p>2. Master the methods for the isolation and selection of industrial microorganism.</p> <p>3. Master the methods for preventing industrial microorganisms from degeneration and for rejuvenation of degenerated microorganisms.</p> <p>4. Master the theory and practice for the preservation of industrial microorganisms.</p> <p>5. Stimulate students' homeland feelings, pride and sense of mission.</p>	4	Lecture	1, 2, 3, 4, 5
3	<p>Design Method for the Optimal Fermentation Media</p> <p>1. Types of fermentation media and the reasonable content of nutrients;</p> <p>2. Common materials for carbon and nitrogen sources, inorganic salts, growth factors, minor elements, precursors, activators and inhibitors in fermentation technology;</p> <p>3. Theory and method for fermentation media design.</p>	<p>1. Grasp the types of fermentation media and the reasonable content of nutrients;</p> <p>2. Master the common materials for carbon and nitrogen sources, inorganic salts, growth factors, minor elements, precursors, activators and inhibitors in fermentation technology;</p> <p>3. Master the theory and method for fermentation media design.</p> <p>4. Cultivate students' materialistic world outlook,</p>	4	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		scientific spirit and innovative thinking.			
4	<p>Aseptic Technology for Fermentation Industry</p> <ol style="list-style-type: none"> <li>1. The concepts, such as sterilization, disinfection, and antiseptics;</li> <li>2. The harms of contamination to fermentation process;</li> <li>3. The effects of microbiological contamination on different fermentation process as well as contamination at different time;</li> <li>4. Methods to judge microbiological contamination and reason analysis;</li> <li>5. The strategy to prevent and control microbiological contamination;</li> <li>6. Theory and methods for media disinfection and sterilization;</li> <li>7. Technology of batch and continuous sterilization;</li> <li>8. Aseptic conditions and theories for the fermentation equipments.</li> </ol>	<ol style="list-style-type: none"> <li>1. Understand the concepts, such as sterilization, disinfection, and antiseptics;</li> <li>2. Understand the harms of contamination to fermentation process;</li> <li>3. Understand the effects of microbiological contamination on different fermentation process as well as contamination at different time;</li> <li>4. Master the methods to judge microbiological contamination and reason analysis;</li> <li>5. Master the strategy to prevent and control microbiological contamination;</li> <li>6. Understand theory and methods for media disinfection and sterilization;</li> <li>7. Master technology of batch and continuous sterilization;</li> <li>8. Understand aseptic conditions and theories for the fermentation equipments.</li> </ol>	2	Lecture	1, 2, 3, 4, 5
5	<p>Seed Preparation for Fermentation Process</p> <ol style="list-style-type: none"> <li>1. Concepts of seed culture, see age, seed volume, and fermentation tank series;</li> <li>2. Effects of nutritional and</li> </ol>	<ol style="list-style-type: none"> <li>1. Understand the concepts of seed culture, see age, seed volume, and fermentation tank series;</li> <li>2. Master the effects of nutritional and cultivation</li> </ol>	2	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	cultivation conditions on inoculum quality, such as culture formular, inoculum, temperature, humidity, pH, aeration, agitation; 3. The parameters to assess culture, such as cell number, biochemical specifications, productivity, and enzyme activity.	conditions on inoculum quality, such as culture formular, inoculum, temperature, humidity, pH, aeration, agitation; 3. Master the parameters to assess culture, such as cell number, biochemical specifications, productivity, and enzyme activity.			
6	Fermentation Kinetics 1. The kinetic balance and internal law of cell growth, substrate consuming and product concentration during fermentation; 2. The concepts of cell growth rate, the rate of substrate consuming and the rate of substrate consuming and the rate of product formation are introduced; 3. The concept and establishment of Monod equation.	1. Master the kinetic balance and internal law of cell growth, substrate consuming and product concentration during fermentation; 2. Understand the concepts of cell growth rate, the rate of substrate consuming and the rate of product formation are introduced; 3. Understand the concept and establishment of Monod equation. 4. Stimulate students' homeland feelings, pride and sense of mission. 5. Cultivate students' materialistic world outlook, scientific spirit and innovative thinking.	1	Lecture	1, 2, 3, 4, 5
7	Oxygen Requirement and Supplies of Oxygen 1. The importance of dissolved oxygen in submerged fermentation; 2. Factors such as features of fermentation broth, specific surface area between air and liquid, agitation,	Understand the importance of dissolved oxygen in submerged fermentation; Master the Factors such as features of fermentation broth, specific surface area between air and liquid,	2	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	air line velocity, surfactant, ionic strength, cells concentration affect oxygen transfer coefficient.	agitation, air line velocity, surfactant, ionic strength, cells concentration affect oxygen transfer coefficient. 3. Stimulate students' homeland feelings, pride and sense of mission. 4. Cultivate students' materialistic world outlook, scientific spirit and innovative thinking.			
8	Fermentation Process Control 1. The importance of temperature control to fermentation process and the effect of temperature on cell growth and metabolic products formation; 2. The composition of fermentation heat and its calculation method; 3. The effect of pH on cell growth and product formation; 4. The reasons for the pH change and the the pH control methods; 5. The foam properties and the behavior of foam formation during fermentation; 6. The effect of foam on fermentation is discussed and the industrial antifoaming strategies; 7. The effect of dissolved carbon dioxide on cell growth and product formation; 8. The definition respiratory quotient and its application, the methods of determining the CO <sub>2</sub> content and the strategies for CO <sub>2</sub> control in fermentation off-gas; 9. The advantages of fed-batch fermentation and the feeding nutrient and strategy; 10. The effect of nutrient	1. Understand the importance of temperature control to fermentation process and the effect of temperature on cell growth and metabolic products formation; 2. Master the composition of fermentation heat and its calculation method; 3. Understand the effect of pH on cell growth and product formation; 4. Understand the reasons for the pH change and the pH control methods; 5. Understand the foam properties and the behavior of foam formation during fermentation; 6. Understand the effect of foam on fermentation is discussed and the industrial antifoaming strategies; 7. Understand the effect of dissolved carbon dioxide on cell growth and product formation; 8. Master the definition respiratory quotient and its	7	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	concentration on fermentation.	application, the methods of determining the CO <sub>2</sub> content and the strategies for CO <sub>2</sub> control in fermentation off-gas; 9. Master the advantages of fed-batch fermentation and the feeding nutrient and strategy; Master the effect of nutrient concentration on fermentation.			
9	Fermentation of Genetic Engineering Strain 1. Characteristics and type of genetic engineering strain and gene expression system; 2. Stability of genetic engineering strain.	1. Master characteristics and types of genetic engineering strain and gene expression system; 2. Understand stability of genetic engineering strain. 3. Stimulate students' homeland feelings, pride and sense of mission.	2	Lecture	1, 2, 3, 4, 5
10	Fermentation of Immobilization Cells 1. Advantage of immobilized cells and characteristics changes of cells during immobilization; 2. Methods for Enzyme immobilization; 3. Advances and applications of immobilization technology.	1. Master advantage of immobilized cells and characteristics changes of cells during immobilization; 2. Master methods for Enzyme immobilization; 3. Understand advances and applications of immobilization technology.	2	Lecture	1, 2, 3, 4, 5
11	Solid State Fermentation 1. Theory and technical feature of solid state fermentation; 2. Bioreactors for solid state fermentation; 3. Applications of solid state fermentation.	1. Master theory and technical feature of solid state fermentation; 2. Master the bioreactors for solid state fermentation; 3. Understand applications of solid state fermentation are discussed. 4. Stimulate students' homeland feelings, pride	2	Lecture	1, 2, 3, 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		and sense of mission. 5. Cultivate students' materialistic world outlook, scientific spirit and innovative thinking.			
12	Large Scale Cultivation Technology of Animal Cells 1. The significance of animal cells cultivation technology; 2. The composition and preparation of media for animal cells cultivation; 3. Experimental techniques involved in the cells cultivation.	1. Master the significance of animal cells cultivation technology; 2. Master the composition and preparation of media for animal cells cultivation; 3. Understand experimental techniques involved in the cells cultivation. 4. Stimulate students' homeland feelings, pride and sense of mission. 5. Cultivate students' materialistic world outlook, scientific spirit and innovative thinking.	2	Lecture	1, 2, 3, 4, 5

### V Period Distribution and Teaching Modes

The period distribution is as the following table:

Lecture	Topic	Teaching Hours	Requirements
1	Overview	1	Know the concept of fermentation engineering.
2	Strains of Fermentation Industry	4	Learn the strains of fermentation industry.
3	Design Method for the Optimal Fermentation Media	4	1. Mastery fermentation media design; 2. Learn aseptic technology and seed preparation; 3. Learn fermentation kinetics and oxygen requirement.
4	Aseptic Technology for Fermentation Industry	2	
5	Seed Preparation for Fermentation Process	4	
6	Fermentation Kinetics	1	
7	Oxygen Requirement and Supplies	2	
8	Fermentation Process Control	6	1. Learn the control of fermentation

9	Fermentation of Genetic Engineering Strain	2	process;
10	Fermentation of Immobilization Cells	2	2. learn the fermentation of genetic engineering strain; 3. Learn the fermentation of immobilization cells.
11	Solid State Fermentation	2	1. Learn solid state fermentation;
12	Large Scale Cultivation Technology of Animal Cells	2	2.Learn the mechanism of antibody modification; 3. Know Large scale cultivation of animal cells.
Total		32	

### Teaching methods:

According to the teaching goal of the course and characteristics, give priority to with teacher, professor, student's self-study as auxiliary means, combining with multimedia courseware. Topic study of teaching methods in teaching, increase the communication between teachers and students, students, guide students to think independently, to strengthen the training of thinking and language expression ability training. Make full use of its advantages of audio-visual, strengthen the teaching content, and indicate the focus, to explain the difficulty, study thought and method are given, emphasis on the necessary teaching practice.

Students can accord the content of the teacher's lecture, the initiative to obtain relevant information online, by watching related knowledge of science and education films, to help their understanding of fermentation engineering. To improve student's abilities of autonomous learning, some contents will be assigned to study after class. Then students have to do a presentation in class. In addition, we will choose some reasonable topics to discuss in class.

### VI Assessment

1. The assessment approach will be taken as written examination;
2. The item includes: noun explanation, blank questions, label the diagram, short-answer questions and the discussion essay questions.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
attendance	At least 5 times	10%	1, 2, 3,4
class performance	Question answer, discussion and presentation	20%	1, 2, 3,4
unit tests	2 times	20%	1, 2, 3,4
final exam	Close-book	50%	1, 2, 3,4

### VII Textbooks and References

#### 1. Textbook

[1] E.M.T. El-Mansi, C.F.A. Bryce, B. Dahhou, S. Sanchez, A.L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology (3rd Edition), CRC Press of Taylor & Francis Group, 2012 .

#### 2. References

[1] P.F. Stanbury, A. Whitaker, S.J. Hall. Principles of Fermentation Technology (2nd Edition), Oxford Press, 1995

[2] Henry C. Vogel, Celeste L. Todaro. Fermentation and Biochemical Engineering Handbook

(2nd Edition), Noyes Publications, 1997.

[3] Carlos Ricardo Soccol, Ashok Pandey, Christian Larroche. Fermentation Processes Engineering in the Food Industry. 2002

### **3. Web Resources**

[1] [https://www.btec.ncsu.edu/industry/short\\_courses/fermentation.php](https://www.btec.ncsu.edu/industry/short_courses/fermentation.php)

[2] <https://www.cabdirect.org/?target=%2fcabdirect%2fabstract%2f20153181801>

[3 ] <https://www.omicsgroup.org/journals/fermentation-technology.php>

**Written by:** Jie Xiong

**Reviewed by:** Xiumei Zhou

**Date:** 2021.04.30

# Syllabus of Gene engineering

**Course Name/Title:** Gene Engineering      **Course code:** 86907

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 32 Classroom Hours

**Course Credit:** 2

## I Course Introduction

Genetic engineering is one of the core teaching contents for biotechnology specialty, involved in many subjects such as chemistry, physics, and biology, and so on. The objective of this course is to make students acquire the basic knowledge, principles, theories, and strategies on application of gene engineering, prepare for further advanced study, or make an essential basis for related scientific research and practice.

## II Course Objective

Course Objective 1: The aim of ideological political education is to explain the basic concepts and principles through the organic combination of practical examples, make students realize that the development of biotechnology is based on the continuous in-depth understanding of the nature of things, cultivate students' dialectical thinking concept, revere bioethical safety, and stimulate students' thirst for knowledge and professional mission.

Course Objective 2: The aim of knowledge education is to make students master the basic knowledge and theory of gene engineering, understand the basic principles of gene engineering operation, and recognize the research progress and development trend in the hot field of gene engineering.

Course Objective 3: The aim of capability education is to develop students' experimental skills and ability to analyse and solve problems and to preliminarily design gene engineering experiments using DNA recombination technology.

Course Objective 4: The aim of quality education is to make students have the scientific thought, innovation consciousness and entrepreneurship spirit of seeking truth from facts, have the professional spirit of following academic norms and embrace the national feelings and mission responsibilities of science and technology to return to the country

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
4	Master solid basic theory, basic knowledge and basic skills of biological science	1,2
7	The ability to systematically master basic experimental methods and skills in biotechnology and related fields	2,3,4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Preface Concepts of gene and gene engineering Main content and technical route of gene engineering The importance of gene cloning and DNA analysis	(1) Understand the research content and development process of gene engineering, the frontier and development opportunities of gene engineering. (2) Master some concepts related to gene and gene engineering. (3) Through the story of "painting the snake and adding the feet", the latest transgenic engineering technology research is introduced to prove the subversive understanding of "snakes have feet", and inspire students to think dialectically about "the relationship between biological evolution and gene mutation".	2	Teaching in class and extensive reading after class	1,2,3
2	Chapter 2 plasmid and bacteriophage Plasmid and it's feature Bacteriophage and it's feature	(1) Understand the basic requirements of cloning vector; Commonly used cloning vectors; The general characteristics of plasmids and phages; (2) Master the concept of plasmid, replication, resistance gene, conjugation and compatibility; Some concepts related to phage and their infection and replication characteristics. (3) Through the recent cases of bacteriophage treatment of superbacterial infection, we can guide students to think about the harm of antibiotic abuse and establish the concept of green ecological antibacterial.	2	Teaching in class and extensive reading after class	1,2,4
3	Chapter 3 Purification of DNA from living cells Preparation of total cell DNA, plasmid DNA and bacteriophage DNA	(1) Objective to understand the preparation methods of total cell DNA, plasmid DNA and phage DNA (2) Understand and master the principle of DNA preparation method	2	Teaching in class	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
4	Chapter 4 Manipulation of purified DNA The range of DNA manipulative enzymes Enzymes for cutting DNA-restriction endonucleases Ligation-joining DNA molecules together	(1) The characteristics and functions of nuclease, polymerase, ligase and modifier enzyme, as well as the related experimental methods, were emphasized. (2) Understand and master the mechanism and related concepts of various DNA molecular tools enzymes.	4	Teaching in class	2,3,4
5	Chapter 5 Introduction of DNA into living cells Transformation Identification of recombinants Introduction of phage DNA into bacterial cells Identification of recombinant phages	(1) To understand the methods of DNA introduction into cells, the identification of transformant recombinants and the packaging of phages. (2) Understand and master the principle of DNA transformation and transfection, and the principle of recombinant identification method.	2	Teaching in class	2,3
6	Chapter 6 Cloning Vectors for E. coli Cloning Vectors based on plasmids, M13, and $\lambda$ bacteriophage $\lambda$ and other high-capacity vectors enable genomic libraries to be constructed	(1)Objective to understand the development process of plasmid cloning vectors and their derivatives, as well as the characteristics and functions of these vectors. (2) Focus on the application of these cloning vectors.	2	Teaching in class	2,3
7	Chapter 7 Cloning Vectors for Eukaryotes Vectors for yeast and other fungi, higher plants and animals	(1)Objective to understand the characteristics of various plasmid vectors, animal and plant cloning vectors in yeast. (2) Master the construction, principle and application of these vectors.	2	Teaching in class	2,3
8	Chapter 8 How to Obtain a Clone of a Specific Gene	(1) Understand the basic strategy of gene cloning, the construction method of gene library and the identification	2	Teaching in class	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	The problem of selection Direct selection Identification of a clone from a gene library Methods for clone identification	method of gene cloning. (2) Master the relevant concepts of the above strategies and methods, and the basic principles of gene library construction and cloning and identification technology.			
9	Chapter 9 The Polymerase Chain Reaction The polymerase chain reaction in outline PCR in more detail After the PCR: studying PCR products Real-time PCR enables the amount of starting material to be quantified	(1) Understand the history of PCR invention and related stories; PCR is a three-step cycle; The characteristics of PCR products; Factors affecting PCR amplification; The principle of primer design. (2) Master the concept of PCR; Heat resistant DNA polymerase; The principle of PCR primer design; The principle of various PCR techniques; Quantitative PCR technology. (3) By telling anecdotes about the invention of PCR technology, students can understand the importance of respecting original innovation in scientific research, and establish the scientific spirit of seeking truth from facts and pursuing truth.	2	Teaching in class and extensive reading after class	1,2,3,4
10	Chapter 10 Sequencing Genes and Genomes The methodology for DNA sequencing How to sequence a genome	(1) Understand chain termination and pyrophosphate sequencing technology; Genome sequencing strategy; Sequencing enzyme; Understand the development trend of genome sequencing. (2) Understand and master the principles of the above sequencing technology, and learn to analyze the genome using relevant bioinformatics tools.	2	Teaching in class	2,3
11	Chapter 11 Studying Gene Expression and Function Studying the RNA	(1) Understand the basic knowledge of gene transcription and expression; Methods for the detection and functional study of transcripts and	2	Teaching in class	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	transcript of a gene Studying the regulation of gene expression Identifying and studying the translation product of a cloned gene	translation products. (2) Understand and master the concepts related to gene transcription and expression, the principles of transcripts and translation products detection methods.			
12	Chapter 12 Studying Genomes Genome annotation Studies of the transcriptome and proteome	(1) Understand the commonly used bioinformatics tools and related concepts of genome analysis; Various research methods related to transcriptomics and proteomics. (2) Understand and master the principles of the above concepts and methods, and learn to use these methods to analyze problems. (3) The contribution of Chinese scientists in sequencing human genome, silkworm genome, rice genome and so on is described to stimulate students' professional pride and enthusiasm for scientific research.	2	Teaching in class	1,2,3,4
13	Chapter 13 Production of Protein from Cloned Genes (1) Special vectors for expression of foreign genes in E. coli	(1) Understand the concept of gene expression; The promoters commonly used in prokaryotic expression and their characteristics; The expression vector of T7 promoter system was induced and regulated; The characteristics of E. coli expressing foreign protein. (2) Master the concept of gene expression and the principle of promoter and induced expression in prokaryotic expression.	2	Teaching in class	2,3
14	Chapter 13 Production of Protein from Cloned Genes (2) Production of recombinant protein by eukaryotic cells	(1) Objective to understand the characteristics of yeast insect and mammalian cell expression vectors and translation products. (2) Master the basic characteristics of eukaryotic expression system;	2	Teaching in class	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		Promoter and vector systems are commonly used.			
15	Chapter 14 Gene Cloning and DNA Analysis in Medicine Production of recombinant pharmaceuticals Identification of genes responsible for human diseases Gene therapy	(1) Understand all kinds of genetic engineering drugs and their production process; Biochip technology; Gene therapy technology; Typical bioethical cases. (2) Master the production principle of genetic engineering drugs; Bioethics in life science research. (3) This paper introduces the outstanding contribution of Zhou Jian, a Chinese scientist, in the research of HPV vaccine, so as to stimulate students' sense of home and country that they can use what they learn and serve the society.	2	Teaching in class and extensive reading after class	1,2,3,4
16	Chapter 15 Gene Cloning and DNA Analysis in Agriculture The gene addition approach to plant genetic engineering Gene subtraction Problems with genetically modified plants	(1) Understand transgenic plant technology and its development. (2) Master the technology of gene addition or deletion in plant genetic engineering; Application of transgenic animals and plants. (3) This paper discusses the recent human embryo gene editing event using crispr-cas9 technology and its impact, so as to enhance students' awe of bioethics.	2	Teaching in class and extensive reading after class	1,2,3,4

#### V Period Distribution and Teaching Modes

	Teaching	Practice	Discussion	Note	Summary
Preface	2				2
The basic principles of gene cloning and DNA analysis	15		1		16
The applications of gene cloning and DNA analysis in research	10				10
The applications of gene	2.5	0.5			3

cloning and DNA analysis in biotechnology					
Bioethics and safety measures of genetic engineering	0.5		0.5		1
Total	30.0	0.5	1.5		32

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Arrival late, Leaving early and Absence	10%	4
homework + Classroom Performance	Classroom questioning and homework review. Focusing on the mastery of knowledge points.	10%	1,2,3
Course paper	Reviewing the progress in the hot field related to gene engineering in no less than 2000 words.	30%	1,2,3,4
Final exam	Close book. Score according to the scoring standard	50%	2,3,4

## VII Textbooks and References

### (一) Textbook

[1] T.A. Brown, Gene cloning and DNA analysis: An Introduction, 7th edition, facsimile reprint, Higher Education Press, Beijing, 2018.

### (二) References

[1] T.A. Brown 著, 魏群等译, 基因克隆和 DNA 分析 (第 7 版), 高等教育出版社, 2018 年出版。

[2] 徐晋麟 主编: 《基因工程原理》(第二版), 科学出版社, 2018 年出版。

[3] 吴乃虎 编著: 《基因工程原理》(第二版), 科学出版社, 2015 年出版。

[4] Robert F. Weaver 编著, 郑用璠等译: 《分子生物学》(第五版), 科学出版社, 2013 年出版。

[5] S.T. Desmond, An Introduction to Genetic Engineering, 3<sup>rd</sup> edition, Cambridge University Press, 2008.

### (三) Web resources

[1] [浙江理工大学网络教学平台 \(chaoxing.com\)](http://chaoxing.com)

[2] Biological Concepts and Approach, Yi Rao, <http://www.raolab.org/displaynews.php?id=337>

**Written by: Jian Chen**

**Reviewed by: Nie ZuoMing**

**Date: April 28, 2021**

# Syllabus of Immunology

**Course Name/Title:** : Immunology

**Course Code:** 86910

**Classification and characteristic of the course:** (basic subject)(optional)

**Total teaching hours:** 32 teaching hours

**Credit:** 2

**Prerequisite:** Cell Biology

**Applicable specialty:** Biotechnology specialty

**Department (Room):** Department of Biotechnology

## 1、 Introduction of the course

Immunology is the study of the immune system to recognize and eliminate harmful organisms and their components (invasions in vitro, produced in vivo) in response to the process and mechanism of science, is the study of the immune system to their own antigen tolerance, to prevent the occurrence of autoimmune diseases is to study the abnormal function of the immune system and the pathogenesis of the corresponding diseases and preventive measures of science. Its main task is to enable students to master the basic knowledge of immunology, basic theory and basic skills. To be engaged in biotechnology engineering, genetic engineering, biochemistry related disciplines of work and continue to learn to lay the foundation. In view of the current situation of biomedicine development in China, ideological and political education should be introduced at any time to train students to be high-level talents who love the motherland and have high ideological and moral cultivation.

## 2、 Course Objective

### ( 1 ) Ideological and political objectives

Cultivate a group of new people who love the motherland and have high ideological, moral and cultural qualities. They have a strong sense of social responsibility, a sound personality and a strong sense of teamwork, have good professional ethics, and follow the professional spirit of academic norms, master solid basic theory and research methods of biological science, have the sense and spirit of seeking truth and innovation, in order to contribute to the development of China ' s biomedical technology.

### (2) Knowledge Objective

Understanding the basic functions of the immune system. To understand the characteristics of immune response Master the role of immune molecules and antigen molecules in the immune response. To master the classification and function of immune cells.

### (3) Competency Goals

The structure of immune organ and the function of immune system were described correctly. The ability to analyze the immune response process correctly. Thinking from the point of view of immunology in learning.

### (4) Quality Objective

Students have the ability of dialectical thinking with seek truth from facts ideological style, innovative consciousness and entrepreneurial spirit.

## 3、 The corresponding relationship between curriculum teaching objectives and graduation requirements

Graduation requirements	Graduation requirement target point	Objectives
Graduation requirements 4	Through compulsory and elective courses by a more systematic professional theory and professional skills training, to master solid basic theory of biological science, basic knowledge and basic skills; Have the ability to obtain employment, further education and start a business in the field of biotechnology and biological application.	Course objectives 1,2, 4
Graduation requirements 4, 7	The ability to systematically master basic experimental methods and skills in immunology and related fields, including the principles of antigen-antibody response, complement activation pathways, cellular/humoral immune responses, etc.	Course objectives 1, 2, 3, 4

#### 4、The relationship between teaching content and curriculum objectives

The relationship of teaching content and objectives

No.	Teaching contents	Teaching requirements	hours	methods	objectives
1	Introduction	(1)To master the characteristics of the immune system, focusing on the central immune organs and peripheral immune organs. (2)To understand the basic concept of immunization and its development. (3)Group discussion on the achievements of Chinese scholars in immunology to stimulate students' feelings of home and country.	2	Lectures, online courses, group discussions	Course objectives 1,2
2	Antigen	(1)To understand the basic concept of antigen and the three factors affecting immune response. (2)To understand the classification of antigens according to different criteria and the basic characteristics of antigens; TD-Ag and TI-Ag. Key points to master: the basic characteristics of antigens and determine the specificity of the structural basis.	2.5	Lectures, online courses, group	Course objectives 1,2
3	Immunoglobulin	(1)To understand the preparation mechanism and process of monoclonal antibody and polyclonal antibody. (2)To understand the classification and heterogeneity of immunoglobulins, focusing on the basic structure and function of immunoglobulins, the characteristics of various immunoglobulins, the biological functions of v Region and C region.	2.5	Lectures, online courses, group	Course objectives 1, 3, 4
4	Complement	(1)To understand the classification of complement	2.5	Lectures,	Course

No.	Teaching contents	Teaching requirements	hours	methods	objectives
	system	system and various regulatory factors of complement activation. (2)To understand the biological function of complement, focusing on the classical pathway and by-pass pathway of complement activation. (3)The difficulty is the classical approach of complement activation.		online courses, group	objectives 2, 3, 4
5	Cytokine	(1)To understand the concept and classification of cytokines. (2)To understand the receptor and structure of cytokines, and to grasp the biological activity, mode and characteristics of action of various cytokines.	1	Lectures, online courses, group	Course objectives 1, 2, 3
6	Leukocyte differentiation antigen and adhesion molecule	(1)To understanding the classification of adhesion molecules. (2)To understand the functions of various adhesion molecules.	1	Lectures, online courses, group	Course objectives 1, 2
7	Major histocompatibility complex	(1)To understand the origin of the definition of MHC and the concept of human MHC. (2) To understand the main biological functions of MHC, and to grasp the characteristics of Hlai and Class II molecules in structure, tissue distribution and interaction with antigenic peptides.	2	Lectures, online courses, group	Course objectives 1, 2, 3
8	Immune cell	(1)To understand the process of recognition, killing and clearance of specific antigen by phagocytes, and the specific surface markers, main biological functions and significance of NK cells. (2)To understanding the dual signal transduction pathway of T lymphocyte activation and the process by which B cells recognize antigens and produce antibodies. Emphasis is placed on: the important molecules and their functions on the surface of lymphocyte, the characteristics and functions of CD4 + T cells and CD8 + T cells, the important molecules and their functions on the surface of lymphocyte, and the antigen receptor complex of lymphocyte.	6	Lectures, online courses, group discussion	Course objectives 1, 2, 3, 4
9	Antigen presenting cells and antigen processing and	(1)To understand the source, distribution, developmental differentiation and migration of dendritic cell (2)To understand the reason and process of exogenous	2	Lectures, online courses, group	Course objectives 1, 2, 3

No.	Teaching contents	Teaching requirements	hours	methods	objectives
	presentation	antigen presented by MHCI pathway and endogenous antigen presented by MHCII pathway. (3)To master the process of handling and presenting different antigens by MHCI and class II pathway. The difficulty is the function and significance of CLIP in antigen presentation by MHCCII pathway.			
10	Adaptive immune response	(1)To understand the difference between adaptive and innate immune responses. (2)To understand the role of memory T lymphocyte in the re-immune response and the characteristics of the re-humoral immune response. (3)To master the three stages of T lymphocyte mediated cellular immune response: antigen recognition stage; T lymphocyte activation, proliferation and differentiation stage; T lymphocyte effect stage. Lymphocyte B mediates the three stages of the humoral immune response: the antigen recognition stage; the lymphocyte activation, proliferation and differentiation stage; and the lymphocyte effect stage. The significance of cellular immune response and humoral immune response to organism. The challenge is the concept and significance of how T lymphocyte proliferate and differentiate, how CD8 + T cells are indirectly activated, how B lymphocyte proliferate and differentiate, how antibody affinity matures, and how somatic cells undergo high frequency mutations.	6	Lectures, online courses, group discussion	Course objectives 1, 2, 3, 4
11	Immune tolerance	(1)To understand the expression of innate tolerance and the expression of acquired tolerance. (2)To understand the concept of tolerance, the difference between immunotolerance and immunosuppression. It is important to master the induction condition and formation mechanism of immune tolerance.	2	Lectures, online courses, group	Course objectives 1, 2, 3
12	Hypersensitivity	(1)To understand the difference and relationship between hypersensitivity, immune tolerance and immune response (2)To understand the mechanism of type I and type II hypersensitivity, and to grasp the mechanism and significance of Th1 cell-mediated delayed hypersensitivity.	2	Lectures, online courses, group	Course objectives 1, 2, 3

## 5、 Course hours allocation and teaching methods

(1) Course time allocation (according to the order (units of knowledge or items) allocation of total hours, reasonable allocation of lectures, experiments, exercises, discussions, counseling and other teaching links required hours)

Schedule of theoretical courses or theoretical teaching contents:

Teaching hours Methods Contents	Theoretical Lecture	Exercise	Discussion	Notes	Teaching hours
Unit 1: Introduction	2	0	0.5		2
Unit 2: Antigen	2	0.5	0		2.5
Unit 3: Immunoglobulin	2	0.5	0		2.5
Unit 4: Complement	2	0.5	0		2.5
Unit 5: Cytokine	1	0	0		1
Unit 6: Leukocyte differentiation antigen	1	0	0		1
Unit 7: Major histocompatibility complex	2	0.5	0		2.5
Unit 8: Immune cells	4	1	1		6
Unit 9: Antigen presenting cells	2	0	0		2
Unit 10: Adaptive immunity	4	1	1		6
Unit 11: Immune tolerance	2	0	0		2
Unit 12: Hypersensitivity	2	0	0		2
Total	25.5	4	2.5		32

(2) Teaching methods

On the basis of teaching, the relevant literature and on-line knowledge contents of the self-study course are added. In the course of teaching, many effective teaching methods such as elicitation and discussion are used to strengthen the communication between teachers and students, to guide students to think independently and to strengthen the training of thinking.

## 6、 Course Assessment

Method or means of assessment	Assessment requirements	Check weight	Corresponding course objectives
Final exam	Opened books, papers, according	50	Course

	to the marking standards for grading		objectives 1, 2, 4
Online study	According to the online learning time and the completion of online exercises to score	40	Course objectives 1, 2, 3, 4
Attendance and performance in class discussion	No unexcused absence from class. Extra points will be given to students for attending lectures and answering questions with positive thinking	10	Course objectives 1, 2, 3

## 7、Recommended teaching materials and reference materials

(1) Teaching materials: (list the titles, authors, publishing houses, etc.)

[1] Xue Tao Cao, ed. Medical Immunology, People's Medical Publishing House, 2018.

(2) Reference books: (list the titles, authors, publishing houses, etc.)

[1] Gong Feili, medical immunology (2nd edition) , Science Press, 2003.

[2] Kim bo-chuen, editor-in-chief, medical immunology (5th edition) , People's Medical Publishing House, 2011.

(3) Online resources: (online course website)

[1]<https://www.zjooc.cn/ucenter/teacher/course/build/spoc>

Course teaching team:

**Written by:** Chen Kan

**Reviewed by:** Wang Yigang

**Date:** April 21, 2021

# Syllabus of Molecular Biology

**Course Name/Title:** Molecular Biology                      **Course code:** 86911  
**Course Type:** Specialized Course、Compulsory Course  
**Total Teaching Hours:** (Classroom Hours: 48    Laboratory Hours or Tutorial Hours 0)  
**Course Credit:** 3

## I Course Introduction

Molecular biology is a subject which develops rapidly in recent years and is applied more and more widely in the field of life science. It has penetrated into all fields of life science, especially medicine, agronomy, biotechnology and bioengineering. This course introduces the basic principles and operation methods of molecular biology technology, and details prokaryotic and eukaryotic expression systems. Through the teaching of this course, students can systematically master the basic theory, technology and method of molecular biology, preliminarily grasp the application and development trend of molecular biology, lay a solid foundation for learning other basic courses, lay a theoretical foundation for the research project of molecular biology technology, track the development trend in time, and cultivate bioengineering talents who master the theory and technology of molecular biology Professional undergraduate talents

## II Course Objective

Molecular biology seeks to explain the relationships between the structure and function of biological molecules and how these relationships contribute to the operation and control of biochemical processes.

Course objective 1: Cultivate students to study independently, be brave in innovation, take responsibility, enhance the sense of responsibility and mission of the times, integrate knowledge with practice, and be firm believers, active communicators and model practitioners of socialist core values.

Course objective 2: DNA replication, DNA damage and repair

Course objective 3: Regulation of gene expression and protein synthesis

Course objective 4: Technology for manipulating DNA and design experiments

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	1. Love the motherland, have high ideological and moral quality and cultural quality; have a strong sense of social responsibility, a sound personality and a strong sense of teamwork; have good professional ethics, follow the	Course Objective 1,2,3,4

	professional spirit of academic norms, master a solid basic theory of biological sciences and research methods, and have the consciousness and spirit of seeking truth and innovation.	
Graduation Requirement 4	4. To receive more systematic training in professional theories and skills through compulsory and elective courses, and to master solid basic theories, basic knowledge and basic skills of biological sciences.	Course Objective 2,3,4
Graduation Requirement 7	7. The ability to use various modern media technologies to actively acquire scientific research information and other knowledge; the ability to systematically master the basic experimental methods and skills in biotechnology and related fields, including the mastery of key technologies related to life sciences, including gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases, and basic bioinformatics analysis technology.	Course Objective 4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 History of Molecular Biology and Genetic Materials 1.1 What is Molecular Biology 1.2 A Brief History of Molecular Biology	Understand the concepts, research content of molecular biology, assessment methods and reference books of molecular biology. China's contribution to human genome sequencing and the progress of sequencing technology in recent years have enhanced students' national	3	Classroom teaching	Course Objective 1

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		self-esteem and love for biotechnology major.			
2	Chapter 2 DNA Damage and Repair 2.1 Factors Causing DNA Damage 2.2 DNA Damage 2.3 DNA Repair	Understand the concept of DNA damage, including oxidative damage, alkylation and adducts, etc. Grasp the concept of spontaneous DNA damage, including transamination, depyridine and depyrimidine Grasp the concepts of DNA repair, including the concepts and mechanisms of photoactivation, alkyltransferase, cleavage repair, mismatch repair, and SOS emergency response.	3	Classroom teaching	Course Objective 2
3	Chapter 3 Recombination and Transposition 3.1 Homologous Recombination 3.2 Site-specific Recombination 3.3 DNA Transposition	Understand bacterial transposons: insertion sequence, transposition mechanism, Tn3 replicating transposition, non-replicating transposition Master the RecBCD pathway of homologous recombination, Holliday Junctions, Resolving Holliday Junctions transposition Master the transposons of eukaryotes: Ac/Ds transposons; P elements Master retrotransposons: retroviruses, retrotransposons. Master the basic principles of gene transcription in prokaryotes, including the initiation, synthesis and termination of transcription.	3	Classroom teaching	Course Objective 3
4	Chapter 4 Transcription in Prokaryotic 4.1 Basic Principles of Transcription 4.2 E. coli RNA Polymerase 4.3 The E. coli 70S Promoter	Understand the concept of coding strand, template strand, promoter. Master the basic principles of gene transcription in prokaryotes, including the initiation, synthesis and termination of transcription.	3	Classroom teaching	Course Objective 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
5	Chapter 5 Eukaryotic RNA poly and promoters 5.1 Main Features of Eukaryotic Transcription 5.2 Three Eukaryotic Polymerases 5.3 Promoters and Enhancers	Master 3 types of polymerases, different polymerase transcription objects, especially type 2 Understand the concept of enhancers	3	Classroom teaching	Course Objective 4
6	Chapter 6 Operons and Major Shifts in Bacterial Transcription 6.1 Lactose Operons 6.2 Arabinose Operon 6.3 Tryptophan Operon 6.4 Sigma Factor Switching 6.5 The RNA Polymerase Encoded in Phage T7 6.6 Infection of E. coli by Phage $\lambda$	Master 3 types of polymerases, different polymerase transcription objects, especially type 2 Master promoters and enhancers. The application of case analysis operator in positive clone detection, encouraging students to learn and use them	3	Classroom teaching	Course Objective 1,3,4
7	Chapter 7 Transcription Activators in Eukaryotes 7.1 Categories of Activators 7.2 Structures of DNA-binding Motifs of Activators 7.3 Independence of the Domains of Activators 7.4 Functions of Activators 7.5 Interaction Among Activators 7.6 Regulation of Transcription Factors	Grasp the concept of activator. Master the theories and important terms about the transcription activator.	3	Classroom teaching	Course Objective 3
8	Chapter 8 Chromatin Structure and Its Effects on Transcription	Master the chromatin structure and the effects on transcription Master the basic concepts, theories and	6	Classroom teaching	Course Objective 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	8.1 Chromatin Structure Histones Nucleosomes The 30-nm Fiber Higher-Order Chromatin Folding 8.2 Chromatin Structure and Gene Activity The Effects of Histones on Transcription of Class II Genes Nucleosome positioning Histone Acetylation Histone Deacetylation Chromatin Remodeling Heterochromatin and Silencing	important terms of the gene activity			
9	Chapter 9 RNA Processing I :Splicing 9.1 Genes in Pieces 9.2 The Mechanism of Splicing of Nuclear mRNA Precursors 9.3 Self-Splicing RNAs	Master the basic concepts,theories and important terms of the splicing	3	Classroom teaching	Course Objective 3,4
10	Chapter 10 RNA Processing II :Capping and Polyadenylation 10.1 Capping 10.2 Polyadenylation 10.3 Coordination of mRNA Processing Events		3	Classroom teaching	Course Objective 3,4
11	Chapter 11 Genetic Code and tRNA Class hours 11.1 Genetic Code 11.2 tRNA Structure and Function	The characteristics of genetic code and the structure and function of tRNA lay a foundation for understanding the biological process of protein translation	3	Classroom teaching	Course Objective 3,4
12	Chapter 12 Protein	Basic concepts of protein synthesis,	6	Classroom	Course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>Synthesis</p> <p>12.1 The Mechanism of Translation I: Initiation</p> <p>12.2 The Mechanism of Translation II: Elongation and Termination</p> <p>12.3 Posttranslational Events</p> <p>Basic concepts of protein synthesis, mechanisms of protein synthesis, initiation in eukaryotes, master the mechanism of initiation process of protein synthesis</p> <p>Master the mechanism of protein synthesis and understand translation regulation and post-translation biological activities.</p>	<p>mechanisms of protein synthesis, initiation in eukaryotes, master the mechanism of initiation process of protein synthesis</p> <p>II: Master the mechanism of protein synthesis and understand translation regulation and post-translation biological activities.</p>		m teaching	Objective 3,4
13	<p>Chapter 13 Molecular Tools</p> <p>13.1 Model Organism</p> <p>13.2 Nucleic acid manipulation and analysis techniques</p> <p>13.2.1 Gene Clone</p> <p>13.2.2 Vector</p> <p>13.2.3 Transformation</p> <p>13.2.4 Molecular Tools for Studying Genes and Gene Activity</p>	<p>Understand the Model Organism used in gene engineering and the restriction endonuclease and tool enzyme commonly used in gene engineering.</p> <p>The characteristics and types of genetic engineering carriers: plasmids, human phages and viral vectors.</p> <p>Several pathways for the preparation of target genes. The introduction ways of DNA molecules into host cells.</p> <p>The case study shows the rapid development of biotechnology in the past 20 years. Encourage students to keep forging ahead and develop lifelong learning</p>	6	Classroom teaching	Course Objective 1,3,4

### V Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Classroom performance	Students are required to attend all classes. Students will be organized into groups to discuss topics provided by teacher	20%	Course Objectives 1,2,3,4,
Assignment	Score according to the homework	20%	Course Objectives 2,3,4
Final exam	Closed-book exam,	60%	Course Objectives 1,2,3,4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### **VI Textbooks and References**

[1] 赵亚华, 《分子生物学教程》第三版, 科学出版社, 2011年7月出版。

[2] 朱玉贤, 《现代分子生物学》第四版, 高等教育出版社, 2013年12月出版。

[3] Robert F. Weaver 著, 郑用璉等译, 《分子生物学》原书第五版, 科学出版社, 2016年5月出版。

[4] Watson, JD; Baker, TA; Bell, SP; Gann A; Levine, M; Losick, R. Molecular Biology of the Gene(影印版), 科学出版社, 2011年7月出版。

[5] 李振刚, 《分子遗传学》(第四版), 科学出版社, 2016年12月出版

**Written by: Qiaojun Jia**

**Reviewed by: Qiuling He**

**Date: 2021/05/06**

# Syllabus of Biochemistry

**Course Name/Title:** Biochemistry      **Course Code:** 86915

**Course Type:** Basic Course (Compulsory Course)

**Total Teaching Hours:** 72 (72 Classroom Hours)

**Course Credit:** 4.5

## I Course Introduction

Biochemistry is a scientific discipline studying the chemical processes within and relating to living organisms. The task of this course is to communicate the chemical principles governing the structure, function, and interactions of biological molecules to students encountering biochemistry for the first time, and to train them to look at the biological phenomena from the viewpoint of chemistry. Beyond simply memorizing molecular structures and biochemical pathways, it is more important to guide students to explore how and why biological molecules are organized on various levels and with an amazing degree of coordination and control, and how this makes life possible.

## II Course Objective

### 1. Ideological and political objective:

- 1.1 To build up the correct values in scientific research by giving proper examples in class.
- 1.2 To cultivate the students to be rigorous in scientific study.
- 1.3 To have innovative thinking and creativity.

### 2. Knowledge objective:

- 2.1 To master the basic concepts, theories and important terms in biochemistry.
- 2.2 To master the concepts, classifications, structures, properties and functions of biological molecules, i.e. proteins, enzymes, nucleic acids, carbohydrates and lipids, et al.

### 3. Ability goal:

- 3.1 To master the generation and conversion of biological energy, important metabolic pathways and their regulations as well as integrations in the cell, and become familiar with the related biochemical reactions.
- 3.2 To master the reproduction, transfer and expression of genetic information in molecular terms.
- 3.3. To master the principles of popular techniques in biochemistry.

### 4. Quality objective:

- 4.1. To cultivate students' serious and responsible occupation ethics and work style.
- 4.2 To build students' awareness of quality and safety.
- 4.3 To develop students' ability to adapt to the career change.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Index Point	Requirements	Course Objectives
Graduation Requirement 3	Be able to read English professional article with fluency and search related literature, master the basic knowledge of		Course Objectives 1,2,3

	scientific methodology and scientific writing; possess good computer skills.	
Graduation Requirement 4	Master the basic theories of biological sciences and technologies, mathematical statistics, biological engineering, etc; understand the theoretical bioindustry knowledge, and be able to analyze and solve the biological problems using the learned knowledge.	Course Objectives 1,2,3,4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Introduction Section I: Concept of biochemistry. Section II: Cellular foundations of biochemistry. 1. Classification of cell. 2. Structural organization of prokaryotic cells. 3. Structural organization of eukaryotic cells. 4. Structural organization of viruses. Section III: Chemical foundations of biochemistry. Section IV: Physical foundations of biochemistry. Section V: Four main classes of biological molecules. 1. Carbohydrates. 2. Lipids. 3. Proteins. 4. Nucleic acids.	1. Mastering: Concept of biochemistry, chemical and physical foundations of biochemistry. 2. Comprehending: Cellular foundations of biochemistry. 3. Understanding: Four main classes of biological molecules. 4. To build up the correct values in scientific research by giving proper examples in class. (Ideological and political objective)	2	Classroom teaching	1,2,4
2	Chapter 2 Protein Section I: Molecular building blocks of proteins: amino acids. 1. General structures of amino acids. 2. Structures of the 20 ubiquitous amino acids.	1. Mastering: Structures and properties of amino acids, structures and properties of proteins. 2. Comprehending: Relationships between structure and function of	10	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>3. Properties of amino acids.</p> <p>Section II: Structures and properties of proteins.</p> <ol style="list-style-type: none"> <li>1. Peptide and peptide bonds.</li> <li>2. Primary structure of protein.</li> <li>3. Secondary and supersecondary structure of protein.</li> <li>4. Tertiary structure of protein.</li> <li>5. Quaternary structure of protein.</li> <li>6. Prediction of protein structure.</li> <li>7. Classification of proteins.</li> <li>8. Physicochemical properties of protein.</li> <li>9. Proteomics.</li> </ol> <p>Section III: Structure–function relationships of proteins.</p> <ol style="list-style-type: none"> <li>1. The folding and conformation of protein.</li> <li>2. Protein denaturation and renaturation.</li> <li>3. Protein stability.</li> <li>4. Correlation between conformation and function of protein.</li> <li>5. Protein-misfolding-related diseases.</li> </ol> <p>Section IV: Protein techniques.</p> <ol style="list-style-type: none"> <li>1. Salting out.</li> <li>2. Dialysis.</li> <li>3. Chromatography.</li> <li>4. Electrophoresis: Native PAGE, SDS-PAGE, isoelectric focusing, 2-D electrophoresis.</li> <li>5. Ultracentrifugation.</li> <li>6. Protein sequencing.</li> <li>7. Solid-phase synthesis of polypeptides.</li> </ol>	<p>proteins.</p> <ol style="list-style-type: none"> <li>3. Understanding: Protein techniques.</li> <li>4. To cultivate the students to be rigorous in scientific study(Ideological and political objective)</li> </ol>			
3	<p>Chapter 3 Enzymes</p> <p>Section I: History of enzymology.</p>	<ol style="list-style-type: none"> <li>1. Mastering: Enzyme kinetics, mechanism of enzyme catalysis,</li> </ol>	12	Classroom teaching	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>Section II: Naming and classification of enzymes.</p> <p>Section III: Structural components of enzymes.</p> <ol style="list-style-type: none"> <li>1. Apoenzymes, cofactors and holoenzymes.</li> <li>2. Coenzymes and vitamins.</li> <li>3. Active centers of enzymes.</li> <li>4. Isozymes.</li> </ol> <p>Section IV: Properties of enzyme catalysis.</p> <ol style="list-style-type: none"> <li>1. Acceleration of chemical reactions by enzymes.</li> <li>2. Specificity of enzymes.</li> <li>3. Controllability of enzyme activity.</li> </ol> <p>Section V: Mechanism of enzyme catalysis.</p> <ol style="list-style-type: none"> <li>1. Transition state and activation energy.</li> <li>2. Lock and key hypothesis.</li> <li>3. Induced fit hypothesis.</li> <li>4. Enzyme-substrate interactions.</li> </ol> <p>Section VI: Enzyme kinetics.</p> <ol style="list-style-type: none"> <li>1. Effects of substrate concentration on the reaction rate.</li> <li>2. Michaelis-Menton equation.</li> <li>3. Michaelis constant <math>K_m</math> and Maximum reaction rate <math>V_{max}</math>.</li> <li>4. Measurement of <math>K_m</math> and <math>V_{max}</math>.</li> <li>5. Effects of enzyme concentration on the reaction rate.</li> <li>6. Other factors affecting the reaction rate: temperature, pH.</li> <li>7. Inhibition of enzyme-catalyzed reactions.</li> </ol> <p>Section VII: Enzyme inhibitors and drugs.</p>	<p>regulation of enzyme activity.</p> <ol style="list-style-type: none"> <li>2. Comprehending: Structural components of enzymes, naming and classification of enzymes.</li> <li>3. Understanding: Enzyme inhibitors, coenzymes and vitamins, history of enzymology. Describe the purposes of classification and taxonomy in the study of prokaryotes.</li> <li>4. To have innovative thinking and creativity(Ideological and political objective)</li> </ol>			

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Section VIII: Regulation of enzyme activity. 1. Allosteric regulation. 2. Covalent modification. 3. Zymogen activation. Section IX: Enzymes in the diagnosis of pathology.				
4	Chapter 4 Nucleic acids (Supporting course objectives: 1, 3, 8) Section I: Building blocks of nucleic acids. 1. Ribose and Deoxyribose. 2. Nitrogenous bases. 3. Nucleosides. 4. Nucleotides. 5. Other functions of nucleotides. Section II: Classification, structure and function of nucleic acids. 1. 3'-5' phosphodiester bonds. 2. The primary structure of nucleic acids (the nucleotide sequence). 3. Classification of nucleic acid. 4. Advanced structure and function of DNA. 5. DNA organization in cells. 6. Types, advanced structure and function of RNA. 7. Interactions between nucleic acids and proteins. 8. Ribozyme. Section III: Physicochemical properties of nucleic acids. 1. Spectroscopic properties of nucleic acids. 2. Denaturation and renaturation of DNA. 3. Nucleic acid hybridization. 4. Nucleic acid hydrolysis.	1. Mastering: Building blocks of nucleic acids, classification, structure and function of nucleic acids. 2. Comprehending: Physicochemical properties of nucleic acids. 3. Understanding: Nucleic acid techniques. 4. To cultivate the students to be rigorous in scientific study (Ideological and political objective)	4	Classroom teaching	1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Section IV: Nucleic acid techniques. 1. Chemical synthesis of nucleic acid. 2. Purification and quantification of nucleic acid.				
5	Chapter 5 Carbohydrate metabolism Section I: Types, structures and chemistry of carbohydrates. 1. Monosaccharide. 2. Oligosaccharide. 3. Polysaccharide. 4. Glycoconjugate. 5. Carbohydrates as informational molecules. Section II: Glycolysis (anaerobic oxidation of carbohydrates). 1. Essential features of glycolysis. 2. The reactions of glycolysis. 3. The fate of pyruvate and NADH produced in glycolysis. 4. Regulation of glycolysis. 5. Substrates other than glucose in glycolysis. 6. Cell response to hypoxic stress. Section III: The citric acid cycle (TCA cycle, aerobic oxidation of carbohydrates). 1. The chemical logic of the TCA cycle. 2. The formation of acetyl coenzyme A from pyruvate. 3. The reactions of the TCA cycle. 4. Energy yield of the TCA cycle. 5. Biosynthesis intermediates provided by the TCA cycle. 6. Anaplerotic reactions.	1. Mastering: Types, structures and chemistry of carbohydrates, glycolysis, TCA cycle. 2. Comprehending: Pentose phosphate pathway, glycogen metabolism, gluconeogenesis. 3. Understanding: Regulation of blood sugar level. 4. To build up the correct values in scientific research by giving proper examples in class (Ideological and political objective)	10	Classroom teaching	1,2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>7. The regulation of the TCA cycle.</p> <p>8. Major metabolic pathways converging on the TCA cycle.</p> <p>Section IV: The pentose phosphate pathway.</p> <p>1. The reaction of the pentose phosphate pathway.</p> <p>2. The regulation of the pentose phosphate pathway.</p> <p>3. Metabolic disorders associated with the pentose phosphate pathway.</p> <p>Section V: Glycogen metabolism.</p> <p>1. Glycogen synthesis.</p> <p>2. Glycogen degradation.</p> <p>3. Regulation of glycogen metabolism.</p> <p>Section VI: Glyconeogenesis.</p> <p>1. Substrates of glyconeogenesis.</p> <p>2. Glyconeogenic pathway.</p> <p>3. The Cori cycle.</p> <p>Section VII: Regulation of blood glucose level.</p>				
6	<p>Chapter 6 Lipid metabolism</p> <p>Section I: Types, structures and functions of lipids.</p> <p>1. Simple lipid.</p> <p>2. Compound lipid.</p> <p>3. Isoprenoid lipid.</p> <p>4. The digestion and absorption of lipids.</p> <p>Section II: Biological membranes.</p> <p>1. The compositions of biological membranes.</p> <p>2. The architecture and properties of biological membranes.</p> <p>3. Membrane dynamics.</p> <p>4. Solute transport across membrane.</p>	<p>1. Mastering: Types, structures and functions of lipids, metabolism of fatty acids.</p> <p>2. Comprehending: Metabolism of glycerophospholipids, sphingolipids and cholesterol.</p> <p>3. Understanding: Triglyceride hydrolysis and synthesis, lipoprotein metabolism.</p> <p>4. To cultivate the students to be rigorous in scientific study (Ideological and political</p>	6	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>Section III: Oxidation of fatty acids.</p> <ol style="list-style-type: none"> <li>1. Mobilization of fatty acids.</li> <li>2. Activation and transport of fatty acids.</li> <li>3. The reaction of <math>\beta</math>-oxidation.</li> <li>4. <math>\alpha</math> and <math>\omega</math>-oxidation.</li> <li>5. Energy yield of fatty acid oxidation.</li> <li>6. Alternative oxidation pathways.</li> <li>7. Synthesis of ketone bodies.</li> <li>8. Oxidation of ketone bodies as fuels.</li> </ol> <p>Section IV: Fatty acid synthesis.</p> <ol style="list-style-type: none"> <li>1. Transport of acetyl CoA to the cytosol.</li> <li>2. Carboxylation of acetyl CoA.</li> <li>3. Elongation and desaturation.</li> <li>4. Regulation of fatty acid metabolism.</li> </ol> <p>Section V: Triglyceride hydrolysis and synthesis.</p> <p>Section VI: Metabolism of glycerophospholipids and sphingolipids.</p> <ol style="list-style-type: none"> <li>1. Synthesis of glycerophospholipids.</li> <li>2. Synthesis of sphingolipids.</li> <li>3. Degradation of glycerophospholipids and sphingolipids.</li> </ol> <p>Section VII: Cholesterol metabolism.</p> <ol style="list-style-type: none"> <li>1. Biosynthesis of cholesterol.</li> <li>2. Transport of cholesterol.</li> <li>3. The conversion of cholesterol.</li> <li>4. Regulation of cholesterol metabolism.</li> </ol> <p>Section VIII: Lipoprotein metabolism.</p>	objective)			

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	1. Chylomicrons. 2. VLDLs, IDLs and LDLs. 3. HDLs.				
7	Chapter 7 Amino acid metabolism Section I: General metabolism of amino acids. 1. Transamination reactions. 2. Oxidative deamination of glutamate. 3. Transdeamination. 4. Purine nucleotide cycle. 5. Formation of Asn and Gln. 6. Transportation of amino acid nitrogen to the liver. 7. The urea cycle. 8. Links between the citric acid and urea cycles. 9. Regulation of the urea cycle. 10. Metabolism of carbon skeletons of amino acids. Section II: Individual metabolism of some amino acids. 1. Decarboxylation of amino acids. 2. One carbon unit. 3. S-adenosyl methionine. 4. Synthesis of the catecholamines. 5. Degradation of branched-chain amino acids. Section III: Biosynthesis of amino acids. 1. Formation of amino acids from $\alpha$ -keto acids by transamination. 2. Families of pathways of amino acid biosynthesis.	1. Mastering: General metabolism of amino acids. 2. Comprehending: Individual metabolism of some amino acids. 3. Understanding: Biosynthesis of amino acids. 4. To build up the correct values in scientific research by giving proper examples in class(Ideological and political objective)	3	Classroom teaching	2, 3
8	Chapter 8 Nucleotide metabolism Section I: Nucleotide synthesis.	1. Mastering: Synthesis of purine and pyrimidine	4	Classroom	1,2,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	1. The de novo pathway of purine synthesis. 2. Synthesis of AMP and GMP. 3. Phosphorylation of AMP and GMP. 4. Regulation of purine synthesis. 5. Purine salvage pathway. 6. Purine nucleotide transformation. 7. The de novo pathway of pyrimidine synthesis. 8. Regulation of de novo pyrimidine synthesis. 9. The salvage pathway of pyrimidine synthesis. 10. The synthesis of deoxyribonucleotides. 11. The regulation of deoxyribonucleotide synthesis. Section II: Degradation of nucleotides. 1. Degradation of purine nucleotides. 2. Degradation of pyrimidine nucleotides. Section III: Nucleotide metabolism-related diseases. Section IV: Antimetabolites.	nucleotides. 2. Comprehending: Degradation of purine and pyrimidine nucleotides. 3. Understanding: Nucleotide metabolism-related diseases, antimetabolites. 4. To have innovative thinking and creativity(Ideological and political objective)		teaching	
9	Chapter 9 Electron transport and oxidative phosphorylation Section I: Electron transport chains (ETC). 1. Components of ETC. 2. Reduction potentials of electron carriers. 3. Structures and functions of complexes I, II, III and IV. Section II: Coupling with oxidative phosphorylation. 1. Chemiosmotic coupling. 2. P/O ratio.	1. Mastering: Electron transport chains, oxidative phosphorylation. 2. Comprehending: Aerobic oxidation of cytosolic NADH, effect factors of oxidative phosphorylation. 3. Understanding: Mutations of mtDNA, aging and aging-related diseases.	4	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>3. ATP synthase or the F<sub>0</sub>F<sub>1</sub> complex.</p> <p>Section III: Aerobic oxidation of cytosolic NADH.</p> <ol style="list-style-type: none"> <li>1. Glycerol-3-phosphate shuttle.</li> <li>2. Malate-aspartate shuttle.</li> </ol> <p>Section IV: Effect factors of oxidative phosphorylation.</p> <ol style="list-style-type: none"> <li>1. Inhibitors of electron transport.</li> <li>2. Uncouplers.</li> </ol> <p>Section V: Mutations in mitochondrial DNA (mtDNA), aging and aging-related diseases.</p>	<p>4. To cultivate the students to be rigorous in scientific study (Ideological and political objective)</p>			
10	<p>Chapter 10 DNA synthesis – replication</p> <p>Section I: Fundamental rules of DNA replication.</p> <ol style="list-style-type: none"> <li>1. Semiconservative replication.</li> <li>2. Bidirectional DNA replication.</li> <li>3. Semidiscontinuous and Okazaki Fragments.</li> </ol> <p>Section II: Key enzymes and protein factors in DNA replication of E. coli.</p> <ol style="list-style-type: none"> <li>1. DNA polymerase.</li> <li>2. Model of the replisome.</li> </ol> <p>Section III: DNA replication in E. coli.</p> <ol style="list-style-type: none"> <li>1. Initiation.</li> <li>2. Elongation.</li> <li>3. Termination.</li> </ol> <p>Section IV: DNA replication in eukaryote.</p> <ol style="list-style-type: none"> <li>1. Eukaryotic cell cycle.</li> <li>2. Multiple replicons.</li> <li>3. Eukaryotic DNA polymerases.</li> <li>4. Other enzymes and proteins in DNA replication of eukaryote.</li> <li>5. Replication of the ends of chromosomes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Mastering: Fundamental rules and characteristics of DNA replication in E. coli and eukaryote.</li> <li>2. Comprehending: DNA damage, mutation and repair.</li> <li>3. Understanding: Reverse transcription and other replication models, DNA recombination.</li> <li>4. To build up the correct values in scientific research by giving proper examples in class (Ideological and political objective)</li> </ol>	4	Classroom teaching	1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>Section V: Reverse transcription and other replication models.</p> <ol style="list-style-type: none"> <li>1. Retrovirus.</li> <li>2. Phage DNA replication.</li> <li>3. Mitochondrial DNA replication.</li> </ol> <p>Section VI: Repair of damaged DNA.</p> <ol style="list-style-type: none"> <li>1. DNA damage and mutation.</li> <li>2. Nucleotide excision repair.</li> <li>3. Transcription-coupled repair.</li> <li>4. Base excision repair.</li> <li>5. Mismatch repair.</li> <li>6. Direct repair.</li> <li>7. SOS response repair.</li> </ol> <p>Section VII: DNA recombination.</p> <ol style="list-style-type: none"> <li>1. Homologous genetic recombination.</li> <li>2. Site-specific recombination.</li> <li>3. Transposable genetic elements.</li> <li>4. Gene rearrangements and immunology.</li> </ol>				
11	<p>Chapter 11 RNA synthesis – transcription</p> <p>Section I: DNA-dependent synthesis of RNA.</p> <ol style="list-style-type: none"> <li>1. DNA-dependent RNA polymerase.</li> <li>2. Promoter sites on the DNA template.</li> </ol> <p>Section II: Transcription in prokaryote.</p> <ol style="list-style-type: none"> <li>1. Initiation.</li> <li>2. Elongation.</li> <li>3. Termination.</li> </ol> <p>Section III: Transcription in eukaryote.</p> <ol style="list-style-type: none"> <li>1. Eukaryotic RNA polymerases.</li> <li>2. Eukaryotic transcription factors.</li> </ol>	<ol style="list-style-type: none"> <li>1. Mastering: DNA transcription, RNA processing.</li> <li>2. Comprehending: RNA polymerases in prokaryote and eukaryote.</li> <li>3. Understanding: Promoter, eukaryotic transcription factors, genomic RNA replication.</li> <li>4. To cultivate the students to be rigorous in scientific study (Ideological and political objective)</li> </ol>	4	Classroom teaching	1,2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Section IV: RNA processing. 1. Pre-mRNA processing. 2. Processing of pre-rRNA and pre-tRNA. 3. RNA editing. 4. RNA degradation. Section V: Genomic RNA synthesis. 1. RNA-dependent synthesis of RNA. 2. DNA-mediated synthesis of RNA.				
12	Chapter 12 Protein synthesis – translation Section I: The genetic code. Section II: Major biomolecules involving the translation. 1. Ribosome. 2. mRNA. 3. tRNA. 4. Amino acids. 5. Auxiliary protein factors. Section III: Activation of amino acids. Section IV: Translation in prokaryotes. 1. Initiation of translation. 2. Elongation. 3. Termination and release. 4. Polyribosomes. Section V: Translation in eukaryotes. Section VI: Quality control of mRNA. Section VII: Events following protein translation. 1. Processing of proteins. 2. Posttranslational modifications. Section VIII: Protein targeting. 1. Signal hypothesis.	1. Mastering: Genetic code, protein translation in prokaryotes and eukaryotes. 2. Comprehending: Quality control of mRNA, events following protein translation. 3. Understanding: Protein targeting, inhibitors of protein synthesis, protein degradation. 4. To have innovative thinking and creativity(Ideological and political objective)	3	Classroom teaching	1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	2. Lysosomal proteins. 3. Mitochondrial proteins. 4. Nuclear proteins. 5. Proteins of the endoplasmic reticulum. 6. Integral plasma membrane proteins. Section IX: Inhibitors of protein synthesis. Section X: Protein degradation. 1. ATP-dependent proteolytic system. 2. ATP-independent proteolytic system.				
13	Chapter 13 Regulation of gene expression Section I: Principles of gene regulation. 1. Specificity of gene expression. 2. Types of gene expression. 3. The specific gene sequences. 4. Regulatory proteins. Section II: Regulation of gene expression in prokaryotes. 1. Regulation at the DNA level. 2. Regulation at the transcription level. 3. Regulation at the translation level. 4. Regulation induced by environmental signals. 5. Global regulation at the genome level. Section III: Regulation of gene expression in eukaryote. 1. Regulation at the chromosomal level. 2. Regulation at the DNA level. 3. Regulation at the transcription level. 4. Regulation at the	1. Mastering: Regulation of gene expression in prokaryotes. 2. Comprehending: Regulation of gene expression in eukaryotes. 3. Understanding: Principles of gene regulation. 4. To build up the correct values in scientific research by giving proper examples in class(Ideological and political objective)	3	Classroom teaching	1,2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	post-transcriptional processing and transport level. 5. Regulation at the translation and post-translational processing level.				
14	Chapter 14 The popular biochemical techniques Section I: Molecular hybridization and blotting technique. 1. The principle of molecular hybridization and blotting technique. 2. Types and applications of blotting techniques. Section II: The principle and application of polymerase chain reaction (PCR). 1. The principle of PCR. 2. The application of PCR. Section III: Recombinant DNA technology (molecular cloning). 1. Concepts related to molecular cloning. 2. Basic principles and procedures of molecular cloning. Section IV: Nucleic acid sequencing. 1. RNA sequencing. 2. DNA sequencing. 3. The application of DNA sequencing. Section V: Gene library. 1. Genomic DNA library. 2. cDNA library. 3. The application of cDNA library. 4. cDNA library vs. genomic DNA library. Section VI: Expression of proteins using recombinant	1. Mastering: Molecular hybridization and blotting technique, PCR, molecular cloning, nucleic acid sequencing. 2. Comprehending: Gene library, protein expression, protein engineering, biological chip techniques, protein-protein and protein-DNA interaction methods. 3. Understanding: Heredity-modified animal model, cloning and identification of disease-related genes, gene therapy. 4. To have innovative thinking and creativity(Ideological and political objective)	3	Classroom teaching	2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	DNA. Section VII: Proteins engineering. 1. Random mutation. 2. Site-directed mutation. Section VIII: The establishment and application of heredity-modified animal model. 1. Transgenic technology. 2. Nuclear transfer technology. 3. Gene targeting. 4. Gene knockout. 5. Gene knockin. 6. Gene knockdown. Section IX: The methods of protein-protein and protein-DNA interaction study. 1. Protein-protein interaction technology. 2. Protein-DNA interaction molecular analysis technology. Section X: Biological chip techniques. 1. Gene chip. 2. Protein chip. Section XI: Cloning and identification of disease-related genes. 1. Functional cloning. 2. Positional cloning. Section XII: Gene therapy. 1. Approach of gene therapy. 2. Types of gene therapy. 3. Vectors in gene therapy.				

#### V Period Distribution and Teaching Modes

Lecture	Topics	period	Teaching modes
1	Introduction	2	theoretical lecturing
2	Amino acid and protein	10	theoretical lecturing

3	Enzymes	12	theoretical lecturing
4	Nucleotide and nucleic acid	4	theoretical lecturing
5	Electron transport and oxidative phosphorylation	4	theoretical lecturing
6	Carbohydrate and its metabolism	10	theoretical lecturing
7	Lipid and its metabolism	6	
8	Nucleotide metabolism	4	
9	Amino acid metabolism	3	
10	DNA synthesis – replication	4	theoretical lecturing
11	RNA synthesis – transcription	4	
12	Protein synthesis – translation	3	
13	Regulation of gene expression	3	
14	Popular biochemical techniques	3	theoretical lecturing
	Total	72	

### VI Suggestions for Teaching

The main teaching method is lecturing. In the class, a variety of teaching techniques, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be used to provide students with various learning experiences and encourage student's initiatives. Homework will be assigned after the class. In-class quizzes will be taken at times during the semester to evaluate student's learning effectiveness. Students will be guided to search and read the latest papers about some course-related topics, and of course, have chance to do a presentation in the class for those topics. Course materials, i.e. syllabus, CAI courseware, study guide, biochemical vocabulary, and references, should be provided to students. To expand student's biochemistry vocabulary, word competition will be hold some time in the semester and trophy will be given.

### VII Suggestions for Course Learning

Learning actually is a very autonomous process. To guarantee the quality of the lecturing, student should read the text before the class. Student should get ready to discuss biochemical questions with classmates and teacher in the class. Students are responsible for understanding the course materials instructed and assigned in the class, including text, papers and homework. Student should study some chapter and the assigned research papers on his/her own, prepare the corresponding PPT and lecture in the class. Students are expected to solve biochemical problems based upon the course materials.

### VIII Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Attendance will be checked randomly in class. Two points will be subtracted for each absence.	5%	Course Objective 2,3,4
Presentation	An in-class presentation is required for assigned chapter. Students are divided into several groups. Each group is responsible for one section of the chapter. Students should self-study the corresponding text, prepare the PPT and lecture in the class.	5%	Course Objective 2,3
Quizzes	Several quizzes will be given in the semester.	20%	Course Objectives 1-4
Mid-term Exam	The mid-term exam will be a two-hour closed-book exam given in the mid-term week.	35%	Course Objectives 1-4
Final Exam	The final exam will be a two-hour closed-book exam given in the last week.	35%	Course Objectives 1-4

## IX Textbooks and References

### 1. Textbook:

1. D. L. Nelson, M. M. Cox: Lehninger Principles of Biochemistry (sixth edition), W.H. Freeman Company, 2012.
2. 杨荣武主编:《生物化学原理》(第2版), 高等教育出版社, 2012年出版。

### 2. References:

1. C. K. Mathews, K. E. van Holde, D. R. Appling, S. R. Anthony-Cahill: Biochemistry (fourth edition), Prentice Hall, 2012.
2. Reginald H. Garrett, Charles M. Grisham: Biochemistry (fourth edition), Mary Finch, 2008.

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**Date:** 2021/05/07

# Syllabus of Biostatistics and Experimental Design

**Course Name/Title:** Biostatistics and Experimental Design      **Course code:** 86918

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 (32 Classroom Hours)

**Course Credit:** 2

## I Course Introduction

The course is a professional elective course for students majoring in biology, and it is also an important professional tool for life science and medical research. This course provides students with common statistical analysis and experimental design methods to enable them to independently design experiments, analyze and process biological big data. This course not only introduces rigorous statistical theory and methods, but also closely integrates bio-industry and scientific research practice. The ability to correctly analyze experimental or observational data will be of great benefit to students taking a wide range of research- and project-based courses. The ideological and political elements is also integrated into teaching process, including respecting data, respecting science and caring for life to strengthen the professional ethics education of student and carry forward the spirit of people oriented. The course is helpful for students to develop exploratory thinking, reverse thinking, divergent thinking and critical thinking.

## II Course Objective

**Course objective 1:** The ideological and political elements, including respecting data, respecting science and caring for life, are integrated into teaching process to strengthen the professional ethics education of student and carry forward the spirit of people oriented.

### (1) Knowledge goal:

**Course objective 2:** Understand the development prospects and career development opportunities of biostatistics.

**Course objective 3:** Understand the basic methods of data analysis.

**Course objective 4:** Understand the basic principles of biostatistics.

**Course objective 5:** Understand the application and development status of statistical inference.

**Course objective 6:** Understand the basic principles of hypothesis testing.

**Course objective 7:** Understand the basic principles of analysis of variance.

**Course objective 8:** Understand regression and related analysis methods.

**Course objective 9:** Be able to use the methods and principles learned to design experiments scientifically.

**Course objective 10:** Be able to effectively collect, process, and analyze biological information, so as to extract new biological information.

### (2) Ability target:

**Course objective 11:** Cultivate students' critical thinking ability.

**Course objective 12:** Cultivate students' ability to analyze and solve problems.

**Course objective 13:** Develop students' ability to write course papers.

### (3) Quality goals:

**Course objective 14:** Cultivate students' interest in studying biotechnology.

**Course objective 15:** Cultivate students' teamwork spirit.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland, have high ideological and moral qualities and cultural qualities. Have a strong sense of social responsibility, a sound personality and a strong sense of teamwork. Have a good professional ethics, follow academic standards. Master the solid basic theories and research methods, and have the sense of truth-seeking and innovation.	Course Objective 1
Graduation Requirement 4	Obtain systematic professional theory and professional skills training through compulsory and elective courses. Master the solid basic theories, basic knowledge and basic skills of biological sciences.	Course Objective 2, 3, 4, 5, 6, 7, 8,
Graduation Requirement 8	Can summarize, organize, and analyze experimental results. Be able to use the theoretical knowledge and skills to engage in scientific research in biological sciences, biotechnology and related fields.	Course Objective 9, 10, 11, 12, 13, 14

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	General remarks: (1) The concept of biostatistics (2) The development and significance of biostatistics (3) Common statistical	(1) Understand the learning purpose, tasks, content and research objects of the course. (2) Introduce the concepts, main content, learning objectives and methods of biostatistics, overview of statistical development, and some	2	Lecture in class	Course Objective 1, 3, 12

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	terms	commonly used statistical terms. (3) Understand the basic definition, application objects, main content and characteristics of this course of biostatistics, the development process of biostatistics and the significance of this course for subsequent experiments and research work. (4) Taking Premier Zhu Rongji's story of "No Fake Accounts" as an example, tell students that they can't modify data at will in the experiment, practice falsification, and develop a down-to-earth style of work.			
2	Arrangement of test data and calculation of characteristic number: (1) Classification and arrangement of test data (2) Calculation of characteristic number of test data	(1) Master the sorting methods of qualitative trait data, quantitative trait data, discrete and continuous data. (2) Understand the calculation method of the mean and variance of the experimental data.	2	Lecture in class	Course Objective 3, 12
3	Theoretical distribution and sampling distribution: (1) Probability basis (2) Probability distribution (3) Sampling distribution	(1) Understand the relationship and calculations between events and the basic concepts and calculations of probability. (2) Master several common probability distributions, such as binomial distribution, Poisson distribution, normal distribution and standard normal distribution, etc. (3) Master the distribution of several sample statistics drawn from the normal population.	4	Lecture in class	Course Objective 4, 5, 11
4	Statistical inference: (1) Basic principles of hypothesis testing (2) Hypothesis test of sample mean	(1) Understand the definition and main content of statistical inference (2) Understand the concepts, basic methods and steps of hypothesis testing, two-tailed testing and	6	Lecture in class, group discussion	Course Objective 1, 5, 6, 12, 13

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	(3) Hypothesis test of sample frequency (4) Parameter estimation	one-tailed testing, and two types of errors in hypothesis testing (3) Combining the new crown epidemic, introduce vaccine research and development, reduce the probability of two types of errors, speed up vaccine research and development, and cut off the spread of new crown pneumonia (4) Master the method of hypothesis testing of the average of a single sample and the comparison of the average of two samples, the hypothesis testing of the frequency of a single sample and the comparison of the frequency of two samples (5) Master the interval estimation of the population mean, the interval estimation of the difference between two population means, the interval estimation of the population frequency and the difference between the frequencies of the two populations.			
5	$\chi^2$ test: (1) Principles and methods of $\chi^2$ test (2) Suitability test (3) Independence test	(1) Understand the definition of $\chi^2$ distribution, the basic principles and methods of $\chi^2$ test (2) Master the method of suitability test, solve the definition of independence test, test the independence of $2 \times 2$ , $2 \times C$ , $R \times C$ contingency table, and test the homogeneity of variance	2	Lecture in class	Course Objective 6, 11, 15
6	Variance analysis: (1) Basic principles of analysis of variance (2) One-way analysis of variance (3) Two-factor analysis of variance	(1) Understand the basic concepts and basis of analysis of variance, the decomposition of the sum of squares and degrees of freedom, and the significance test of statistical hypotheses - F test (2) Master the analysis of variance of repeated observations and the analysis	6	Lecture in class	Course Objective 7, 11, 12, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		of variance of unequal repeated observations, the two-factor analysis of variance without repeated observations and the two-factor analysis of variance of equal repeated observations			
7	Regression and correlation analysis: (1) Regression and related concepts (2) Unary linear regression analysis (3) Linear correlation analysis	(1) Understand regression and related concepts and the main differences between the two, the mathematical model of unary linear regression (2) Master the establishment of one-variable linear regression equation, the significance test of linear regression, the interval estimation and prediction of linear regression (3) Understand the correlation coefficient, master the significance test of the correlation coefficient, and understand the relationship between correlation and regression	4	Lecture in class	Course Objective 8, 10, 12
8	Test design: (1) Basic principles of experimental design (2) Simple experimental design (3) Other experimental designs	(1) Understand the basic principles and methods of experimental design (2) Master the experimental design methods of random group, chi-square, Latin, etc. (3) Teachers demonstrate by themselves, infect students with rigorous scientific research spirit in the process of scientific research, and guide students to invest in national scientific research.	6	Lecture in class, group discussion	Course Objective 1, 9, 10, 14, 15

## V Period Distribution and Teaching Modes

(1) Assignment of course hours

### Time allocation table for theoretical courses or theoretical teaching content:

Teaching hours Course content	Teaching methods			Remark	Subtotal
	Theory teaching	Exercise lesson	Discussion Class		
Course content 1: General	2				2

Course content 2: Sorting out and characteristics of test data	2				2
Course content 3: Theoretical distribution and sampling distribution	4				4
Course content 4: Statistical	6				6
Course content 5: $\chi^2$ test	2				2
Course content 6: Variance	5		1		6
Course content 7: Regression and correlation analysis	4				4
Course content 8: Test design	5		1		6
Total	30		2		32

(2) Teaching method

This course uses PPT, video, etc. for multimedia teaching. Before each class, a few questions related to the course content are asked to the students through the QQ group to encourage the students to preview. At the beginning of the class, ask questions to understand the students' understanding of the course content. At the beginning of the second class, a group of students will give a 10-minute oral report each time; group discussions will be used to interact with the students during the course. After class, students are required to complete open-ended questions after consulting related literature.

**VI Assessment**

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance and classroom performance	20 points deducted for one absence from class, 5 points deducted for one late arrival	20%	Course Objective 1, 2, 14
Assignments and quizzes	4 times	30%	Course Objective 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Final exam		50%	Course Objective 3, 4, 5, 6, 7, 8, 9, 10

**VII Textbooks and References**

(1) Teaching materials:

B. Burt Gerstman, Basic Biostatistics, the second version, Jones & Bartlett Learning, LLC, 2014.

(2) References

[1] Rongsai Du Editor (or series): Biostatistics, and Higher Education Press, published in

2001.

[2] Songgang Li Editor (or series): Practical statistics, Peking University Press, published in 2004.

(3) Network resources: (this course website or the main network resource links)

[1] <http://www.jpkc.swust.edu.cn/C10/zcr-2.htm>

[2] <http://www.biostatistic.net/portal.php>

[3] <http://jpkc.yzu.edu.cn/course/shwtj/prolist2.asp?typeid=392>

[4] <http://jpkc.jmu.edu.cn/skyclass/C298/Co>

[5] <http://www.stat.ucla.edu>.

[6] <http://www.psychstat.smsu.edu/introbook/sbk00.htm>

**Written by: Chen Cen**

**Reviewed by: Dai Qi**

**Date: 2021.5.19**

# Syllabus of Ecology

**Course Name/Title:** Ecology      **Course code:** 86920

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 Classroom Hours

**Course Credit:** 2

## I Course Introduction

Ecology, the study of relationships between organisms and the environment, has been a focus for human study for as long as we have existed as a species. Our survival has depended upon how well we could observe variations in the environment and predict the responses of organisms to those variations. This course is designed to present an introduction to current theories and practices in ecology. Students are introduced 1) to the various questions (in a broad sense) asked by ecologists, 2) to the ideas (theories, models) from which hypotheses are suggested to answer the questions, and 3) to the ways in which ecologists go about gathering data to refute or support the proposed hypotheses. Specific ecological studies are used to illustrate some of what has been learned about the natural world through the study of ecology. Thus, the course emphasizes the conceptual models by through which we attempt to understand complex biological systems, the facts upon which those models are based, and the processes through which we learn these facts.

The course begins with a brief introduction to the nature and history of the discipline of ecology, followed by section I, which includes two chapters on natural history—life on land and life in water and a chapter on population genetics and natural selection. Sections II through VI build a hierarchical perspective through the traditional subdisciplines of ecology: section II concerns adaptations to the environment; section III focuses on population ecology; section IV presents the ecology of interactions; section V summarizes community and ecosystem ecology; and finally, section VI discusses large-scale ecology and includes chapters on landscape, geographic, and global ecology. The goal of this course is to build a foundation of ecological knowledge around key concepts for students.

## II Course Objective

**Course objective 1:** An understanding of the nature and extent to which ecological scientists see order and pattern in nature.

**Course objective 2:** An understanding of how ecological scientists study animal and plant populations the extent to which populations can be considered to exhibit structure.

**Course objective 3:** Skills and understanding in the use of quantitative tools (particularly statistical and functional models) relevant to the field that are used to analyze data and formulate new predictions.

**Course objective 4:** Skills and understanding in the use of sampling and data gathering tools germane to the field that are used to test predictions.

**Course objective 5:** An understanding in areas of focus in current investigative activity (e.g. life tables, stable age distributions, density dependent factors, discrete population models, population estimation, resources and consumers, and competition) within the parts of the discipline we are able to study this term.

**Course objective 6:** An enhanced appreciation for embracing the importance of variability, complexity and uncertainty in the pursuit of scientific truth.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Could understand the biological science and biological technology, mathematical statistics and biological engineering principle and other basic theory; understand the biological industry theory, possess the ability of analyzing problems.	Course Objective 1-6
Graduation Requirement 5	Have the biotechnology engineering practice and the basic technological innovation ability by using the knowledge of gene engineering, microbiological engineering and fermentation engineering methods and tools. By the integrated application of the theoretical knowledge and skills, possess the ability of designing downstream product of biotechnology and related fields research.	Course Objective 3, 4, 5, 6

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	1. Introduction to the nature and history of the discipline of ecology 2. Forest Canopy Research: A Physical and Scientific Frontier 3. Climatic and Ecological Change: Past and Future	1. Know the overview of Ecology. 2. Understand the sampling ecological research. 3. Master how to investigate the ecological research evidence.	4	Lectures in class, group discussions	Course objective: 1,2
2	1. Life on Land 2. Life in Water 3. Population Genetics	1. Understand the process of natural selection. 2. Master the features of various	4	Lectures in class	Course objective: 1,2,3,4,5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	and Natural Selection	natural history and geography of biomes. 3. Understand the soil as the foundation of terrestrial biomes as an environmental factor.			
3	1. Temperature Relations 2. Water Relations 3. Energy and Nutrient Relations 4. Social Relations	1. Understand the effects of temperature and performance of organisms. 2. Know the effects of water availability. 3. Understand the definition of optimal foraging theory.	6	Lectures in class	Course objective: 1,2,3,4,5
4	1. Population Distribution and Abundance 2. Population Dynamics 3. Population Growth 4. Life Histories	1. Define population, density, and abundance. 2. Describe population dynamics and express population size as a balance between the opposing processes of birth, death, immigration, and emigration. 4. List factors influencing population growth in aquatic and terrestrial environments. 5. Describe the concept of life history and some of its components.	6	Lectures in class	Course objective: 1,2,3,4
5	1. Intraspecific Competition 2. Complex Interactions 3. Plant and Coral Mutualisms 4. Evolution of Mutualism	1. Master the main types of competition 2. Master the types of exploitative interactions: predation, herbivory, parasitism, and disease. 3. Master the main types of mutualism.	4	Lectures in class	Course objective: 1,2,3,4,5
6	1. Species Abundance and Diversity 2. Species Interactions and Community Structure 3. Primary and Secondary Production 4. Nutrient Cycling and	1. Can describe the concepts of community and community structure. 2. Master the definition and methods of species abundance and diversity calculation. 3. Primary and Secondary Production	4	Lectures in class, group discussions	Course objective: 1,2,3,4,5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Retention 5. Succession and Stability	4. Enhance students' sense of community webs. 5. Establish students' correct scientific research ethics through group discussion on nutrient cycling and retention and succession and stability.			
7	1. Landscape Ecology 2. Geographic Ecology 3. Global Ecology	1. Can define a landscape from the perspective of landscape ecology. 2. List the differences between landscape ecology and other subdisciplines of ecology, such as community and ecosystem ecology. 3. Understand the role of geologic processes in creating and maintaining landscape structure.	4	Lectures in class	Course objective: 1,2,3,4,5

#### V. Distribution of course hours and teaching methods

##### (1) The allocation of course hours

	Theory taught	Problem lesson	Discuss lesson	Remark	Subtotal
1. Introduction to Ecology	3	0	1		4
2. Natural History and Evolution	4	0	0		4
3. Adaptations to the Environment	6	0	0		6
4. Population Ecology	6	0	0		6
5. Interactions	3	0	0		4
6. Communities and Ecosystems	3	0	1		4
7. Large-Scale Ecology	4	0	0		4
Total	30	0	2		32

##### (2) Teaching methods

We encourage student use a learning approach called *constructivism* to actively build

knowledge rather than receive knowledge passively. Multimedia will be adopted in the teaching process, such as PPT, video, and software of genetics course. Course presentation is encouraged during the process focuses on several genetic issues.

**Interactive Notebooks.** We strongly encourage students to keep an Interactive Notebook this semester. This is a 3ring binder with chronologically organized notes, returned assignments, exams, handouts, study guides and readings. Keeping such a notebook is a basic study skill that will help you relate topics to previous ideas, document strategies to solve homework problems and have, at the end of the semester, a personalized course pack that you can easily reuse in future classes and research projects.

**Electronic devices.** We strongly discourage the use of electronic devices in the classroom.

## VI Assessment

### Exams and quizzes

Generally, quizzes are intended primarily to help the instructor assess student understanding of readings and key concepts, and to motivate students to keep up with the readings. Final Exam is based on students' performance in analyzing, synthesizing and applying knowledge (rather than, say, plugging numbers into equations, running software, etc.). Study guides will be provided to highlight key concepts in the class, and a sheet with key formulae will be provided for use the exams, to encourage students to focus their effort on understanding rather than memorizing.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Classroom performance	Attendance, Q&A, Class presentations	20%	1-8
Quizzes & problem sets	3 big quizzes, open-book (appx. per 3 weeks)	25%	1-8
Final exam	Close-book, formulae will be provided	55%	1-8

## VII Textbooks and References

### 1. Textbook:

[1] Manuel C. Molles. 2015. *Ecology: Concepts & Applications*, 7th ed. McGraw Hill Education.

### 2. Reference:

[1] Michael L. Cain et al., 2013. *Ecology*, 3rd ed. Sinauer Associates.

[2] 牛翠娟等编著《基础生态学》（第三版），高等教育出版社，2015年出版。

### 3. Online Resources:

[3] <http://ww2.tnstate.edu/ganter/BIO412SyllabusF%2799.html>

[4] <http://jan.ucc.nau.edu/~jde7/ese425/eco/index.html>

[5] <http://www.muskingum.edu/~ingold/courses/308syll.htm>

[6] <https://www.coursera.org/learn/biodiversity>

**Written by:** Zhechen Qi

**Reviewed by:** Ruihong Wang

**Date:** May 25<sup>th</sup>, 2021

# Syllabus of Biomedical Engineering

**Course Name/Title:** Biomedical Engineering

**Course Code:** 86922

**Course Type:** Basic Course, Optional Course

**Total Teaching Hours:** 32 (Classroom Hours: 32)

**Course Credit:** 2

## I Course Introduction

Biomedical Engineering is a basic optional course intended for biotechnology students in full-English teaching classes. This course serves as an introduction and overview of the field of biomedical engineering. Students in their sophomore year or junior year should be adequately prepared for this course. More importantly, this course could lay a solid foundation for their further research and study.

## II Course Objective

### 1. Ideological and political Targets

**Course Objective 1:** By selecting people and events that resonate with students, guide students to feel patriotic, and cultivate future generations who are well-prepared to join the socialist cause.

### 2. Knowledge Targets

**Course Objective 2:** Comprehend the application and development of Biomedical Engineering

**Course Objective 3:** Comprehend the professional status and recent advances in Biomedical Engineering

**Course Objective 4:** Comprehend tissue engineering and the future directions

**Course Objective 5:** Comprehend basic mechanics and biomechanics of materials

**Course Objective 6:** Master the types, properties and their applications of biomaterials

**Course Objective 7:** Comprehend the basic bioinstrumentation system and bioinstrumentation design

**Course Objective 8:** Master the biopotential measurements and comprehend bioanalytical sensors

**Course Objective 9:** Comprehend the history of bioelectric phenomena and master the model of a whole neuron

**Course Objective 10:** Comprehend the modes of medical imaging and make a comparison

### 2. Ability Targets

**Course Objective 11:** Ability of critical thinking

**Course Objective 12:** Ability of oral expression and thesis writing

**Course Objective 13:** Ability of creative thinking and to carry out innovative experiments

### 3. Quality Targets

**Course Objective 14:** Cultivate learning interest in biotechnology

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Understand basic theories of bioscience, biotechnology, mathematical statistics and bioengineering, comprehend theoretical knowledge of biological industry, and master the ability to solve problems.	Course Objective 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Graduation Requirement 5	Master methods, frameworks and tools in the research area of gene engineering, microbiological engineering, fermentation engineering. Learn to use the theoretical knowledge together with practical skills, to work with R&D in biotechnology and related product, and to have the abilities of practicing and innovation of down-streamed biotechnology.	Course Objective 1, 2, 3, 11, 12, 13, 14

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<p><b>Introduction of Biomedical Engineering</b></p> <p>1) Lesson plan and textbook</p> <p>2) BME discipline in China</p> <p>3) Course schedule of BME in HUST</p>	<p>1) Comprehend the application and development of Biomedical Engineering</p> <p>2) Comprehend the professional status and recent advances in Biomedical Engineering</p>	2	in-class lecture	1, 2, 3, 11, 12, 13, 14
2	<p><b>Biomedical Engineering: A Historical Perspective</b></p> <p><b>The Evolution of the Modern Health Care System</b></p> <p>1) The Modern Health Care System</p> <p>2) What is Biomedical Engineering?</p> <p>3) Roles Played by the Biomedical Engineers</p>	<p>1) Identify the major role that advances in medical technology have played in the establishment of the modern health care system</p> <p>2) Define what is meant by the term biomedical engineering and the roles biomedical engineers play in the health care delivery</p>	2	in-class lecture	1, 2, 3, 11, 12, 13, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	4) Recent Advances in Biomedical Engineering 5) Professional Status of Biomedical Engineering	system 3) Explain why biomedical engineers are professionals			
3	<b>Biomechanics</b> 1) Introduction 2) Basic Mechanics 3) Mechanics of Materials 4) Viscoelastic Properties 5) Cartilage, Ligament, Tendon, and Muscle 6) Clinical Gait Analysis 7) Cardiovascular Dynamics	1) Understand the application of engineering kinematic relations to biomechanical problems 2) Understand the application of engineering kinetic relations to biomechanical problems 3) Understand the application of engineering mechanics of materials to biological structures 4) Use MATLAB to write and solve biomechanical static and dynamic equations 5) Use Simulink to study viscoelastic properties of biological tissues 6) Understand how kinematic equations of motion are used in clinical analysis of human gait 7) Understand how kinetic equations of motion are used in clinical analysis of human gait 8) Explain how biomechanics applied to human gait is used to quantify pathological conditions, to suggest surgical and clinical treatments, and to	4	in-class lecture	1, 5, 11, 12, 13, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		quantify their effectiveness 9) Understand basic rheology of biological fluids 10) Understand the development of models that describe blood vessel mechanics			
4	<b>Biomaterials</b> 1) Materials in Medicine: From Prosthetics to Regeneration 2) Biomaterials: Types, Properties and Their Applications 3) Lessons from Nature on Biomaterial Design and Selection 4) Tissue–Biomaterial Interactions 5) Biomaterials Processing Techniques for Guiding Tissue Repair and Regeneration 6) Safety Testing and Regulation of Biomaterials 7) Application-Specific Strategies for the Design and Selection of Biomaterials	1) Understand the complexity of natural tissue structure that biomaterials scientists seek to replace with biomaterials 2) Describe several different types of biological responses to implanted materials 3) Understand the benefits and differences among the various classes of biomaterials used in medicine 4) Design bio-inspired medical device features to enhance or modify cellular interactions 5) Explain a variety of methods to fabricate scaffolds for tissue engineering 6) Understand the rationale for selecting particular chemistries and structures for several different medical product applications 7) Know where to find the appropriate testing protocols to demonstrate	8	in-class lecture; exercise class	1, 5, 6, 11, 12, 13, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		medical product safety			
5	<p><b>Tissue Engineering</b></p> <p>1) What Is Tissue Engineering?</p> <p>2) Biological Considerations</p> <p>3) Physical Considerations</p> <p>4) Scaling Up</p> <p>5) Implementation of Tissue Engineered Products</p> <p>6) Future Directions: Functional Tissue Engineering and the “-Omics” Sciences</p>	<p>1) Discuss the growing area of cellular therapies</p> <p>2) Discuss the three general categories of extracorporeal bioreactors</p> <p>3) Understand the cellular dynamics underlying tissue function</p> <p>4) Qualitatively describe the importance of stem cells in tissue function</p> <p>5) Quantitatively describe cellular fate processes</p> <p>6) Analytically describe mass transfer in three different configurations</p> <p>7) Explain the parameters that characterize the tissue environment and how to approach mimicking them <i>in vitro</i></p> <p>8) Describe the issues fundamental to scale-up</p> <p>9) Define functional tissue engineering and how the “-omics” sciences are driving this newly created research area</p> <p>10) Discuss the issues that one encounters when implementing cellular therapies or bioartificial organs to patients</p>	8	in-class lecture; Seminar	1, 4, 11, 12, 13, 14
6	<p><b>Bioinstrumentation</b></p> <p>1) Introduction</p> <p>2) Basic Bioinstrumentation System</p> <p>3) Charge, Current, Voltage, Power, and</p>	<p>1) Describe the components of a basic instrumentation system</p> <p>2) Analyze linear circuits using the nodevoltage method</p> <p>3) Simplify complex circuits</p>	2	in-class lecture	1, 7, 8, 11, 12, 13, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Energy 4) Resistance 5) Linear Network Analysis 6) Linearity and Superposition 7) The “venin”s Theorem 8) Inductors 9) Capacitors 10) A General Approach to Solving Circuits Involving Resistors, Capacitors, and Inductors 11) Operational Amplifiers 12) Time-Varying Signals 13) Active Analog Filters 14) Bioinstrumentation Design	using The ‘venin’s equivalent circuits 4) Solve circuits involving resistors, capacitors, and inductors of any order 5) Analyze circuits that use operational amplifiers 6) Determine the steady-state response to sinusoidal inputs and work in the phasor domain			
7	<b>Bioelectric Phenomena</b> 1) Introduction 2) History 3) Neurons 4) Basic Biophysics Tools and Relationships 5) Equivalent Circuit Model for the Cell Membrane 6) The Hodgkin-Huxley Model of the Action Potential 7) Model of a Whole Neuron 8) Chemical Synapses	1) Describe the history of bioelectric phenomenon 2) Qualitatively explain how signaling occurs among neurons 3) Calculate the membrane potential due to one or more ions 4) Compute the change in membrane potential due to a current pulse through a cell membrane 5) Describe the change in membrane potential with distance after stimulation 6) Explain the voltage clamp experiment and an action potential 7) Simulate an action potential using the Hodgkin-Huxley model	2	in-class lecture	1, 9, 11, 12, 13, 14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		8) Describe the process used for communication among neurons			
8	<b>Medical Imaging</b> 1) Introduction 2) Diagnostic Ultrasound Imaging 3) Magnetic Resonance Imaging 4) Magnetoencephalography 5) Contrast Agents 6) Comparison of Imaging Modes 7) Image Fusion	1) Distinguish between the principles of pulse echo ranging and ultrasound imaging 2) Describe how ultrasound images are formed 3) Explain the fundamentals of acoustic wave propagation, reflection, and refraction 4) Describe the operation and characteristics of a piezoelectric transducer 5) Explain the principle of an acoustic matching layer 6) Discuss the basic types of acoustic scattering	4	in-class lecture	1, 10, 11, 12, 13, 14

#### V Period Distribution and Teaching Modes

Course Content	Teaching Modes					Subtotal
	Theory teaching	Exercise class	Seminar	Comment		
Course Content 1: Introduction of Biomedical Engineering	2				2	
Course Content 2: Biomedical Engineering: A Historical Perspective	2				2	
Course Content 3: Biomechanics	4				4	
Course Content 4: Biomaterials	6	2			8	
Course Content 5: Tissue Engineering	6		2		8	
Course Content 6: Bioinstrumentation	2				2	
Course Content 7: Bioelectric Phenomena	2				2	

Course Content 8: Medical Imaging	4				4
Sum	28	2	2		32

### VI Assessment

Biomedical Engineering is a Basic optional course. The assessment of this course includes attendance, homework/quiz and course report.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	1. Deduction of 10 points if absence without reason each time 2. Deduction of 5 points if be late for class each time	20%	14
Homework/Quiz	Four times	60%	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Course report	Preview the course content to determine a specific topic, and make a report with PPT	20%	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

### VII Textbooks and References

[1] John D.Enderle Joseph & D.Bromzino. Introduction to Biomedical Engineering, 3rd Edition; Academic Press: London, 2010.

[2] John Wiley & Sons. Bioinstrumentation, , New York, 2013.

[3] West Conshohocken. Annual Book of ASTM Standards, vol. 13.01, Medical and Surgical Materials and Devices, American Society of Testing and Materials (ASTM) International, Pennsylvania, 2010.

[4] D.J. DiLorenzo, J.D. Bronzino. Neuroengineering, CRC Press, Boca Raton, FL, 2016.

[5] John Wiley. Biomechanics and Motor Control of Human Movement, fourth ed. New York, NY, 2009.

**Written by: Meng Miao**

**Reviewed by: Cen Chen**

**Date: 2021.04.12**

# Syllabus of Literature Search and Science Thesis Writing

**Course Name/Title:** Literature Search and Science Thesis Writing

**Course Code:** 86924

**Course Type:** Basic Course, Optional Course

**Total Teaching Hours:** 16 (Classroom Hours: 16)

**Course Credit:** 1

## I Course Introduction

Literature Search and Science Thesis Writing combines theory, methods and practice into one course which can not only stimulate the innovation but also cultivate the creative ability of college students.

## II Course Objective

**Course Objective 1:** Popularize the results of high-tech applications, inspire students to explore, innovate, and advocate scientific spirit

### 1. Knowledge Targets

**Course Objective 2:** Acquaint with different databases

**Course Objective 3:** Acquaint with scientific literature

**Course Objective 4:** Acquaint with the way and skill of science thesis writing

**Course Objective 5:** Acquaint with different search devices for literatures searching

**Course Objective 6:** Comprehend the importance of literature search during research and study

### 2. Ability Targets

**Course Objective 7:** Ability of collect, systemize and utilize the scientific documents

**Course Objective 8:** Ability of using the traditional and modern search devices and methods

**Course Objective 9:** Ability of manage the methods and skills of thesis writing

### 3. Quality Targets

**Course Objective 10:** Lay a solid foundation for students' further research and study

**Course Objective 11:** Cultivate good writing habits during scientific research

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 3	With knowledge of literature, history, philosophy, bioethics, ideological and moral, political science, art, law, psychology and other aspects of knowledge. To learn about the development of human society and its laws,	Course Objective 10, 11

	including economics, law, political science, sociology, journalism and other aspects of knowledge. Has a strong mathematical, physical, chemical and other aspects of knowledge. With the initial economics, management and other aspects of knowledge. Have a certain human quality, to develop the basic consciousness of lifelong learning.	
Graduation Requirement 5	Can expertly use foreign language reading professional journals and literature search, master the scientific methodology and scientific writing and other aspects of the basic knowledge; have a strong computer operating technology.	Course Objective 2, 3, 4, 5, 6, 7, 8, 9

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<b>Find a Topic and Enjoy Writing Your Science Thesis:</b> (1) The right topic for you and narrow your topic (2) What are the rules of a science thesis? (3) Thesis templates (4) The importance of planning (5) Get your information into a workable form (6) Creating a plan for your thesis	(1) Comprehend the way of topic selection and master the skill to choose a good topic (2) Give a basic understanding of standard conventions of thesis writing, along with suggestions as to the best way of approaching the task (3) Through telling the stories about some scientists, students can perceive the methods and thoughts of scientists to explore the world, and eliminate boredom in class	2	in-class lecture	Course Objective 1, 6, 7, 8, 10, 11
2	<b>Planning and Writing Materials and</b>	(1) Produce a detailed recipe section for your experiments	2	in-class lecture	Course Objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p><b>Methods/ Results:</b></p> <p>(1) The importance of forward planning</p> <p>(2) Planning materials and methods</p> <p>(3) Writing methods and materials section</p> <p>(4) Planning your results chapter</p> <p>(5) What results to include and not to include</p> <p>(6) The order in which to present your results</p> <p>(7) Writing your results chapter</p> <p>(8) Preparing for your introduction and discussion chapters</p> <p>(9) Common mistakes and key points</p>	<p>(2) Learn to give a brief outline of each experimental strategy and present your data</p> <p>(3) Introduce the types and cases of academic plagiarism to make students understand what are the forbidden areas of scientific paper writing, the serious impact and consequences of academic plagiarism, and then develop good academic moral habits.</p>			e 1, 4, 8, 9, 10, 11
3	<p><b>Planning and Writing the Introduction and Discussion:</b></p> <p>(1) Structure of the introduction chapter</p> <p>(2) Literature survey</p> <p>(3) Planning and writing your introduction</p> <p>(4) Structure of the discussion chapter</p> <p>(5) Your reference</p> <p>(6) Planning and writing your discussion</p> <p>(7) Common mistakes and key points</p>	<p>(1) Master how to plan and write introduction discussion</p>	2	in-class lecture	Course Objective 5, 7, 8, 9, 10, 11
4	<p><b>Figures and Tables:</b></p> <p>(1) Creating figures</p> <p>(2) Size and scale</p>	<p>(1) Provide the information you are trying to convey, and plan your figure and tables without including redundant</p>	4	in-class lecture	Course Objective 5, 7, 8,

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	(3) Figure legends (4) Black and white or color? (5) Annotating Tables (6) Numbers and titles for tables (7) Footnotes for tables (8) Basic guidelines and key points	ideas or data (2) Introduce software to display figures and tables			9, 10, 11
5	<b>Layout:</b> (1) Fonts, line spacing, margins, headers and footers (2) Alignment of text (3) Title and headings (4) Separating sections and chapters (5) Inserting page numbers (6) Footnotes (7) Check your layout on the final version of your manuscript (8) Common mistakes and key points	(1) Master the skills to present your manuscript logically and consistently	2	in-class lecture	Course Objective 5, 7, 8, 9, 10, 11
6	<b>Literature Search and Writing the References:</b> (1) Why and what to reference? (2) Literature search (3) Storing your reference (4) Add citations to your text as you write (how to use Endnote) (5) Common mistakes (6) Key points	(1) Aware of the importance of scientific literature and master how to search, store and cite the reference (2) While teaching, many achievements from high-tech applications are involved. These can not only reflect the hardships of scientists in exploring and innovating, but also inspire students' enthusiasm for academic and scientific research.	4	in-class lecture	Course Objective 1, 2, 3, 5, 10, 11

## V Period Distribution and Teaching Modes

Teaching Modes Period Distribution	Theory teaching	Exercise class	Seminar	Comment	Subtotal
<del>Course Content</del>					
Course Content 1: Find a Topic and Enjoy Writing Your Science Thesis	2				2
Course Content 2: Planning and Writing Materials and Methods/Results	2				4
Course Content 3: Planning and Writing the Introduction and Discussion	2				2
Course Content 4: Figures and Tables	4				2
Course Content 5: Layout	2				2
Course Content 6: Literature Search and Writing the References	4				4
Sum	16				16

## VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance and Classroom Performance	1) Absence no reason deduct 5 points each time 2) Inappropriate behaviors deduct 3 points each time 3) Participate in class and answer questions actively plus 3 points each time	40%	9, 10
Homework/Quiz	Four times	60%	1, 2, 3, 4, 5, 6, 7, 8

## VII Textbooks and References

[1] Daniel Holtom & Elizabeth Fisher. Enjoy Writing Your Science Thesis or Dissertation, 2<sup>nd</sup> Edition; Imperial College Press: London, 2003.

[2] Beverly Ann Chin. How to Write a Great Research Paper, 1<sup>st</sup> Edition; Jossey-Bass: A Wiley Imprint: San Francisco, 2004.

[3] Charles Lipson. How to Write a BA Thesis, University of Chicago, 2005.

[4] William Zinsser. On Writing Well, Harper Perennial, 2016.

[5] Paul Oliver. Writing Your Thesis, SAGE Publications Ltd, 2013.

**Written by: Cen Chen**

**Reviewed by: Meng Miao**

**Date: 2021.04.12**

# Syllabus of Microbiology

**Course Name/Title:** Microbiology                      **Course code:** 86925

**Course Type:** Specialized Course, Compulsory Course

**Total Teaching Hours:** 48 (Classroom Hours: 48)

**Course Credit:** 3

## I Course Introduction

Microbiology is the study of microscopic organisms, such as bacteria, viruses, archaea, fungi and protozoa. This discipline includes fundamental research on the biochemistry, physiology, cell biology, ecology, evolution and clinical aspects of microorganisms, including the host response to these agents. It is one of the largest and most complex of the biological sciences because it integrates subject matter from many diverse disciplines. Microbiology is a subject of rich theory, but also is highly potential in industrial applications. The course of microbiology aims to guide students to enter the microscopic world, where they can learn fundamental and applicable knowledge about microorganism, and know some important microbiology-related molecular tools.

According to the nature of this course, tasks and limited time setting, it will focus on the basic theories of microbial morphology, physiology and biochemistry, genetic variation, ecological distribution and practical application, and combine the introduction of new theories and new results in microbiology to make students understand the current development of the subject. During the course, we also incorporate some important ideological and political theories that are closely associated with microbiology, such as the policy that Chinese government adapted to control the COVID-19 pandemic, and delivery of its positive influence worldwide. Students will gradually gain the ability to analyze and solve problems in microbiology, and pay attention to permeate ideological education, professional ethics education, and gradually train student dialectical thinking, so that students can form good professional ethics.

## II Course Objective

### 1. Ideological and political objective

1.1 Motivate student's patriotism by introducing the successful control and prevention of COVID-19 pandemic in China;

1.2 Culture student's science spirit by introducing some important findings associated with microbiology;

1.3 Culture student's creative thinking by introducing some original discoveries in microbiology, such as penicillin and CRISPR.

### 2. Knowledge objective

2.1 Differentiate viruses, bacteria, fungi, algae and protozoans in terms of structure, physiology, genetics, replication and reproduction, ecological niches, and interactions with man and the environment.

2.2 Differentiate the eubacteria and archeobacteria into significant taxa based on genetics, physiology and morphology with special attention to those known to have the greatest impact on human.

2.3 Understand the implications of the presence and functions of microorganisms in terms of economics, industry, the environment, history, health care and research.

2.4 Understand how microorganisms grow, their unique nutritional requirements, how their growth can be controlled and the cellular mechanisms and structures target by antibiotics.

2.5 Understand the mechanisms of prokaryotic DNA replication, nucleic acid transcription and translation, mutations and mobile genetic elements.

2.6 Understand the techniques used to observe, identify, measure, manipulate, study and genetically modify microorganisms.

**3. Ability objectives**

3.1 Abilities to solve problem on microbiology.

3.2 Abilities to apply microbes in industry, food, medicine, and environment.

3.3 Abilities to innovate and create.

**4. Quality objectives**

4.1 Cultivate learning interest in biotechnology.

4.2 Possess the ability of practical and realistic attitude and innovation spirit.

**III Correlations between Course Objectives and Graduation Requirements**

<b>Graduation Requirements Index Point</b>	<b>Graduation Requirements</b>	<b>Course Objectives</b>
4	Receive systematic training of professional theory and professional skills through compulsory and elective courses, and master solid basic theories, basic knowledge and basic skills of biological sciences	1, 2
7	Capability in skillfully using various modern media technologies to actively acquire scientific research information and other knowledge; The ability to systematically master basic experimental methods and skills in biotechnology and related fields, including mastering gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology for major diseases, and key technologies related to life sciences such as basic analysis technology of bioinformatics	1, 3, 4

**IV Correlations between Course Content and Course Objectives**

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<p>Chapter 1 The main themes of microbiology</p> <ol style="list-style-type: none"> <li>1. The Scope of Microbiology</li> <li>2. General Characteristics of Microorganisms</li> <li>3. Human Use of Microorganisms</li> <li>4. The Historical Foundations of Microbiology</li> <li>5. Taxonomy: Organizing, Classifying, and Naming Microorganisms</li> <li>6. The Origin and Evolution of Microorganisms</li> </ol>	<ol style="list-style-type: none"> <li>1. Motivate students' science spirit by introducing important microbiologists contributing to the development of microbiology.</li> <li>2. Define microbiology and microorganisms, and identify the major organisms included in the science of microbiology.</li> <li>3. Describe the basic characteristics of prokaryotic cells and eukaryotic cells and their evolutionary origins.</li> <li>4. Outline the major events in the history of microbiology, including the major contributors to the early development of microscopy, medical advances, aseptic techniques, and the germ theory of disease.</li> <li>6. Define taxonomy and its supporting terms classification, nomenclature, and identification.</li> </ol>	3	Classroom teaching	1,2,4
2	<p>Chapter 2 Tools of the Laboratory: Methods of Studying Microorganisms</p> <ol style="list-style-type: none"> <li>1. Methods of Microbial Investigation</li> <li>2. The Microscope: Window on an Invisible Realm</li> </ol>	<ol style="list-style-type: none"> <li>1. Describe the basic plan of an optical microscope, and differentiate between magnification and resolution.</li> <li>2. Distinguish between simple, differential, and</li> </ol>	3	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	3. Additional Features of the Six "I's" 4. Media: Foundations of Culturing	structural stains, including their applications. 3. Define <i>inoculation</i> , <i>media</i> , and <i>culture</i> , and describe sampling methods and instruments, and what events must be controlled. 4. Describe three basic techniques for isolation, including tools, media, incubation, and outcome. 5. Understand the classification of media based on different properties.			
3	Chapter 4 A Survey of Prokaryotic Cells and Microorganisms 1. Basic Characteristics of Cells and Life Forms 2. Prokaryotic Profiles: The Bacteria and Archaea 3. The Cell Envelope: The Boundary Layer of Bacteria a. Bacterial Internal Structure 4. Bacterial Shapes, Arrangements, and Sizes 5. Classification Systems of Prokaryotic Domains: Archaea and Bacteria 6. Survey of Prokaryotic Groups with Unusual Characteristics	1. Characterize the organization of a prokaryotic cell. 2. Describe the generalized anatomy of bacterial cells. 3. Distinguish among the types of external cell appendages. 4. Describe the structure and position of bacterial flagella and axial filaments, and their attachment patterns. 5. Explain how flagella influence motility and motile behavior. 6. Discuss the structure and functions of pili and fimbriae. 7. Define glycocalyx, and describe its different forms and functions.	6	Classroom teaching	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<ol style="list-style-type: none"> <li>8. Outline the structure and functions of cell walls, and explain the role of peptidoglycan.</li> <li>9. Describe features of the bacterial chromosome and plasmids.</li> <li>10. Discuss the resistance and significance of endospores.</li> <li>11. Describe the shapes of bacteria and their possible variants.</li> <li>12. Describe the purposes of classification and taxonomy in the study of prokaryotes.</li> </ol>			
4	<p>Chapter 5 A Survey of Eukaryotic Cells and Microorganisms</p> <ol style="list-style-type: none"> <li>1. The History of Eukaryotes</li> <li>2. Form and Function of the Eukaryotic Cell: External Structures and Internal Structures</li> <li>3. Eukaryotic-Prokaryotic Comparisons and Taxonomy of Eukaryotes</li> <li>4. The Kingdom of the Fungi</li> <li>5. Survey of Protists: Algae</li> <li>6. Survey of Protists: Protozoa</li> </ol>	<ol style="list-style-type: none"> <li>1. Describe the plan of a basic eukaryotic cell and organelles,</li> <li>2. and indicate the structures all cells possess and those found only in some groups.</li> <li>3. Describe the types of eukaryotic locomotor appendages.</li> <li>4. Characterize the cell wall and membrane of eukaryotic cells.</li> <li>5. Compare and contrast prokaryotic cells, eukaryotic cells, and viruses.</li> <li>6. Outline the basics of eukaryotic taxonomy.</li> <li>7. Differentiate between characteristics of yeasts and molds, and define fungal spores.</li> <li>8. Classify types of fungal</li> </ol>	6	Classroom teaching	

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>spores and explain their functions.</p> <p>9. Discuss the main features of fungal classification and</p> <p>10. representative examples of each group.</p> <p>11. Explain how fungi are identified.</p> <p>12. Discuss the importance of fungi in ecology, agriculture, commerce, and medicine.</p> <p>13. Discuss the major characteristics of algae, and explain how they are classified.</p>			
5	<p>CHAPTER 6 An Introduction to Viruses</p> <p>1. Overview of Viruses</p> <p>2. The General Structure of Viruses</p> <p>3. How Viruses Are Classified and Named</p> <p>4. Modes of Viral Multiplication</p> <p>5. The Multiplication Cycle in Bacteriophages</p> <p>6. Techniques in Cultivating and Identifying Animal Viruses</p> <p>7. Viral Infection, Detection, and Treatment</p> <p>8. Prions and Other Nonviral Infectious Particles</p>	<p>1. Motivate student's patriotism by introducing the successful control and prevention of COVID-19 pandemic in China; Indicate how viruses were discovered and characterized.</p> <p>2. Describe the unique characteristics of viruses.</p> <p>3. Discuss the origin and importance of viruses.</p> <p>4. Describe the general structure and size range of viruses.</p> <p>5. Distinguish among types of capsids and nucleocapsids.</p> <p>6. Describe envelopes and spikes, and discuss their origins.</p> <p>7. Explain the functions of capsids, nucleocapsids, envelopes, and spikes.</p>	6	Classroom teaching	1,2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<ul style="list-style-type: none"> <li>8. Explain the classification scheme used for viruses.</li> <li>9. Indicate the characteristics used in identifying and naming viruses.</li> <li>10. Relate the stages in the multiplication cycle of animalviruses, and summarize what is happening in each stage.</li> <li>11. Describe the stages in the multiplication cycle of bacteriophages.</li> <li>12. Explain what is meant by lysogeny, prophage, and lysogenic induction and conversion.</li> <li>13. Compare the methods and uses of cell culture, bird embryos, and live animals in growing viruses.</li> </ul>			
6	<p>CHAPTER 7 Microbial Nutrition, Ecology, and Growth</p> <ul style="list-style-type: none"> <li>1. Microbial Nutrition</li> <li>2. Transport: Movement of Substances across the Membrane</li> <li>3. Environmental Factors That Influence Microbes</li> <li>4. Ecological Associations among Microorganisms</li> <li>5. The Study of Microbial Growth</li> </ul>	<ul style="list-style-type: none"> <li>1. Describe the major environmental factors to which microbes must adapt for survival.</li> <li>2. Define nutrition and nutrients and their subcategories based on need and quantity.</li> <li>3. Differentiate between organic and inorganic nutrients.</li> <li>4. Discuss the origins, types, and functions of bioelements and nutrients.</li> <li>5. Describe the main categories of nutritional types among organisms.</li> </ul>	6	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<ol style="list-style-type: none"> <li>6. Describe the range of temperatures a microbe can function within.</li> <li>7. Explain the adaptive temperature groups with examples of microbes that exist in them.</li> <li>8. List the major gases and describe microbial requirements for these gases.</li> <li>9. Identify the adaptations of microbial groups to variations in pH.</li> <li>10. Identify microbial adaptations to osmotic pressure.</li> <li>11. Discuss the range of associations among microorganisms and their basic qualities.</li> <li>12. Explain what occurs in symbiosis and coevolution.</li> <li>13. Differentiate among mutual, commensal, and parasitic associations, providing examples.</li> <li>14. Differentiate among synergism and antagonism with examples.</li> <li>15. Describe the process of population growth and how it is measured.</li> <li>16. Explain the stages in the population growth curve and its practical importance.</li> <li>17. 28. Relate the various ways that microbes in</li> </ol>			

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		cultures and samples are enumerated.			
7	<p>CHAPTER 8 An Introduction to Microbial Metabolism: The Chemical Crossroads of Life</p> <ol style="list-style-type: none"> <li>1. The Metabolism of Microbes</li> <li>2. The Pursuit and Utilization of Energy</li> <li>3. Pathways of Bioenergetics</li> <li>4. Biosynthesis and the Crossing Pathways of metabolism</li> <li>5. Photosynthesis: The Earth's Lifeline</li> </ol>	<ol style="list-style-type: none"> <li>1. Relate the main points of bioenergetics and energy strategies in microorganisms.</li> <li>2. Describe the main catabolic pathways and where they occur in aerobic respiration.</li> <li>3. Define <i>glycolysis</i> and explain its input and output, its basic steps, and how it is linked to the Krebs cycle and oxidative phosphorylation.</li> <li>4. Explain how cells perform anabolic functions and what is involved in amphibolism.</li> <li>5. Identify several pathways where molecules can be redirected or converted into useful cell products.</li> <li>6. Describe several mechanisms in biosynthesis of macromolecules.</li> </ol>	3	Classroom teaching	2, 3
8	<p>CHAPTER 9 Microbial Genetics</p> <ol style="list-style-type: none"> <li>1. Introduction to Genetics and Genes: Unlocking the Secrets of Heredity</li> <li>2. Applications of the DNA Code: Transcription and</li> <li>3. Genetic Regulation of Protein Synthesis and Metabolism</li> <li>4. Mutations: Changes in the Genetic Code</li> <li>5. DNA Recombination Events</li> </ol>	<ol style="list-style-type: none"> <li>1. Emphasize the importance of understanding the viral mutation in control and prevention learned from the outbreak of COVID19 mutations.</li> <li>2. Discuss the basic nature of genetic material in eukaryotes, prokaryotes, and viruses.</li> <li>3. Distinguish major points</li> </ol>	6	Classroom teaching	1,2,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	6. The Genetics of Animal Viruses	<p>of difference between prokaryotic and eukaryotic transcription and translation.</p> <p>4. Explain the functions of operons in bacterial genetic control.</p> <p>5. Describe the main features of the lactose operon and inducible operons.</p> <p>6. Describe the main features of repressible operons.</p> <p>7. Define a mutation and explain how mutant forms are identified.</p> <p>8. Explain the causes and types of mutations and their effects.</p> <p>9. Describe the main features of conjugation and its outcomes.</p> <p>10. Discuss what is required for bacterial transformation and its outcomes.</p> <p>11. Identify the basic processes involved in transduction and the end results.</p>			
9	<p>CHAPTER 10 Genetic Engineering: A Revolution in Molecular Biology</p> <p>1. Basic Elements and Applications of Genetic Engineering</p> <p>2. Recombinant DNA Technology: How to Imitate Nature</p> <p>3. Genetically Modified</p>	<p>1. Introduce the potential of microbiology in revolution of molecular biology, raising student's interests in microbiology.</p> <p>2. Introduce GMO, encourage students to discuss the advantage, disadvantage, bio-safety, and ethic issues.</p>	6	Classroom teaching	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>Organisms</p> <p>4. Genetic Treatments: Introducing DNA into the Body</p> <p>5. Genome Analysis: Fingerprints and Genetic Testing</p>	<p>3. Explain what is involved in recombinant DNA technology.</p> <p>4. Characterize the events in cloning, using an example.</p> <p>5. Discuss some protein products of recombinant DNA and their applications.</p> <p>6. Define what is meant by the term <i>transgenic</i> or <i>genetically modified organisms</i>.</p> <p>7. Describe the uses of genetically modified bacteria and viruses.</p> <p>8. Discuss genetic modifications in plants and animals, explaining how they are carried out and giving examples of applications.</p>			
	<p>CHAPTER 11 Physical and Chemical Agents for Microbial Control</p> <p>1. Controlling Microorganisms</p> <p>2. Physical Methods of Control: Heat</p> <p>3. Physical Methods of Control: Radiation</p> <p>4. Using Filtration to Remove Microbes</p> <p>5. Chemical Agents in Microbial Control</p>	<p>1. Introduce the success of our country in the control and prevention of COVID-19 pandemic, but not in most of other countries, motivating student's patriotism.</p> <p>2. Summarize the major categories of microbial control and its purposes.</p> <p>3. Evaluate the relative resistance of different groups of infectious agents.</p> <p>4. Define and differentiate among the major terms for microbial control, citing examples of each.</p>	3	Classroom teaching	1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<ol style="list-style-type: none"> <li>5. Identify the parameters of microbial death, and describe several factors that influence the rate of death.</li> <li>6. Summarize what practices in microbial control influence the effectiveness of an antimicrobial agent.</li> <li>7. Identify the targets of antimicrobial control agents.</li> </ol>			
	<p>CHAPTER 12 Procedures for Identifying Pathogens and Diagnosing Infections</p> <ol style="list-style-type: none"> <li>1. An Overview of Clinical Microbiology</li> <li>2. Phenotypic Methods</li> <li>3. Genotypic Methods</li> <li>4. Immunologic Methods</li> <li>5. Immunoassays: Tests of Great Sensitivity</li> <li>6. Viruses as a Special Diagnostic Case</li> </ol>	<ol style="list-style-type: none"> <li>1. Describe what is involved in the main categories of laboratory identification of infectious agents.</li> <li>2. Explain several techniques in specimen collection and the concerns in acquiring good cultures.</li> <li>3. Summarize the main procedures in isolation, cultivation, and identification of pathogens.</li> <li>4. Describe some direct methods of testing a specimen.</li> <li>5. Summarize the aims in selection of culture techniques and media.</li> <li>6. Explain the basis of biochemical and other methods of testing.</li> <li>7. Explain the different variations on genetic testing and how they can be used in identification and diagnosis.</li> </ol>	3	Classroom teaching	1,2,3,4

### V Period Distribution and Teaching Modes

Lecture	Topic	Chapter	Teaching modes
1	The main themes of microbiology	1	theoretical lecturing
2	Tools of the Laboratory: Methods of Studying Microorganisms	2	theoretical lecturing
3	Tools of the Laboratory: Methods of Studying Microorganisms	2	theoretical lecturing
4	A Survey of Prokaryotic Cells and Microorganisms	3	theoretical lecturing
5	A Survey of Prokaryotic Cells and Microorganisms	3	theoretical lecturing
6	A Survey of Eukaryotic Cells and Microorganisms	4	theoretical lecturing
7	A Survey of Eukaryotic Cells and Microorganisms	4	theoretical lecturing
8	An Introduction to Viruses	5	theoretical lecturing
9	An Introduction to Viruses	5	theoretical lecturing
10	Microbial Nutrition, Ecology, and Growth	6	theoretical lecturing
11	Microbial Nutrition, Ecology, and Growth	6	theoretical lecturing
12	An Introduction to Microbial Metabolism	7	theoretical lecturing
13	Microbial Genetics	8	theoretical lecturing
14	Microbial Genetics	8	theoretical lecturing
15	Physical and Chemical Agents for Microbial Control	9	theoretical lecturing
16	Procedures for Identifying Pathogens and Diagnosing Infections	10	theoretical lecturing

### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Homework	Average score from all assignments divided by 5	20%	2
Attendance	Deduct 1 for one leave, lost the score if leave three times for a semester	10%	1
Presentation	Oral presentation about microbiology for 5-10 min, marked according to	10%	2

	performance and accuracy		
Final exam	Closed-book examination, marked according to scoring criteria	60%	2, 3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### **VII Textbooks and References**

#### **Textbook:**

Kathleen Park Talaro, Barry Chess, Foundation in Microbiology, 9th ed. McGraw-Hill.

#### **Reference:**

Madigan MT, Martinko JM and Parker J. 2000. Brock Biology of Microorganisms, 13<sup>th</sup> ed. Prentice-Hall.

Nicklin J, Graeme-cook K, Paget T and Killington RA. 1999. Instante Notes in Microbiology. BIOS. Scientific Publishers.

周德庆 2002 微生物学教程 第二版 高等教育出版社.

沈萍 1999 微生物学 高等教育出版社.

**Written by: Zhiyou Du**

**Reviewed by: Weibo Jin**

**Date: 2021/05/01**

# Syllabus of Bioinformatics

**Course Name/Title:** Bioinformatics                      **Course code:** 86927

**Course Type:** (Specialized Course)(Compulsory Course)

**Total Teaching Hours:** 32            (Classroom Hours: 32 )

**Course Credit:** 2

## I Course Introduction

Biology and information science are the two most rapidly developing and influential Sciences in the world. The interdisciplinary integration of these two sciences has formed a broad sense of bioinformatics, which is attracting the attention of scientists with new ideas. Bioinformatics is a new subject in the field of life science. In the face of the huge molecular biological information produced by various omics technologies, the importance of bioinformatics will become more and more prominent. It will undoubtedly bring revolutionary changes to the research of life science. It is a new interdisciplinary subject that comprehensively utilizes the theoretical methods of biology, mathematics, physics, information science and computer science.

This course mainly introduces the basic concepts, research contents, methods and applications of bioinformatics, and how to acquire, process, store, distribute and interpret genome information from Internet, and how to use computer software for biological sequence alignment and analysis, protein spatial structure simulation and prediction, gene regulation and metabolic network, In order to explore and cultivate students' ability of interdisciplinary learning. Bioinformatics has become an important part of the whole development of life science and the frontier of life science research.

Bioinformatics is a required course for Biotechnology majors, which is suitable for students who have basic knowledge of Biochemistry, molecular biology and computer science. This course is mainly based on multimedia teaching, supplemented by classroom assisted question answering; Combined with online resources and software application of experimental courses, students can predict the results of relevant biological experiments, reduce the blindness of experiments, and lay a necessary foundation for future scientific research and practice of biological sciences. Combining the professional knowledge of bioinformatics with the content of Ideological and political education, we can achieve the goal of Ideological and political education.

## II Course Objective

Course objective 1: In the process of bioinformatics professional knowledge points education, combined with examples to show the outstanding achievements made by Chinese scientists in the process of theoretical development or practical application of corresponding knowledge points, stimulate students' feelings of home and country, sense of pride and sense of mission.

Objective 2: to be familiar the usage of bioinformatics databases including sequence information query, browse and download.

Objective 3: to understand and master the principles and analysis techniques of sequence alignment, molecular evolution, gene annotation, transcriptome and gene regulation network.

Objective 4: to understand and master the prediction of protein structure and principles and analysis methods of computer aided drug design.

Objective 5: to develop the habit of analysis before experiment in the process of scientific research.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland, have higher ideological and moral quality and cultural quality; Have good professional ethics, follow the professional spirit of academic norms, master solid basic theories and research methods of biological science, and have the consciousness and spirit of seeking truth and innovation.	Course Objective 1-5
Graduation Requirement 3	Master the basic theoretical knowledge of mathematics, physics and chemistry; Have strong computer and information science operation technology.	Course Objective 2-4
Graduation Requirement 4	Through the compulsory and elective courses, we will receive more systematic professional theory and professional skills training, and master solid basic theory, basic knowledge and basic skills of biological science.	Course Objective 2-4
Graduation Requirement 5	Proficient in reading professional journals and literature retrieval in foreign languages.	Course Objective 1-5

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Introduction to Bioinformatics 1)Forward: Human genome project 2)Bioinformatics: When and Why 3)What is Bioinformatics 4)Bioinformatics: Contents and Applications	(1) Understand the basic concept and development trend of bioinformatics. (2) Understand the learning content and application scope of bioinformatics	2	Lectures, online courses,	Course objectives 1-5
2	Chapter 2 Introduction of bioinformatics databases 1)Genomes of Model Organism 2)Categories and Characteristics of Bioinformatics Databases 3)Introduction to Primary	(1) To understand the common databases of bioinformatics and their corresponding information storage formats; (2) Master common database information browsing and retrieval methods.	6	Lectures, online	Course objectives 1, 2, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Databases 4)Introduction to Secondary Databases 5)Format of biological data 6)NCBI and the Entrez Retrieval System				
3	Chapter 3 Sequence Alignment 1)Similarity Analysis of Nucleotide Sequence 2)Principle and algorithm of two sequence alignment 3)Pair/multiple sequence alignment	(1) Understand the principle of sequence alignment; (2) Master the common methods or tools of sequence alignment. (3) Most of the short read comparison tools used in omics analysis are written by Chinese people. In the course, the achievements of Chinese scientists in short reads comparison are introduced to stimulate students' feelings of home, pride and mission.	6	Lectures, online	Course objectives 2, 3, 5
4	Chapter 4 Molecular evolution and phylogeny 1)Molecular evolution and phylogeny 2)Construction of molecular phylogenetic tree 3)Construction and application of phylogenetic tree	(1) Objective to understand the principle and common methods of molecular phylogenetic analysis. (2) Master the construction method of phylogenetic tree. (3) Achievements of Chinese scientists racing the origin of COVID-19 by using phylogenetic tree, and exposes the false accusations of foreign countries against China.	4	Lectures, online	Course objectives 2, 3, 5
5	Chapter 5 Eukaryotic gene annotation 1)Annotation of protein coding genes 2)Annotation of RNA gene 3)Annotation of repetitive sequences 4)Annotation of pseudogenes	(1) Understanding the characteristics and prediction methods of eukaryotic genes (2) Master the content and method of eukaryotic gene annotation	2	Lectures, online	Course objectives 2, 3, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
6	Chapter 6 Transcriptomics 1) Overview of transcriptomics 2) Experimental design and sequencing process 3) Core analysis of transcriptome data 4) Functional analysis	(1) To understand the concept of transcriptomics and its research significance (2) Master the analysis process and methods of transcriptomics	2	Lectures, online	Course objectives 2, 3, 5
7	Chapter 7 Systems biology 1) Basic concepts of systems biology 2) Basic techniques and methods of systems biology 3) Gene expression regulatory network 4) Metabolic network 5) Signal transduction pathway 6) Protein-protein interaction network	(1) Understand the basic concepts and analysis methods of systems biology (2) Master the construction of gene expression regulatory network (3) Master the construction strategy of metabolic network. (4) To explain the achievements of Chinese scientists in the research of metabolic regulatory network of active ingredient synthesis in medicinal plants, and to stimulate students' enthusiasm for learning and feelings of home and country.	6	Lectures, online	Course objectives 2, 3, 5
8	Chapter 8 Prediction of Protein structures 1) Relationship between protein structure and function 2) prediction of a protein structure	(1) Understand the relationship between protein structure and function (2) Master the method and principle of protein advanced structure prediction	2	Lectures, online	Course objectives 4, 5
9	Chapter 9 Computer aided drug molecular design 1) The history and current situation of drug research and development 2) Common methods of computer aided drug design 3) The principle of molecular docking	(1) Understanding the analysis methods of protein structure and function (2) Master the principle and method of molecular docking	6	Lectures, online	Course objectives 4, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	4)Several representative molecular docking methods				

#### V Period Distribution and Teaching Modes

Teaching hours Methods Contents	Theoretical Lecture	Exercise	Discussion	Notes	Teaching hours
	Unit 1: Introduction	2			
Unit 2: Molecular evolution and phylogeny	3	3			6
Unit 3: Sequence Alignment	3	3			6
Unit 4: Molecular evolution and phylogeny	2	1	1		4
Unit 5: Eukaryotic gene annotation	2				2
Unit 6: Transcriptomics	2				2
Unit 7: Systems biology	1		1		2
Unit 8: Prediction of a protein structures	1	1			2
Unit 9: Computer aided drug molecular design	3	3			6
Total	19	11	2		32

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Final exam	Close-book, according to the marking standards for grading	50%	Course objectives 1-5
Presentation and homework	According to presentation and	40%	Course objectives 1-5

	homework to score		
Attendance and performance in class discussion	No unexcused absence from class. Extra points will be given to students for attending lectures and answering questions with positive thinking	10%	Course objectives 1-5

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### VII Textbooks and References

(1) Teaching materials: (list the titles, authors, publishing houses, etc.)

[1] T.Charlie Hodgman, Andrew French, David R. Westhead. 生物信息学：第2版 = Bioinformatics: Second Edition : 导读版: 英文. 科学出版社, 2010

(2) Reference books: (list the titles, authors, publishing houses, etc.)

[1] 陈铭：《生物信息学》第3版，科学出版社，2018年出版。

(3) Online resources: (online course website)

[1] <https://www.zjoc.cn/course/2c918083701ae12401702e71b4ee1d87>

**Written by: Jin Weibo**

**Reviewed by: Nie Zuoming**

**Date: 2021/4/19**

# Syllabus of Cell Engineering

**Course Name/Title:** Cell Engineering

**Course code:** 86928

**Course Type:** Basic Course

**Total Teaching Hours:** 32

**Course Credit:** 2

## I Course Introduction

### Suggestions for Teaching

Students are requested to preview the text before each class. During the multimedia teaching, a variety of methods, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be utilized to guarantee the teaching effectiveness. Homework will be assigned after the class. Students will be guided to search and read the latest papers for the cell engineering themes. This course aims to cultivate the student of the Times who are responsible for the great task of national rejuvenation.

### Suggestions for Course Learning

Learning is actually a very autonomous process. To guarantee the quality of English lecturing, students need to preview the text before the class. Students are responsible for understanding the material presented in the lectures, as well as assigned course materials, which include text, papers and homework. Students will be requested to self-learning some chapters, prepare the corresponding PPT and lecture in the class. Students are expected to solve cell engineering problems based on the class learning. Scientific materials, which all available on the website teaching platform for students' autonomous learning. The goal is to help students develop their autonomy, horizon and practicality in the learning of cell engineering.

## II Course Objective

Bioengineering or biotechnological engineering (including biological systems engineering) is the application of concepts and methods of biology (and secondarily of physics, chemistry, mathematics, and computer science) to solve real-world problems related to the life sciences and/or the application thereof, using engineering's own analytical and synthetic methodologies and also its traditional sensitivity to the cost and practicality of the solutions arrived at. Bioengineering is a comprehensive technology based on life sciences and applies biological systems and engineering principles to produce biological products and create new biological species.

“Cell Engineering” introduces the principles and new approaches in cell and tissue engineering. It includes both the fundamentals and the current trends in cell and tissue engineering, in a way useful both to a novice and an expert in the field. It is organized to gradually assemble an insight in cell and tissue function starting from a molecular level, extending to a cellular micro-level and finishing at the tissue macro-level. In specific, biological, physiological, biophysical, biochemical, medical, and engineering aspects are covered from the standpoint of the development of functional substitutes of biological tissues for potential clinical use. In the area of tissue engineering the focus is on the in vitro cultivation of functional tissue equivalents based on

the integrated use of isolated cells, biomaterials, and bioreactors. The novel techniques for cell and tissue imaging and characterization, some of which are described in detail such as atomic force microscopy. Finally, mathematical modeling methods are presented as valuable and indispensable tools in cell and tissue engineering. Numerous illustrations enhance the quality and ease of use of the presented material. Important of all, guide students to establish socialist core values, moral beliefs and scientific thinking.

### 1. Knowledge Goal

**Course Objective 1:** Master the development of cell engineering, basic concepts, plant cell engineering and animal cell engineering.

**Course Objective 2:** Understand the concepts: differentiation and dedifferentiation, artificial seeds, cell fusion and somatic cell hybridization, haploid and polyploidy, fertilization, stem cells and adult stem cells.

**Course Objective 3:** Master the principles of popular techniques in cell engineering, i.e. cell culture, artificial seeds, cell fusion, vitro fertilization, preparation of pharmaceutical proteins, test-tube baby and mammalian sex control.

### 2. Ability Goal

**Course Objective 5:** Train students' ability to access and read foreign literature.

**Course Objective 6:** Train students' ability to write course papers.

**Course Objective 7:** Cultivate students' ability to express language

### 3. Quality objectives

**Course Objective 8:** Cultivate students with a serious, rigorous, realistic scientific style.

**Course Objective 9:** Cultivate students to master dialectical thinking, abstract thinking and other scientific logic thinking method.

**Course Objective 10:** Cultivate students' love of biology.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Master the knowledge of cell engineering, etc	Course Objective 1,2,3,4
Graduation Requirement 2	Skillfully using English reading professional journals	Course Objective 5,6,7,8,9,10
Graduation Requirement 3	Understanding the forefront of technology and development trend of this field.	Course Objective 1,2,3,5

## IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction to Cell engineering	Section I: Bioengineering 1.Development of Bioengineering 2.Contemporary Bioengineering Section II: Cell Engineering	2	Lecture, discussion	Supporting course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		1. History of cell engineering 2. Relationship between cell engineering and other bioengineering technologies 3. Applications of cell engineering			Objective 1,5 ,8,9, 10
2	Cell Engineering Basics	1. The instrument and condition of cell culture 2. Cleaning and sterilisation 3. The basic methods of cell culture and tissue culture	3	Lecture, discussion	Supporting course Objective 1,5 ,8,9, 10
3	Animal cell culture & Preparation and expression of medicinal proteins	1. Animal cell culture 2. Small-scale animal cell culture methods 3. Large-scale animal cell culture 4. Factors of large-scale animal cell culture 5. Preparation of pharmaceutical protein with animal cells	2	Lecture, discussion	Supporting course Objective 1,2,5 ,8, 9,10
4	plant tissue and organ culture	1. Plant tissue culture 2. Plant embryo culture 3. Hairy root culture 4. Plant cell culture and preparation of secondary metabolites	2	Lecture, discussion	Supporting course Objective 3,5 ,8,9, 10
5	Artificial seeds and virus-free of plants	1. Artificial seeds 2. Virus elimination of plants	2	Lecture, discussion	Supporting course Objective 3,5 , 6,8,9,10
6	Protoplast culture and mutagenesis	1. Protoplast culture 2. Protoplast mutagenesis	2	Lecture, discussion	Supporting course Objective 3,5 ,9,10
7	Hybridoma technology and monoclonal antibody	1. Hybridoma technology 2. Monoclonal antibody 3. Humanized monoclonal antibody	2	Lecture, discussion	Supporting course Objective 3,5 , 6,7,9,10

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
8	In vitro fertilization & animals cloned by nuclear transfer	1. IVF animals 2. Animals cloned by nuclear transfer	2	Lecture, discussion	Supporting course Objective 2,3,4
9	Polyploid and transgenic animals	1. Polyploid animals 2. Transgenic animals 3. It is necessary to treat the transgenic technology dialectically and standardize the management so that it can serve human health	2	Lecture, discussion	Supporting course Objective 2,3,5,6
10	Stem cell	1. Characteristics of stem cells 2. Embryonic stem cells 3. Adult stem cells 4. Guide students to establish correct moral and legal concepts	2	Lecture, discussion	Supporting course Objective 1,2,3,4,10
11	Tissue engineering	1. Tissue engineering and its three elements 2. Technical routes of tissue engineering 3. Tissue engineering bioreactors 4. Tissue engineering products	2	Lecture, discussion	Supporting course Objective 1,2,3,4,12
12	Cell fusion and somatic cell hybridization	1. Cell fusion 2. Somatic hybridization	2	Lecture, discussion	Supporting course Objective 3,8,9,10
13	Haploid plants	1. Chromosome engineering 2. Polyploid plants 3. Haploids and homozygous diploid plants 4.	2	Lecture, discussion	Supporting course Objective 3,6,8,9,10

### V Period Distribution and Teaching Modes

#### 1. Distribution of teaching hours

Teaching hours	Teaching methods	Theory teaching	Exercise class	Discussion class	Remarks	Subtotal (class hours)
Course content (section)						
Introduction to cell engineering		2	0	0		2
Cell engineering basics		2	0	0		2
Animal cell culture and preparation and expression of medicinal proteins		2	0	1		3
Plant tissue and organ culture		4	0	0		4
Artificial seeds and virus-free of plants		2	0	0		2
Protoplast culture and mutagenesis		2	0	0		2
Hybridoma technology and monoclonal antibody		2	0	0		2
In vitro fertilization and animals cloned by nuclear transfer		2	0	1		3
Polyploid and transgenic animals		2	0	1		2
Stem cells		2	0	2		4
Tissue engineering		2	0	0		2
Cell fusion and somatic cell hybridization		2	0	0		2
Haploid plants		2	0	0		2
Total		28	0	4		32

## 2. Teaching methods and techniques

Students are requested to preview the text before each class. During the multimedia teaching, a variety of methods, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be utilized to guarantee the teaching effectiveness. Homework will be assigned after the class. Students will be guided to search and read the latest papers for the cell engineering themes.

## VI Assessment

The final grade components:

**Attendance (20%).** Students attending class regularly (in body and mind) is needed. This means they not only should be present in class, but also can answer question properly and discuss actively in class. Attendance will be checked randomly in class. The regular attendance will occupy 20% of the final grade.

**In-class presentation (15%).** An in-class presentation is required for some chapter. Students are divided into several groups. Each group is responsible for one section of that chapter. Students should self-study the corresponding text, prepare the PPT and lecture in the class. 15% of the final grade comes from this part.

**Homework (15%).** Homework will be assigned for each chapter, occupying 15% of the final grade.

**Final exam (50%).** The Final will be a comprehensive, two-hour exam given during finals week.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Active participation	20%	1、 2
In-class presentation	Active participation	15%	1、 3、 4
Homework	Active participation	15%	1、 2、 3
Final exam	Active participation	50%	2、 3、 4

## VII Textbooks and References

### Textbook:

Li Zhiyong. 《Cell Engineering》 (Second Edition) , Science Press, 2014.

### References:

- [1]. Bojana Obradovic. Cell and Tissue Engineering. Springer, 2012.
- [2]. Lao W D. 2003. Repair Medicine and Tissue Engineering. Beijing, Chemical Industry Press.
- [3]. Li Z Y. 2008 Cell Engineering. Beijing: Higher Education Press.
- [4]. Anoop Menachery, Nityanand Kumawat, Mohammad Qasaimeh. Label-free microfluidic stem cell isolation technologies. TrAC Trends in Analytical Chemistry, 89(2017):1-12.
- [5]. Mostafa Soleimannejad, Somayeh Ebrahimi-Barough, Samad Nadri, Retina tissue engineering by conjunctiva mesenchymal stem cells encapsulated in fibrin gel: Hypotheses on novel approach to retinal diseases treatment. Medical Hypotheses, 101(2017):75-77.

**Written by: Yanfang Sun**

**Reviewed by: Yuehong Wu**

**Date: 2021.04.19**

# The Syllabus of Genetic Diagnosis & Biotherapy

**Course Title:** Genetic Diagnosis & Biotherapy      **Course Code:** 86947

**Category and nature of the course:** specialized elective courses

**Period:** 32

**Credit hour:** 2

**Basic course:** Cell Biology

**Associate professionals:** Biotechnology, biopharmaceutics, marine biological resources

**Department of Biotechnology**

## First, the course introduction

With the continuous development of human economy and society, the progress of modern science and technology, especially the rapid development of modern medical technology and biotechnology, people's research on gene therapy, stem cell differentiation, transplantation and molecular mechanism and its therapeutic effect is becoming more and more abundant and in-depth, which will bring about great changes in the diagnosis and treatment of human diseases. As students of biology-related majors, we should have a deeper understanding of the basic concepts and applications of gene diagnosis and gene therapy and biotherapy for diseases, and have a preliminary understanding of the frontier progress of research in this field. This course focuses on gene diagnostic techniques, biotherapy techniques and their clinical transformation applications, focusing on the basic techniques and principles of gene diagnosis, biological therapy for neurological diseases, blood system diseases, cardiovascular diseases, endocrine system diseases, and tumor-related genes and gene therapy. This course is a professional elective and is associated with courses in cell biology, molecular biology, immunology, etc.

Gene diagnosis and biotherapy are the frontiers and hot spots in the field of biomedicine, especially in the context of the global epidemic of xinguan, the development and breakthrough in this field are related to the development of China's medical and health care, people's life health and the great rejuvenation of the Chinese nation. In the teaching of this course, will be integrated into the current global prevention and control of the new crown epidemic, the development of the new crown vaccine and other content, so that students know that the development of science and technology, biomedicine progress is an important guarantee for national development, people's lives, will play an important role in China's cooperation and competition with other countries in the world, enhance students' interest in learning their profession, cultivate students' national conditions.

## Second, the curriculum teaching objectives

1. To enhance students' interest in learning their major and cultivate their national conditions. In the teaching of this course, will be integrated into the current global prevention and control of new crown epidemic, new crown vaccine research and development and other content, so that students know that the development of science and technology, biomedicine progress is the country's rapid development, people's healthy life is an important guarantee, will play an important role in China's cooperation and competition with other countries in the world.

2. Through this course, students learn about the main tools, problems and directions of current genetic diagnosis and biological therapy.

3. By learning about gene diagnosis and biological therapy, students integrate knowledge of molecular biology, cell biology, immunology, and more.

4. Through the study of this course, stimulate students' sense of innovation, improve students' scientific research ethics, and cultivate students' correct academic ideas.

**Third, the corresponding relationship between the curriculum teaching objectives and graduation requirements**

Graduation requirements	Graduation requirements indicator points	Course objectives
Graduation requirements 1	Love the motherland, with high ideological and moral quality and cultural quality, with a strong sense of social responsibility, sound personality and strong sense of team, with a good professional ethics, follow academic norms of professionalism, master a solid basic biological science theory and research methods, have a sense of truth-seeking and innovation and spirit.	Course goals 1,4
Graduation requirements 2	Through compulsory and elective courses, more systematic professional theory and professional skills training, master a solid biological science basic theory, basic knowledge and basic skills.	Course goals 2,3
Graduation requirements 3	Through certain biotechnology experiments, practical experience, master the experimental skills of relevant courses and related biological experimental data processing and analysis methods, to understand the field of cutting-edge technology and trends.	Course goals 1,2,3,4
Graduation requirements 4	The ability to actively acquire scientific research information and other knowledge using a variety of modern media technologies, and the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key life science-related technologies including gene cloning and expression technology, microbiological detection and diagnostic techniques, genetically modified technologies, early diagnosis of major diseases, and bioinformatics basic analysis techniques.	Course goals 2,3

The relationship between teaching content and curriculum objectives

**The relationship between curriculum teaching content and curriculum objectives**

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
1	(1)The concept of genetic diagnosis;	(1)Master the basic concepts and technical means of genetic	4	Lectures in class	Course goals 1,2,3

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
	<p>(2) the basic technique of gene diagnosis;</p> <p>(3) Clinical application of gene diagnosis.</p>	<p>diagnosis;</p> <p>(2) Understand the clinical application of gene diagnosis.</p> <p>(3) Through panel discussions on the current global prevention and treatment of new crown outbreaks, new crown vaccine research and development and other content, so that students know that the development of science and technology, biomedicine progress is an important guarantee for national development, people's lives. Strengthen students' interest in learning this profession and cultivate students' national conditions.</p>			
2	<p>(1) The significance of clinical transformation of biological therapy;</p> <p>(2) The current situation and problems of clinical transformation of biological therapy</p> <p>(3) Prospects for clinical transformation of biotherapy.</p>	<p>(1) To understand the broad and narrow definition of biotherapy, the current situation of clinical transformation of biotherapy and the existence of problems and significance, so that students can establish a preliminary understanding of this course, for the follow-up learning to lay the foundation.</p> <p>(2) Establish students' correct scientific research ethics through group discussion on He Jiankui's "gene-edited baby" incident.</p>	2	Lectures in class, group discussions	Course goals 1,2,3,4
3	<p>(1) Hematopoietic stem cell therapy;</p> <p>(2) Interstable charge stem cell therapy;</p>	<p>(1) To understand the process of hematopoietic stem cell production and differentiation and its application in clinical,</p>	2	Lectures in class, group discussions	Course goals 1,2,3,4

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
	<p>(3) Stem cells and metabolic diseases;</p> <p>(4) Stem cell standardization preparation, quality control and cryothermal preservation;</p> <p>(5) Application of bone marrow-derived stem cells.</p>	<p>to understand the process of producing and differentiating interstitial stem cells and its application in clinical practice, to understand the mechanism and research status of stem cells to treat metabolic syndrome, and to understand the preparation and preservation techniques of stem cells. Understand the ethical and legal issues involved in embryonic stem cell applications, as well as the advantages and problems of bone marrow-derived stem cell applications.</p> <p>(2) Enhance students' sense of social responsibility through panel discussions on the donation of bone marrow stem cells .</p>			
4	<p>(1) Stem cell transplantation to treat cerebral palsy;</p> <p>(2) Stem cell transplantation to treat brain trauma;</p> <p>(3) Stem cell transplantation to treat spinal cord injury;</p> <p>(4) Stem cell transplantation to treat neurodegenerative diseases.</p>	<p>Master the main types of neurological diseases, clinical manifestations and clinical stem cell treatment methods and effects, understand the treatment of neurological diseases of other traditional methods.</p>	2	Lectures in class	Course goals 2,3
5	<p>(1) Cytokines for the treatment of blood tumors;</p> <p>(2) The application of monoclonal antibodies in the treatment of blood</p>	<p>Master the types of malignant diseases in the blood system, understand the biological treatment methods of two types of malignant diseases of</p>	2	Lectures in class	Course goals 2,3

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
	<p>malignant diseases;            (3) follow-up immune cells to treat blood malignant diseases;            (4) CAR-T cells treat blood malignant diseases;            (5) The application of tumor vaccine in the treatment of blood malignant diseases.</p>	<p>the blood system, namely, indirect anti-blood tumor methods that kill or inhibit tumor growth through cytokines, bacteria, vaccines, drugs or gene importation, and direct anti-blood tumor methods that directly interfere with tumor cell growth, transformation or metastasis using immune-effect cells.</p>			
6	<p>(1) The application of gene therapy in the treatment of cardiovascular diseases;            (2) The application of cell therapy in the treatment of cardiovascular diseases            (3) The application of immunotherapy in the treatment of cardiovascular diseases.</p>	<p>Master the concepts and strategies of gene therapy to understand the application of gene therapy in coronary heart disease, heart failure, arrhythmia, and to understand the application of bone marrow source stem cells, skeletal muscle source myoblasts, heart intrinsic stem cells, and other related stem cells in the treatment of cardiovascular disease. Understand the relationship between cardiovascular disease and immunity and understand the application of immunomodulatory therapy and vaccine therapy in the treatment of cardiovascular disease.</p>	2	Lectures in class	Course goals 2,3
7	<p>(1) Clinical application of autologous stem cell technology;            (2) The application of cytokines in angiogenesis.</p>	<p>Learn about the clinical application of autogenic stem cells in the treatment of ischemia in the lower extremities and the latest advances in the study of</p>	2	Lectures in class	Course goals 2,3

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
		cytokines in angiogenesis.			
8	(1) The mechanism by which stem cells treat skin damage; (2) Clinical transformational studies of stem cells to treat skin damage; (3) The role and clinical transformation of stem cells in tissue engineering skin research.	Understand the traditional methods of skin injury treatment, master the mechanism and clinical application of stem cells to treat skin injury, and understand the role of stem cells in tissue engineering skin research.	2	Lectures in class	Course goals 2,3
9	(1) Recombinant the types and applications of human growth hormone; (2) Biological treatment of pituitary adenoma; (3) Pancreatic and islet cell transplantation; (4) Gene therapy strategies for diabetes.	Master the types of recombinant human growth hormone and its application in the treatment of growth hormone deficiency, and understand the biological treatment strategies of endocrine metabolic diseases such as pituitary adenomas and diabetes.	2	Lectures in class	Course goals 2,3
10	(1)TNF- $\alpha$ inhibitors to treat rheumatoid immune system diseases; (2) Interleukin -1 inhibitors to treat rheumatoid immune system diseases; (3)Interleukin -6 inhibitors to treat rheumatoid immune system diseases; (4)B cell scavengers to treat rheumatism immune system diseases; (5) Co-stimulant blockers to treat rheumatoid immune system diseases; (6)The current application	Learn about the two main treatments currently used in the field of rheumatology: biologics (drugs) and stem cell therapy.	2	Lectures in class	Course goals 2,3

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
	of stem cells in rheumatism.				
11	(1) The silent treatment of cancer genes and primary cancer genes; (2) Reconstruction of tumor inhibition gene expression; (3) immunogene therapy of tumors; (4) Suicide gene therapy; (5) Anti-tumor angiogenesis gene therapy; (6) Tumor multidrug-resistant gene therapy; (7) anti-telomerase therapy; (8) Multigene combination therapy.	Master the principles, characteristics and strategies of tumor gene therapy.	6	Lectures in class	Course goals 2,3
12	(1) Time to distinguish the principles and characteristics of fluorescence immunoassays; (2) Time to distinguish the technical types of fluorescence immunoassays.	Understand the development course, principles and characteristics of time-resolution fluorescence immunoassay analysis.	2	Lectures in class	Course goals 2,3
13	Time-resolution fluorescence immunoassay kit development and application.	Understand the development process of time-resolution fluorescence immunoassay kit and its application in tumor markers, infectious diseases, diabetes, thyroid function detection, etc	2	Lectures in class	Course goals 2,3

#### V. Distribution of course hours and teaching methods

##### (i) The allocation of course hours

	theory Taught	problem lesson	discuss lesson	remark	subtotal
Concept and application of gene diagnosis	3	0	1		4
An introduction to biotherapy technology and its clinical transformation application	1	0	1		2
Stem cell therapy	1	0	1		2
Biological treatment of neurological diseases	2	0	0		2
Biological treatment of blood system diseases	2	0	0		2
Biological treatment of cardiovascular disease	2	0	0		2
Application of autologous stem cell transplantation in vascular diseases	2	0	0		2
Stem cells and skin tissue damage repair and regeneration	2	0	0		2
Biological treatment of endocrine metabolic diseases	2	0	0		2
Biological treatment of rheumatic immune system	2	0	0		2

diseases					
Tumor-related genes and gene therapy	6	0	0		6
Time distinguishes the principle and type of fluorescence immunoassay	2	0	0		2
Time-resolution fluorescence immunoassay kit development and application	2	0	0		2
Total	29	0	3		32

## (2) Teaching methods

Teaching methods - mainly teachers and professors, students self-study as a supplementary means. In the teaching, we will adopt the teaching method of seminar, strengthen the communication between teachers and students, guide students to think independently, and strengthen the training of thinking training and language expression ability.

The use of modern education technology, with images, intuitive charts, data, the use of case teaching and other diversified, three-dimensional teaching methods, and strive to vivid, image, so that students easy to understand and master.

Sixth, the course assessment

The method or approach to the assessment	Assessment requirements	Assessment weights	Corresponding to course objectives
Attendance and classroom performance	Attend and listen carefully on time	30	Course objectives 1, 2, 3, 4
The final exam is written	Closed volume, based on the scoring criteria	70	Course objectives 1, 2, 3, 4

## 7. Recommend teaching materials and reference materials

### teaching materials:

Yang Tao et al., Gene Diagnostics and Cell Therapy, Science and Technology Literature Press, 1st edition, published in August 2018.

Lu Jianxin, Editor-in-Chief, Wang Peichang, Testing and Clinical Diagnostics - Molecular Diagnostics, 1st Edition, May 2010.

Liu Dazhao, Editor-in-Chief, Philosophy of Science and Technology, Higher Education Press, January 2019.

### reference book:

Gu Jianren, Editor-in-Chief of Cao Xuetao, Gene Therapy, Science Press, 1st edition, published in

February 2001.

Editor-in-Chief, *Molecular Biology of Modern Gene Therapy*, Science Press, 2nd edition, published in September 2014.

**Written by: Yuan Qin**

**Reviewed by: YiGang Wang**

**Date: April 19, 2021**

# Syllabus of Human Anatomy and Physiology

**Course Name/Title:** Human Anatomy and Physiology      **Course Code:** 86952

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 hr (Classroom Hours: 32 hr, Laboratory Hours: 0 hr)

**Course Credit:** 2

## I Course Introduction

This course is designed to provide students with a basic understanding of mechanisms by which the normal human body functions, how the organ systems operate and interact with each other to maintain homeostasis, and how the human body adapt to changes in the internal and external environment. This course will help students understand the mechanistic link between the basic sciences and medicine so as to cultivate students' scientific spirit, social responsibility, and professional ethics, laying the foundation for the follow-up professional course learning. Ideological and political elements will be incorporated in the whole process of teaching by introducing the story of physiologist and their great achievements to encourage students' the creative consciousness and increase their sense of responsibility and mission.

## II Course Objective

1. Encourage students' creative consciousness and increase their sense of responsibility and mission, stimulate their national pride, and cultivate their self-confidence;
2. Explain the normal function of organ systems of the body and their interactions;
3. Narrate the contribution of each organ system for the maintenance of homeostasis;
4. Elucidate the physiological aspects of normal growth and development;
5. Describe the physiological responses and adaptations to environmental stresses;
6. List the physiological principles underlying the pathogenesis and treatment of disease;
7. Cultivate students' strong scientific interest, critical thinking ability, and innovative consciousness.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland and have high ideological, moral and cultural quality; have strong sense of social responsibility, sound personality, and strong team consciousness; have good professional ethics, follow the professional spirit of academic norms, master solid basic theory and research	Course Objective 1, 7

	methods of biological science, and have the consciousness and spirit of seeking truth and innovation.	
Graduation Requirement 4	Through the compulsory and elective courses, students should receive systematic professional theory and professional skill training, and master solid basic theory, basic knowledge, and basic skills of biological science.	Course Objective 2, 3, 4,5, 6
Graduation Requirement 8	Have the ability to summarize, sort out, and analyze the experimental results; comprehensively apply the theoretical knowledge and skills; have the ability to engage in scientific research in biological science, biotechnology, and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; have strong scientific interest and critical thinking ability.	Course Objective 5, 6, 7

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter One: Introduction 1. Introduction 2. Homeostasis 3. Control systems	1. Master: Basic properties of the living body; internal environment and homeostasis; types of the regulation on body function: positive feedback and negative feedback. 2. Familiar: Objects and levels used for physiological studies. 3. Know: Physiological production and development; the characters and physiological meaning of feed-forward control.	2 hr	Classroom teaching	Course Objective 2, 3
2	Chapter Two: Cellular Physiology 1. Cell membrane: properties 2. Cell membrane:	1. Master: The bioelectric phenomena of cells and their mechanisms; the excitation and excitability of nerve and muscle; the conduction and transmission	2 hr	Classroom teaching	Course Objective 2, 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	permeability 3. Cell membrane: transport 4. Bioelectricity 5. Resting membrane potential 6. Action potential 7. Excitation-contraction coupling 8. Skeletal muscle	mechanisms of action potential; transport function across the cell membrane. 2. Familiar: The molecule structures of cell membrane and muscle cell; the principle of muscle contraction. 3. Know: Transmembrane signal transmission functions of the cell.			
3	Chapter Three: Blood 1. Components and physicochemical properties of blood 2. Blood cells and their functions 3. Blood coagulation and fibrinolysis 4. Blood type	1. Master: Components and physicochemical properties of blood; concept of hematocrit value; the number of blood cells; physiologic properties and generating regulation of red blood cells; blood coagulation; ABO blood group system. 2. Familiar: Function of platelet; anticoagulation system; fibrinolysis; the principle of blood transfusion. 3. Know: The materials and factors of red blood cells generating; Rh blood group system.	4 hr	Classroom teaching	Course Objective 2, 3, 4, 5, 6
4	Chapter Four: Circulation 1. Introduction 2. Heart 3. Electrocardiogram 4. Cardiac cycle 5. Neural regulation of cardiac function 6. Intrinsic regulation of cardiac function 7. Cardiac output 8. Hemodynamics 9. Special circulations	1. Master: Myocardial bioelectric phenomena and their mechanism; the characters of excitation transmission in heart; the periodicity changes and their characters of myocardial excitability, autorhythmicity, and the pacemaker of heart; pumping function of heart and evaluation; the concept, mechanism and influencing factors of arterial blood pressure; carotid sinus and aortic arch baroreceptor reflex. 2. Familiar: The nervous and	6 hr	Classroom teaching	Course Objective 1, 2, 3, 4, 5, 6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>humoral regulation of the arterial blood pressure stability; the principles, characters, and physiological meaning of first heart sound and second heart sound; venous return and central venous pressure and their influencing factors; the pathways and meaning of microcirculation; formation and return of interstitial fluid; carotid body and aortic body chemoreceptor reflex.</p> <p>3. Know: Regulation of heart pumping function; cardiac reserve of pumping function; coronary circulation; pulmonary circulation and cerebral circulation.</p> <p>4. By introducing the development history of the pacemaker, stimulate students' creative consciousness and increase their sense of responsibility and mission. Cultivate students' strong scientific interest and critical thinking ability.</p>			
5	<p>Chapter Five: Respiration</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Lung volumes and capacities</li> <li>3. Mechanics of ventilation</li> <li>4. Ventilation-perfusion ratio</li> <li>5. Gas exchange</li> <li>6. Neural/chemical regulation of respiration</li> <li>7. Artificial respiration</li> </ol>	<ol style="list-style-type: none"> <li>1. Master: The basic process of respiration; the power and resistance of pulmonary ventilation; mechanisms of respiratory gases exchange and their influencing factors; pulmonary capacity, pulmonary ventilation and alveolar ventilation; oxygen-hemoglobin dissociation curve and it's influencing factors; reflex regulation of respiration.</li> <li>2. Familiar: The concepts of oxygen capacity, oxygen content, and oxygen saturation; forms of</li> </ol>	2 hr	Classroom teaching	Course Objective 2, 3, 4, 5, 6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>oxygen and carbon dioxide in the blood; formation of respiratory centers and rhythmical breathing.</p> <p>3. Know: Function of airways; artificial respiration.</p>			
6	<p>Chapter Six: Gastrointestinal System</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Chewing &amp; swallowing</li> <li>3. Gastric secretion</li> <li>4. Regulation of gastric secretion</li> <li>5. Biliary &amp; pancreatic secretions</li> <li>6. Colon</li> <li>7. Nutrition</li> </ol>	<ol style="list-style-type: none"> <li>1. Master: The concepts of digestion and absorption; characteristics of gut smooth muscle; the character, the component, and the function of gastric juice; gastric receptive relaxation and gastric peristalsis; forms of small intestine motor; absorption and mechanism of nutrients in small intestine.</li> <li>2. Familiar: Concept of gastrointestinal hormones; innervation of digestive system; gastric emptying and its regulation; the secretion regulation of gastric juice, pancreatic juice, bile, and small intestine fluid.</li> <li>3. Know: Regulation of small intestine motor; digestion in oral cavity; digestion in large intestine.</li> <li>4. Introduce the story of physiologist Barry Marshall who did the research through his own body experiments, and demonstrated that the gastric ulcer was mainly caused by <i>Helicobacter pylori</i> infection. With outstanding observation, extraordinary courage, and belief, the discovery of the mechanism of gastric ulcer caused by <i>Helicobacter pylori</i> lightens the path for the peptic ulcer healing, which encourages students to have the decision and courage to</li> </ol>	4 hr	Classroom teaching	<p>Course Objective</p> <p>1, 2, 3, 4, 5, 6</p>

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		persevere in exploring the truth.			
7	Chapter Seven: Urinary System 1. Introduction to renal system 2. Glomerular filtration 3. Renal tubule functions 4. Regulation of renal functions 5. Micturition	1. Master: The three pathways of urine formation; glomerular filtration, and the influencing factors of glomerular filtration; osmotic diuresis and glomerulotubular balance; function and regulation of ADH. 2. Familiar: Characteristics of renal blood circulation and renal blood flow regulation; reabsorption of the importance solutes ( $\text{Na}^+$ , $\text{H}_2\text{O}$ , $\text{HCO}_3^-$ and glucose); the mechanism of urinary concentration and dilution. 3. Know: The concept and meaning of clearance; function and regulation of aldosterone; secretion of $\text{H}^+$ , $\text{NH}_3$ , $\text{K}^+$ ; Micturition reflex.	4 hr	Classroom teaching	Course Objective 2, 3, 4, 5, 6
8	Chapter Eight: Endocrine System 1. Introduction 2. Hypothalamic control system 3. Anterior pituitary hormones 4. Posterior pituitary hormones 5. Thyroid 6. Calcium regulation hormones 7. Endocrine of pancreatic islets 8. Adrenals 9. Functions of cortisol 10. Endocrine control of growth	1. Master: Concept and general characteristics of hormone; hypothalamic regulatory peptide; function relation between hypothalamus and pituitary; physiological functions of growth hormones, thyroid hormones, and glucocorticoids. 2. Familiar: Physiological functions of insulin; regulation of adenohipophysis hormones secretion; mechanisms of hormone action; regulation of thyroid hormones secretion. 3. Know: Physiological function and secretion regulation of glucagon, and hormones regulating calcium metabolism. 4. By Introducing the insulin was first synthesized by chemical	4 hr	Classroom teaching	Course Objective 1, 2, 3, 4, 5, 6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>methods in the world by Chinese scientists in 1965, patriotism education could be carried out to arouse students' national pride and encourage their responsibility and mission.</p>			
9	<p>Chapter Nine: Nervous System</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Synaptic transmission</li> <li>3. Neurotransmitters and receptors</li> <li>4. Reflexes</li> <li>5. Voluntary movements</li> </ol>	<ol style="list-style-type: none"> <li>1. Master: General principles for activities of nervous; synapse and synaptic transmission; the basic process of classical synaptic transmission; postsynaptic potential: excitatory postsynaptic potential and inhibitory postsynaptic potential; the conception of transmitter and receptor: major transmitters and receptor system; reflex and reflex arc; the characters of central excitatory transmission, central inhibition; the motor unit of skeleton muscle; stretch reflex; the function of autonomic nervous system and their chemistry transmission.</li> <li>2. Familiar: The classify and function of nerve fibers.</li> <li>3. Know: Axoplasmic transport of nerve fibers; nutrition of nerve fibers; the function of neuroglia cells; electrical synapse; contact ways of central neurons; local circuit neurons; central facilitation; body sensory afferent pathway, visceral sensation; the regulation system of somatic motor.</li> </ol>	2 hr	Classroom teaching	Course Objective 2, 3, 4, 5, 6
10	<p>Chapter Eleven: Reproduction</p> <ol style="list-style-type: none"> <li>1. Introduction to reproductive systems</li> </ol>	<ol style="list-style-type: none"> <li>1. Master: Physiological functions of testosterone, estrogen and progesterone.</li> <li>2. Familiar:</li> </ol>	2 hr	Classroom teaching	Course Objective 2, 3, 4, 5, 6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	2. Hypothalamic-pituitary-gonadal axis 3. Male reproductive physiology 4. Female reproductive physiology 5. Puberty 6. Pregnancy	Pituitary-ovary-endometrium changes relationship in menstrual cycle. 3. Know: Capacitation of acrosome; process of pregnancy.			

### V Period Distribution and Teaching Modes

#### Period Distribution:

Content for classroom teaching	Hours
Chapter One: Introduction	2
Chapter Two: Cellular Physiology	2
Chapter Three: Blood	4
Chapter Four: Circulation	6
Chapter Five: Respiration	2
Chapter Six: Gastrointestinal system	4
Chapter Seven: Urinary System	4
Chapter Eight: Endocrine System	4
Chapter Nine: Nervous System	2
Chapter Ten: Reproduction	2

#### Teaching Modes:

Teacher should emphasize the teaching key points, applying various teaching methods to improve the teaching quality of physiology, such as case teaching method, heuristic teaching method, and problem-based teaching, to arouse the students' interest in learning physiology. Use Pictures and Videos to exhibit the abstract knowledge.

### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Classroom performance	Answer questions; Take part in the discussion	20%	Course Objectives 1, 2, 3, 4, 5, 6, 7
Assignments	Frequency and quantity of assignments	30%	Course Objectives 2, 3, 4, 5, 6
Final examination	Close-book examination	50%	Course Objectives 2, 3, 4, 5, 6

### VII Textbooks and References

#### Textbooks

Zhu DN, Widmaier EP, Raff H, Strang KT (2020) Textbook of Physiology (Adaptation Edition). Second Edition. Science Press.

**References**

John EH (2016) Textbook of Medical Physiology, Thirteenth Edition. Elsevier.

Unglaub SD (2018) Human Physiology: An Integrated Approach. Eighth Edition. Prentice-Hall.

Costanzo LS (2019) BRS Physiology, Seventh Edition. Wolters Kluwer.

**Written by:** Jingjing Luo

**Reviewed by:** Dan Wang

**Date:** April 19, 2021

# Syllabus for Introduction to Hotspots in Life Sciences

**Course Name/Title:** Introduction to Hotspots in Life Science

**Course code:** 86953 **Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 h (Classroom Hours) **Course Credit:** 2

## I Course Introduction

The introduction to hotspots in life sciences is a collection of the latest information on life science research and is an expanded content of basic professional courses. This course mainly introduces the hot research issues and scientific progress in the latest life science research, and their significance and potential application value to the development of human beings or life sciences. Let students understand the current technology system used by the frontier research institutes of life sciences, the development status and market demand of the bio-industry, and constantly update their knowledge in the frontier fields of biotechnology. The forefront of biotechnology is the latest collection of technological developments spanning a wide range of disciplines. Recent developments in synthetic biology, genomics, precision medical technology and transgenic technology are all based on traditional biotechnology. It can be better expanded the knowledge of biotechnology system based on learning other courses. Therefore, students would be better to complete the basic courses of molecular biology, bioinformatics, genetics, cell biology and other specialized course before entering the forefront of biotechnology.

## II Course Objective

Objective 1. Understand the relationship between the development trend of life science and the sustainable development of human society and ecological environment. Understand the frontiers of biological life science and the demands of social development, especially the tasks of life science research in China. Develop the spirit of patriotism and constantly explore the spirit of knowledge innovation, improve students' professional quality.

Objective 2. Combine technical theory with practice to understand the achievements and methods applied in life sciences, as well as the progress in medicine, microbiology, zoology, and botany.

Objective 3. Understand and grasp the status and trends of biotechnology development at home and abroad, master cutting-edge biotechnology at a broader and deeper level, expand the breadth and depth of knowledge, accumulate new technological systems, and meet the society's professional talent needs.

Objective 4. Understand the inherent systematisms and integrity of the basic knowledge of biology.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland, have higher ideological and moral quality and cultural quality;	Course Objective 1,3

	Have good professional ethics, follow the professional spirit of academic norms, master solid basic theories and research methods of biological science, and have the consciousness and spirit of seeking truth and innovation.	
Graduation Requirement 4	Could understand the biological science and biological technology, mathematical statistics and biological engineering principle and other basic theory; understand the biological industry theory, possess the ability of analyzing problems.	Course Objective 2,4
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	Course Objective 2, 3,4
Graduation Requirement 8	Have the ability to summarize, organize and analyze experimental results, comprehensively use the theoretical knowledge and skills that they have mastered, and engage in scientific research in biological sciences, biotechnology and related fields;	Course Objective 2, 3,4

	have the basic ability of downstream engineering practice and technological innovation of biotechnology; develop strong scientific interest and critical thinking skills.	
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#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction 1.1 History of life sciences 1.2 The key issues have been resolved by life sciences that restrict human development 1.3 Annual major discoveries and breakthroughs in the field of life sciences 1.4 Outlook of global Life Science industry	1. Understand the milestones experienced in the development of life sciences 2. Understand the role of life sciences in solving key issues of human development 3. Understand the hot issues of research in the field of life sciences 4. Understand the direction of future life science development	2	Lectures	1, 2, 3, 4
2	Synthetic biology: Heavenly Creations	1. Understand the nature of synthetic biology 2. Understand the role of synthetic biology in the field of life sciences 3. Understand the application prospects of synthetic biology in various fields	4	Lectures Literature review	1, 2, 3, 4
3	Frontiers of Non-coding RNA Research	Understand the systems biology of non-coding RNA 2. Understand the new experimental technology of non-coding RNA research 3. Understand the mechanism and function of plant small non-coding RNA 4. Understand the research progress of non-coding RNA in medical field	4	Lectures Literature review	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
4	Sequencing technology development and application prospects	<ol style="list-style-type: none"> <li>Understand the development history of DNA sequencing technology</li> <li>Familiar with sequencing strategies and principles</li> <li>Understand the application prospects and significance of sequencing technology in the field of life sciences</li> </ol>	4	Lectures Literature review	1, 2, 3, 4
5	Ten scientific breakthroughs: gene editing technology	<ol style="list-style-type: none"> <li>The discovery and development of gene editing technology</li> <li>The principles of different types of gene editing tools</li> <li>The application of gene editing technology (combined with annual hot research)</li> <li>The challenges of gene editing technology</li> <li>The achievements of Chinese scholars in this field and inspire students' sense of pride and mission</li> </ol>	4	Lectures Literature review	1, 2, 3, 4
6	Tumor immunity and targeted therapy	<ol style="list-style-type: none"> <li>Understand the principle and development process of tumor targeted immunotherapy</li> <li>Understand the development trend of global tumor immunotherapy (combined with hot paper)</li> <li>Understand the challenges faced by tumor targeted immunotherapy</li> <li>Understand the future direction of tumor immunotherapy</li> </ol>	4	Lectures Literature review	1, 2, 3, 4
7	Frontier New Field of Ecological Science	<ol style="list-style-type: none"> <li>Understand the frontier hot spots of ecological science</li> <li>Understand the annual</li> </ol>	2	Lectures	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		ecological science hotspots			
8	Frontier New Fields of Agricultural Science	1. Understand the frontier hotspots of agricultural science 2. Understand the hot and frontier issues of annual agricultural science research	4	Lectures Literature review	1, 2, 3, 4
9	Frontier New Fields of zoology and plant Science	1. Understand the frontier hotspots of zoology and plant Science 2. Understand the hot and frontier issues of annual zoology and plant Science research	4	Lectures Literature review	1, 2, 3, 4

#### V Period Distribution and Teaching Modes

Teaching hours Methods Contents	Theoretical Lecture	Exercise	Discussion	Notes	Teaching hours
	Unit 1: Introduction	2			
Unit 2: Synthetic biology: Heavenly Creations	4				4
Unit 3: Frontiers of Non-coding RNA Research	3		1		4
Unit 4: Sequencing technology development and application prospects	3		1		4
Unit 5: Ten scientific breakthroughs: gene editing technology	3		1		4
Unit 6: Tumor immunity and targeted therapy	4				4
Unit 7: Frontier New Field of Ecological Science	2				2
Unit 8: Frontier New Fields of Agricultural Science	3		1		4

Unit 9: Frontier New Fields of zoology and plant Science	3		1		4
Total	27		5		32

This course focuses on the latest frontier hotspots in the development of life sciences, and there is no textbook as references. Most of the lectures are the annual hot issues in the field of life sciences in the past three years. Therefore, students should be prepared for the topics and learning reference materials before class.

It is suggested that the teaching strategy adopts heuristic teaching mode to integrate multiple teaching methods. Encourage students to participate in teaching, inspire students' interest and guide students to learn actively. The teaching methods include problem-oriented style, storytelling, case study, discussion, student presentation, etc.

#### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Class performance	Attendance, basic points (70) + bonus points (maximum 30 points).	30%	1、2、3、4
Discussion and Presentation	5-10 minutes/Presentation	30%	1、2、3、4
Curriculum paper	2000-3000words	40%	1、2、3、4

#### VII Textbooks and References

(I) Reference books:

- [1]杨焕明主编:《基因组学 2016》,科学出版社,2016年出版。  
 [2] A.M. 莱斯克著,薛庆中,胡松年等译.基因组学概论(第二版) [Introduction to Genomics(Second Edition)]. 科学出版社,2016年出版  
 [3]李凯,沈钧康,卢光明编著:《基因编辑》,人民卫生出版社,2016年出版。

(II) Online resources:

- [1] <https://www.cbre.us/research-and-reports>  
 [2] <http://www.sciencenet.cn>  
 [3] <https://www.sciencemag.org/journals>  
 [4] <http://www.nature.com/nbt/index.html>

**Written by: He Qiuling**

**Reviewed by: Jin Weibo**

**Date: 2021/4/26**

## Syllabus of Protein and Enzyme Engineering

**Course Name/Title:** Protein and Enzyme Engineering      **Course code:** 86955

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 (32 Classroom Hour)

**Course Credit:** 2

### I Course Introduction

Enzyme Engineering is a basic optional course intended for biotechnology students in full-English teaching classes. This course serves as an introduction and overview of the field of Enzyme engineering. Students in their sophomore year or junior year should be adequately prepared for this course. More importantly, this course could lay a solid foundation for their further research and study.

### II Course Objective

Enzyme engineering is one of the main and important courses for students whose majority is biotechnology. Learning this course let students grasp how to obtain the required enzymes through design and artificial operation, how to improve the enzyme catalytic characters with enzyme improvement technologies, and how to make full use of enzyme catalytic function.

#### 1. Ideological and political Targets

**Course Objective 1:** By selecting people and events that resonate with students, guide students to feel patriotic, and cultivate future generations who are well-prepared to join the socialist cause.

#### 2. Knowledge objective

**Course objective 2:** Master how to obtain the required enzymes through design and artificial operation;

**Course objective 3:** Master how to improve the enzyme catalytic characters with enzyme improvement technologies;

**Course objective 4:** Master how to make full use of enzyme catalytic function.

#### 3. Ability objective

**Course objective 5:** Develop students' abilities of acquisition of knowledge, application of knowledge, and innovation.

#### 4. Quality objectives

**Course objective 6:** Possess the abilities of dialectical thinking, realistic attitude, innovation spirit and good professional ethics.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Index Point	Requirements	Course Objectives
Graduation Requirement 4	Could understand the biological science and biological technology, statistics and biological	mathematical and biological	Course Objective 1,2,3,4,5,6

	engineering principle and other basic theory; understand the biological industry theory, possess the ability of analyzing problems.	
Graduation Requirement 7	Have the biotechnology engineering practice and the basic technological innovation ability by using the knowledge of gene engineering, microbiological engineering and fermentation engineering methods and tools. By the integrated application of the theoretical knowledge and skills, possess the ability of designing downstream product of biotechnology and related fields research.	Course Objective 1,2,3,4,5,6

#### IV Correlations between Course Content and Learning Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<b>Introduction of Enzyme Engineering</b> 1.Conception of enzyme and its development; 2.The characteristics of enzyme action; 3.Factors that affecting enzyme action; 4.Classification and Nomenclature of Enzymes; 5.Determination of enzyme activity; 6.Methods for enzyme production; 7.Development survey of enzyme engineering.	1.Understand the concepts of enzyme and its development; 2.Understand characteristics of enzyme action and factors affecting enzyme action; 3.Master Classification and Nomenclature of Enzymes; 4.Know the determination of enzyme activity and methods for enzyme production.	2	in-class lecture	1, 2, 3, 4, 5,6
2	<b>Enzyme Production by Microbial Fermentation.</b> 1.Regulation of enzyme biosynthesis in microbial biosynthesis in microbial	1.Understand regulation of enzyme biosynthesis in microbial cells; 2.Master characteristic of	4	in-class lecture	1, 2, 3, 4,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	cells; 2.Characteristic of microbes for enzyme production; 3.Fermentation process conditions and its control; 4.Enzyme fermentation kinetics; 5.Enzyme production by immobilized cell fermentation; 6.Enzyme production by immobilized protoplast fermentation.	microbes for enzyme production; 3.Master fermentation process conditions and its control; 4.Understand enzyme fermentation kinetics; 5.Understand enzyme production by immobilized cell fermentation; 6.Understand enzyme production by immobilized protoplast fermentation.			
3	<b>Enzyme Production by Animal and Plant Cell Cultures</b> 1.The regulation of enzyme biosynthesis in animal and plant cells; 2.Enzyme production by plant cell culture; 3.Enzyme production by animal cell culture.	1.Understand the regulation of enzyme biosynthesis in animal and plant cells; 2.Master enzyme production by plant cell culture; 3.Master enzyme production by animal cell culture.	2	in-class lecture	1, 2,3,4,5,6
4	<b>Extraction, Separation and Purification of Enzymes</b> 1.Cell disruption and enzyme extraction; 2.Precipitation separation; 3.Centrifugal separation; 4.Filtration and membrane separation; 5.Chromatographic separation; 6.Electrophoresis separation; 7.Extraction separation; 8.Crystallization; 9.Concentration and Drying.	1.Understand cell disruption and enzyme extraction; 2.Master precipitation separation; 3.Master centrifugal separation; 4.Master filtration and membrane separation; 5.Master chromatographic separation; 6.Master electrophoresis separation; 7.Master extraction separation; 8.Master crystallization; 9.Master concentration and drying.	6	in-class lecture	1, 2,3,4,5,6
5	<b>Enzyme Molecular</b>	1.Master metal ion substitution	6	in-class	1, 2,3,4,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<b>Modification</b> 1.Metal ion substitution modification; 2.Macromolecular binding modification; 3.Side chain group modification; 4.Peptide chain limited hydrolysis modification; 5.Nucleotide chain cleavage modification; 6. Amino acid substitution modification; 7.Nucleotide substitution modification; 8.Physical modification; 9.Application of enzyme molecular modification.	modification; 2.Master macromolecular binding modification; 3.Master side chain group modification; 4.Master peptide chain limited hydrolysis modification; 5.Master nucleotide chain cleavage modification; 6.Master amino acid substitution modification; 7.Master nucleotide substitution modification; 8.Understand physical modification; 9.Understand application of enzyme molecular modification.		lecture	
6	<b>Immobilization of Enzymes, Cells and Protoplasts</b> 1.Basic Enzyme immobilization; 2.Cell immobilization; 3.Protoplast immobilization.	1.Master enzyme immobilization; 2.Master cell immobilization; 3.Master protoplast immobilization.	3	in-class lecture	1, 2,3,4,5,6
7	<b>Enzyme Catalysis in Non-aqueous Phases</b> 1.The main scopes of enzyme catalysis in non-aqueous phase; 2.Effects of water and organic solvents on enzyme catalysis in organic media; 3.The catalytic characters of enzymes in organic media; 4.Conditions of enzyme catalytic reaction in organic media and its control; 5.Application of enzyme catalysis in non-aqueous phase.	1.Understand the main scopes of enzyme catalysis in non-aqueous phase; 2.Master effects of water and organic solvents on enzyme catalysis in organic media; 3.Master the catalytic characters of enzymes in organic media; 4.Master conditions of enzyme catalytic reaction in organic media and its control; 5.Master application of enzyme catalysis in non-aqueous phase.	2	in-class lecture	1, 2,3,4,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
8	<b>Enzyme Directed Evolution</b> Introduction 1.The characteristics of enzyme directed evolution; 2.Random mutation of enzyme gene; 3.Directed selection of enzyme gene mutants; 4.The applications of enzyme directed evolution.	1.Understand the characteristics of enzyme directed evolution; 2.Master random mutation of enzyme gene; 3.Master directed selection of enzyme gene mutants; 4.Master the applications of enzyme directed evolution.	2	in-class lecture	1, 2,3,4,5,6
9	<b>Enzyme Reactors</b> 1.Types of enzyme reactors; 2.Choice of enzyme reactors; 3.Design of enzyme reactors; 4.Enzyme reactor operation.	1.Understand types of enzyme reactors; 2.Understand choice of enzyme reactors; 3.Master design of enzyme reactors; 4.Master enzyme reactor operation.	3	in-class lecture	1, 2,3,4,5,6
10	<b>Fermentation of Genetic Engineering Strain</b> 1.Enzymes application in pharmaceutical industry; 2.Application of enzymes in food; 3.Enzyme application in light and chemical industries; 4.Enzyme application in environmental protection; 5.Enzyme application in biotechnology.	1.Master enzymes application in pharmaceutical industry; 2.Understand application of enzymes in food; 3.Understand enzyme application in light and chemical industries; 4.Master enzyme application in environmental protection; 5.Master enzyme application in biotechnology.	2	in-class lecture	1, 2,3,4,5,6

#### V Period Distribution and Teaching Modes

	theory Taught	problem lesson	discuss lesson	remark	subtotal
Overview	2		0		2
Enzyme Production by Microbial Fermentation	3		1		4
Enzyme Production	2		0		2

by Animal and Plant Cell Cultures					
Extraction, Separation and Purification of Enzymes	5		1		6
Enzyme Molecular Modification	5		1		6
Immobilization of Enzymes, Cells and Protoplasts	3		0		3
Enzyme Catalysis in Non-aqueous Phases	2		0		2
Enzyme Directed Evolution	2		0		2
Enzyme Reactors	3		0		3
Applications of Enzymes	1		1		2
Total	28		4		32

## VI Assessment

The assessment approach will be taken as review paper about enzyme engineering;

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
attendance	At least 5 times	10%	1, 2, 3, 4, 5,6
class performance	Question answer, discussion and presentation	20%	1, 2, 3, 4, 5,6
unit tests	2 times	20%	1, 2, 3, 4, 5,6
review paper	at least 3 pages	50%	1, 2, 3, 4, 5,6

## VII Textbooks and References

### 1. Textbook

[1] Guo Yong, 《Enzyme Engineering》 Third Edition, Science Press, Beijing, 2012.

### 2. References

[1] Yuan QS, Zhao J. Enzyme and enzyme engineering, East China University of Science and Technology Press, Shanghai, 2006

[2] Guo Yong, Modern Biochemical technology, Second edition, China Light Industry Press, Beijing, 2007

### 3. Web Resources

[1] <http://10times.com/enzyme-engineering>

[2] <http://www.sciencedirect.com/science/article/pii/S1755040807010028>

[3] <http://www.springer.com/cn/book/9781461592921>

**Written by:** Mei Jun

**Reviewed by:** Miao Meng

**Date:**2021.04.30

# Syllabus of Genomics

**Course Name/Title: Genomics**      **Course code: 86956**

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 Classroom Hours

**Course Credit:** 2

**Applicable major:** Bachelor of Biotechnology in English

**Department (Office):** Department of Biotechnology

## 一、 Course Introduction

Genomics mainly introduce the field of study in biology ending in -omics, such as genomics, proteomics, transcriptomics, or metabolomics. The course aims at the collective characterization and quantification of pools of biological molecules that translate into the structure, function, and dynamics of an organism or organisms. The applications mainly include genomics, proteomics, metabolomics, transcriptomics, lipidomics, immunomics and so on. This course focuses on the introduction of different Genomic studies and their applications. Through the study of omics, we want to stimulate students' love for science.

## 二、 Course Objective

The overall aim of the course is to provide practical and theoretical skills concerning classical as well as new large-scale and technology-driven approaches in molecular biology, and to discuss and evaluate when and how these methods are best put into use.

### Objective 1:

Education objective: stimulate students' love for science and patriotism

### Objective 2:

**Knowledge objectives:** Students should master the basic concept involved in genomics and its applications, be familiar with some points and some functional genomics projects, comprehend the principles of sequencing.

### Objective 3:

**Ability objectives:** Encouraging students to integrate theory with practice, and improve their ability of self-study. For example, what is genomics and the related research fields?

### Objective 4:

**Quality objectives:** Possess the ability of solving the practical problem, dialectical thinking

## II Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses,	Course Objective 1,2,3,4

	and master basic knowledge and skills of biological sciences	
Graduation Requirement 6	Through certain experimental and practical experience in biotechnology, they will master the experimental skills of related courses as well as relevant biological experimental data processing and analysis methods, and understand the frontier technology and development trend of this field.	Course Objective 1,2,3,4
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	Course Objective 1,2,3,4
Graduation Requirement 8	Could summarize, organize, and analyze experimental results, synthesize the theoretical knowledge and skills acquired, and engage in scientific research in biological sciences, biotechnology, and related fields; they have the basic ability to practice biotechnology downstream engineering and technological innovation; they have a strong scientific interest and the ability to think critically.	Course Objective 1,2,3,4

## II Correlations between Course Contents and Course Objectives

### Correlations between Course Contents and Course Objectives

No	Course Contents	Teaching requirement	Credit	Teaching Method	Course Objectives
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No	Course Contents	Teaching requirement	Credit	Teaching Method	Course Objectives
1	<p>1.1 What is Omics?</p> <p>1.2 The History of Omics?</p> <p>1.3 The important Events in the development of Omics</p> <p>1.4 Applications of Omics</p>	<p>1. Understand the concepts of omics and its application</p> <p>2. Stimulate students' love for science and patriotism</p>	3	Lecture	Objectives 1,2,3,4
2	<p>2.1 The importance of Genomics in the Omics?</p> <p>2.2 Why we developed the genomics?</p> <p>2.3 How the genomics developed?</p> <p>2.4 The important Events in the development of HGP project</p>	<p>1. Comprehend the importance of Genomics and its development</p> <p>2. Stimulate students' love for science and patriotism</p>	3	Lecture	Objectives 1,2,3,4
3	<p>3.1 Genome Structure</p> <p>3.2 Genome Replication</p> <p>3.3 Genome Expression</p> <p>3.4 Genome Regulation</p> <p>3.5 Genome Recombination</p>	<p>1. Handle the characteristics of genome;</p> <p>2. Comprehend the genome regulation;</p> <p>3. Stimulate students' love for science and patriotism</p>	3	Lecture	Objectives 1,2,3,4
4	<p>4.1 Constitutive expression and Induced expression</p> <p>4.2 Genome Regulation in Prokaryotes</p> <p>4.3 Genome Regulation in Eukaryotes</p> <p>4.4 Application of Genome Regulation</p>	<p>1. Handle the genome regulation in Eukaryotes;</p> <p>2. Comprehend the application of genome regulation</p>	3	Lecture	Objectives 1,2,3,4
5	<p>5.1 Why needs to go for functional genomics?</p> <p>5.2 The methodology for functional genomic research</p> <p>5.3 Functional genomics is reverse genetics</p> <p>5.4 Reverse genetic research methods</p> <p>5.5 RNA interference</p>	<p>1. Comprehend methodology for functional genomic research;</p> <p>2. Understand RNA interference</p>	2	Lecture	Objectives 2,3,4

No	Course Contents	Teaching requirement	Credit	Teaching Method	Course Objectives
6	6.1 Overview of Transcriptomics 6.2 Methods of construction 6.3 How to analysis 6.4 Applications of Transcriptomics 6.5 Relation to proteome	1. Handle the methods of Transcriptomics 2. Understand applications of transcriptomics	2	Lecture	Objectives 2,3,4
7	7.1 Introduction to proteomics 7.2 Evolution from protein chemistry to proteomics 7.3 Sample preparation and prefractionation steps 7.4 Gel-based proteomics& Gel-free proteomics 7.5 Quantitative proteomics 7.6 Interactomics: techniques to study protein-protein interactions 7.7 Modificomics: understanding post-translational modifications by using proteomic techniques 7.8 Structural proteomics 7.9 Challenges and prospects of proteomic research	1. Handle the methods of proteomics 2. Understand applications of proteomics	4	Lecture	Objectives 2,3,4
8	8.1 Introduction to Metabolomics 8.2 Technologies 8.3 Other ways of metabolite analysis 8.4 Quantitative metabolomics 8.5 Metabolomics and carbon metabolism 8.6 Metabolite analysis and biochemical pathways 8.7 Metabolite profiling in phenotyping and breeding	1. Handle the methods of metabolomics 2. Understand applications of metabolomics	4	Lecture	Objectives 2,3,4
9	9.1 Introduction to Ionomics 9.2 Technologies 9.3 Application of Ionomics	1. Understand the concepts of Ionomics 2. Understand the methods of Ionomics and its applications	2	Lecture	Objectives 2,3,4
10	10.1 Introduction to Phenomics 10.2 Technologies 10.3 Application of Phenomics	1. Understand the concepts of Phenomics 2. Understand the	2	Lecture	Objectives 2,3,4

No	Course Contents	Teaching requirement	Credit	Teaching Method	Course Objectives
		methods of Phenomics and its applications			
11	11.1 Introduction to Epigenomics 11.2 Technologies 11.3 Application of Epigenomics	1. Understand the concepts of Epigenomics 2. Understand the methods of Epigenomics and its applications	2	Lecture	Objectives 2,3,4

#### IV Practice Plan and Requirement

##### 1 schedule

Lecture	Topic	Chapter	Instructor
1	Omics	Chapter 1	
2	Genomics I	Chapter 2	
3	Genomics II	Chapter 3	
4	Genomics III	Chapter 3	
5	Genome Regulation	Chapter 4	
6	Functional Genomics	Chapter 5	
7	Transcriptomics I	Chapter 6	
8	Transcriptomics I	Chapter 6	
9	Proteomics I	Chapter 7	
10	Proteomics II	Chapter 7	
11	Metabolomics I	Chapter 8	
12	Metabolomics II	Chapter 8	
13	Ionomics	Chapter 9	
14	Phenomics	Chapter 10	
15	Epigenomics I	Chapter 11	
16	Epigenomics II	Chapter 11	

##### 2 Suggestions for Teaching

(With regard to different teaching processes, adopt different teaching modes, methods, and media. A variety of teaching methods and a flexible range of activities are suggested to provide students with various learning experiences and encourage their initiatives. Special stress should be put on the introduction of modern educational technology with an optimal integration of various teaching media. Make reasonable use of presentation instruments, inquiring instruments, interaction instruments and design instruments to effectively improve the teaching quality.)

##### Presentation:

There are 7 specific issues of genomics selected, and students select one randomly. They should prepare the presentation by themselves and give us presentations. In this process, they will experience self-learning skills and ability to give a professional presentation. All the students will give them scores (Language proficiency, slide quality, response to answers) after they presentation.

### Curriculum paper due dates:

One review paper is required from each student covering a topic in Omics. The curriculum paper should include introduction, methods, and applications. Each student must get approval for the chosen topic from the instructor. Review papers will be a comprehensive evaluation of the chosen topic using information from relevant books, current journal articles, and current review articles. Students will be expected to research the topic carefully and perform literature searches through library or internet sources. Internet resources should be used cautiously as websites are not considered a reliable source of information. Use these resources for general information, and as a guide to peer-reviewed resources. Review papers that display a lack of support from scientific journals will be marked down. The review paper will be 8-10 pages in length (double-spaced). The review papers will be turned at the end of the course.

### Curriculum Topics

- 1. Functional genomics
- 2. Metagenomic
- 3. Transcriptomics
- 4. Proteomics
- 5. Phenomics
- 6. Inomics
- 7. Epigenetics

### 3 Suggestions for Course Learning

(Mainly include tips for learning methods, course preparation information and requirements, and requirements for assignments, autonomous learning, discussion, etc.)

The adequate preparation and fluent oral English are key elements to give a wonderful class teaching and study. Interest is the best teacher, and it's also promise of study on student's own initiative.

### 六、Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Frequencies of assignments; question response	10%	1、2、3、4
Presentation	5-10 minutes	40%	1、2、3、4
Curriculum paper	More than 2000 words	50%	1、2、3、4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### VIII Textbooks and References

Genomes 4: Brown T.A., 2018.

Transcriptomics and Gene Regulation: Jiaqian Wu, 2016

**Written by: Ling Xu**

**Reviewed by: Qiuling He**

**Date:2021-4-20**

# Syllabus of Genetics

**Course Name/Title:** Genetics      **Course code:** 86957

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 40 Classroom Hours;

**Course Credit:** 2

## I Course Introduction

Genetics is the study of genes, heredity, and genetic variation in living organisms. It is a course designed for biotechnology majors and is part of the core curriculum. The objective of the course is to introduce the principles of Mendelian, molecular, and population genetics. In addition to the body of facts associated with genetics, you will be introduced to the methods that various scientists have used to solve different problems in genetics and the methodology that was used to test competing theories.

**Pre-requisites:** You must have completed a general or introductory biology course and a college algebra course with a C or better in both. The biology course will have given you the basics of the terminology and major theories in biology. The college algebra course will have given you the tools to manipulate the mathematical equations that you need to understand genetics.

## II Course Objective

**Course objective 1:** To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)

**Course objective 2:** To learn patterns of inheritance from parent to offspring, and the rules that govern the transmission of traits from parents to offspring.

**Course objective 3:** To describe the molecular mechanisms for the flow of genetic information in and among cells.

**Course objective 4:** To describe the behavior of chromosomes during cell division in both normal and abnormal situations.

**Course objective 5:** To describe the control of gene expression in prokaryotes and eukaryotes.

**Course objective 6:** To understand the gene distribution, variation and change in populations, and learn the processes that influence the gene pool of natural populations.

**Course objective 7:** To describe the role of nature and nurture in producing variance among individuals in a population.

**Course objective 8:** To learn to search the primary literature of genetics and to summarize and synthesize the information in a written format.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Understand the biological science and biological technology, mathematical	Course Objective 1-8

	statistics and biological engineering principle and other basic theory; understand the biological industry theory, possess the ability of analyzing problems.	
Graduation Requirement 5	Be familiar with biotechnology engineering practice and the basic technological innovation ability by using the knowledge of gene engineering, microbiological engineering and fermentation engineering methods and tools. By the integrated application of the theoretical knowledge and skills, possess the ability of designing downstream product of biotechnology and related fields research.	Course Objective 3, 4, 5, 7, 8

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction to Genetics	To learn patterns of inheritance from parent to offspring, and the rules that govern the transmission of traits from parents to offspring.	2		Course Objective 3, 4, 5, 7, 8
2	Mendelian Genetics Extensions of Mendelian Genetics	To learn patterns of inheritance from parent to offspring, and the rules that govern the transmission of traits from parents to offspring.	2		Course Objective 3, 4, 5, 7, 8
3	Chromosome Mapping in Eukaryotes	To describe the behavior of chromosomes during cell division in both normal and abnormal situations.	2		Course Objective 1, 2
4	Genetic Analysis and Mapping in Bacteria and Bacteriophages	To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)	2		Course Objective 2, 3
5	Sex Determination and Sex Chromosomes	To describe the molecular mechanisms for the flow of	2		Course Objective

<b>Num.</b>	<b>Course Content</b>	<b>Teaching Requirement</b>	<b>Period</b>	<b>Teaching modes</b>	<b>Course Objectives</b>
	Chromosome Mutations: Variation in Number and Arrangement	genetic information in and among cells.			e 3、 4
6	DNA Structure and Analysis	To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)	2		Course Objective 3、 4
7	DNA Organization in Chromosomes	To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)	2		Course Objective 3、 5
8	DNA Replication and Recombination	To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)	2		Course Objective 5、 6
9	Gene Mutation, DNA Repair, and Transposition	To learn the molecular structure and function of genes, and gene behavior in context of a cell or organism (e.g. dominance and epigenetics)	2		Course Objective 5、 6
10	Regulation of Gene Expression in Prokaryotes	To describe the control of gene expression in prokaryotes and eukaryotes.	2		Course Objective 5、 6
11	Regulation of Gene Expression in Prokaryotes	To describe the control of gene expression in prokaryotes and eukaryotes.	2		Course Objective 7、 8
12	Regulation of Gene Expression in Eukaryotes	To describe the control of gene expression in prokaryotes and eukaryotes.	2		Course Objective 7、 8
13	Regulation of Gene Expression in Eukaryotes	To describe the control of gene expression in prokaryotes and eukaryotes.	2		Course Objective 7、 8
14	Developmental Genetics	To describe the control of gene expression in prokaryotes and eukaryotes.	2		Course Objective 7、 8
15	Quantitative Genetics and Multifactorial Traits	To understand the gene distribution, variation and change in populations, and learn	2		Course Objective 7、 8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		the processes that influence the gene pool of natural populations.			
16	Population and Evolutionary Genetics	To describe the role of nature and nurture in producing variance among individuals in a population.	2		Course Objective 8

### V Period Distribution and Teaching Modes

### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Classroom performance	Attendance, Q&A, Class presentations	20%	1-8
Quizzes & problem sets	3 big quizzes, open-book (appx. per 3 weeks)	25%	1-8
Final exam	Close-booked, formulae will be provided	55%	1-8

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### VII Textbooks and References

#### 1. Textbook:

[1] William Klug et al. 2012. *Concepts of Genetics*, 10th ed. PEARSON.

#### 2. Reference:

[1] Snustad & Simmons, 2012. *Principles of Genetics*, 6th ed. WILEY.

[2] 刘祖洞等编著《遗传学》（第三版），高等教育出版社，2013年出版。

#### 3. Online Resources:

[3] MIT OpenCourse <http://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/>

[4] Wikiversity: <http://en.wikiversity.org/wiki/Genetics/Course>

[5] Learn Genetics: <http://learn.genetics.utah.edu>

[6] MUN Principles of Genetics: <http://www.mun.ca/biology/scarr/Bio2250.html>

**Written by:** Zhechen Qi

**Reviewed by:** Wanli Guo

**Date:** Apr 20<sup>th</sup>, 2021

## Syllabus of Introduction to Biotechnology

**Course Name/Title:** Introduction to Biotechnology      **Course code:** 86958  
**Course Type:** Basic Course/Compulsory Course  
**Total Teaching Hours:** 16 (Classroom Hours: 0, Laboratory Hours or Tutorial Hours: 0 )  
**Course Credit:** 1

### I Course Introduction

This course is a basic compulsory course for first-year students in English-taught classes of biotechnology majors. It aims to let students understand the development status and career development opportunities of the main application fields of biotechnology, cultivate students' professional learning interest, and become a follow-up professional course. Lay the foundation for your learning.

### II Course Objective

Course objective 1: Correctly evaluate the development status of the biotechnology industry in China.

Course objective 2: Summarize the development status and career development opportunities of the main application fields of biotechnology.

Curriculum Objective 3: Strengthen the interest in studying biotechnology.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master basic knowledge and skills of biological sciences	1, 2, 3
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life	1, 2, 3

	sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	
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(Note: Basic courses and specialized courses must correlate with the graduation requirements as specified in the Program outline. The correlated graduation requirement index point must be put before the descriptive phrases or sentences. General courses are exempted from this rule.)

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Biotechnology century and its workforce 1) What's biotech 2) How biotech affects us 3) Current status in China 4) The biotech workforce	1. Define biotechnology and understand the many scientific disciplines that contribute to technology; 2. Describe how biotechnology affects our daily life; 3. Discuss the current status of biotechnology in China; 4. List career options that arise as a result of our society's increasing dependence on biotechnology.	2	1. Lecture; 2. Group discussion; 3. Group sharing.	1, 2, 3
2	Botany and Genetics 1. Introduction to Plant Biology and Biotechnology: Extraordinary plants, people, and the environment. 2. Genetically modified crops: boon or boondoggle?	1. Understand the basic concepts of plant biology and contents of biotechnology utilities in plant science. 2. Understand the basic technologies applied in genetically modified organism. The social impact of GMOs.	2	problem-based learning (PBL) and case study based learning (CBL) are used.	1, 2, 3
3	Animal Biotechnology 1) Animal Biotechnology and Its Roles	Try to find out elementary knowledge and application of Animal Biotechnology and new gene edited tool CRISPR/Cas9 System and its related ethics problem	2	1. Lecture;	1, 2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	2) CRISPR/Cas9 System and Its Applications in Transgenic Animals 3) Animal Biotechnology: Science-Based Concerns				
4	Microbial biotechnology 1) In the past 2) At present (vital) 3) In the future	1. Understand microorganisms and master the main techniques of microorganisms; 2. Understand the role of microbial technology in basic biological research; 3. Understand the application fields (medicine, food, agriculture, environment) and development value of microbial technology 4. Understand the philosophical significance of "small creatures do great things"; understand the relationship between microorganisms and nature, ecology, and health	2	1. Lecture; 2. Group discussion; 3. Group sharing.	1, 2, 3
5	Bioremediation 1) Overview of bioremediation 2) Microbial bioremediation 3) Phytoremediation 4) Examples of bioremediation	1. Explain what the bioremediation is and describe why it is important; 2. Define microbial bioremediation and understand how it can be used to clean up the environment 3. Define phytoremediation and understand how it can be used to clean up the environment 4. Provide examples of how organisms can be used in bioremediation	2	1. Lecture; 2. Group discussion; 3. Group sharing.	1, 2, 3
6	Molecular biology 1) Definition of molecular biology	Master the definition and application fields of molecular biology. Understand the concepts, history and research content of	2	1. Lecture	1, 2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	2) Relationship to other biological sciences 3) Brief History of molecular biology 4) Application of molecular biology	molecular biology. China's contribution to human genome sequencing and the progress of sequencing technology in recent years have enhanced students' national self-esteem and love for biotechnology major.			
7	Medical biotechnology 1) Gene expression and regulation as drug targets 2) Tumor immunity and immune therapies 3) Oncolytic viral therapies	Master the DNA cloning, vector, host, expression vector characteristics and recombinant protein expression technology involved in gene manipulation technology.	2	1. Lecture	1, 2, 3
8	Marine biotechnology 1) What is oceanography? 2) What is marine Resources? 3) How to understand integrated utilization of marine biological resources?	1. The manifestation of the diversity of marine biological resources; 2. The history, current situation and prospects of the development and utilization of marine biological resources; 3. The basic means of the development and utilization of marine biological resources.	2	1. Lecture; 2. Group discussion.	1, 2, 3

### V Period Distribution and Teaching Modes

#### 1. Course period distribution

contents	period	Teaching modes					sum
		lecture	exercise	discussion	memo		

Biotechnology century and its workforce 1) What's biotech 2) How biotech affects us 3) Current status in China 4) The biotech workforce	2				2
Botany and Genetics 1) Extraordinary plants, people, and the environment 2) Organic vs. conventional farming – which is better?	2				2
Animal Biotechnology 1) Animal Biotechnology and Its Roles 2) CRISPR/Cas9 System and Its Applications in Transgenic Animals 3) Animal Biotechnology: Science-Based Concerns	2				2
Microbial biotechnology 1) In the past 2) At present (vital) 3) In the future	2				2
Bioremediation 1) Overview of bioremediation 2) Microbial bioremediation 3) Phytoremediation 4) Examples of bioremediation	2				2
Molecular biology 1) Definition of molecular biology	2				2
Medical biotechnology 1) Gene expression and regulation as drug targets 2) Tumor immunity and immune therapies 3) Oncolytic viral therapies	2				2
Marine biotechnology 1) What is oceanography? 2) What is marine Resources? 3) How to understand integrated utilization of marine biological resources?	2				2
Total	16				16

## 2. Teaching methods

This course relies on the Superstar platform and adopts a blending method. Divide students into groups of 3-4 people. In each class, 3-4 activities will be designed for the teaching content. After the questions are raised, the students will discuss them, and the students will take the initiative to speak and share the results of the discussion, and then the teacher will give an intensive lecture.

### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	1 absence or 2 lateness means scored zero for this section.	10%	1, 2, 3
Class performance	basic points (70) + bonus points (maximum 30 points).	10%	1, 2, 3
Assignment	6-7	25%	1, 2, 3
Course report	See below	55%	1, 2, 3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### Course report evaluation rubric for *Introduction of Biotechnology*\*

	<b>Excellent ( &gt;90 )</b>	<b>Good ( 80-89 )</b>	<b>Moderate ( 70-79 )</b>	<b>Fair ( 60-69 )</b>	<b>Failure ( &lt;60 )</b>
<b>Topic ( 10% )</b>	The topic is fully focused on one aspect of modern biotech, the title is consistent with the text.	The topic is focused on one aspect of modern biotech, the title is consistent with the text.	The topic is basically focused on one aspect of modern biotech, the title is basically consistent with the text.	The topic is relatively broad and do not fully reflect the progress of a certain field of modern biotech, the title does not quite agree with the text.	The topic is too extensive to reflect the progress of a certain field of modern biotech, the title does not agree with the text.
<b>Logic and structure of the text</b>	Accurate issue exposition,	Accurate issue exposition, moderately	Basically accurate issue exposition,	The issue exposition is not accurate	The issue exposition is not accurate,

<b>( 60% )</b>	well organized content, clear narration; accurate and logical arguments.	organized content, clear narration; and moderately accurate and logical arguments.	organized content, clear narration; and basically accurate and logical arguments.	enough, the content is not clear enough, the narrative layer is not clear enough; the argument is not sufficient, accurate and logical.	the content is not clear, the narrative layer is not clear; The argument is not sufficient, accurate and logical
<b>Format ( 10% )</b>	The number of words, line spacing, and font fully meet all requirements.	The number of words, line spacing, font meet all requirements.	The number of words, line spacing, font basically meet all requirements.	The number of words, line spacing, font not quite meet all requirements.	The number of words, line spacing, font not meet all requirements.
<b>Grammar ( 10% )</b>	Appropriate language, proper words, no grammatical or spelling mistakes.	Moderately appropriate language, proper words, a small number of grammatical or spelling mistakes.	There are certain errors in the sentence, which makes the reader have some difficulty in understanding, but can express the main content.	More errors in the sentence, the language is not appropriate, barely able to express the main content.	Many wrong sentences, inappropriate language, unable to express the main content.
<b>Reference ( 10% )</b>	Reasonable citation of original text, and citation of latest literature, quoted in the text, the number of references and recording format fully meet the requirements.	Moderate citation of original text, and citation of latest literature, quoted in the text, the number of references and recording format meet the requirements.	Basically moderate citation of original text, and citation of latest literature, quoted in the text, the number of references and recording format basically meet the requirements.	Over-citing the original text, the cited literature is not new enough, not quoted in the text, the number of references and recording format basically do not meet the requirements.	Plagiarizing the original text and citing the old references, not quoted in the text. The number of references and recording format do not meet the requirements.

## **VII Textbooks and References**

1. Teaching materials: (list the title, author, publisher, etc.): none
2. Network resources: (this course website or link to main network resources)

[1] <http://openstaxcollege.org/textbooks/concepts-ofbiology/get>

[2] <http://www.microbeworld.org>

[3] <http://www.isaaa.org/>

[4] <http://www.biotech-now.org/tag/animal-biotechnology>

[5] <https://global.britannica.com/science/DNA-fingerprinting>

[6] <http://www.pollutionissues.com/A-Bo/Bioremediation.html>

[7] <http://www.biotechnology.amgen.com>

**Written by: Guo Jiangfeng**

**Reviewed by: Jin Weibo**

**Date: May 20, 2021**

## Syllabus of Cell Biology

**Course Name/Title:** Cell Biology                      **Course code:** 86959

**Course Type:** (Specialized Course)(Compulsory Course)

**Total Teaching Hours:** 48 (Classroom Hours )

**Course Credit:** 3

### I Course Introduction

The cell is a fascinating, complex, and dynamic unit that forms the fundamental basis of unicellular and multicellular life. Cells are constantly engaging with their environment and making active decisions, and we will dissect these cellular processes. Cell biology studies the basic structure and function of the cell. By employing modern techniques achieved by physics, chemistry and molecular biology, the basic life of cell are shown from different layers ( micrological, sub-micrological and molecular level ). Main contents include extracellular matrix, biomembrane systems and protein sorting, the cytoskeleton systems and cell motility, the nucleus and gene expression, cellular reproduction and differentiation, aging and apoptosis, signal transduction, cancer, cell origins and evolution, techniques in cell and molecular biology etc. Throughout this course, there will be an emphasis on developing hypotheses, designing experiments, and analyzing data.

### II Course Objective

Objective 1: Develop the spirit of patriotism. Enhance students' interest and understanding of science, improving the students` critical thinking skills and creating an innovative spirit in team work.

Objective 2: Understand the relationship between the basic structure and function of cells, knowing various research methods of cell biology.

Objective 3: Understand the mechanism of cell proliferation, differentiation and expression regulation, cell senescence and apoptosis, and cell signal transduction pathways.

Objective 4: Cultivate students' ability to analyze and solve problems. Develop scientific writing and oral communication skills.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master basic knowledge and skills of biological sciences	Course Objective 1,2,3
Graduation Requirement 7	The ability to proactively use various modern media	Course Objective 1,2,3,4

	<p>technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;</p>	
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#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction to cell Biology	(1) Understand research field of cell biology (2) Introduce the achievements made by Chinese scientist in the field of cell biology to cultivate students' patriotism and scientific and technological innovation spirit.	3	Lecture	1,2
2	Technologies in cell Biology	Understand the principle of the technologies used in cell biology and application of the techniques.	3	Lecture, Presentation, discussion	1,2,4
3	Plasma membrane	(1) Mastering structure of membrane and the chemical composition of membrane (2) Comprehending the movements and floatability of the membrane lipid and protein molecules (3) Understanding dissymmetry of membrane, the functions of plasma membrane	3	Lecture	1,2,4
4	The movement of	Understanding simple diffusion,	3	Lecture,	1,2,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	substances across cell membrane	facilitated diffusion, active transport		discussion	
5	Endomembrane System	(1) Mastering structure, function of endomembrane system (2) Comprehending glycosylation in the RER and Golgi complex, degradation of proteins by ubiquitin-proteasome system (3) Understanding lysosomes are heterogeneous.	3	Lecture, discussion	1,2,4
6	Membrane trafficking	(1) Mastering types of vesicle transport and their functions; targeting vesicles to a particular compartment (2) Comprehending signal sequence, signal recognition particle (SRP). (3) Understanding exocytosis	4	Lecture, discussion	1,2,4
7	Cell communication	(1) Mastering G-protein-linked receptor signaling pathway, enzyme linked receptor (2) Comprehending: signal molecules, receptors, second messenger, molecular switches, protein kinase, intracellular signaling complexes (3) Understanding NFκB signaling pathway, Notch signaling pathway, Wnt signal pathway (4) With the ability to explain the mechanisms of important life phenomena and apply for further graduated student of master degree.	7	Lecture, Presentation, discussion	1,3,4
8	The cytoskeleton and cell motility	Mastering the composition and function of cytoskeleton, the difficult part of the course, motility of cytoskeleton	4	Lecture	1,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
9	Nucleus and chromosome	(1) Mastering composition of nucleus and chromosomes (2) Comprehending function of chromosome and chromatin (3) Understanding the nuclear pore complex, chromatin and chromosomes	3	Lecture	1,3,4
10	Cellular division and cell cycle	(1) Mastering maturation promoting factor (MPF) (2) Comprehending the Role of Protein Kinases (3) Understanding regulation of cell cycle	3	Lecture, discussion	1,3,4
11	Cell differentiation and Regulation	(1) Mastering the concept of differentiation (2) Comprehending the controls of cell differentiation (3) Understanding the effects of cell differentiation	3	Lecture, discussion	1,3,4
12	Tumor cells	(1) Mastering the basic knowledge about cancer cell (2) Comprehending the cause of cancer (3) Understanding the genetics of cancer (4) Introduction the achievements made by Chinese scientist in cancer research to cultivate students' patriotism	3	Lecture, discussion	1,3,4
13	Apoptosis	(1) Master the molecular mechanism of apoptosis mediated by Fas (2) Master the molecular mechanism of Apoptosis mediated by mitochondria	3	Lecture, discussion	1,3,4
14	Extracellular matrix	(1) Master the composition and the functions of ECM (2) Comprehend specialized structures on cell surface (3) Understand cell junction	3	Lecture	1,3,4

## V Period Distribution and Teaching Modes

### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Attendance in labs is mandatory. 5 points will lose for each missed lab.	10%	1
Class participation	Answer the questions correctly and take part in the discussion section actively in class.	10%	1, 2,3,4
Presentation	Students are required to present a short review related to the discussion topic.	10%	1, 2,3,4
assignments	essay question at least 3 times	20%	1, 2,3,4
Final Exam		50%	1, 2, 3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### VII Textbooks and References

The required textbook for this course is:

Karp G., Cell and Molecular Biology, 7th ed., Published by John Wiley & Sons, Inc., 2013.

#### References:

Ding Mingxiao *et al.*, Cell Biology, 5th ed. High Education Publisher, 2020

Alberts B *et al.*, Molecular Biology of the Cell, and Essential Cell Biology, 6th ed. New York and London, Garland Publishing, Inc. 2014.

Lodish H. *et al.*, Molecular Cell Biology, 5th ed. Scientific American Books, Inc. 2007.

**Written by: Yanping Quan**

**Reviewed by: Yuehong Wu**

**Date: 2021.4.21**

# Syllabus of Bioseparation Engineering

**Course Name/Title: Bioseparation Engineering**                      **Course code: 86964**

**Course Type:** (Specialized Course)( Optional Course )

**Total Teaching Hours** 32 (Classroom Hours: 2 Laboratory Hours or Tutorial Hours 0)

**Course Credit:** 2

## I Course Introduction

Bioseparation engineering is the main course of biological engineering major. In order to improve the teaching quality, and to construct the unique teaching system on bioseparation engineering course of biological engineering major, optimizing course contents, reform teaching methods and teaching means, improving experimental teaching model and cultivating students' ability of consulting literature were put forward.

Bioseparations engineering deals with the scientific and engineering principles involved in large-scale separation and purification of biological products. It is a key component of most chemical engineering/biotechnology/bioprocess engineering programmes. This course discusses the underlying principles of bioseparations engineering written from the perspective of an undergraduate course. It covers membrane based bioseparations in much more detail than some of the other books on bioseparations engineering. Based largely on the lecture notes the author developed to teach the course, this course is especially suitable for use as an undergraduate level. It is main targeted at graduate students.

## II Course Objective

The Bioseparation Engineering is now being taught in English so as to enhance educational qualities, thus entitled English curriculum in Zhejiang Sci-Tec University.

**Course objective 1.** Bioseparations are critical to the success of modern bio-technology and represent a major manufacturing cost for a wide variety of products. A safe and economic process must be found quickly somewhere in an extremely large parameter space which simply cannot be explored in depth. Bioseparations engineering deals with the scientific and engineering principles involved in large-scale separation and purification of biological products. It is a key component of most chemical engineering/biotechnology/bioprocess engineering programmes.

**Course objective 2.** Fundamental scientific principles underlying the recovery, purification and formulation of biologics (biotherapeutics), especially proteins, are examined. Emphasis is placed on delineating the key chemical and physical properties of biomolecules that impact downstream processing and formulation development.

**Course objective 3.** Laboratories in the analytical and small-scale purification facility provide students with 'hands-on' exposure to key scientific principles and small scale unit

operations.

**Course objective 4.** The other important task of the curriculum is to enlighten students' intelligence on the base of biological knowledge, build up the conception for humans' development with the nature harmoniously. Actually, separations design is a continuing battle to eliminate un-promising regions of parameter space until one finally arrives at an acceptable process. So step is to see what bioseparations have in common, and we begin and learn that process.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	To receive more systematic training in professional theories and skills through compulsory and elective courses, and to master solid basic theories, basic knowledge and basic skills of biological sciences.	Course Objective 1,2,3,4
Graduation Requirement 2	Through certain experimental and practical experience in biotechnology, they will master the experimental skills of related courses as well as relevant biological experimental data processing and analysis methods, and understand the frontier technology and development trend of this field.	Course Objective 1,2,4
Graduation Requirement 3	The ability to use various modern media technologies to actively acquire scientific research information and other knowledge; the ability to systematically master the basic experimental methods and skills in biotechnology and related fields, including the mastery of gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, and early diagnosis of major diseases and basic bioinformatics analysis techniques and other key technologies related to life sciences. Translated with <a href="http://www.DeepL.com/">www.DeepL.com/</a>	Course Objective 1,3,4

## IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<b>Introduction</b> Bioseparation/Key applications of separation technology in applied biology/Fermentation technology/Why need to know upstream and downstream processing	Why bioseparation is key applications of separation technology in applied biology in the future.	2	Lectures, online courses, group seminars etc	1,2,3,4
2	<b>Bioseparation/ classification</b> Introduction/The Need for Bioseparation/ classification of Bioseparation Steps/ Upstream and Downstream Processing/ Some Factors Influencing Bioseparation	1) Know basic concept of Bioseparation etc.. 2) Understand basic theories of Bioseparation etc..	3	Lectures, online courses, group seminars etc	1,2,3
3	<b>Steps in Bioseparation processes</b> Introduction/Product Excretion from the Cell or Cell Disruption/Initial Fractionation/High-Resolution Fractionation/ Conclusions	Understand concept of bioseparation processes etc.	3	Lectures, group seminars etc	1,2,3
4	<b>High-Resolution Fractionation Processes</b> Introduction/Chromatographic Procedures/ Crystallization/Other Techniques/ Conclusions	1) Understand the concept of fractionation biotechnology etc. 2) know chromatographic Procedures/ Crystallization etc.	3	Lectures, online courses, group seminars etc	1,2,3
5	<b>Interfacial protein adsorption and inactivation during bioseparation</b> Introduction/Reaction and Inactivation at Liquid-Liquid Interfaces/Reaction and Inactivation at Gas-Liquid Interfaces/ Reaction and Inactivation at Liquid-Solid	Grasp concepts on Liquid-Liquid Interfaces/ Gas-Liquid Interfaces and significance etc.	3	Lectures, online courses, group seminars etc	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Interfaces/ Conclusions				
6	<b>Protein inactivations during chromatographic methods of separation</b> Introduction/ Chromatographic Techniques / Conclusions	1) Grasp concepts on chromatographic techniques etc. 2) Know potential usage of Chromatographic Techniques etc.	3	Lectures, online courses, group seminars etc	1,2,3
7	<b>Protein Inactivations during novel bioseparation techniques</b> Introduction/Liquid-Liquid Extraction/ Conclusions	Know basic concept and potential usage of Liquid-Liquid Extraction etc.	3	Lectures, online courses, group seminars etc	2,3,4
8	<b>Adsorption influence on Bioseparation and inactivation</b> Introduction/ Adsorption of Proteins and Other Biological Macromolecules/ Heterogeneity in Protein Adsorption/ Techniques for Qualitative Characterization of Protein/ Models for Protein Adsorption on Surfaces/ Conclusions	Know basic concept and potential usage of Know basic concept and potential usage of etc.	3	Lectures, online courses, group seminars etc	2,3
9	<b>Applications and Economics of Bioseparation</b> Introduction/Scale-Up Procedures/ Economics of Bioseparation/ Conclusions	Requirements procedures of scale-up to separation etc.	3	Lectures, online courses, group seminars etc	2,3
10	<b>Protein Refolding Inactivation during Bioseparation</b> Introduction/Different Purification Protocols for recovering proteins in the denatured state/In Vitro Folding Mechanisms/ Conclusions	Grasp basic concept of protein refolding etc. Know the significance and necessity of different Purification protocols etc.	3	Lectures, online courses, group seminars etc	2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
11	<b>Validation of the Production of Biological Products</b> Introduction/Validation of rDNA Processes /Validation of Column-Based Separation Processes/ Validation of Analytic Methods for Pharmaceutical Product Development/ Process Validation of Bulk Biopharmaceuticals/Validation of the Preparation of Clinical Monoclonal Antibodies/Validation Studies for Regeneration of Ion-Exchange Cellulose Columns/Cleaning Validation and Residue Limits/ Conclusions	Grasp basic concept of Validation etc. Know the significance and necessity procedure of Preparation of Clinical Monoclonal Antibodies etc	3	Lectures, online courses, group seminars etc	2,3,4

#### V Period Distribution and Teaching Modes

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attend class, Classroom performance	Frequencies of assignments	Classroom performance 50%	1,2
Presentation, Course paper, etc	Homework, Article reading, etc	presentation 40%	2,3
Big Assignments	Visit factory or Biology company	visit10%	1,2 &3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### **VIII Textbooks and References**

- [1] 曹学君著,《现代生物分离工程》,华东理工大学出版社,上海,2007年1月
- [2] 欧阳平凯,胡永红著,《生物分离原理及技术》,化学工业出版社,北京,2006年2月
- [3] 谭天伟著,《生物分离技术》,第二版,化学工业出版社,北京,2007年8月
- [4] Industrial Bioseparations: Principles and Practice, By Daniel Forciniti, Publish Date: 2007-12-31
- [5] Principles of Bioseparations Engineering, By Raja Ghosh, Publish Date: 2006-10-31
- [6] Bioseparation Engineering: A Comprehensive Dsp Volumen, Paperback - 2009), by Ajay Kumar,  
Abhishek Awasthi
- [7] Process Scale Bioseparations for the Biopharmaceutical Industry, By Abhinav A. Shukla, Mark R. Etzel,  
Shishir Gadam, Publication Date: 2006-07-07

**Written by: Ou LI and Hongxin ZHAO**

**Reviewed by: Haimin CHEN**

**Date: 2021/05/07**

# Syllabus of Developmental Biology

**Course Name/Title:** Developmental biology **Course code:** 86965

**Course Type:** Specialized Course, Optional Course

**Total Teaching Hours:** Classroom Hours: 32

**Course Credit:** 2

## I Course Introduction

Developmental biology is the study of the process by which organisms grow and develop. Modern developmental biology studies the genetic control of cell growth, differentiation and "morphogenesis," which is the process that gives rise to tissues, organs and anatomy. Embryology is a subfield, the study of organisms between the one-cell stage (generally, the zygote) and the end of the embryonic stage, which is not necessarily the beginning of free living. Embryology was originally a more descriptive science until the 20th century. Embryology and developmental biology today deal with the various steps necessary for the correct and complete formation of the body of a living organism.

The related field of evolutionary developmental biology was formed largely in the 1990s and is a synthesis of findings from molecular developmental biology and evolutionary biology which considers the diversity of organismal form in an evolutionary context.

The findings of developmental biology can help to understand developmental malfunctions such as chromosomal aberrations, for example, Down syndrome. An understanding of the specialization of cells during embryogenesis may yield information on how to specialize stem cells to specific tissues and organs, which could lead to the specific cloning of organs for medical purposes. Another biologically important process that occurs during development is apoptosis - programmed cell death or "suicide". For this reason, many developmental models are used to elucidate the physiology and molecular basis of this cellular process. Similarly, a deeper understanding of developmental biology can foster greater progress in the treatment of congenital disorders and diseases, e.g. studying human sex determination can lead to treatment for disorders such as congenital adrenal hyperplasia.

## II Course Objective

Development biology is the study of a process whereby a single cell (the fertilized egg) divides and selectively activates expression of genes to produce a complex organism composed of many cell types. In recent years, with the progress of disciplines in field of life sciences, developmental biology has evolved into a multidisciplinary subject, involving a number of disciplines, such as Cell biology, Embryology, Genetics etc. that are coordinated. The conceptual framework of developmental biology is following the procedures of from morphology to mechanism and from tissues and organs to cells to molecule. The scope of developmental biology covers animal development and plant development and the key questions is differentiation, morphogenesis, growth, reproduction, evolution, environmental intergration. The Central of developmental mechanisms is selectively expression of space/timing gene in cell differentiation.

### (1) Knowledge objectives:

**Course objective 1:** Understand and master the basic definition and theory in developmental biology

**Course objective 2:** Understanding the whole development process and mechanisms of different kinds of organisms consisting of mammal animals, invertebrate animals and plants

**(2) Ability objectives:**

**Course objective 3:** Familiar and grasp with the principle and application of the research techniques in developmental biology

**Course objective 4:** By giving presentation to cultivate self-learning skills

**(3) Quality objectives:**

**Course objective 5:** To cultivate students with basic knowledge of developmental biology.

**Course objective 6:** Motivate the creative thinking of student by introduce frontier study on developmental biology around the world

**III Correlations between Course Objectives and Graduation Requirements**

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation requirements 4	Biological sciences and biotechnology	Course objective 1, 2, 3, 5
Graduation requirements 5	Acquisition of knowledge: self-learning skills, skills on communication and expression	Course objective 4
Graduation requirements 7	Innovation: creative thinking and ability to carry out innovative experiments and technological development	Course objective 5, 6

**IV Course Content and Learning Objective**

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	An introduction of development and developmental biology	To realize the main content and stages of animal developmental, the brief history, research scope and key questions of developmental biology, the central developmental mechanism, and the model organisms.	4	Lectures in class	teaching objective 1, 2
2	Spermatogenesis 1. Forming the haploid spermatid 2. Spermatogenesis: The differentiation of the sperm 3. Structure of the sperm	To learn the structure and forming of the haploid spermatid, the process of spermatogenesis, hormonal and genetic regulation of spermatogenesis.	2 hours	Lectures in class	teaching objective 1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	4. The arrangement of germ cells in the seminiferous tubule 5. Hormonal regulation and Genetic regulation of spermatogenesis				
3	Oogenesis 1. Stages of oogenesis 2. The specific feature of oogenetic meiosis 3. Hormonal regulation and Gene transcription of oogenesis 4. Structure of the egg 5. types of eggs	To learn the stages of oogenesis, the feature of oogenetic meiosis, hormonal and genetic regulation of oogenesis	2 hours	Lectures in class	teaching objective 1, 2, 3, 5
4	Fertilization: Beginning a New Organism Section 1: Recognition of egg and sperm Section 2: Gamete fusion and the prevention of polyspermy Section 3: The activation of egg metabolism	To learn the recognition of egg and sperm, gamete binding and recognition in mammals and sea urchins, gamete fusion and the prevention of polyspermy, the activation of egg metabolism	4 hours	Lectures in class	teaching objective 1, 2, 5, 6
5	Cleavage and Blastula Section 1: The specific features of cleavage Section 2: The patterns of embryonic cleavage	To learn the specific features of cleavage, the patterns of embryonic cleavage, blastula formation	2 hours	Lectures in class	teaching objective 1, 2, 3, 4
6	Gastrulation and Morphogenesis	To learn the ways of cell migration during gastrulation, sea Urchin gastrulation, lancelet gastrulation and morphogenesis, amphibian gastrulation, gastrulation in fish	2 hours	Lectures in class	teaching objective 1, 2, 3, 4
7	Gastrulation and	To learn gastrulation in birds,	2 hours	Lectures	teaching

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Morphogenesis	mammals, extraembryonic structures in terrestrial animals, germ layer derivations and the organogenesis		in class	objective 1, 2, 5, 6
8	Embryonic Cell Differentiation & Regulation of Selective Gene Expression	To learn specification and commitment, morphogenetic determinant and cytoplasm localization	2 hours	Lectures in class	teaching objective 1, 2, 3, 4
9	Embryonic Cell Differentiation & Regulation of Selective Gene Expression	To learn Cell-Cell communication in development, epigenetic regulation on gene differential expression	2 hours	Lectures in class	teaching objective 1, 2, 5, 6
10	Body plan and pattern formation during embryogenesis and organogenesis--Axis Specification and Formation	To learn the body plan and pattern formation in Drosophila, axis formation in Amphibians	2 hours	Lectures in class	teaching objective 1, 2, 5, 6
11	Organogenesis Section I. Germ plasm and the determination of the primordial germ cells	To learn germ plasm and the determination of the primordial germ cells	2 hours	Lectures in class	teaching objective 1, 2, 5, 6
12	Organogenesis Section II. Germ cell migration	To learn Germ cell migration	2 hours	Lectures in class	teaching objective 1, 2, 5, 6
13	Sex determination	To learn Primary and secondary sex determination, sex determination in Drosophila	2 hours	Lectures in class	teaching objective 1, 2, 5, 6
14	Sex determination Section 3. Decisions of germ cell differentiation in C. Elegans ovotestis Section 4. Germ cell	To learn Decisions of germ cell differentiation in C. elegans ovotestis, germ cell fates, environmental sex determination	2 hours	Lectures in class	teaching objective 1, 2, 5, 6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	fates Section 5. Environmental sex determination				

#### V Period Distribution and Teaching Modes

	theory Taught	problem lesson	discuss lesson	remark	subtotal
An introduction of development and developmental biology	4		0		4
Spermatogenesis	1		1		2
Oogenesis	1		1		2
Fertilization: Beginning a New Organism	3		1		4
Cleavage and Blastula	1		1		2
Gastrulation and Morphogenesis	4				4
Embryonic Cell Differentiation & Regulation of Selective Gene Expression	4				4
Body plan and pattern formation during embryogenesis and organogenesis--Axis Specification and Formation	2		0		2
Organogenesis	3				4
Sex determination	3				4
Total	28		4		32

## VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Attend class	20%	1,3,5,6
Presentation	Oral presentation	40%	1,4,5,6,
Curriculum paper	A review paper	40%	1,2,3,5,6

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

## VII Textbooks and References

### 1. Textbook:

[1] Developmental Biology, 10<sup>th</sup> Edition, Scott F. Gilbert, Swarthmore College, 2012, Publishers: Sinauer Associates, Inc.

### 2. References:

[1] Principles of Development. Lewis Wolpert, Rosa Beddington, Thomas Jessell, Peter Lawrence,  
[2] Elliot Meyerowitz, Jim Smith. Oxford university press, Oxford university press Inc., New York.

[3] 《发育生物学》，张红卫主编，2001，高等教育出版社。

[4] 《发育生物学》，Müller W A(德)，黄秀英等译，1998，高等教育出版社。

[5] 《发育生物学》，桂建芳等，2002，科学出版社

**Written by:** Ruihong Wang

**Reviewed by:** Zhechen Qi

**Date:** 2021-5-23

# Syllabus of Inorganic and Analytical Chemistry

**Course Name/Title:** Inorganic and Analytical Chemistry **Course code:** 86966

**Course Type:** (Specialized Compulsory Course)

**Total Teaching Hours:** (Classroom Hours: 48 )

**Course Credit:** 3

## I Course Introduction

Inorganic and analytical chemistry is a specialized compulsory course as well as the first basic chemistry course for students majoring in biotechnology. It consists of inorganic chemistry and analytical chemistry.

Inorganic chemistry includes two parts, theory and elements. Theoretical part includes periodic trends, structures of atoms and molecules, chemical thermodynamics and chemical equilibrium. Elementary part includes the properties of some important elements in the periodic table. Limited by the course hour, only part one can be lectured in class hours.

Analytical chemistry only refers to chemistry analysis, which includes data processing and the principles and methods of titrimetric analysis.

The teaching way of thinking is from structure, balance and property to application. Students are required to grasp the fundamental principles of inorganic chemistry as well as the analytical and data processing methods in analytical chemistry. Furthermore, the course should cultivate the students' ability of applying the concept of inorganic and analytical chemistry analyzing and solving practical problems.

## II Course Objective

1. Dialectic materialism theories will be utilized during the course to explain chemical basic principles and rules of elements and chemical reactions, in order to promote formation of Weltanschauung of dialectic materialism.

Try to help students to understand some questions of wide interest in order to enrich their social responsibilities, strengthen their understanding about that science and technology is the first fertility, let them get to know the current status of the chemistry and chemical industries in the world, inspire their proper attitude towards study, love and get them to devote to chemistry and chemical technology relating career. Teach student scientific thinking way, help them adapt study in university and improve their ability of self-study and self-solving chemistry questions.

Combine new development of the chemical industries, reflect the developing trends of inorganic and analytical chemistry and its practical applications in high technologies, stimulate students' enthusiasm and consciousness, and incubate their independence, activity and creativity

2. Knowledge objective: Students are required to grasp the fundamental principles of inorganic chemistry as well as the analytical and data processing methods in analytical chemistry. Furthermore, the course should cultivate the students' ability of applying the

concept of inorganic and analytical chemistry analyzing and solving practical problems.

3. Ability objective: Objective to cultivate students' self-study ability, and enhance their technique of practical operation.
4. Quality objectives: It helps train students' serious and strict attitude

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 3	Master solid basic theory, basic knowledge chemistry science	Course Objective 1, 2
Graduation Requirement 8	The ability to systematically master basic I methods and skills in biotechnology and related fields	Course Objective 2,3,4

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Introduction §1.1 Chemistry---the central science full of practicability and creativity §1.2 Features of chemical changes §1.3 History, revival and development of inorganic and analytical chemistry §1.4 How to study easily but efficiently inorganic and analytical chemistry §1.5 Styles and forms of examination for the course	Make clear how to study effectively and efficiently, clarifying requirements, course plan and styles of examinations	1	Lecture and seminar	1,4
2	Chapter 2 Thermochemistry §2.1 Basic terms in thermodynamics §2.2 the First law of thermodynamics §2.3 Thermochemistry §2.4 the Second law of thermodynamics §2.5 Gibbs function	<b>To know:</b> the measurement of the heat effect in chemical reactions, Gibbs equation. <b>To understand:</b> the concepts of state function, enthalpy, molar enthalpy change, standard molar enthalpy of formation and so on. <b>To grasp:</b> thermochemical equation, enthalpy change of a reaction, Hess' law and related calculation.	4	Lecture	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
3	Chapter 3 Chemical kinetics and Chemical equilibria §3.1 Chemical equilibria §3.2 The shift of a equilibrium §3.3 Chemical reaction rate and reaction mechanisms §3.4 Effect of concentration of reactants on reaction rate —the rate expression §3.5 the relation between concentration of reactants and reaction time §3.6 Effect of temperature on reaction rate—Arrhenius equation §3.7 Brief introductory to reaction rate theory §3.8 Effect of catalyst on the rate of chemical reaction	<b>To know:</b> reaction mechanisms <b>To understand:</b> reaction rate theory, the relation between concentration of reactants and reaction time <b>To grasp:</b> Chemical equilibria, Effect of concentration of reactants on reaction rate	4	Lecture	2, 3
4	Chapter 4 Dissociation Equilibria § 4.1 The theories of acids and bases § 4.2 Equilibria in solutions of weak acids and weak bases § 4.3 Solutions of strong electrolytes § 4.4 Buffer solutions § 4.5 Precipitation-dissolution equilibria	<b>To know:</b> activity and the activity coefficient, common ion effect, HSAB rules <b>To understand:</b> the equilibrium of stepwise process of polyprotic weak acid and calculation of equilibrium composition <b>To grasp</b> The theories of acids and bases, Equilibria in solutions of weak acids and weak bases	8	Lecture	2, 3
5	Chapter 5 Redox Reactions §5.1 The fundamental concepts of redox reactions §5.2 Equalization of redox reaction chemical equation §5.3 Electrode potentials §5.4 Application of electrode potentials	<b>To know:</b> Equalization of redox reaction chemical equation <b>To understand</b> Application of electrode potentials <b>To grasp</b> Electrode potentials	6	Lecture	2, 3
6	Chapter 6 Atomic structure 6.1 The atomic structure of hydrogen 6.2 The atomic structure of many-electron atoms 6.3 Periodic law of elements	<b>To know:</b> Schrödinger equation, wave function and electron cloud <b>To understand:</b> hydrogen spectrum and the concept of energy level	4	Lecture	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<b>To grasp</b> Periodic law of elements			
7	Chapter 7 Molecular structure §7.1 Valence Bond Theory §7.2 Valence Shell Electron Pair Repulsion (VSEPR) Theory §7.3 Molecular Orbital Theory §7.4 Bond Parameters	<b>To know:</b> Molecular Orbital Theory <b>To understand:</b> Valence Shell Electron Pair Repulsion (VSEPR) Theor <b>To grasp</b> Valence Bond Theory	4	Lecture	2, 3
8	Chapter 8 Coordination compounds §8.1 Configurations and definition of Coordination Compounds §8.2 Classification and nomination of Coordination Compounds §8.3 Isomerism of coordination compounds. §8.4 Chemical Bonding Theory in Complexes	<b>To know:</b> Chemical Bonding Theory in Complexes <b>To understand:</b> Isomerism of coordination compounds. <b>To grasp</b> Configurations and definition of Coordination Compounds, Classification and nomination of Coordination Compounds	4	Lecture	2, 3
	Chapter 9 Error and Data Processing in quantitative analysis 9.1 significant figure 9.2 Source and classification of error 9.3 Processing of test data	<b>To understand:</b> Source and classification of error <b>To grasp:</b> Processing of test data	4	Lecture	2, 3
	Chapter 10 Titrimetric analysis 10.1 General Principles 10.2 Acid-base Titration 10.3 Complexometric Titration 10.4 Oxidation-reduction Titration 10.5 Precipitation Titration	<b>To know:</b> distribution coefficient, conditional potentials, coefficient of acid effect, conditional stability constant, the difference between the stoichiometric point and the end point. <b>To understand:</b> titration curve <b>To grasp:</b> basic concepts of titrimetric analysis, application of titrimetric analysis and calculation methods of titrimetric	9	Lecture	2, 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		analysis			

#### V Period Distribution and Teaching Modes

	Teaching	Practice	Discussion	Note	Summary
Preface	0.5		0.5		1
Thermochemistry	3.5	0.5			4
Chemical kinetics and Chemical equilibria	4				4
Dissociation Equilibria	7.5	0.5			8
Redox Reactions	5.5	0.5			6
Atomic structure	4				4
Molecular structure	4				4
Coordination compounds	3.5	0.5			4
Error and Data Processing in quantitative analysis	3.5	0.5			4
Titrimetric analysis	8.5	0.5			9
Total	44.5	3	0.5		48

#### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Arrival late, Leaving early and Absence	10%	4
homework + Classroom Performance	Classroom questioning and homework review. Focusing on the mastery of knowledge points.	30%	1,2,3
Final exam	Close book. Score according to the scoring standard	60%	2,3,4

#### VII Textbooks and References

1. David S. Hage & James D. Carr, Analytical Chemistry and Quantitative Analysis, China Machine Press, 2012.

2. 魏云霞, 马明广, Analytical Chemistry 分析化学(双语版), 化学工业出版社, 2013.

3. 陆家政, 无机化学, 化学工业出版社, 2009

网络资源:

[1] <http://jpkc.nwu.edu.cn/pthx/introduction/index.html>

[1] [http://jpkc.whu.edu.cn/coursefile/wuhandaxuejingpinkechengzaixian\\_20080527/index.php](http://jpkc.whu.edu.cn/coursefile/wuhandaxuejingpinkechengzaixian_20080527/index.php)

**Written by: REN Xiaoyuan**

**Reviewed by: Zhao XueQin**

**Date: 2021/5/4**

## Syllabus of Botany

**Course Name/Title: Botany**                      **Course code: 86968**

**Course Type:** (Specialized Course)(Compulsory Course)

**Total Teaching Hours:** 32 (Classroom Hours: 32 )

**Course Credit:** 2

### I Course Introduction

This book consists of 11 chapters. Chapter 1, an introduction to the science of botany, introduces important biological concepts and lays the foundation for understanding how science works and information on the three domains recognized in classification of organisms. Chapter 2 focuses on the structure and functions of cells and their membranes. Chapters 4-6 discuss the structural adaptations of roots, stems, and leaves. Chapters 7,8 describe reproduction in flowering plants, including discussions of flowers, fruits, and seeds. Chapter 9 describes how biologists classify plants. Gymnosperms in Chapter 10 and flowering plants in Chapter 11.

### II Course Objective

**Course objective 1:** Master plant kingdom and the diversity of plants, understand the role of plants in nature and national economy, improve the students' interest in study of botany.

**Course objective 2:** Master plant cell growth and differentiation, plant tissue and types, establish the concept of plant organs.

**Course objective 3:** Master plant root, stem and leaf morphology and developmental process, understand the dialectical relationship between morphological structure and physiological function.

**Course objective 4:** Master flower, fruit and seed morphology and developmental process, understand the dialectical relationship between morphological structure and physiological function.

**Course objective 5:** Master the classification of plants and important plant species, including gymnosperms and flowering plants.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Through the compulsory and elective courses, we will receive systematic professional theory and professional skills training, and master solid basic theory, basic knowledge and basic skills of biological science.	Course Objective 1,2,3,4,5
Graduation Requirement 5	Be proficient in reading professional journals and literature retrieval in foreign languages, and be able to communicate and write in foreign languages.	Course Objective 1,2,3,4,5

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	CHAPTER 1 An Introduction to the Science of Botany	<ol style="list-style-type: none"> <li>1) Briefly describe the field of botany, and give short definitions of at least five subdisciplines of plant biology.</li> <li>2) Summarize and discuss the features of plants and other organisms that distinguish them from nonliving things.</li> <li>3) Distinguish among the six kingdoms and three domains, and give representative organisms for each.</li> <li>4) Master binomial system of nomenclature.</li> <li>5) For example, Chinese Nobel laureate Tu youyou found that artemisinin can effectively treat malaria, encourage students to devote themselves to national scientific research and inspire their patriotic feelings.</li> </ol>	2	Classroom teaching	course objective 1
2	CHAPTER 2 Plant Cells	<ol style="list-style-type: none"> <li>1) Contrast prokaryotic and eukaryotic cells.</li> <li>2) Describe the functions of the following 10 parts of a plant cell: plasma membrane, nucleus, chloroplasts, mitochondria, ribosomes, endoplasmic reticulum, Golgi apparatus, vacuole, cytoskeleton, and cell wall.</li> <li>3) Summarize the similarities and differences between plant cells and animal cells.</li> <li>4) Explain the basic structure of the fluid mosaic model of a membrane.</li> </ol>	2	Classroom teaching	course objective 2
3	CHAPTER 3 Plant Tissues	<ol style="list-style-type: none"> <li>1) Discuss the plant body, including the root system and shoot system.</li> </ol>	4	Classroom teaching	course objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		2) Describe the ground tissue system (parenchyma tissue, collenchyma tissue, and sclerenchyma tissue) of plants. 3) Outline the structure and function of the vascular tissue system (xylem and phloem) of plants 4) Describe the dermal tissue system (epidermis and periderm) of plants. 5) Discuss what is meant by growth in plants and how it differs from growth in animals. 6) Distinguish between primary and secondary growth.			2
4	CHAPTER 4 Plant Organs: Roots	1) Describe the functions of roots, and describe two features of roots that shoots lack. 2) Contrast the structure of a primary eudicot root and a monocot root, and describe the functions of each tissue. 3) Trace the pathway of water from the soil through the various root tissues. 4) Describe several roots that are modified to perform unusual functions. 5) Discuss the significance of roots to humans.	4	Classroom teaching	course objective 3
5	CHAPTER 5 Plant Organs: Stems	1) Describe three functions of stems. 2) Relate the functions of each tissue in an herbaceous stem. 3) Contrast the structures of an herbaceous eudicot stem and a monocot stem. 4) Distinguish between the structures of stems and roots. 5) Outline the transition from primary growth to secondary	4	Classroom teaching	course objective 3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>growth in a woody stem. List the two lateral meristems, and describe the tissues that arise from each.</p> <p>6) Contrast the various stems that are specialized for asexual reproduction.</p>			
6	CHAPTER 6 Plant Organs: Leaves	<p>1) Describe the major tissues of the leaf (epidermis, mesophyll, xylem, and phloem), and relate the structure of the leaf to its function of photosynthesis.</p> <p>2) Contrast leaf structure in eudicots and monocots.</p> <p>3) Outline the physiological changes that accompany stomatal opening and closing.</p> <p>4) List at least five modified leaves, and give the function of each.</p>	2	Classroom teaching	course objective 3
7	CHAPTER 7 Plant Organs: Flowers	<p>1) Name the parts of a flower, and describe the functions of each part.</p> <p>2) Compare the general characteristics of flowers pollinated in different ways (by insects, birds, bats, and wind).</p> <p>3) Master the morphology and composition of flower, development and reproduction of angiosperm, development of embryo.</p>	2	Classroom teaching	course objective 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
8	CHAPTER 8 Plant Organs: Seeds and Fruits	<ol style="list-style-type: none"> <li>1) Distinguish between pollination and fertilization.</li> <li>2) List and define the main parts of a seed.</li> <li>3) Distinguish among simple, aggregate, multiple, and accessory fruits; give examples of each type; and cite several different methods of seed and fruit dispersal.</li> </ol>	2	Classroom teaching	course objective 4
9	CHAPTER 9 The Classification of Plants	<ol style="list-style-type: none"> <li>1) Define taxonomy, and explain why the assignment of a scientific name to each species is important for biologists.</li> <li>2) Identify the biologist who originated the binomial system of nomenclature, and describe the general scheme of the system.</li> <li>3) List and describe the hierarchical groupings of classification</li> <li>4) Define systematics, and describe the cladistic approach to systematics.</li> <li>5) List and briefly describe the three domains and six kingdoms recognized by many biologists.</li> <li>6) For example, the compendium of the compendium written by Li shizhen in Ming Dynasty benefits human health, encourage students to actively develop China's rich medicinal plant resource.</li> </ol>	2	Classroom teaching	course objective 5
10	CHAPTER 10 The Plant Kingdom: Gymnosperms	<ol style="list-style-type: none"> <li>1) Compare the features of seeds with those of spores, and discuss the adaptive advantages of plants that reproduce by seeds.</li> <li>2) Distinguish between a seed and an ovule, and define integuments.</li> <li>3) Summarize the features that distinguish gymnosperms from</li> </ol>	2	Classroom teaching	course objective 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		seedless vascular plants. 4) Name and briefly describe the four phyla of gymnosperms. 5) Contrast monoecious plants and dioecious plants. 6) Trace the steps in the life cycle of pine, and compare the sporophyte and gametophyte generations. 7) Describe the ecological and economic significance of gymnosperms. 8) Trace the evolution of gymnosperms from seedless vascular plants.			
11	CHAPTER 11 The Plant Kingdom: Flowering Plants	1) Summarize the features that distinguish flowering plants from gymnosperms. 2) Describe the ecological and economic significance of the flowering plants. 3) Distinguish between monocots and eudicots, the two largest classes of flowering plants, and give specific examples of each class. 4) Briefly explain the life cycle of a flowering plant, and describe double fertilization. 5) Discuss some of the evolutionary adaptations of flowering plants. 6) Trace the evolution of flowering plants from gymnosperms. 7) Distinguish between basal angiosperms and core angiosperms. 8) Briefly describe the distinguishing characteristics and give an example or two of each of the following flowering plant families: magnolia, walnut, cactus, mustard, rose, pea, potato,	6	Classroom teaching	course objective 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		pumpkin, sunflower, grass, orchid, and agave.			

#### V Period Distribution and Teaching Modes

CHAPTER 1: An Introduction to the Science of Botany, classroom teaching, 2 class hours.

CHAPTER 2: Plant Cells, classroom teaching, 2 class hours.

CHAPTER 3: Plant Tissues, classroom teaching, 4 class hours.

CHAPTER 4: Plant Organs-Roots, classroom teaching, 4 class hours.

CHAPTER 5: Plant Organs-Stems, classroom teaching, 4 class hours.

CHAPTER 6: Plant Organs-Leaves, classroom teaching, 2 class hours.

CHAPTER 7: Plant Organs-Flowers, classroom teaching, 2 class hours.

CHAPTER 8: Plant Organs-Seeds and Fruits, classroom teaching, 2 class hours.

CHAPTER 9: The Classification of Plants, classroom teaching, 2 class hours.

CHAPTER 10: The Plant Kingdom-Gymnosperms, classroom teaching, 2 class hours.

CHAPTER 11: The Plant Kingdom-Flowering Plants, classroom teaching, 6 class hours.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
classroom performance		30%	Oral questioning
conventional assignments	11times/term	20%	Observation of performance
final exam	close-book	50%	Written test

#### VII Textbooks and References

**Textbooks:** Botany, handout by instructor

**References:** Fu Guilian, 《Molecular biology inspection technology》Version 1, People's Medical Publishing House, Published in 2003.

**Written by:** Yang Zongqi

**Reviewed by:** Qi Zhecheng

**Date:** 2021.4.19

# Syllabus of Zoology

**Course Name/Title:** Zoology                      **Course code:** 86969

**Course Type:** Basic Course (Compulsory Course)

**Total Teaching Hours:** 32 (Classroom Hours: 32)

**Course Credit:** 2

## I Course Introduction

Zoology is one of the compulsory courses offered to undergraduate students who major in bioscience in a college or university, and is now being taught in English so as to enhance educational qualities, thus entitled English curriculum in Zhejiang Sci-Tech University.

The English curriculum of Zoology is a survey of the major Phyla of animals. Emphasis is placed upon: the major patterns of animal form within each Phylum, taxonomic diversity, life-history strategies, ecological relationships, and evolutionary development.

## II Course Objective

Through the study of Zoology course, students are expected to attain the following course objectives:

### 1. Knowledge targets

**Course Objective 1:** Strengthen education of the protection of wild animals, the protection of natural resources and rational development and utilization, and enhance the students' awareness of environmental protection and patriotic feelings

**Course Objective 2:** Comprehend the professional status and recent advances in Zoology

**Course Objective 3:** Master the knowledge on basic form, structure and function of major groups of animals

**Course Objective 4:** Understand principles of animal morphology, taxonomy, and evolution

### 2. Ability targets

**Course Objective 5:** Improve ability of expression academic ideas fluently, special literature reading and thesis writing

**Course Objective 6:** Improve ability of creative thinking and to carry out innovative experiments

### 3. Quality targets

**Course Objective 7:** Gain an elementary training in scientific research, and lay a good foundation to competent for teaching Zoology and relevant courses.

**Course Objective 8:** Enlighten students' intelligence on the base of zoological knowledge, direct them to go deep into understanding animals, living beings, and even the whole nature, build up the conception for humans' development with the nature harmoniously, and become capable of maintaining and protecting biodiversity and ecological environment scientifically.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	A comprehensive understanding of	Course Objective 1,2,3,4,5,6

	the basic theory of biological science and biotechnology, understanding of biological industry and other aspects of theoretical knowledge, and to master the ability to use them to analyze and solve problems	
Graduation Requirement 7	With the comprehensive use of the theoretical knowledge and skills, engaging in biotechnology and related fields of product development, engineering practice and technical innovation	Course Objective 7,8

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction	Comprehend the biologic kingdoms and the place occupied by animals, the theories and evidences to group organisms into kingdoms, the status of animal kingdom, the objective and significance to study zoology, methodology for zoological studies; Through the development history of zoology in China from glory to decline and then to catching up, emphasize national consciousness, carry out patriotism education, take national interests, national conditions concept and international vision as the key content, guide the students to correctly understand the responsibility and historical mission of The Times, and stimulates the youth dream with the Chinese dream;	2	Lecture	1,2,3,5,6
2	Taxonomy and Phylogeny of Animals, and protozoa	Comprehend order in Diversity, Linnaeus and Taxonomy; Grasp binomial species nomenclature, species concept, taxonomic characters, phylogenetic inference and theories of Taxonomy Master characteristics of important groups, Euglena, Ciliata, Amoeba and paramecium; commonly seen species belonging to the group. Understand the relationship between protozoans and humans, systematic development of protozoans Understand parasitic species and parasitic control principles and protozoa in academic and economic	2	Lecture	1,2,3,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		research value and economic significance. The introduction of Tu Youyou and other scientists in the process of artemisinin development and the success of malaria control is of great significance to the anti-malaria work in China and the world			
3	The Origin of multicellular animals and porifera	Comprehend the evolution from monocellular animals to multicellular ones, evidences of multicellular animals originating from monocellular ones, the important stages of embryonic development; Grasp form and structure of poriferans, reproduction and development of poriferans, classification and the place of the phylum Porifera (Calcarea, Hexactinellida, Demospongiae) and economic values of poriferans Expand and discusse "what is life" this classic and eternal question, introduce thousands of years of ancient and modern Chinese and foreign exploration of life and the cognitive process, through the above content to make students love life, understand life, fear life	2	Lecture	3,4,5,6,7,8
4	Coelenterata	Grasp characteristics of the phylum Coelenterata (radial symmetry, two embryonic layers, original nervous system -- nerve net), representative of the phylum -- Hydra, classes of the phylum (Hydrozoa, Scyphozoa, Anthozoa); Comprehend systematic development of coelenterates	2	Lecture	3,4,5,6,7,8
5	Platyhelminthes	Grasp characteristics of Platyhelminthes, Turbellaria (representative -- Dugesia, characteristics and classification of the class), Trematoda (representative Clonorchis sinensis, characteristics and classification of the class), Cestoda (representative -- Taenia solium, characteristics and classification of the class); Comprehend systematic development of Platyhelminthes and control principles	2	Lecture	3,4,5,6,7,8
6	Nematoda	Grasp characteristics of the phylum Nematoda, representative -- Ascaris lumbricoides,	2	Lecture	3,4,5,6,7

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		classification of the phylum, several important, commonly seen worms. Comprehend systematic development of Nematoda and control principles			,8
7	Annelida	Grasp characteristics of the phylum Annelida: metamerism, secondary coelom, seta and parapodium, circulative system, metanephridium, nerve cord, trochophore, representative -- Pheretima: external form, internal structure, classification of the phylum Annelida: Polychaeta, Oligochaeta, Hirudinea; Comprehend economic significance of annelids and systematic development of annelids	2	Lecture	3,4,5,6,7,8
8	Mollusca	Grasp characteristics and classification of the phylum Mollusca: Gastropoda [Representative -- Cipangopaludina, Characteristics, the origin of the asymmetrical body, Classification of the class Gastropoda]; Lamellibranchia (Representative -- Anodonta, Characteristics, Classification of the class Lamellibranchia); Cephalopoda (Representative -- Sepia, Classification of the class Cephalopoda). Comprehend economic importance of mollusks and systematic development of mollusks	2	Lecture	3,4,5,6,7,8
9	Arthropoda	Grasp main characteristics of Arthropoda (solid and developed exoskeleton, highly efficient respiratory apparatus -- trachea, simplified open circulatory system, metamerism with tagmatization, jointed appendages, strong and powerful, striated muscle, sensitive feeling organs and developed nervous system, unique digestive system and newly emerged Mulpigian tube).	2	Lecture	3,4,5,6,7,8
10	Arthropoda	Grasp classification of Arthropoda [Onychophora (or Prototracheata), Crustacea, Merostomata, Arachnoida , Myriapoda, Insecta (representative -- Oxya chinensis, summary and characteristics, important groups)]; Understand relationship between arthropods and humans and systematic development of arthropods	2	Lecture	3,4,5,6,7,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
11	Chordata	Grasp main characteristics of Phylum Chordata (notochord, dorsal tubular nerve cord, pharyngeal gill slits, heart and aorta, post-anal tail), chordate classification [Urochordata (Styela clava); Cephalochordata (Branchiostoma belcheri), vertebrata (Cyclostomata, Pisces, Amphibia, Reptilia, Aves, Mammalia)], Urochordata (Styela clava) Cephalochordata (Branchiostoma belcheri), vertebrata [apparent head, notochord, gill, gill slits, lung, upper jaw, lower jaw, perfect circulatory system, kidney, paired appendages (fin, limb)]	2	Lecture	3,4,5,6,7,8
12	Class Cyclostomata and Pisces	Grasp Main characteristics of class Cyclostomata (form and ten systems of lamprey), Cyclostomata classification; Understand ecology of Cyclostomata. Grasp main characteristics of class Pisces, including form, structure, and function of its ten systems, points of fish classification; Understand fish migration and its economic significance	2	Lecture	3,4,5,6,7,8
13	Class Amphibia	Understand transformation of animals from aquatic forms to terrestrial ones; Grasp main characteristics of Class Amphibia (form, structure, and function of Amphibia), classification of Amphibia; Understand economic significance of Amphibia	2	Lecture	3,4,5,6,7,8
14	Class Reptilia	Grasp main characteristics of Class Reptilia, classification of Reptilia (form, structure, and ecological features of lizards, snakes and boas, tortoises and turtles, and crocodiles); Understand relationship between reptilians and humans	2	Lecture	3,4,5,6,7,8
15	Class Aves	Grasp main characteristics of class Aves, classification of Aves (form, structure, and function of ostriches, penguins, and various birds belonging to the superorder Carinatae), reproduction, ecology and migration of birds; Understand relationship between birds and humans	2	Lecture	3,4,5,6,7,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
16	Class Mammalia	Grasp main characteristics of Class Mammalia, classification of Mammalia (form, structure, function and ecological points of duckbills, kangaroos, and various animals belonging to the Subclass Eutheria); Undersand biological bases on mammal conservation, persistent utilization and vermin control	2	Lecture	3,4,5,6,7,8

#### V Period Distribution and Teaching Modes

As the above table shows, the course is comprised of 16 times of lectures with each lasting 2 periods. The lecture is performed mainly by teachers' teaching, while students' self-study is a good supplement. In teaching process, heuristic method, method of discussion and other effective ones are adopted to strengthen communication between teachers and students, guide students to think independently, to mobilize the enthusiasm of students, and to train students on the ability to obtain information to solve problems.

Teaching means is by using multimedia courseware, making full use of the advantages of acoustic image, and then supplemented by the necessary writing on the blackboard, so as to strengthen the teaching content, point out the key part, explain the difficulties.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
classroom performance	call-over in the classroom and questions	15%	1,2,3,4,5,6,7,8
classroom performance	presentation	15%	1,2,3,4,5,6,7,8
conventional assignments	outside class	20%	1,2,3,4,5,6,7,8
final exam	close-book	50%	1,2,3,4,5,6,7,8

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### VII Textbooks and References

Cleveland P. Hickman, Jr, et al., Integrated principles of Zoology. McGraw-Hill press. 2014

**Written by: Jiang Yonghou**

**Reviewed by: Chen Jian**

**Date: 2021.4.18**

# Syllabus of Plant Physiology

**Chinese name of course:** 植物生理学

**Course Code:** 86970

**English name of course:** Plant Physiology

**Classification and characteristic of the course:** (basic subject)(optional)

**Total teaching hours:** 32 teaching hours (32 for lectures, 0 for experiments, computer or extra-curricular practice)

**Credit:** 2

**Prerequisite:** Botany

**Applicable specialty:** Biotechnology specialty

**Department (Room):** Department of Biotechnology

## 1、 Introduction of the course

Plant Physiology is the basic course and includes a lot of contents; we thus selected the main points for teaching. In addition, the course ties closely with other courses of plant science, such as plant molecular biology, bioreactor, bioengineering, and plant metabolism. Therefore, we will introduce students to essential topics of plant physiology. The main contents include photosynthesis and other biochemical processes of plants, water transport and nutrient uptake, plant interactions with the environment, phytohormone, and signaling from sunlight.

## 2、 Course Objective

### (1) Ideological and political objectives

There are many positive stories in the research history of Plant Physiology that will attract students to study plant science. Such as the application of GAs in fruit culture, the green revolution, ethylene detection history. In addition, the story of Yuan Longping will improve the students' learning passion. Importantly, Plant Physiology plays core roles in ensuring people's basic living needs in China, such as semi-dwarf breeding, plant modification of contaminant environments. Thus, the ideological and political objectives are to use the stories to attract students to study Plant Physiology, explain the problems that we meet in agriculture system and environments today and let students deeply understand the sentence "Clear waters and green mountains are as good as mountains of gold and silver".

### (2) Knowledge Objective

Students should master basal principles, be familiar with some points, and comprehend some hypotheses. Encouraging students to integrate theory with practice, and improve their ability of self-study. For example, let students to analyze the relation between the biosynthesis of GA in plants and GA's applications in the culture of fruits and flowers.

### (3) Quality Objective

Students have the ability of solving the practical problem, mastering some techniques in Plant Physiology, dialectical thinking with the results they get from their experiments.

## 3、 The corresponding relationship between curriculum teaching objectives and graduation requirements

Graduation requirements	Graduation requirement target point	Objectives
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Graduation Requirement 3	Having the knowledge of the general literature, history, philosophy, bioethics, ideological and moral, political science, art, law, and psychology. Learning the law of development of human society and its knowledge, including economics, law, political science, sociology, journalism and other aspects, and knowledge of mathematics, physics, chemistry, and etc. Having the well operation skills in computer and information science.	Course objectives 1,2
Graduation Requirement 4	Receiving systematic training in professional theories and skills through compulsory and elective courses, and master solid basic theories, basic knowledge and basic skills of Bioscience.	Course objectives 2, 3

#### 4、 The relationship between teaching content and curriculum objectives

##### The relationship of teaching content and objectives

No.	Teaching contents	Teaching requirements	hours	methods	objectives
1	Plant Cell	1. Plant life: Unifying principles 2. Overview of plant structure 3. The plant cell 4. The cytoskeleton 5. Cell cycle regulation 6. Plasmodesmata <b>The emphases:</b> Structure of the plant cells, cytoskeleton, cell regulation, plasmodesmata, and the differences between plant and animal cells. <b>The difficulties:</b> Cytoskeleton, cell regulation, and plasmodesmata.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
2	Energy and Enzymes	1. Energy flow through living systems 2. Energy and work 3. The direction of spontaneous processes 4. Free energy and chemical potential 5. Redox reactions 6. The electrochemical potential 7. Enzymes: the catalysts of life <b>The emphases:</b> Energy flow through living systems, free energy and chemical potential, redox reactions, and enzymes. <b>The difficulties:</b> Free energy and chemical potential, redox reactions, and enzymes.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
3	Water and plants	1. Water in plant life 2. The structure and properties of water 3. Water transport processes 4. Water in the soil 5. Water absorption by roots 6. Water transport through the xylem 7. Water movement from the leaf to the atmosphere 8. Overview: the soil-plant-atmosphere continuum <b>The emphases:</b> Water transport processes, water	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3

No.	Teaching contents	Teaching requirements	hours	methods	objectives
		absorption by roots, water transport through the xylem, and water movement from the leaf to the atmosphere. <b>The difficulties:</b> Water transport processes and water movement from the leaf to the atmosphere.			
4	Mineral nutrition and solute transport	1. Essential nutrients, deficiencies, and plant disorders 2. Treating nutritional deficiencies 3. Soil, roots, and microbes 4. Passive and active transport 5. Transport of ions across a membrane barrier 6. Membrane transport processes 7. Ion transport in roots <b>The emphases:</b> Essential nutrients, deficiencies, and plant disorders, passive and active transport, membrane transport processes, and ion transport in roots <b>The difficulties:</b> Essential nutrients, deficiencies, and plant disorders, passive and active transport, and membrane transport processes.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
5	Assimilation of mineral nutrients	1. Nitrogen in the environment 2. Nitrate assimilation 3. Ammonium assimilation 4. Biological nitrogen fixation 5. Sulfur assimilation 6. Phosphate assimilation 7. Cation assimilation 8. Oxygen assimilation 9. The energetic of nutrient assimilation <b>The emphases:</b> Nitrogen fixation, nitrogen, sulfur, phosphate, and oxygen assimilation. <b>The difficulties:</b> Nitrogen, sulfur, phosphate, and oxygen assimilation.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
6	Photosynthesis: the light reactions	1. Photosynthesis in higher plants 2. General concepts 3. Key experiments in understanding photosynthesis 4. Organization of the photosynthetic apparatus 5. Organization of light-absorbing antenna systems 6. Mechanisms of electron transport 7. Proton transport and ATP synthesis in the chloroplast 8. Repair and regulation of the photosynthetic machinery 9. Genetics, assembly, and evolution of photosynthetic systems <b>The emphases:</b> Photosynthesis in higher plants, key experiments in understanding photosynthesis, organization of the photosynthetic apparatus, mechanisms of electron transport, proton transport and ATP synthesis in the chloroplast, and repair and regulation of the photosynthetic machinery.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3

No.	Teaching contents	Teaching requirements	hours	methods	objectives
		<b>The difficulties:</b> Mechanisms of electron transport, proton transport and ATP synthesis in the chloroplast, and repair and regulation of the photosynthetic machinery.			
7	Photosynthesis: Carbon reactions	<ol style="list-style-type: none"> <li>1. The calvin cycle</li> <li>2. Regulation of the calvin cycle</li> <li>3. The C2 oxidative photosynthetic carbon cycle</li> <li>4. CO<sub>2</sub>-concentrating mechanisms I : algal and cyanobacterial pumps</li> <li>5. CO<sub>2</sub>-concentrating mechanisms II : the C4 carbon cycle</li> <li>6. CO<sub>2</sub>-concentrating mechanisms III: crassulacean acid metabolism</li> <li>7. Synthesis of starch and sucrose</li> </ol> <p><b>The emphases:</b> The calvin cycle, CO<sub>2</sub>-concentrating mechanisms, and synthesis of starch and sucrose.  <b>The difficulties:</b> The calvin cycle and synthesis of starch and sucrose.</p>	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
8	Respiration and lipid metabolism	<ol style="list-style-type: none"> <li>1. Overview of plant respiration</li> <li>2. Glycolysis: a cytosolic and plastidic process</li> <li>3. The citric acid cycle: a mitochondrial matrix process</li> <li>4. Electron transport and ATP synthesis at the inner mitochondrial membrane</li> <li>5. Respiration intact plants and tissues</li> <li>6. Lipid metabolism</li> </ol> <p><b>The emphases:</b> Plant respiration, glycolysis, citric acid cycle, electron transport and ATP synthesis at the inner mitochondrial membrane, and lipid metabolism.  <b>The difficulties:</b> Plant respiration, glycolysis, and citric acid cycle.</p>	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
9	Genome structure and gene expression	<ol style="list-style-type: none"> <li>1. Nuclear genome organization</li> <li>2. Plant cytoplasmic genomes: mitochondria and plastids</li> <li>3. Transcriptional regulation of nuclear gene expression</li> <li>4. Posttranscriptional regulation of nuclear gene expression</li> <li>5. Tools for studying gene function</li> <li>6. Genetic modification of crop plants</li> </ol> <p><b>The emphases:</b> Plant genomes, cytoplasmic genomes, and transcriptional and posttranscriptional regulations of gene expression.  <b>The difficulties:</b> Transcriptional and posttranscriptional regulations of gene expression.</p>	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3
10	Signals and signal transduction	<ol style="list-style-type: none"> <li>1. Temporal and spatial aspects of signaling</li> <li>2. Signal perception and amplification</li> <li>3. Hormones and plant development (Auxin: the growth hormone, gibberellins: regulators of plant height, cytolinins: regulators of cell division, ethylene: the gaseous hormone, and abscisic acid: a seed</li> </ol>	3	Lectures Quiz Discussion	Course objectives: 1, 2, 3

No.	Teaching contents	Teaching requirements	hours	methods	objectives
		<p>maturation and antistress signal)</p> <p>10. Phytohormone metabolism and homeostasis</p> <p>4. Signal transmission and cell-cell communication</p> <p><b>The emphases:</b> Concepts of signaling, signaling perception and amplification, plant hormones and plant developments, phytohormone metabolism and homeostasis, and signal among cells.</p> <p><b>The difficulties:</b> Signaling perception and amplification and plant hormones and plant developments.</p>			
11	Growth and development	<p>1. Embryogenesis, seed dormancy, germination, and seedling establishment</p> <p>2. The role of cytokinesis in pattern formation</p> <p>3. Meristems in plant development</p> <p>4. Cell differentiation</p> <p>5. Initiation and regulation of developmental pathways</p> <p>6. Vegetative growth and organogenesis (Leaf development, root development, and seed and fruit development)</p> <p>7. The analysis of plant growth</p> <p>8. Senescence and programmed cell death</p> <p><b>The emphases:</b> The role of cytokinesis in pattern formation, meristems in plant development, cell differentiation, senescence and programmed cell death, and vegetative growth and organogenesis.</p> <p><b>The difficulties:</b> The role of cytokinesis in pattern formation, meristems in plant development, cell differentiation, and vegetative growth and organogenesis.</p>	3	Lectures Quiz Discussion	Course objectives: 1, 2, 3
12	Signals from sunlight	<p>1. Plant photoreceptors</p> <p>2. Phytochromes</p> <p>3. Phytochrome responses</p> <p>4. Phytochrome signaling pathways</p> <p>5. Blue-light responses and photoreceptors</p> <p>6. Cryptochromes</p> <p>7. The coaction of cryptochrome, phytochrome, and phototropins</p> <p>8. Phototropins</p> <p>9. Responses to ultraviolet radiation</p> <p><b>The emphases:</b> Phytochromes, phytochrome responses, phytochrome signaling pathways, blue-light responses and photoreceptors, cryptochromes, phototropins, and responses to ultraviolet radiation.</p> <p><b>The difficulties:</b> Phytochromes, phytochrome signaling pathways, blue-light responses and photoreceptors.</p>	3	Lectures Quiz Discussion	Course objectives: 1, 2, 3
13	The control of flowering and floral development	<p>1. Floral evocation: integrating environmental cues</p> <p>2. The shoot apex and phase changes</p> <p>3. Circadian rhythms: The clock within</p> <p>4. Photoperiodism: Monitoring day length</p> <p>5. Vernalization: Promoting flowering with cold</p>	3	Lectures Quiz Discussion	Course objectives: 1, 2, 3

No.	Teaching contents	Teaching requirements	hours	methods	objectives
		6. Long-distance signaling involved in flowering 7. The identification of florigen 8. Floral meristems and floral organ development <b>The emphases:</b> The shoot apex and phase changes, circadian rhythms, photoperiodism, vernalization, long-distance signaling involved in flowering, the identification of florigen, and floral meristems and floral organ development. <b>The difficulties:</b> Circadian rhythms, photoperiodism, vernalization, long-distance signaling involved in flowering, the identification of florigen			
14	Abiotic stress	1. Defining plant stress 2. Acclimation and adaptation 3. Environmental factors and their biological impacts on plants 4. Stress-sensing mechanisms in plants 5. Signaling pathways activated in response to abiotic stress 6. Developmental and physiological mechanisms that protect plants against abiotic stress <b>The emphases:</b> Stress factors, acclimation and adaptation, stress-sensing mechanisms in plants, signaling pathways according to abiotic stress. <b>The difficulties:</b> Acclimation and adaptation, stress-sensing mechanisms in plants, signaling pathways according to abiotic stress.	2	Lectures Quiz Discussion	Course objectives: 1, 2, 3

### 5. Course hours allocation and teaching methods

(1) Course time allocation (according to the order (units of knowledge or items) allocation of total hours, reasonable allocation of lectures, experiments, exercises, discussions, counseling and other teaching links required hours)

Schedule of theoretical courses or theoretical teaching contents:

Teaching hours Methods Contents	Theoretical Lecture	Exercise	Discussion	Notes	Teaching hours
	Chapter 1 Plant Cell	1.5		0.5	
Chapter 2 Energy and Enzymes	1.5	0.5			2
Chapter 3 Water and plants	1.5		0.5		2
Chapter 4 Mineral nutrition and solute transport	1.5	0.5			2
Chapter 5 Assimilation of mineral nutrients	1.5		0.5		2
Chapter 6 Photosynthesis: the	1.5	0.5			2

light reactions					
Chapter 7 Photosynthesis: Carbon reactions	1.5		0.5		2
Chapter 8 Respiration and lipid metabolism	1.5	0.5			2
Chapter 9 Genome structure and gene expression	1.5		0.5		2
Chapter 10 Signals and signal transduction	2.5	0.5			3
Chapter 11 Growth and development	2.5		0.5		3
Chapter 12 Signals from sunlight	2.5	0.5			3
Chapter 13 The control of flowering and floral development	2.5		0.5		3
Chapter 14 Abiotic stress	1.5	0.5			2
Total	25	3.5	3.5		32

## (2) Teaching methods

Heuristic teaching may be one of the best strategies for teaching of Plant Physiology, and some teaching methods can be accepted for inspiring students' interests, encouraging students to participate in teaching. Such as question based teaching, case analysis, telling stories, discussion, and presentation, etc.

## 6、 Course Assessment

Method or means of assessment	Assessment requirements	Check weight	Corresponding course objectives
classroom performance	frequencies of assignments; question response	30%	1, 2, 3
unit tests	14 times	30%	1, 2, 3
final exam	open-book	40%	1, 2, 3

## 7、 Recommended teaching materials and reference materials

- 1 Taiz and Zeiger. Plant Physiology and Development, Sixth Edition. Sinauer Associates, Inc., Sunderland, (2015).
- 2 <http://6e.plantphys.net/>

Course teaching team:

**Written by:** Guo Wanli

**Proofread by:** Chen Shaoning,

**Date:** 19-04-2021

# Syllabus of Virology

**Course Name/Title:** Virology                      **Course code:** 86972  
**Course Type:** (Specialized Course) (Optional Course)  
**Total Teaching Hours:** 32 (Classroom Hours: 32 Laboratory Hours or Tutorial Hours)  
**Course Credit:** 2

## I Course Introduction

Virology is the study of viruses-submicroscopic, parasitic particles of genetic material contained in a protein coat-and virus-like agents. It focuses on the following aspects of viruses: their structure, classification and evolution, their ways to infect and exploit host cells for reproduction, their interaction with host organism physiology and immunity, the diseases they cause, the techniques to isolate and culture them, and their use in research and therapy. Virology is considered to be a subfield of microbiology or of medicine.

## II Course Objective

1. Combining the professional knowledge of Virology with the content of ideological and political education, we can achieve the goal of ideological and political education.

By discussing the achievements and progress of in the field of virology which were made by Chinese scientific and technological workers, we can cultivate students' patriotism and scientific and technological innovation spirit, and also improve the concept of scientific and technological innovation thinking. The purpose is to establish good sense of social responsibility, perfect personality and a strong sense of team spirit, realistic and innovative consciousness and spirit.

2. Its main task is to make the students master the basic theory and basic skills, basic knowledge of Virology.

3. Is engaged in biotechnology engineering, gene engineering, biochemistry related work and to lay the foundation for learning.

4. Virology requires that you know a little about almost every subject in biology.

5. Virology constantly tests your ability to think and pull information together.

6. Memorize, we cannot memorize many combinations of facts that define viruses. We have to think. The devil and the delight are in the details of learning the strategies and tactics of viruses.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Comprehensive understanding of the basic theory, understanding of biological industry and other aspects of the theoretical knowledge, and master the ability to use their analytical problems.	Course Objective 1,2,3
Graduation Requirement 7	Master the methods, frameworks	Course Objective 1,2,3,4,5,6

	<p>and tools involved in the field of virology.</p> <p>With the comprehensive use of the theoretical knowledge and skills, engaged in biotechnology and related fields of product research and development capabilities, with biotechnology downstream engineering practice and technical innovation.</p>	
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#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Overview of Virology	1. Understanding the virus discovery, History of viruses and What is virus 2. Introduce and discuss the achievements made by Chinese scientist in the field of cell biology, cultivate students' patriotism and scientific and technological innovation spirit.	2	Lecture and discussion	Course Objective 1,2,3,4,5,6
2	Chapter 2 Viruses and their importance	1. Understanding viruses are ubiquitous on Earth 2. Master nature of viruses 3. Comprehending reasons for studying viruses	2	Lecture and discussion	Course Objective 1-6
3	Chapter 3 The Infectious Cycle	Understanding virus cultivation and assay of viruses	2	Lecture, discussion and Exercise	Course Objective 1-6
4	Chapter 4 Genomes and Genetics	1. Understanding a virion contains the genome of a virus in the form of one or more molecules of nucleic acid. 2. Understanding for any one virus the genome is composed of either RNA or DNA. 3. Understanding virus genomes and genetic methods	2		Course Objective 1,2,3,4,5,6
5	Chapter 5 Virus structure	1. Understanding introduction to virus structure; 2. Understanding other virion	2	Lecture and discussion	Course Objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		components 3. Understanding virus genomes and virus proteins		n	1,2,3,4,5,6
6	Chapter 6 Virus Transmission	1. Understanding introduction to virus transmission; 2. Understanding transmission of plant/vertebrate/invertebrate viruses 3. Understanding attachment and Entry; Assembly	2	Lecture and discussion	Course Objective 1,2,3,4,5,6
7	Chapter 7 Vaccines	1. Understanding introduction to virus vaccines; 2. Understanding vaccines stimulate a protective immune response, 3. Understanding how vaccines work in the real world; 4. Understanding live attenuated virus vaccines 5. Understanding inactivated virus vaccines 6. Understanding live recombinant virus vaccines 7. Introduce and discuss the achievements made by Chinese scientist in the field of vaccines to cultivate students' patriotism and scientific and technological innovation spirit.	2	Lecture and discussion	Course Objective 1,2,3,4,5,6
8	Chapter 8 Viral gene therapy	1. Understanding virus vector; 2. Understanding indications addressed by gene therapy clinical trials; 3. Understanding gene therapy to some genetic and viral disease	3	Lecture and discussion	Course Objective 1,2,3,4,5,6
9	Chapter 9 Evolution	1.Introduction; Modern virology has provided a window on the mechanisms of evolution; 2.Four main drivers of virus evolution. 3.Roles of evolution, The general interactions of hosts and viruses; 4.Diseases of exploration and	3	Lecture and discussion	Course Objective 1,2,3,4,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		colonization; Four main drivers of virus evolution.			
10	Chapter 10 HIV and AIDS	1.Introduction to HIV; 2.Progression of HIV infection; 3.Prevention of HIV transmission; 4.Sources of further information	3	Lecture and discussion	Course Objective 1-6
11	Chapter 11Ebola virus	1.Introduction 2.Outbreak of ebola virus disease 3.How are human infected 4.How can infection be prevented	2	Lecture and discussion	Course Objective 1-6
12	Chapter 12 Anti-viral drugs	1.Introduction to anti-viral drugs 2.Development of anti-viral drugs 3.Examples of anti-viral drugs 4.Anti-viral drug research	4	Lecture and discussion	Course Objective 1-6
13	Chapter 13 Viruses and cancer	1.Introduction to viruses and cancer 2.Virus-associated cancers in animals 3.Cell lines derived from virus-associated cancers 4.How do viruses cause cancer? Prevention of virus-induced cancers 5. Introduce and discuss the achievements made by Chinese scientist in the field of cancer to cultivate students' patriotism and scientific and technological innovation spirit.	3	Lecture and discussion	Course Objective 1,2,3,4,5,6

#### V Period Distribution and Teaching Modes

During the multimedia teaching, a variety of methods, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be utilized to guarantee the teaching effectiveness. Homework will be assigned after the class.

Students are requested to preview the text before each class. Students will be guided to search and read the latest papers for the virology themes. To enlarge scientific vocabulary, the students are divided into 4 groups and word competition will be held during the semester and trophy will be given to the good team.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
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Attendance	Students attending class regularly (in body and mind) is needed. This means they not only should be present in class, but also can answer question properly and discuss actively in class. Attendance will be checked randomly in class.	10%	1,2,3
In-class presentation	An in-class presentation is required for some chapter. Students are divided into several groups. Each group is responsible for one section of that chapter. Students should self-study the corresponding text, prepare the PPT and lecture in the class.	20%	1,2,3,4,5,6
Homework	Homework will be assigned after the company visiting	20%	1,2,3,4,5,6
Final Exam	The Final will be a comprehensive, two-hour exam given during finals week.	50%	1,2,3,4,5,6

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### **VII Textbooks and References**

1. Virology principles and applications (John B. Carter and Venetia A. Saunders 2015).
2. <http://www.virology.ws/course/>

**Written by: Wu Yuehong**

**Reviewed by: You Zhengying**

**Date: 2021-4-25**

# Syllabus of Molecular Detection Techniques

**Course Name/Title:** Molecular Detection Techniques

**Course code:** 86975

**Course Type:** (Specialized Course)(Optional Course)

**Total Teaching Hours:** 32 (Classroom Hours: 32 )

**Course Credit:** 2

## I Course Introduction

Molecular detection technology is a course of Biochemistry based on Biochemistry and molecular biology, which includes two parts: basic theory and basic technology. Focus on the molecular biology laboratory technology basic theory, method and application technology and related basic concepts, principle and method; and introduces some recent development of important technology and its application, fully reflects the development trend of test technology of molecular biology. Consists of three parts: the first part mainly introduces: biological macromolecules (genes) the structure and function of genome structure and function, gene and genome theories; second part mainly introduces the basic operation of molecular biology and molecular biology techniques commonly used, including the main and purification technology, restriction enzyme analysis, spectrum PCR technology, recombinant hybrid technology, gene technology, DNA and protein electrophoresis, DNA polymorphism analysis and DNA fingerprint technology and DNA chip technology of nucleic acid separation. The third part introduces the application of molecular biological technology, based on the understanding of the molecular biology of commonly used technology, introduces the polymerase chain reaction and its application in gene diagnosis technology and application of nucleic acid molecules, hybrid bio chip technology and application and application of bioinformatics in molecular diagnosis etc. Combining the professional knowledge of bioinformatics with the content of Ideological and political education, we can achieve the goal of Ideological and political education.

## II Course Objective

Course objective 1: Combining the professional knowledge of molecular detection technology with the content of Ideological and political education, we can achieve the goal of Ideological and political education. Cultivate a group of new people who love the motherland and have high ideological, moral and cultural qualities. They have a strong sense of social responsibility, a sound personality and a strong sense of teamwork, have good professional ethics, and follow the professional spirit of academic norms, master solid basic theory and research methods of molecular detection technology, have the sense and spirit of seeking truth and innovation, in order to contribute to the development of China's biomedical technology.

Objective 2: Master and understand the principles of the techniques in molecular biology. Understanding the application of molecular biology techniques.

Objective 3: Familiar with the principle and application of the techniques in molecular biology. Grasp and understand some of the commonly used experimental techniques in molecular biology.

Objective 4: Students have the ability of dialectical thinking with seek truth from facts ideological style, innovative consciousness and entrepreneurial spirit.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Through the compulsory and elective courses, we will receive more systematic professional theory and professional skills training, and master solid basic theory, basic knowledge and basic skills of biological science.	Course Objective 1-4
Graduation Requirement 6	Through a certain biological technology experiment, practical experience, master the experimental skills of related courses and related biological experiment data processing and analysis methods, understand the frontier technology and development trend in this field.	Course Objective 1-4
Graduation Requirement 7	The ability to skillfully use various modern media technologies to actively acquire scientific research information and other knowledge; The ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key technologies related to life science, including gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases, basic analysis technology of bioinformatics, etc.	Course Objective 1-4

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Introduction (1) the history of molecular detection technology (3) The application of molecular detection technology	(1) Master the main content of molecular detection technology (2) Familiar with the history of molecular detection technology	2	Lectures, online courses, group discussions	Course objectives 1,2
2	Chapter 2 Allele-specific mutation detection based on PCR (1) PCR-ARMS (2) PCR-ASO (3) Competitive Oligopring	(1)To understand the design principles of PCR-ARMS. (2) To understand the design principles of PCR-ASO in genome mutation detection. (3) To understand the design principles and application of Competitive Oligopring	8	Lectures, online courses, group	Course objectives 1-4
3	Chapter 3 Allele-specific mutation detection based on	(1)To understand the basic concept of electrophoresis-based	2	Lectures, online	Course objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	gel electrophoresis (1) Principle and application of SSCP (2) Principle and application of HAD	method. (2) To understand the mutation detection by SSCP and HAD		courses, group	es 1-4
4	Chapter 4 Detection of abnormal gene expression level (1) The principle of real-time PCR and its application case in disease detection. (2) The principle and application of digital PCR	(1) To understand the detection method of gene expression. (2) To understand the principle of real-time PCR and its application case in disease detection. (3) To understand the principle of digital PCR and its application case in disease detection. (4) To explain the achievements of Chinese scientists in the detection of COVID-19 based on real-time PCR and to stimulate students' enthusiasm for learning and feelings of home and country.	6	Lectures, online courses, group	Course objectives 1-4
5	Chapter 5 Detection of abnormal chromosome structure (1) Cytogenetic method (2) FISH	(1) To understand the molecular cytogenetics in Molecular diagnostics (2) To understanding the principle of fluorescence in situ hybridization and its application in abnormal chromosome structure	2	Discussion, online courses, group	Course objectives 1-4
6	Chapter 6 Detection of genomic duplications and deletions (1) Types of genomic duplication or deletion (2) Detection method of genomic duplication and deletion	(1) To understand the disease types caused by genomic duplication or deletion (2) Examples are given to illustrate the application of FISH in the detection of genomic duplication and deletion diseases	2	Lectures, online courses, group	Course objectives 1-4
7	Chapter 7 Detection of pathogenic microorganism	(1) To understand the detection principle of pathogenic	6	Lectures, online	Course objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	(1) the detection principle of pathogenic microorganism. (2) Examples are given to illustrate the application of protein hybridization in the detection of pathogenic microorganism. (3) Application of gene edit, isothermal PCR in pathogenic microorganisms.	microorganism. (2) To master the principle of protein hybridization in the detection of pathogenic microorganism. (3) To explain the achievements of Chinese scientists in the detection of COVID-19 based on protein hybridization and to stimulate students' enthusiasm for learning and feelings of home and country.		courses, group	es 1-4
8	Chapter 8 Early diagnosis of embryo (1)The principle of high through-put sequencing. (2) Examples are given to illustrate the application of NGS in the Early diagnosis of embryo.	(1)To understand the principle and method of high through-put sequencing. (2) To explain the achievements of Chinese scientists in the Early diagnosis of embryo based on NGS and the application in medicine which will stimulate students' enthusiasm for learning and feelings of home and country.	4	Lectures, online courses, group	Course objectives 1-4

#### V Period Distribution and Teaching Modes

Teaching hours	Methods	Theoretical Lecture	Exercise	Discussion	Notes	Teaching hours
		2	0	0		2
		8	0	2		10
		4	0	2		6
		2	0	0		2
		2	0	0		2
		4	0	2		6

microorganism					
Unit 7: Early diagnosis of embryo	3	0	1		4
Total	25	0	7		32
Unit 1: Introduction	2	0	0		2

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Final exam	Opened books, papers, according to the marking standards for grading	50	Course objectives 1-4
Presentation and pre-class test	According to presentation and pre-class test to score	40	Course objectives 1-4
Attendance and performance in class discussion	No unexcused absence from class. Extra points will be given to students for attending lectures and answering questions with positive thinking	10	Course objectives 1-4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

## VII Textbooks and References

(1) Teaching materials: (list the titles, authors, publishing houses, etc.)

There is no suitable textbook at present.

(2) Reference books: (list the titles, authors, publishing houses, etc.)

[1] MOLECULAR DIAGNOSTICS, ELSEVIER, 3rd Edition, 2017 Editors G. P. Patrinos, P. B. Danielson and W. J. Anson

(3) Online resources: (online course website)

[1] <https://www.zjooc.cn/course/2c918083701ae12401702e71b4ee1d87>

**Written by: Wu Fangli**

**Reviewed by: Jin Weibo**

**Date: 2021/4/19**

# Syllabus of Biological products Inspection and Quarantine

**Course Name/Title:** Biological products Inspection and Quarantine **Course code:** 86976

**Course Type:** Specialized Course, Optional Course

**Total Teaching Hours:** Classroom Hours: 32

**Course Credit:** 2

## I Course Introduction

Biological products inspection and quarantine is a specialized optional course in biotechnology professional teaching programs, it requires student learning this course before that they have learned organic chemistry, analytical chemistry, biochemistry and microbiology. This course is a comprehensive and strong technological applied science. After learning this course, students can master the procedures of biological products quality inspection and quarantine, and related theoretical knowledge and basic principles. Meanwhile, students will establish the awareness of full control of the biological products quality.

## II Course Objective

(1) Ideological and political objective:

Course objective 1: To build up the correct values in scientific research by giving proper examples in class.

Course objective 2: To cultivate the students to be rigorous in scientific study and to have innovative thinking and creativity.

Course objective 3: To cultivate self-learning skills by giving presentation.

(2) Knowledge objective:

Course objective 4: To master the basic knowledge and basic theory of biological products inspection and quarantine.

Course objective 5: To know the test items of biological products inspection and quarantine.

Course objective 6: To master the common technology of biological products inspection and quarantine and the application of some modern technologies in detection.

(3) Ability goal:

Course objective 7: Have the work ability to be engaged in relevant work of biological products inspection and quarantine and quality control and detection.

Course objective 8: Have the basic ideas and ability to solve the problem of product quality.

Course objective 9: Have the active exploration spirit and innovation consciousness.

(4) Quality objective:

Course objective 10: Cultivate students' serious and responsible occupation ethics and work style.

Course objective 11: Build students' awareness of quality and safety.

Course objective 12: Develop students' ability to adapt to the career change.

Course objective 13: Students will have the habit of deep thinking.

Course objective 14: Students will have scientific learning attitude.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation requirements 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master basic knowledge and skills of biological sciences	Course objective 1, 2, 3, 5
Graduation requirements 6	Through certain experimental and practical experience in biotechnology, they will master the experimental skills of related courses as well as relevant biological experimental data processing and analysis methods, and understand the frontier technology and development trend of this field.	Course objective 4, 7, 8, 9, 10
Graduation requirements 8	Could summarize, organize, and analyze experimental results, synthesize the theoretical knowledge and skills acquired, and engage in scientific research in biological sciences, biotechnology, and related fields; they have the basic ability to practice biotechnology downstream engineering and technological innovation; they have a strong scientific interest and the ability to think critically.	Course objective 5, 6, 11, 12, 13, 14

### IV Course Content and Learning Objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction 1.1. The concept and classification of biological products 1.2. The importance of the inspection and quarantine of biological products 1.3. The basic procedure of biological products inspection and	1. To master the concept of biological products and the basic procedures of inspection and quarantine. 2. To understand the classification of biological products, and the importance of inspection and quarantine, and the application of biological detection technology. Key point: the concept of biological products; the basic	2	Lectures in class	teaching objective 1,2,5,7,8,9,12

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	quarantine 1.4. The application of biological products inspection and quarantine technology	procedure of inspection and quarantine. 3. To build up the correct values in scientific research by giving proper examples in class. (Ideological and political objective) Difficult point: the basic procedure of biological products inspection and quarantine.			
2	Detection Item of Biological Products 2.1. Biological detection items 2.2. Physical and chemical detection items	1. To know the biological detection items and physical and chemical detection items of biological products. 2. To master sterility test and stability test. 3. To cultivate self-learning skills by giving presentation (Ideological and political objective) Key point: sterility test; stability test. Difficult point: stability test.	2	Lectures in class	teaching objective 1, 2, 3, 4,6,7,9,10,11,12,14
3	Cell Examination 3.1 Cell identification test 3.2 Cell tumorigenicity test	1. To know the general principle and methods of cell identification. 2. To understand and master the various test methods of cell tumorigenicity. 3. To build up the correct values in scientific research by giving proper examples in class. (Ideological and political objective) Key point: DNA fingerprinting, PCR technology, immunological method to check cell; Animal inoculation method, cell infiltration method, cell clonal growth method to detect cell tumorigenicity.	4	Lectures in class	teaching objective 1, 2, 3, 5,6,7,8,10,12,13,14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		Difficult point: the application of various methods in cell identification; animal inoculation method; cell clonal growth method.			
4	<p>Bacterial and Fungi Detection</p> <p>4.1. Biological characteristics of bacterial and fungi.</p> <p>4.2. Medium preparation.</p> <p>4.3. Bacterial detection.</p> <p>4.3.1 Culture method</p> <p>4.3.2 PCR technology</p> <p>4.3.3 Immunological method</p> <p>4.3.4 Physical and chemical assay</p> <p>4.4 Fungi detection.</p>	<p>1. To know the biological characteristics of bacterial and fungi.</p> <p>2. To master the choice and preparation of medium.</p> <p>3. To understand the culture and identification of common pathogens and master several of which must be seized in the inspection and quarantine.</p> <p>4. To understand the detection of bacterial L type.</p> <p>5. To master endotoxin detection.</p> <p>Key point: medium choice; the culture and identification of common pathogens; endotoxin detection.</p> <p>6. To cultivate the students to be rigorous in scientific study and to have innovative thinking and creativity. (Ideological and political objective)</p> <p>Difficult point: how to put these technologies into practice.</p>	14	Lectures in class	teaching objective 1, 2, 5, 6,7,8,9,11,12,14
5	<p>Mycoplasma Detection</p> <p>5.1 Overview</p> <p>5.2 Culture method for detection mycoplasma</p> <p>5.3 PCR technology</p> <p>5.4 ELISA assay</p>	<p>1. To know the basic characteristics of mycoplasma and the effect on the cell.</p> <p>2. To master various methods of mycoplasma detection, and understand their advantages and disadvantages.</p> <p>3. To cultivate self-learning skills by giving presentation (Ideological and political objective)</p>	4	Lectures in class	teaching objective 1, 2, 3, 4,5,7,9,10,12,13,14

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		Key point: culture method for detection mycoplasma. Difficult point: the choice of mycoplasma detection methods in biological products.			
6	Virus Detection 6.1 The overview of virus 6.2 Virus detection 6.2.1 Blood cell adsorb test 6.2.2 Hemagglutination 6.2.3 Cell subculture 6.2.4 Immunofluorescence assay 6.2.5 Animal inoculation method 6.2.6 Others 6.3 Retrovirus detection 6.4 Special virus adventitious agents detection	1. To understand and master various virus detection methods and special virus detection method. 2. To know retrovirus detection methods. 3. To cultivate the students to be rigorous in scientific study and to have innovative thinking and creativity. (Ideological and political objective) Key point: virus detection; special virus adventitious agents detection Difficult point: how to put these methods into practice.	6	Lectures in class	teaching objective 1, 2, 3, 4,5,6,8,9,11,12,14

#### V Period Distribution and Teaching Modes

	theory Taught	problem lesson	discuss lesson	remark	subtotal
1	2		0		2
2	2		0		2
3	3		1		4
4	10		4		14
5	3		1		4
6	5		1		6
Total	28		7		32

## VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Attend class	30%	1,3,5,6,7,8,9,10,11,12
Presentation	Oral presentation	40%	1,2,4,5,6,7,8,9,12,13,14
Final examination	Exam	30%	1,2,3,5,6,9,10,11,13,14

An important part of the assessment is to check the teaching effect. The form of final examination will be closed book. The kinds of questions have choice, judgment, nouns' explanation, short answer and discussion. The examination content does not exceed the outline, and focuses on the basic concept and mastery of detection technology, as well as application ability.

## VII Textbooks and References

Textbook:

ZhongPing Xie, QiHan Li, MaoSheng Sun. *Biological Products detection Manual-cells with production and test*. Chemical Industry Press, 2008.

References:

- 1、 ZiGang Li, Huijie Wang. *Biological detection technology*. China Light Industry Press, 2007.
- 2、 DongPo Zhou, Kai Zhao, Xi Ma. *Biologicology*. Chemical Industry Press, 2007.
- 3、 Ni Hong. *Phytosanitary method and technology*. Chemical Industry Press, 2006.
- 4、 GuoAn Zhou, QiaoYing Tang. *Production norms and quality control of biological products*. Chemical Industry Press, 2004.
- 5、 ZhiLiang Wang, YiPing Chen, Hu Shan. *Modern animal inspection and quarantine method and technology*. Chemical Industry Press, 2007.
- 6、 Hui Wu. *Animal and plant inspection and quarantine*. China Light Industry Press, 2008.
- 7、 National institutes for drug and biological product control. *China drug inspection standard operating specifications. (2010)* , China Medical Science Press, 2010.

**Written by: Jieqiong Qiu**

**Reviewed by: Yeqing Wu**

**Date: 2021-05-06**

# Syllabus of regulations of inspection and quarantine

**Course Name/Title: Regulations of inspection and quarantine**      **Course code: 86978**

**Course Type:** (Specialized Course)( Optional Course)

**Total Teaching Hours:** 32 (Classroom Hours: 32 )

**Course Credit:** 2

## I Course Introduction

Inspection and quarantine are an important part of China's foreign trade. The main functions of entry-exit inspection and quarantine, such as port public health, national biosecurity, import and export food safety, and import and export commodity safety, have become an extension of the traditional security risk prevention and control scope of the new customs. The laws and regulations of entry and exit inspection and quarantine are included: "Law of the People's Republic of China on Import and Export Commodity Inspection " and its regulations, "Law of the People's Republic of China on Entry and Exit Animal and Plant Quarantine" and its regulations, "Frontier Health and Quarantine Law of the People's Republic of China" and its Specific Rules, "Food Safety Law of the People's Republic of China", and other regulations. The content of inspection and quarantine is a collection of knowledge, practical operations, and regulations related to inspection and quarantine in simple and simple language, in order to guide foreign trade import and export enterprises or the actual work of personnel engaged in inspection and quarantine.

Since the outbreak of the COVID-19, under the guidance of the spirit of "prevention of external import and internal non-proliferation", a huge victory has been achieved in the prevention and control of new coronary pneumonia. The customs inspection and quarantine department insisted on keeping the country safe, effectively cutting off the spread of new coronary pneumonia, and quickly resuming domestic life and work.

## II Course Objective

Regulations of inspection and quarantine include the relevant laws or regulations, inspection and quarantine of entry-exit goods, inspection and quarantine of means of transport, and health quarantine of entry-exit person, etc.. Regulations of inspection and quarantine have a stronger application, are specialized optional course in biotechnology professional, and also compulsory course for inspection personnel. In the same time, the course is a reference material for foreign trade business personnel and entry-exit inspection and quarantine personnel.

### 1. Knowledge objectives

**Course objective 1:** Let students realized the importance of inspection and quarantine work in "keeping the country, protecting the country and the people" and let the students set up a strong spirit of patriotism.

**Course objective 2:** Master the basic concept of inspection and quarantine;

**Course objective 3:** Understand the Law of the People's Republic of China on Import and Export Commodity Inspection " and its regulations;

**Course objective 4:** Understand the law of the People's Republic of China on Entry and Exit Animal and Plant Quarantine" and its regulations;

**Course objective 5:** Understand the “Food Safety Law of the People’s Republic of China”, and other regulations;

**Course objective 6:** Understand the “Frontier Health and Quarantine Law of the People’s Republic of China” and its Specific Rules;

**Course objective 7:** Understand the health quarantine of entry-exit person;

**Course objective 8:** Understand the entry-exit goods inspection and quarantine management.

## 2. Ability objectives

**Course objective 9:** Train and improve students’ self-learning ability;

**Course objective 10:** Have the ability to be engaged in relevant inspection and quarantine work.

**Course objective 11:** Train the ability of customs clearance procedures for entry-exit commodities, animals, plants and their products.

**Course objective 12:** Learning the knowledge of the new biosafety laws, and train the ability of inspection and quarantine for entry-exit biological products.

## 3. Quality objectives

**Course objective 13:** Possess the ability of dialectical thinking;

**Course objective 14:** Possess the ability of practical and realistic attitude and innovation spirit;

**Course objective 15:** Possess the ability of good professional ethics.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	The main objective of this course is to let students to understand the general background of biological products; understand the basic method to inspect the biological products including vaccines, biological drugs and biological diagnostic products	Course Objective 9,10,11,12,13,14,15
Graduation Requirement 6	understand the basic method to inspect the biological products including vaccines, biological drugs and biological diagnostic products; The course will also teach students to understand how to deal with the inspection results.	Course Objective 1,2,3,4,5,6,7,8

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	1.Introduction 1.1 The status and role of China entry-exit inspection and quarantine 1.2 The purpose and task of China entry-exit inspection and quarantine	1. Let students to understand the emergence and development of China entry-exit inspection and quarantine 2. Let students to understand the work content of China entry-exit inspection and quarantine 3. Let students to understand the status, purpose and task of China entry-exit inspection and quarantine.	2	Classroom teaching	1,2
2	2.Laws and Regulations of Entry-Exit Inspection and Quarantine 2.1 Legal basis of Import and Export Commodity Inspection 2.2 Purposes of Commodity inspection 2.3 Inspection on Import Commodities 2.4 Inspection on Export Commodities	1. Let students to understand the general introduction of Law of the People's Republic of China on Import and Export Commodity Inspection and its regulations. 2. Let students to understand the legal basis, purpose of Import and Export Commodity Inspection 3. Let students to Learning the content and procedure of Import and Export Commodity Inspection	2	Classroom teaching	1,2,3
3	3. Law of the People's Republic of China on Entry and Exit Animal and Plant Quarantine and its regulations. 3.2 The Law of the People's Republic of China on the Entry and Exit Animal and Plant 2.3 Frontier Health and Quarantine Law of the People's Republic of China" and its Specific Rules	1. Let students to understand the general introduction of Law of the People's Republic of China on Entry and Exit Animal and Plant Quarantine and its regulations. and its regulations. And General introduction of Frontier Health and Quarantine Law of the People's Republic of China" and its Specific Rules 2. Let students to understand the legal basis, purpose of Entry and Exit Animal and Plant Quarantine and its regulations. 3. Let students to learning the content	2	Classroom teaching	1,4,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>and procedure of Entry and Exit Animal and Plant Quarantine and its regulations.</p> <p>4. Let students to understand the legal basis, purpose of Frontier Health and Quarantine Law.</p> <p>5. Let students to learning the content and procedure of Frontier Health and Quarantine Law.</p> <p>6. Let students realized the importance of inspection and quarantine work in "keeping the country, protecting the country and the people" and firmly patriotic belief.</p>			
4	<p>4. Food Safety Law of the People's Republic</p> <p>4.1 The background of the Food Safety Law</p> <p>4.2 China Food Safety Regulatory System</p> <p>4.3 Legal basis of Import and Export food safety</p> <p>4.4 Inspection and quarantine procedures for Entry-exit food</p>	<p>1. Let students to learning the legislative background, significance, characteristics and new legal system of the Food Safety Law.</p> <p>2. Let students to master the content of the new Food Safety Law</p> <p>3. Let students to master the procedures of Inspection and quarantine for entry-exit food.</p> <p>4. Let students establish a strong sense of food safety, pay attention to life and health.</p>	2	Classroom teaching	1,3,5
5	<p>5. Inspection and Quarantine of Entry Goods</p> <p>5.1 Inspection units and Inspector</p> <p>5.2 Time limit for inspection</p> <p>5.3 Range for inspection</p> <p>5.4 The place for inspection</p> <p>5.5 Inspection and</p>	<p>1. Let students to understand the units and inspector</p> <p>2. Let students to learning time limit, Range, place for Inspection and quarantine</p> <p>3. Let students to master the inspection and quarantine of entry plants, animals and their products</p>	2	Classroom teaching, Group discussion	1,3,4,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	quarantine of entry animals and their products 5.6 Inspection and quarantine of entry plants and their products				
6	6. Inspection and Quarantine of Entry Goods 6.1 Inspection of entry mechanical and electrical products 6.2 Inspection of entry vehicles 6.3 Inspection of entry food	1.Let students to understand the content and procedure of inspection of entry mechanical and electrical products 2.Let students to understand the content and procedure of inspection for entry vehicles 3. Let students to understand the content and procedure for inspection for entry food	2	Classroom teaching, Group discussion	1,3,5,8
7	7.Inspection and Quarantine of Entry Goods 7.1. Inspection of entry wooden packaging 7.2 Inspection of entry Special item 7.3 Inspection of entry cosmetic	1.Let students to understand the content and procedure of inspection for entry wooden packaging。 2. Let students to understand the content and procedure for inspection of entry Special item(i.e biological production, human tissues, vaccine) 3. Let students to understand the content and procedure for entry cosmetic	2	Classroom teaching, Group discussion	1, 3, 8
8	8.Inspection and Quarantine of Entry Goods 8.1 Inspection of entry stone and coating 8.2 Inspection of entry waste that can be used as raw materials 8.3 Inspection of entry exhibit	1.Let students to understand the content and procedure of inspection for entry stone and coating 2. Let students to understand the content and procedure of inspection for entry waste that can be used as raw materials 3. Let students to understand the content and procedure of inspection for entry exhibit.	2	Classroom teaching, Group discussion	1,3,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
9	9.Inspection and Quarantine of Exit Goods 9.1 Inspection and quarantine of exit animals and their products 9.2 Inspection and quarantine of exit plants and their products	1. Let students to understand the laws and regulations of plant, animal and their products in developed countries. 2.Let students to understand the content and procedure of inspection for exit animals and their products. 3.Let students to understand the content and procedure of inspection for exit plants and their products	2	Classroom teaching, Group discussion	1,3,4,8
10	10. Inspection and Quarantine of Exit Goods 10.1 Inspection and quarantine of exit cosmetics 10.2 Inspection and quarantine of exit toy	1. Let students to understand the laws and regulations of cosmetics and toy in developed countries. 2.Let students to understand the content and procedure of inspection for exit cosmetics 3..Let students to understand the content and procedure of inspection for exit toy	2	Classroom teaching, Group discussion	1.3,8
11	11. Inspection and Quarantine of Exit Goods 11.1 Inspection and quarantine of exit Electromechanical products 11.2 Inspection and quarantine of exit food	1. Let students to understand the laws and regulations of Electromechanical products and food in developed countries. 2.Let students to understand the content and procedure of inspection for exit Electromechanical products 3. Let students to understand the content and procedure of inspection for exit food. 4. Inspection and quarantine departments have the sacred responsibility of "keeping the country's door and protecting the country's name" to cultivate students' patriotism and faith..	2	Classroom teaching, Group discussion	1,3,6,8
12	12.Inspection and Quarantine of Exit Goods	1.Let students to understand the laws and regulations of dangerous goods, transport packing material	2	Classroom teaching,	1,3,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	12.1 Inspection and quarantine of exit dangerous goods 12.2 Inspection of transport packing material of dangerous goods	of dangerous goods in developed countries and relevant international regulations. 2.Let students to understand the content and procedure of inspection for exit dangerous goods. 3. Let students to understand the content and procedure of inspection for exit transport packing material of dangerous goods. 4. Let students understand the types of dangerous goods, relevant laws and safety measures, and let students establish a strong sense of safety and cherish life.		Group discussion	
13	13.1Inspection and Quarantine of Entry and exit container 13.2 Inspection and Quarantine of Entry and exit transportation vehicles.	1.Let students to understand the laws and regulations of container & transportation vehicles in developed countries and relevant international regulations. 2. Let students to understand the content and procedure of inspection for Entry and exit container & transportation vehicles	2	Classroom teaching, Group discussion	1,3,8
14	14.Health and Quarantine of entry-exit personnel 14.1 The purpose and scope of health and Quarantine of entry-exit personnel 14.2 What are International Health Regulations (IHR)? 14.3 Objects and Concept of frontier health and Quarantine Law	1. Let students to understand the laws and regulations of frontier health and quarantine law 2. Let students to understand the International Health Regulations (IHR). 3. Let students to understand the content and procedure of health quarantine for entry-exit person 4. To cultivate students' correct awareness of health and epidemic prevention and enhance their health awareness.	2	Classroom teaching, Group discussion	1,5,8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
15	15. Inspection and Quarantine of goods carried by entry-exit passengers, companion animals, express mails and postal articles 15.1 1. Inspection and quarantine of goods carried by passengers 15.2 Inspection and quarantine of companion animals carried by entry-exit passengers 15.3. Inspection and Quarantine of entry-exit express mails and postal articles	1. Let students to understand the relevant international laws and regulations. 2. Let students to understand the content and procedure of inspection and quarantine for goods carried by passengers 3. Let students to understand the content and procedure of inspection and quarantine for companion animals carried by entry-exit passengers 4. Let students to understand the content and procedure of inspection and quarantine for entry-exit express mails and postal articles	2	Classroom teaching, Group discussion	1,3,7,8
16	Final Assessment	Final Assessment	2	Classroom teaching, Group discussion	

#### V Period Distribution and Teaching Modes

Period Distribution Course Content	Teaching Modes			Remarks	Subtotal
	Classroom teaching	Exercise	Group discussion		
1. Introduction	2				2
2. Laws and Regulations of Entry-Exit Inspection and Quarantine	2				2
3. Law of the People's Republic of China on Entry and Exit Animal and Plant Quarantine and its regulations.	2				2

4.Food Safety Law of the People's Republic	2				2
5.Inspection and Quarantine of Entry Goods 5.1 Inspection units and Inspector 5.2 Time limit for inspection 5.3 Range for inspection 5.4 The place for inspection 5.5 Inspection and quarantine of entry animals and their products 5.6 Inspection and quarantine of entry plants and their products	1.5		0.5		2
6. Inspection and Quarantine of Entry Goods 6.1 Inspection of entry mechanical and electrical products 6.3 Inspection of entry vehicles 6.3 Inspection of entry food	1.5		0.5		2
7.Inspection and Quarantine of Entry Goods 7.1. Inspection of entry wooden packaging 7.2 Inspection of entry Special item 7.3 Inspection of entry cosmetic	1.5		0.5		2
8.Inspection and Quarantine of Entry Goods 8.1 Inspection of entry stone and coating 8.2 Inspection of entry waste that can be used as raw materials 8.3 Inspection of entry exhibit	1.5		0.5		2

<p>9. Inspection and Quarantine of Exit Goods</p> <p>9.1 Inspection and quarantine of exit animals and their products</p> <p>9.2 Inspection and quarantine of exit plants and their products</p>	1.5		0.5		2
<p>10. Inspection and Quarantine of Exit Goods</p> <p>10.1 Inspection and quarantine of exit cosmetics</p> <p>10.2 Inspection and quarantine of exit toy</p>	1.5		0.5		2
<p>11. Inspection and Quarantine of Exit Goods</p> <p>11.1 Inspection and quarantine of exit Electromechanical products</p> <p>11.2 Inspection and quarantine of exit food</p>	1.5		0.5		2
<p>12. Inspection and Quarantine of Exit Goods</p> <p>12.1 Inspection and quarantine of exit dangerous goods</p> <p>12.2 Inspection of transport packing material of dangerous goods</p>	1.5		0.5		2
<p>13.1 Inspection and Quarantine of Entry and exit container</p> <p>13.2 Inspection and Quarantine of Entry and exit transportation vehicles.</p>	1.5		0.5		2
<p>14. Health and Quarantine of entry-exit personnel</p> <p>14.1 The purpose and scope of health and Quarantine of entry-exit personnel</p> <p>14.2 What are International Health Regulations (IHR)?</p> <p>14.3 Objects and Concept of frontier health and Quarantine Law</p>	1.5		0.5		2

15. Inspection and Quarantine of goods carried by entry-exit passengers, companion animals, express mails and postal articles 15.1 1. Inspection and quarantine of goods carried by passengers 15.2 Inspection and quarantine of companion animals carried by entry-exit passengers 15.3. Inspection and Quarantine of entry-exit express mails and postal articles	1.5		0.5		2
16. Final Assessment	1.5		0.5		2
<b>Total</b>	<b>26</b>		<b>6</b>		<b>32</b>

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Homework	I will give some questions and students will give me the homework by writing on the textbook	30%	1,2
Course paper	I will give several subjects. Students will give me work after 2-3 weeks	30%	1,3
Class performance	I will give some questions on the class. Meanwhile, the attendance of the students will also be checked	40%	1,2,3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

## **VII Textbooks and References**

### Textbooks:

Jianhua Xie, DeCong Huang etc.. *Regulations for inspection and quarantine and practice*. Chemical Industry Press, 2010.

### References:

*Complete book of inspection and quarantine laws and regulations of Quality Supervision Bureau of the people's Republic of China*. China China Legal Publishing House, 2019

Lei Hong. *WTO and the latest entry-exit inspection and quarantine practice book*. China Customs Press, 2003.

Lei Hong. *Inspection and quarantine of import and export commodity*. GeZhi Press, 2008.

Website: <http://www.customs.gov.cn/>

**Written by: Dekai Wang**

**Reviewed by: Qiaojun Jia**

**Date: April 19, 2021**

# Syllabus of Biopreparatics

**Course Name/Title:** Biopreparatics      **Course code:** 87904

**Course Type:** Specialized Course, Optional Course

**Total Teaching Hours:** Classroom Hours: 32

**Course Credit:** 2

## I Course Introduction

Rapid development of biological products industry requires a lot of biotechnology professional persons, and the biologicology is a bridge to let students from theory to practice. Using technology and method from biochemistry, genetic engineering and cell engineering etc., biologicology can produce biological products to solve disease prevention and diagnosis of human and animal. So biologicology is an applied science of close connection with theory and practice, and is a very important optional course in biopharmaceutical professional. This course consists of six parts, the first part mainly introduces the basic knowledge and skills of biological products' production, the others mainly introduce the production technology of several categories biological products, as well as the developing trend of biological products industry.

## II Course Objective

### Ideological and political objective

**Course objective 1:** The students will build up the correct values in scientific research by giving proper examples in class.

**Course objective 2:** The students will cultivate the students to be rigorous in scientific study and to have innovative thinking and creativity.

### Knowledge objective:

**Course objective 3:** The students will know preparation method of biological products and basic requirement.

**Course objective 4:** The students will master the basic principle and production technology of preventive biological products preparation.

**Course objective 5:** The students will master the basic principle and production technology of treatment biological products preparation.

**Course objective 6:** The students will know the latest progress and developing trend of biological products' field.

### Ability objective:

**Course objective 7:** Have the work ability of engaging in biological products' production and research.

**Course objective 8:** Have active exploration spirits and independent thinking ability.

**Course objective 9:** Have a strong self-learning ability.

### Quality objective:

**Course objective 10:** Cultivate students' responsible occupation ethics and work style.

**Course objective 11:** Enhance students' sense of social responsibility.

**Course objective 12:** Students will have the habit of deep thinking.

**Course objective 13:** Students will have scientific learning attitude.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
<b>Graduation Requirement 4</b>	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master basic knowledge and skills of biological sciences	Course Objective 1, 2, 3, 4, 5, 7, 9, 11, 12, 13
<b>Graduation Requirement 6</b>	Through certain experimental and practical experience in biotechnology, they will master the experimental skills of related courses as well as relevant biological experimental data processing and analysis methods, and understand the frontier technology and development trend of this field.	Course Objective 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13
<b>Graduation Requirement 7</b>	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	Course Objective 1, 2, 6, 11, 12, 13
<b>Graduation Requirement 8</b>	Could summarize, organize, and analyze experimental results, synthesize the theoretical knowledge and skills acquired, and engage in scientific research in biological sciences, biotechnology, and related fields; they have the basic ability to practice biotechnology downstream engineering and technological innovation; they have a strong scientific interest and the ability to think critically.	Course Objective 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13

### IV Course Content and Learning Objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<p>General of Biological Products</p> <p>Chapter 1: Overview of biological products</p> <p>Chapter 2: Biological products preparation</p> <p>Chapter 3: Quality management, detection and standardization of biological products</p> <p>Chapter 4: Packaging, storage and transportation of biological products</p>	<ol style="list-style-type: none"> <li>1. To know the types and application of biological products and their development history.</li> <li>2. To master the method of separation and purification and preparation of biological products.</li> <li>3. To understand the GMP regulations.</li> <li>4. To know quality detection of biological products as well as packaging and transportation requirements.</li> <li>5. To build up the correct values in scientific research by giving proper examples in class (Ideological and political objective)</li> </ol> <p>Key point: biological products preparation.</p> <p>Difficult point: the GMP regulations; quality detection of biological products.</p>	4	Lectures in class	teaching objective 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13
2	<p>Vaccine</p> <p>Chapter 5: Overview of vaccine</p> <p>Section 1: History, development and prospect of vaccine</p> <p>Section 2: Ingredient, property and type of vaccine</p> <p>Section 3: Screening and management of toxin bacteria in biological products</p> <p>Section 4: Planned immunization and combined immunization</p> <p>Section 5: Development and</p>	<ol style="list-style-type: none"> <li>1. To know the development history of vaccine.</li> <li>2. To master ingredient and property and type of vaccine.</li> <li>3. To master screening and management of toxin bacteria in biological products.</li> <li>4. To understand planned immunization and</li> </ol>	13	Lectures in class	teaching objective 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>application of immune adjuvant</p> <p>Section 6: Vaccine and immunization</p> <p>Chapter 6: Gene engineered vaccine</p> <p>Section 1: Gene engineered subunit vaccine</p> <p>Section 2: Gene engineered vectored vaccine</p> <p>Section 3: Nucleic acid vaccine</p> <p>Section 4: Gene deleted live vaccine</p> <p>Section 5: Protein engineered vaccine</p> <p>Section 6: Transgenic plant vaccine</p> <p>Section 7: Superiority of the gene engineered vaccine and its development focus</p> <p>Chapter 7: Bacterial vaccine</p> <p>Section 1: Overview</p> <p>Section 2: Bacterial inactivated vaccine</p> <p>Section 3: Bacterial attenuated live vaccine</p> <p>Section 4: Toxoid vaccine</p> <p>Section 5: Bacterial polysaccharide vaccine</p> <p>Chapter 8: Viral vaccine</p> <p>Section 1: Overview</p> <p>Section 2: Hepatitis vaccine</p> <p>Section 3: AIDS vaccine</p> <p>Section 4: Poliomyelitis vaccine</p> <p>Section 5: Measles vaccine</p> <p>Section 6: Mumps vaccine</p> <p>Section 7: Rubella vaccine</p> <p>Section 8: Varicella and herpes zoster vaccine</p> <p>Section 9: Japanese encephalitis vaccine</p> <p>Section 10: Rabies vaccine</p>	<p>combined immunization.</p> <p>5. To master the application of adjuvant.</p> <p>6. To know the type of several major categories vaccines and master their preparation technologies.</p> <p>7. To cultivate the students to be rigorous in scientific study and to have innovative thinking and creativity. (Ideological and political objective)</p> <p>Key point: ingredient and property and type of vaccine; screening and management of toxic bacteria; adjuvant; the type of gene engineered vaccine, bacterial vaccine, viral vaccine; preparation technology of vaccine.</p> <p>Difficult point: vaccine's type and preparation method.</p>			

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	Section 11: Influenza vaccine Section 12: Epidemic hemorrhagic fever vaccine Section 13: Viral vaccine being developed				
3	Unit 3: Blood Products Chapter 9: Overview of blood and blood products Section 1: The composition and physical and chemical properties of blood Section 2: Blood transfusion Chapter 10: Blood products and their production technology Section 1: Overview Section 2: The type and application and quality control of blood products Section 3: Blood products' production technology Chapter 11: Human blood substitute	1. To know the overview of blood products. 2. To master the production technology of blood products. 3. To know the human blood substitute. Key point: Blood products' production technology. Difficult point: Blood products' production technology. 4. To build up the correct values in scientific research by giving proper examples in class (Ideological and political objective) Key point: Blood products' production technology. Difficult point: Blood products' production technology.	4	Lectures in class	teaching objective 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13
4	Biotechnology drug Chapter 12: Overview of biotechnology drug Chapter 13: Cytokine drug Section 1: Overview Section 2: Interleukin Section 3: Tumor necrosis factor Section 4: Interferon Section 5: Colony-stimulating	1. To know the types of biotechnology drug. 2. To master the preparation method of biotechnology drug. 3. To understand the development of biotechnology drug. 4. To cultivate the students	9	Lectures in class	teaching objective 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>factor</p> <p>Section 6: Growth factor</p> <p>Chapter 14: Recombinant hormone drug</p> <p>Section 1: Recombinant human insulin</p> <p>Section 2: Recombinant human growth hormone</p> <p>Section 3: Gonadotropin-releasing hormone drug</p> <p>Chapter 15: Gene therapy and nucleic acid drug</p> <p>Section 1: Gene therapy</p> <p>Section 2: Nucleic acid drug</p> <p>Chapter 16: Antibody drug</p> <p>Section 1: Overview</p> <p>Section 2: Antitoxin and immune serum</p> <p>Section 3: Monoclonal antibody</p> <p>Section 4: Gene engineering antibody</p>	<p>to be rigorous in scientific study and to have innovative thinking and creativity. (Ideological and political objective)</p> <p>Key point: preparation technology of several drugs.</p> <p>Difficult point: preparation technology of several drugs.</p>			
5	<p>Immune Modulators and Microecological Preparation</p> <p>Chapter 17: Immune Modulators and Microecological Preparation</p> <p>Section 1: Immune modulators</p> <p>Section 2: Microecological preparation</p>	<p>1. To know the type of immune modulators and their therapeutic effect for tumor.</p> <p>2. To know research progress of microecological preparation, such as prebiotics, probiotics, etc..</p> <p>3. To build up the correct values in scientific research by giving proper examples in class (Ideological and political objective)</p> <p>Key point: immune modulators, microecological preparation.</p> <p>Difficult point:</p>	2	Lectures in class	teaching objective 1, 2, 3, 4, 5, 6, 8, 9, 12, 13

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		microecological preparation research.			

## V Practice Plan and Requirement

This course has no practice time, just classroom time. In the list below, it shows each unit requires how many class hours.

Units	Topic	Classroom Hours
Unit 1	General of Biological Products	4
Unit 2	Vaccine	13
Unit 3	Blood Products	4
Unit 4	Biotechnology drug	9
Unit 5	Immune Modulators and Microecological Preparation	2
<b>Total</b>		32 class hours

## VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance/Classroom performance	Roll call and answer the questions	20%	1, 2, 8, 10, 11, 12, 13
Group discussion/Oral presentation	3 persons/Group, assessed by other groups	10%	9, 11, 12
Homework	2-3times	20%	9, 10, 11
Final exam	Close-book	50%	1, 2, 3, 4, 5, 6, 7

This course adopts PPT media mode with blackboard-writing for teaching. Before the class, students are required to have a preview. In the class, the teacher will interact with students by reviewing the knowledge have been taught and some questions. After classes, students may be asked to consult related references and make a summary of studying keynotes. And students also need to do some homework. Meanwhile, student should prepare and do oral presentation by 2-3 persons per group.

Improving students' self-learning ability is an important part of teaching. Students will be required to preview the textbook and read the related references, books. Meanwhile, students will be asked to finish the extracurricular exercise. Another, the teacher can carry on the second class to answer students' questions.

## VII Textbooks and References

### Textbook

[1] Guoxing Nie, Junli Wang, *Biologicology*. Science Press, 2012.

### **References**

- [1] 周东坡, 赵凯, 周晓辉等编著: 《生物制品学》, 化学工业出版社, 2014 年出版.
- [2] 王永芬主编: 《生物制品生产技术》, 化学工业出版社, 2013 年出版.

### **Web sources**

- [1] <http://www.ijbiol.com/CN/volumn/home.shtml>
- [2] <http://www.zgswj.com.cn/WKB3/WebPublication/index.aspx?mid=SWZP>

**Written by: Jieqiong Qiu**

**Reviewed by: Yeqing Wu**

**Date: 2021-05-01**

## Syllabus of Graduation Thesis

**Course Name/Title:** Graduation thesis      **Course code:** 86932

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 16W

**Course Credit:** 8

### I Course Introduction

Undergraduate thesis is the last comprehensive teaching practice of undergraduate teaching to comprehensively test the level of knowledge and ability of students. It aims to cultivate students' comprehensive use of the basic theory, professional knowledge and basic skills of the subject to carry out scientific inquiry analysis to solve the biotechnology related fields Production, research, development and design of the problem, to improve their literature search and professional writing ability, master the field of biotechnology research and development of basic ideas and methods to improve the comprehensive practical ability and quality, cultivate rigorous scientific attitude, team Cooperation and entrepreneurial spirit, to enhance students' social adaptability and employment competitiveness, make it become an outstanding student of the discipline and similar disciplines, but also to meet the broad needs of society, to continue to study or to work to achieve quality and transition.

### II Course objectives

1. Train students' research, literature search, data collection, foreign language literature reading and translation and induction and summary of various information.

2. Under the guidance of the instructor, the basic use of basic theory and professional knowledge and skills, training independent analysis of the problem and the ability to solve the problem.

3. Training program design and demonstration, training rigorous scientific attitude and good work style and the correct research ideas and design ideas.

4. To train students on the application of experimental equipment and maintenance, experimental data analysis, testing and processing and skilled application of computer and other aspects of capacity.

5. Develop students' written and scientific papers writing skills.

6. Consolidate, deepen and broaden the basic theory and professional knowledge, make it systematic, integrated, cultivate students' practical ability, innovation ability and entrepreneurial ability.

7. Train students' team spirit, innovative spirit, collaboration and organizational skills.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Index Point	Requirements	Course Objectives
Graduation Requirement 3			Course Objective 1、4
Graduation Requirement 4			Course Objective 2、3、4、5
Graduation Requirement 5			Course Objective 2、6
Graduation Requirement 6			Course Objective 3、

		4、5
Graduation Requirement 7		Course Objective 5、6
Graduation Requirement 8		Course Objective 3、6、7

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Topic selection	<p>1. The principle of selection</p> <p>(1) Meet the basic requirements of teaching, from the professional talent training objectives, to ensure that the basic scientific research training and comprehensive ability training, and strive to consolidate, deepen and expand the students learn what is conducive to cultivating students' independent ability to work.</p> <p>(2) The topic should in principle require the combination of biotechnology-related industries in production, research and practical tasks in order to promote the teaching, research, production of organic integration.</p> <p>(3) The topic should have a certain degree of theoretical depth and practical application value, should be reflected in the field of biological science and technology development trends and levels, there is a certain degree of innovation.</p> <p>(4) The amount of research content, moderate difficulty, to ensure that the middle level of students in the effective graduation thesis, through the efforts to complete on time.</p> <p>(5) To implement the principle of teaching students in accordance with their aptitude, so that all kinds of students in the original level and ability to have a greater improvement, to encourage outstanding students to be innovative.</p> <p>(6) The distribution of subjects adheres to each subject and an independent completion; if a number of students to participate in the</p>	20	Group discussion	Course Objective 1、2

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>same larger subject, the content must be to be different, clearly defined by each student should be completed independently of the task, to ensure that the workload is full.</p> <p>(7) Graduation thesis title and content are generally not the same as in previous years, unless there is a clear innovation.</p> <p>(8) Topics should be more technically mature.</p> <p>2. Topic range</p> <p>(1) To guide teachers to research part of the research content.</p> <p>(2) The continuation of various types of student research training programs (including challenge cup, new seedlings program, college research program, etc.).</p> <p>(3) Biotechnology-related fields of theory, methods and applied research topics.</p> <p>(4) Other topics that meet the requirements of the biology thesis.</p>			
2	Literature review	After the title and task were determined, students should search for and collect more than 20 references in the first 3 weeks of the graduation thesis, and students should complete the literature review report after references reading.	15	Literature review、 Writing	Course Objective 2、 3
3	Opening report	On the basis of carefully reviewing the literature and writing a review, students independently complete the topic report (including the purpose and significance of the topic, the current situation at home and abroad, the research content, the research plan, the expected results, the schedule, the required equipment, etc.), and the Communication within the group. The opening report will be submitted to the college (department) for review and filing within the 5th week after being reviewed and signed by the instructor.	10	Designment、 Literature review 、 Group discussion and Writing	Course Objective 1、 3
4	Graduation	Graduation thesis requires a reasonable	255	Experimente	Course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	thesis	research plan, unique insights, novelty, high academic value or strong application value; accurate and reliable experimental data; strong practical ability; proficient in comprehensive application of the basic theories and basic theories of the major Basic skills, clear and correct presentation of concepts; proficiency in calculation methods, correct calculation results; rigorous structure, clear levels, fluent text, and meticulous logic. If there are diagrams, the diagrams should be produced accurately, beautifully, and formatted.		nt, Group discussion, Writing	Objective 1, 3, 4, 5, 6, 7
5	Graduation thesis defense	The graduation defense requires an explanation of the main content of the thesis, the expression requires accurate concepts, clear thinking, and the ability to answer the main questions raised by the defense team correctly and fluently.	20	Group discussion	Course Objective 1, 3, 6, 7
6	Studying performance	Able to complete the required tasks for the graduation thesis on time; good learning attitude and strong initiative; respect teachers and have a good spirit of cooperation; observe discipline and no absenteeism; take care of public property.	0	Experiment, Writing	Course Objective 1, 2, 3, 4, 5, 6, 7

## V Period Distribution and Teaching Modes

### ● Period Distribution

Practice project name	Content	Main equipment Or experimental environment	Period	Number of each group	Practice attributes (basic/comprehensive/design/research innovation)	Open request (Compulsory/optional)
Topic selection	Fill in the topic selection declaration form	Practice Base	20	1	Comprehensive, Design	Compulsory
Literature review	Look up the literature and write	Practice Base	15	1	Comprehensive	Compulsory

	a review					
Opening report	Prepare an opening report and reply	Practice Base	10	1	Comprehensive、Design	Compulsory
Graduation thesis	Carry out relevant experiments, collect and organize data, and write papers	Practice Base	240	1	Comprehensive、innovation	Compulsory
Graduation thesis defense	Participate in graduation thesis defense	Practice Base	20	1	Comprehensive	Compulsory
Working performance	Working performance	Practice Base	0	1	Comprehensive	Compulsory

### ● Teaching Modes

#### 1. The timing of graduation thesis

The work of the thesis is mainly focused on the eighth semester, 16 weeks. According to the subject requires, can be arranged about 3 weeks of research and practice. Encourage students to advance into the laboratory, participate in the scientific research work of teachers, to make high-quality graduation thesis, and further cultivate the spirit of innovation to create the conditions.

The order and time allocation of graduation thesis process:

- (1) Research phase: about 1 week
- (2) Open the argument stage: about 2 weeks
- (3) Research or design stage: about 11 weeks
- (4) Writing stage: about 1 week
- (5) Reply stage: about 1 week

#### 2. Graduation thesis implementation

The college set up a leading group of graduation thesis. The members of the group consisted of the president, department director, teaching secretary and so on. The main task is to organize and lead the college graduate thesis work, according to the training objectives and teaching basic requirements, organize graduates to select topics, access to literature, mid-term assessment and defense and a series of work.

##### (1) Graduation thesis mobilization

In the first week of the first semester, the college organized the graduation thesis mobilization, and carried out laboratory management and safety education, so that students clearly the importance of graduation thesis, correctly understand the relationship between future work and graduation thesis work, Stipulate the discipline requirements and the quality requirements of the paper, introduce the rules and regulations of the laboratory and safety requirements to ensure the successful completion of the thesis.

##### (2) To the students issued a task book

Students will meet with the instructor, instruct the instructor to prepare the instruction book of graduation thesis, announce the graduation thesis request and the relevant management regulations to the student, release the thesis task book, explain the purpose, nature, content and requirement of

the thesis clear the paper task.

(3) Access to literature, complete the literature review and open the report

After the subject and the task are determined, the students should be in the first three weeks of the thesis, aim to find and collect all kinds of information about more than 20 literature (including two or more foreign literature), students in the literature on the basis of reading (Including the purpose and significance of the subject, the status quo at home and abroad, research content, research program, expected results, process arrangements, the necessary equipment, etc.), and exchange within the group. The report is reviewed and filed by the instructor in the first five weeks after the examination.

(4) Experimental stage

After the identification of the experimental program, students under the guidance of the instructor, you can follow the design (thesis) process table, and gradually experiment or design. The instructor regularly examines the progress of the experiment (design), promptly questions the questions (questions) and results of the experiment (design). Students are realistic to record the experimental data, timely order, analyze the experimental data or design documents, find the problem in a timely manner to guide the teacher in order to take countermeasures as soon as possible.

(5) Medium-term inspection

In the middle stage, the college unifies the mid-term examination of the thesis (including the completed research content, the obtained results, the next work plan and the research content, etc.), the students fill in the interim inspection report form, the instructor to review the signature The college is reviewed and archived. At the same time, the problems found in the mid-term inspection, instructors and students should immediately find the reasons and improve in a timely manner.

(6) To write a paper phase

After the completion of the experimental study, students write thesis under the guidance of teachers according to "Graduation thesis writing standard of Zhejiang SCI-TECH University", and to guide the teacher validation. The content of the thesis is usually composed of cover, abstract (Chinese and foreign), catalog, text, reference, thanks and appendix. The main part of the thesis should include: preface (including literature review), experimental part, result and discussion, conclusion and so on.

### 3. Graduation thesis process management

To fulfill the graduation thesis are very nervous and has a greater degree of freedom, in order to ensure the quality of graduation thesis, in addition to the requirements of teachers and students to implement the relevant provisions of the school and norms, but also requires:

(1) After receiving the task book, the student will be asked to give the instructor a report (explain the understanding of the subject, the task of undertaking, his own work plan, etc.) during the second to third week.

(2) To carry out the mid-term report to the 7th to 8th week, with the teaching and research section as a unit, in the form of reply, report, for each student to check one by one. Check the understanding of the subject, the completion of the task, the follow-up work arrangements.

(3) In the week before the graduation thesis defense, to organize the title check, the experimental subject to check the experimental demonstration and experimental data, software topics to be demonstrated, etc., to determine the authenticity of the work content.

## **VI Assessment (Graduation thesis defense and grading)**

### **(A) Graduation thesis defense**

#### **1. Defense committee and defense team**

(1) According to the number of professional students, according to the professional or research direction to set up a number of defense group, the defense team members from 5-7 (odd people), recommended to absorb technical basic courses and basic teachers to participate, but also appropriate to employ a high level of theory, The experience of experienced outside school experts to participate.

(2) The defense team set up a head, by the senior title above (including senior) teachers, set up a secretary. Instructors should avoid the defense of their guidance. The team leader of the defense team shall convene a meeting of the members of the defense group before the defense, arrange the order of the reply, and hire the teacher to review the student's graduation thesis.

(3) The defense committee should carefully review the student's graduation thesis before the defense. Respond to a fair, rigorous attitude, in consultation or voting way out of the results.

#### **2. Qualification review**

(1) Students must complete the graduation thesis as planned, the examination and approval by the instructor, signed, and in the graduation thesis at the time of acceptance for the eligible person to obtain the eligibility to participate in the defense.

(2) Students must be in the defense before 2 to 3 days, the thesis will be the defense committee, the defense committee to transfer the thesis to the evaluation of teachers, review teachers to write reviews.

(3) Students are required to submit an opening report and a job log to the defense committee, who cannot participate in the reply.

#### **3. Graduation thesis defense**

(1) After the review of the thesis, by the defense team to respond and open the way.

(2) In the reply, the student shall report to the defense committee the main contents of the thesis, present the relevant chart or drawing, explain the question for about 15 minutes, and answer the question of four or more members of the defense group. Each student answers the question about 15 minutes.

(3) The defense process, should be a good record for the assessment of the results.

### **(B) Graduation thesis grading**

The assessment is mainly for students to complete the thesis and reply to the situation, by the instructor, the paper review teacher, thesis defense team jointly assessed.

#### **1. General requirements**

(1) graduation thesis achievement should be open, fair, just, assessment results adhere to the standard, strict requirements, seeking truth from facts. Adhere to the students to complete the quality and level of graduation thesis, the ability to work independently and innovative spirit, work attitude and work style and defense situation as the basis.

(2) graduation thesis achievements with good, good, medium, pass, fail five score, the number of outstanding people in principle not more than 20% of the number of students in the defense group, medium, pass, fail not less than 20%.

(3) grade grades should be composed of three parts: the teacher's rating, the reviewer's rating

and the defense committee. The weight of the three-part score is: mentor (30%), reviewer (30%), defense committee (40%), and then converted into five grades.

(4) Students who have assessed their grades as "failing" will be reviewed and negotiated with the instructor.

(5) from the graduation thesis by 3% of the proportion of outstanding school graduation thesis.

## **2. Evaluation criteria**

### **(1) Instructor score (30%)**

According to the students' attitude towards the work of graduation thesis, work discipline, analysis of problems and ability to solve problems, hands-on ability and the completion of the task, the level of graduation thesis and the normative writing of graduation thesis. Students who have made pioneering work in the thesis are innovative and should be considered in the score.

### **(2) Reviewers (should be held by lecturers above) Rating (30%)**

According to the meaning of the topic, the completion of the task, the general level of graduation thesis, the normative (the norm of the table and the table), the expression of the thesis, and so on.

### **(3) Defense Committee Rating (40%)**

a. (40%) students in the process of graduation thesis defense, the readme includes: the title of the thesis and the meaning of the topic, instruct the teacher to issue the task; I completed the work, focus on work and completion; test results and analysis and conclusions. Students in the process of telling, to the concept of clear, logical and correct view.

b. Answer questions (60%) are based on the comprehensiveness, correctness and difficulty of answering questions; and the defense committee gives revisions to student graduation thesis.

## **3. Performance evaluation**

After the reply, the defense committee according to the student defense situation, to guide teachers and review the teacher reviews and the quality of the paper, in accordance with the unified scoring criteria and scoring methods to determine the results of each student, the Department of the audit, the examination and approval to the students after the announcement.

## **VII Recommended teaching materials and reference books**

According to the topic of graduation thesis, the instructor selects and draws up relevant literature and reference books.

**Written by:** Haimin Chen

**Reviewed by:** Weibo Jin

**Date:** Apr 18, 2021

# Syllabus of Comprehensive practice of biological products

**Chinese name of course:** 生物制品综合实习

**Course Code:** 87905

**English name of course:** Comprehensive practice of biological products

**Classification and characteristic of the course:** (Specialized Course ) (optional)

**Total teaching hours:** 20 teaching hours ( 20 for extra-curricular practice)

**Credit:** 1

**Prerequisite:** Virology, immunology, gene engineering, biologics

**Applicable specialty:** Biotechnology specialty

**Department (Room):** Department of Biotechnology

## 1、 Introduction of the course

The comprehensive practice of biological products is an important practice link of biotechnology specialty after completing the theoretical course. Through practice, students can gradually contact with the society, cultivate their good moral character and professional skills in various kinds of work, lay the foundation for quickly adapting to the society after graduation, and at the same time, it is also a comprehensive test and improvement process for students' comprehensive ability.

This course is a professional course combining theory with practice. Students are required to acquire the following knowledge and skills through the study of theory and practice of this course. The purpose of graduation practice is to cultivate students' ability to analyze and solve the problems encountered in the production and inspection of biological products by independently and comprehensively using the basic theory, professional knowledge and basic skills of biological products related courses; Improve students' communication ability and professional ethics. Through investigation and practice, we can test the students' application of the knowledge they have learned, so that they can further understand the enterprise, society and national conditions, and encourage the students' dedication and entrepreneurial spirit, so as to complete the initial transition from the learning post to the working post, and lay a solid professional foundation for the post work in related industries after graduation.

## 2、 Course Objective

Course objective 1: to understand the production process, equipment, control points and detection methods of a biological product; Understand the characteristics of production and production organization management and technical management;

Course objective 2: to understand the general layout, process flow chart, equipment layout and piping layout of the internship plant; Understand the import and export channels, operation channels, maintenance channels and attached devices of raw materials and products.

Course objective 3: understand the separation and inspection of biological products and products: be familiar with the separation and inspection process, basic technology and management procedures of biological products and products. Understand the biosafety treatment of the plant.

Course objective 4: fermentation process and technology: generally practice in food, biopharmaceutical, biochemical, brewing and other industries. It is required to be familiar with and master the process, basic technology and management procedures of industrial fermentation.

Course objective 5: through this comprehensive practice, students will have the overall concept and consciousness of the curriculum system;

Course objective 6: good professional ethics and discipline.

### 3.The corresponding relationship between curriculum teaching objectives and graduation requirements

Graduation requirements	Graduation requirement target point	Objectives
Graduation requirements4	Comprehensively understand and master the basic theories of biological science and biotechnology, mathematical statistics, bioengineering principles, understand the theoretical knowledge of biological industry and other aspects, and master the ability to use them to analyze problems.	Course objectives 1-6
Graduation requirements6	Have some experience in biotechnology experiment, understand the frontier technology and development trend in this field.	Course objectives 1-6
Graduation Requirement 7	Ability to skillfully use a variety of modern media technology to actively acquire knowledge such as scientific research information; Ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key technologies related to life science, such as gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases and basic analysis technology of bioinformatics.	Course Objective 1-6
Graduation Requirement 8	Ability to summarize, sort out and analyze experimental results, comprehensively apply theoretical knowledge and skills mastered, and engage in scientific research in biological science, biotechnology and related fields; Have the basic ability of biotechnology downstream engineering practice and technological innovation; Strong scientific interest and critical thinking skills.	Course Objective 1-8

### 4、 The relationship between teaching content and curriculum objectives

The relationship of teaching content and objectives

No.	Teaching contents	Teaching requirements	hours	methods	objectives
1	Production process and management (1) Production process (2) Organization and	(1) Understand the production process, equipment, control points and detection means of a biological product (2) Understand the characteristics of production and production organization	6	Lectures, online courses, group discussions	Course objectives 1-6

No.	Teaching contents	Teaching requirements	hours	methods	objectives
	technical management of production	management and technical management. (3) Through group discussion on China's achievements in vaccine and other related fields, students' feelings of home and country, sense of pride and sense of mission will be aroused.			
2	Principles and methods of production process design (1) Process design principles (2) Equipment features and requirements	(1) Understand the design principles and methods of process and equipment in the production of the product; (2) Understand the structure, model, specification, material, processing characteristics and requirements of the main equipment, as well as the precautions for use and installation, etc; (3) Understand the actual operation and the original design of the guiding ideology and principles of the situation, explore feasible design ideas and improvement methods.	6	Lectures, online courses, group	Course objectives 4-6
3	Hardware layout of the building (1) General layout of the building (2) Layout of hardware equipment	(1) Understand the general layout, process flow chart, equipment layout and piping layout of the internship plant; (2) Understand the import and export channels, operation channels, maintenance channels and attached devices of raw materials and products.	2	Lectures, online courses, group	Course objectives 1, 2, 5, 6
4	Separation and inspection of biological products and products (1) Separation technology of biological products; (2) Basic technology and requirements of biological products testing	(1) Familiar with the separation and inspection process of biological products and products; (2) Understand the basic technology and management procedures of product separation and testing (3) Through the group discussion on the accidents of safety management at home and abroad, as well as China's laws and regulations in this regard, students should pay attention to the biosafety management.	6	Lectures, online courses, group	Course objectives 3-6

## 5、 Course hours allocation and teaching methods

(1) Course time allocation (according to the order (units of knowledge or items) allocation of total hours, reasonable allocation of lectures, experiments, exercises, discussions, counseling and other teaching links required hours)

实验课、课程设计、案例等实践性课程或实践教学内容课时分配表:

实验项目名称	内容提要	所用主要设备或实验环境	实验学时	每组人数	实验属性(基本/综合/设计/研究创新)	开出要求(必做/选做)
Production process and management	(1) Production process (2) Organization and technical management of production	Company	6	4	Comprehensive	Optional
Principles and methods of production process design	(1) Process design principles (2) Equipment features and requirements	Company	6	4	Comprehensive	Optional
Plant and hardware layout	(1) General layout of the plant (2) Layout of hardware equipment	Company	2	4	Comprehensive	Optional
Separation and inspection of biological products and products	(1) Separation technology of biological products; (2) Basic technology and requirements of biological products testing	Company	6	4	Comprehensive	Optional

(2) Teaching methods

Extra-curricular practice and special lecture

## 7、Course Assessment

Method or means of assessment	Assessment requirements	Check weight	Corresponding course objectives
Course paper	No less than 3000 words. It focuses on students' comprehensive mastery of the course, whether they can connect with real life and put forward their own views.	70	Course objectives 1-6
Attendance and performance in class discussion	No unexcused absence from class. Extra points will be given to students for attending lectures and answering questions with positive thinking	30	Course objectives 1-6

## **7、 Recommended teaching materials and reference materials**

(1) Teaching materials: (list the titles, authors, publishing houses, etc.)

No

(2) Reference books: (list the titles, authors, publishing houses, etc.)

No

(3) Online resources: (online course website)

No

**Written by:** Jin Weibo

**Proofread by:** Jianhong Shu

**Date:** 19-04-2021

## Syllabus of Laboratory Exercises of Microbiology

**Course Name/Title:** Laboratory Exercises of Microbiology    **Course code:** 86901

**Course Type:** Basic Course (Compulsory Course)

**Total Teaching Hours:** 32 (Laboratory Hours : 32 )

**Course Credit:** 1

### I Course Introduction

Exercises of Microbiology , as the major course of biotechnology, requires every student understand the basics of microbiology, explore the diversity of microbial life in our world, and grasp the better practical ability. On this course, you'll explore a general introduction to the field of microbiology and investigate the amazing diversity of microbial life. Learn about the significant roles microbes play in health, food, and the environment through expert interviews, lab demonstrations and practical experiments.

#### Exercise 1: Gram Staining

From this experiment, let every student know that the development of science and the progress of mankind are closely related. In the process of learning, we should see the micro knowledge, learn to think deeply about problems, based on life practice, and create a better life.

#### Exercise 2: Endospore, Capsule and Flagella Staining

From this experiment, let every student know that every people are members of the society. No matter where they are in the society and what kind of work they are engaged in, they can give play to their own energy and contribute their own strength to the progress of the society and human beings.

#### Exercise 8: Isolation and Viable Count of Microorganisms in Environmental Samples

From the environmental microorganism compatibility, let the students learn between people and society, between people to mutual tolerance, harmonious development.

### II Course Objective

The course aims to:

1. Microbes exist in every corner of society and develop in harmony with each other. Human beings should also learn to tolerate each other, learn to diversify development, and create a better life together.
2. Providing student with basic laboratory exercises of microbiology, such as microscopic techniques, morphology and staining, basic laboratory and culture techniques, etc;
3. Assisting them to grasp all kinds of basic laboratory techniques and skills in Microbiology;
4. Promoting their understanding of theoretical knowledge about the Microbiology and its laboratory methods;
5. Developing their experiments and research skills.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	Through certain biotechnology experiments and practical experience, master the experimental	2, 3, 4, 5

	skills of related courses and related biological experimental data processing and analysis methods, and understand the cutting-edge technologies and development trends in this field	
Graduation Requirement 7	Proficiency in using various modern media technologies to actively acquire scientific research information and other knowledge; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to master gene cloning and expression technology, microbial detection and diagnosis technology, and genetic modification technology , Early diagnosis technology for major diseases and basic bioinformatics analysis technology and other key technologies related to life sciences	1, 2, 3, 4, 5
Graduation Requirement 8	Have the ability to summarize, sort out and analyze experimental results, comprehensively use the theoretical knowledge and skills they have mastered, and be able to engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; have strong Scientific interest and critical thinking skills.	3, 4, 5

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Bright-Field Light Microscope, Smear Preparation and Simple Staining	(1) Know how to correctly use the microscope — especially the oil immersion lens; (2) Learn how to make and examine a bacterial smear; (3) Observing the bacterial morphology.	2	Classroom explanations, independent experiments	Course Objective 2,3
2	Gram Staining	(1) Understand the biochemistry underlying the Gram staining; (2) Understand the theoretical basis for differential staining	3	Classroom explanations, independent experiments	Course Objective 1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>procedures;</p> <p>(3) Perform a satisfactory Gram staining;</p> <p>(4) Differentiate a mixture of bacteria into gram-positive and gram-negative cells.</p>			
3	Endospore, Capsule and Flagella Staining	<p>(1) Understand the biochemistry underlying endospore staining, perform an endospore staining;</p> <p>(2) Understand the biochemistry of the capsule staining, perform a capsule staining;</p> <p>(3) Understand the biochemical basis of flagella staining, perform a flagella staining.</p>	4	Classroom explanations, independent experiments	Course Objective 1,2,3
4	Yeast Morphology and Counting Cells with a Hemacytometer	<p>(1) Observing the yeast morphology;</p> <p>(2) Understand the principle of hemacytometer, familiar how to use it.</p>	2	Classroom explanations, independent experiments	Course Objective 2,3
5	Observation Morphology of Actinomycetes and Molds	<p>(1) Observing the mycelium morphology of actinomycetes and molds;</p> <p>(2) Familiar how to make and observation filamentous microorganisms with insert coverslip method.</p>	3	Classroom explanations, independent experiments	Course Objective 2,3
6	Detection of Microorganisms in the Environments	<p>(1) Familiar to microbiological culture media preparation and sterilization;</p> <p>(2) Understand and master the principle and precautions of dry heat sterilization, high-pressure steam sterilization, ultraviolet sterilization;</p> <p>(3) Sampling, inoculation, cultivation and determination of microorganisms in different environments.</p>	6	Classroom explanation, group experiment	Course Objective 4,5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
7	Design and Preparation of Microbiological Culture Media	(1) Learn how to make and preparation of common culture media; (2) Designing selective medium according the established target.	4	Classroom explanation, group experiment	Course Objective 4,5
8	Isolation and Viable Count of Microorganisms in Environmental Samples	(1) Understand the reasoning behind pure culture preparations; (2) Correctly use an inoculating loop and needle, use aseptic technique to remove and transfer bacteria for subculturing; (3) Learn how to isolation and maintenance of pure cultures; (4) Familiar to the colony morphology characteristics of bacteria, actinomycetes, yeast, molds, etc; (5) Understand the principle and method of viable count of microorganisms: The Standard Plate Count.	5	Classroom explanation, group experiment	Course Objective 1,4,5
3	Microbial Colony Identification and Pure Cultures Conservation	(1) Familiar to the colony morphology characteristics of bacteria, actinomycetes, yeast, molds, etc; (2) Understand the principle of pure cultures maintenance; (3) Familiar to all kinds of pure cultures conservation.	3	Classroom explanation, group experiment	Course Objective 4,5
			Total 32		

#### V Period Distribution and Teaching Modes

The purpose of these laboratory exercises is to guide students through a process of development of microbiological technique, experimentation, interpretation of data, and discovery in a manner that will complement the textbook and make the study of microbiology both exciting and challenging. So before each exercise, everybody should preview the practice content and review related knowledge in textbook, understand the principle of the exercise. Especially the innovative experiment require students to participate in the experiment design and preparation, design experimental program, implemented after being approved by the classroom teacher. After the experiment, write a research

report according to scientific paper writing format.

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Operations and experimental results	Examine the students' comprehension and practical ability.	15 %	Course Objective 1,2,3
Experimental reports	Examine the students' ability to analyze the experimental results.	35 %	Course Objective 1,2,3
Innovation experiments laboratory report paper	Examine the students' comprehensive application and practical ability.	40 %	Course Objective 1,4,5
Participation and attitude in class	Evaluate students' attitude towards learning.	10 %	Course Objective 1,4,5

## VII Textbooks and References

**Textbooks:** Laboratory Manual of Microbiology, edit by ourself.

**References:**

- (1) Harley J P, Prescott L M. Laboratory Exercises in Microbiology (5th ed.). The McGraw–Hill Companies, 2002.
- (2) Morello J A, Granato P A, Mizer H E. Laboratory Manual and Workbook in Microbiology: Applications to Patient Care (7th ed.). The McGraw–Hill Companies, 2003.
- (3) Michael T. Madigan *et al.* Brock Biology of Microorganisms(14th ed.). Prentice Hall, 2015.
- (4) 周德庆, 徐德强主编. 微生物学实验教程(第4版) [M]. 高等教育出版社, 2019.
- (5) 沈萍, 陈向东主编. 微生物学实验 (第5版) [M]. 高等教育出版社, 2018.

**Written by:** Du Zhiyou

**Reviewed by:** Chen Haimin

**Date:** 2021.05.02

## Syllabus for Cell Biology Laboratory

**Course Name/Title:** Cell Biology Laboratory                      **Course code:** 86902

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 32 h (Laboratory Hours)

**Course Credit:** 1

### I Course Introduction

Cell Biology Laboratory is a laboratory-based course designed to acquaint students with basic practical skills used in cell biology. This course will reinforce the concepts presented in cell biology lecture. The laboratory experiments use visible microscopy to study cell structure, cell organelles, and cytoskeleton in different model systems. Cell culture techniques need to be mastered. Methods of data acquisition, analysis, and written presentation skills will also be covered during the course. These skills and techniques will then be utilized in upper level courses such as biochemistry, genetics, microbiology and molecular biology.

### II Course Objective

Objective 1. Develop the spirit of patriotism. Enhance students' interest and understanding of science, improving the students' critical thinking skills and creating an innovative spirit in team work.

Objective 2. Use current techniques and model systems to explore mechanisms of cell biology. Gain experience in data collection and analysis, interpretation of results, and experimental design.

Objective 3. Develop scientific writing and oral communication skills.

Objective 4. Understand the larger context of how disease states affect cellular function.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	Master the experimental skills of related courses and related biological experimental data processing and analysis methods, and understand the cutting-edge technologies and development trends in this field through certain biotechnology experiments and practical experience.	Course Objective 1, 2,
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic	Course Objective 1, 2, 3, 4

	experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	
Graduation Requirement 8	Have the ability to summarize, organize and analyze experimental results, comprehensively use the theoretical knowledge and skills that they have mastered, and engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; develop strong scientific interest and critical thinking skills.	Course Objective 1, 2, 3, 4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Observation of cell membrane permeability	(1) To understand the general law of cell membrane permeability. (2) Analyze the possible mechanism to further understand the structure and function of cell membrane through the observation of the permeability and hemolytic phenomena. (3) Guide students to establish patriotic spirit and the importance of maintaining the stability of the nation.	4	Experiment in group	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
2	Cell fusion	(1)To understand the basic principle of polyethylene glycol (PEG) induced cell fusion, to master the operation method of cell fusion with PEG. (2) describe the importance of actively introduction of advanced technology from abroad	4	Experiment in group	1, 2, 3, 4
3	Optical microscopic observation of plant cytoskeleton	To understand the structural characteristics of cytoskeleton and observation technology.	4	Experiment in group	1, 2, 3, 4
4	Cell culture	(1)To understand the general methods and steps of cell culture, further familiar with the sterile hoods in the process of cell culture. (2) To passage and propagate a tumor cell line, and to monitor the growth rate and viability of the culture over one week. (3) Develop the students` critical thinking skills and creating an innovative spirit in team work.	4	Experiment in group	1, 2, 3, 4
5	Cell growth curve	To understand the features of cell growth, principles of cell growth curve and to know well the method to drawing of cell growth curve.	4	Experiment in group	1, 2, 3, 4
6	Cryopreservation and recovery of cells	To familiar with the method of cryopreservation and recovery of cell and understand the basic principle of cryopreservation and recovery of cell.	4	Experiment in group	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
7	Induction of cell apoptosis	(1)To understand the induction method of cell apoptosis. (2)To understand and perform the methods of induction of cell apoptosis and detection of apoptotic body.	4	Experiment in group	1, 2, 3, 4
8	Observation of apoptotic cells	To understand and perform the methods of induction of cell apoptosis and detection of apoptotic body.	4	Experiment in group	1, 2, 3, 4

#### V Period Distribution and Teaching Modes

The course was given one 4-hour lab per week. In order to improve students' scientific-thinking, problems-analysing and problem-solving abilities, students are required to perform the cell culture experiments in groups in a whole month and write the laboratory report independently. We also provide the related experiment videos to extend and supplement the knowledge in class and help the students master basic operating skills.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Laboratory report	Label all data clearly, including relevant units. Results section includes the formal presentation of the analysis of raw data as graphs, summary tables, figures. The discussion was shown to the critical analysis.	50%	2, 3, 4
Attendance	Attendance in labs is mandatory. 5 points will lose for each missed lab.	10%	1, 2, 3, 4
Lab performance:	based on the level of contribution to the group's activities, lab technical skills and general level of preparation and enthusiasm for lab experiments	40%	1, 2, 3, 4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### **VII Textbooks and References**

Wei Yu, Yanping Quan. Laboratory Manual of Cell Biology, Zhejiang Sci-tech University.

**Written by:** Wei Yu, Yanping Quan

**Reviewed by:** Yuchong Wu

**Date:** 2021.4.20

# Syllabus of Genetics Experiments

**Course Name/Title:** Genetics Experiments                      **Course code:** 86903

**Course Type:** Specialized Course, Compulsory Course

**Total Teaching Hours:** 32 Laboratory Hours or Tutorial Hours

**Course Credit:** 1

## I Course Introduction

“Genetics Experiments” is one of the professional basic courses for biotechnology major. The content of the course is closely related to basic theory of genetics curriculum. The main task of Genetics Experiments courses are: using common onion, fruit flies, mice and human blood and other samples as experimental subjects, training students’ basic skills and techniques of genetics experiments, fostering students’ ability to correctly observe, record and analyze experimental results, experimental data, and to write experiment. Through experiments training, cultivating students’ dialectical materialist point of view, rigorous scientific attitude, practical ability, consciousness of scientific research, and promoting students to develop good experimental habits.

## II Course Objective

1. Enable students to learn and master the genetics principles and methods through experiments, analyze the experimental results, and write the lab reports correctly.
2. Enable students to master the operation of conventional instruments of basic genetics experiments and the experimental techniques, and improves the student’s experimental operation skills.
3. Enable students to improve the ability of analyzing various experimental phenomena and observations independently.
4. Enable students practice combined with theory.
5. Improve the innovative and pragmatic thinking style and team-work ability.

## III Correlations between Course Objectives and Graduation Requirements

<b>Graduation Requirements</b>	<b>Graduation Requirements Index Point</b>	<b>Course Objectives</b>
Graduation Requirement 6	Master the experimental skills of related courses and experimental data processing and analysis method through biological experiments and practical experience; understand the frontier technology and development trend in this field.	Course Objective 1,2,3,4
Graduation Requirement 7	Have the ability to utilize modern media technology skillfully and acquire scientific research information; have the ability to systematically master the basic experimental methods and skills of biotechnology and related fields. The related key biotechnologies of life	Course Objective 1,2,3,4,5

	science including gene clone and expression technology, microbiological detection and diagnosis technology, transgenic technology, early diagnosis of major diseases technology and basic analysis of bioinformatics.	
Graduation Requirement 8	Have the ability to summarize, sort out, and analyze the experimental results; have the ability to comprehensively apply the theory and skills, and engage in scientific research in biological science, biotechnology and related fields; have the basic ability of biotechnological downstream practice and technological innovation; have strong scientific interest and critical thinking ability.	Course Objective 1,2,3,4,5

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Lab. 1 Plant Mitosis Observation and Permanent Slide Making	1.Master the method of making slides of mitotic cells and understand the chromosome dynamics of cell mitosis. 2.Observe the change and characteristics of chromosomes of onion root tip cells on meiosis phase. 3.Learn the methods of making permanent slide.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
2	Lab. 2 Plant Meiosis and Permanent Slide Making	1. Master the method of making slides of meiotic cells and understand the chromosome dynamics of cell meiosis. 2.Observe the change and characteristics of chromosome on meiosis phase.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
3	Lab. 3 Observation of Human X chromatin	1.Master the method of making slides of female buccal mucosal/hair root cells. 2.Identification of X chromatin morphology of female buccal mucosal/hair root cells.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
4	Lab. 4 Observation of chromosomes of mouse bone marrow cells	1.Grasp the method of preparing chromosome specimens of mammalian bone marrow cells 2.Observe the morphology of animal chromosome, calculate the number of mice chromosome.	4	Direct instruction, cooperative learning, inquiry-based learning, and	Course Objective 1,2,3,4,5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
				experiments	
5	Lab. 5 Observation of salivary gland chromosomes of <i>Drosophila Melanogaster</i>	1.Learn the method of separating salivary gland chromosome of <i>drosophila</i> larvae. 2.Observe the morphological and genetic characteristics of <i>drosophila</i> salivary glands. 3.Understand the somatic chromosome pairing phenomenon	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
6	Lab. 6 Morphological identification and sex-linked inheritance of <i>Drosophila</i>	1.Understand the life cycle of <i>Drosophila</i> , to identify male and female of <i>Drosophila</i> , to observe several common mutant through hybridization experiments with Red-Eye wild-type and white-eye mutant type. 2.Understand the Character separation rule under the control of sex chromosomes, as well as the differences of sex-linked genetic in the reciprocal crosses.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
7	Lab.7 Monohybrid inheritance of <i>Drosophila</i>	1.Understand the Character separation rule under the control of autosome chromosomes in the reciprocal crosses, as well as the differences with sex-linked genetic.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5
8	Lab.8 Human sex determination by SRY gene using PCR amplification technique	1. Understand the molecular mechanism of Sex-determining Region Y (SRY). 2. Master genomic DNA extraction and preparation method of oral epithelial cells. 3. Grasp the basic principles of PCR reactions. 4. Master agarose gel electrophoresis bands for identification.	4	Direct instruction, cooperative learning, inquiry-based learning, and experiments	Course Objective 1,2,3,4,5

#### V Period Distribution and Teaching Modes

Experiment Name	Teaching modes	Period (Hours)	Numbers of Each Group
Lab. 1 Plant Mitosis Observation and Permanent Slide Making	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab. 2 Plant Meiosis and Permanent Slide Making	Direct instruction, cooperative learning, and inquiry-based learning,	4	1-2

	and experiments		
Lab. 3 Observation of Human X chromatin	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab. 4 Observation of chromosomes of mouse bone marrow cells	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab. 5 Observation of salivary gland chromosomes of <i>Drosophila Melanogaster</i>	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab. 6 Morphological identification and sex-linked inheritance of <i>Drosophila</i>	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab.7 Monohybrid inheritance of <i>Drosophila</i>	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2
Lab.8 Human sex determination by SRY gene using PCR amplification technique	Direct instruction, cooperative learning, and inquiry-based learning, and experiments	4	1-2

#### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Experimental reports	Quality of experimental reports	60%	Course Objectives 1,2,3,4
Classroom performance and practice	Fulfill each experiment seriously and independently	40%	Course Objectives 1,2,3,4,5

#### VII Textbooks and References

1. Textbooks: Genetics Experiment Handout by Instructor.
2. References: Longdou Lu & Chongjie Chang. Genetics Experimental Techniques, Science Press. 2007 edition.  
Daxiang Yang. Genetics Experiment. Science Press. 2004 edition.  
Zudong Liu; Shaohui Jiang. Genetics Experiment. Beijing: Higher Education Press. 1987 edition.

**Written by: Xiaoyuan Jia**

**Reviewed by: Zhechen Qi**

**Date: 4/21/2021**

## Syllabus of Bioinformatics experiment

**Course Name/Title:** Bioinformatics experiment                      **Course code:** 86919

**Course Type:** (Specialized Course)(Compulsory Course)

**Total Teaching Hours:** 32            (Experiment Hours: 32 )

**Course Credit:** 1

### I Course Introduction

Biology and information science are the two most rapidly developing and influential Sciences in the world. The interdisciplinary integration of these two sciences has formed a broad sense of bioinformatics, which is attracting the attention of scientists with new ideas. Bioinformatics is a new subject in the field of life science. In the face of the huge molecular biological information produced by various omics technologies, the importance of bioinformatics will become more and more prominent. It will undoubtedly bring revolutionary changes to the research of life science. It is a new interdisciplinary subject that comprehensively utilizes the theoretical methods of biology, mathematics, physics, information science and computer science.

This course mainly introduces the methods and applications of bioinformatics, and how to acquire, process, store, distribute and interpret genome information from Internet, and how to use computer software for biological sequence alignment and analysis, protein spatial structure simulation and prediction, gene regulation and metabolic network, In order to explore and cultivate students' ability of interdisciplinary learning. This course is mainly based on multimedia teaching, supplemented by classroom assisted question answering; Combined with online resources and software application of experimental courses, students can predict the results of relevant biological experiments, reduce the blindness of experiments, and lay a necessary foundation for future scientific research and practice of biological sciences. Combining the professional knowledge of bioinformatics with the content of Ideological and political education, we can achieve the goal of Ideological and political education.

### II Course Objective

Course objective 1: In the process of bioinformatics professional knowledge points education, combined with examples to show the outstanding achievements made by Chinese scientists in the process of theoretical development or practical application of corresponding knowledge points, stimulate students' feelings of home and country, sense of pride and sense of mission.

Objective 2: to master the usage of common bioinformatics databases including sequence information query, browse and download.

Objective 3: to master the research methods of sequence alignment, molecular evolution, gene annotation, transcriptome and gene regulation network.

Objective 4: to master the structure prediction of protein and the principles and analysis methods of computer-aided drug design.

Objective 5: to develop the habit of analysis before experiment in the process of scientific research.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 3	Master the basic theoretical knowledge of mathematics, physics and chemistry; Have strong computer and information science operation technology.	Course Objective 1-5
Graduation Requirement 6	Through a certain biological technology experiment, practical experience, master the experimental skills of related courses and related biological experiment data processing and analysis methods, understand the frontier technology and development trend in this field.	Course Objective 2-5
Graduation Requirement 7	The ability to skillfully use various modern media technologies to actively acquire scientific research information and other knowledge; The ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key technologies related to life science, including gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases, basic analysis technology of bioinformatics, etc.	Course Objective 2-5
Graduation Requirement 8	Have the ability to summarize, sort out and analyze the experimental results, comprehensively use the theoretical knowledge and skills, and engage in scientific research in biological science, biotechnology and related fields; Basic ability of biotechnology downstream engineering practice and technological innovation; Strong scientific interest and critical thinking ability.	Course Objective 1-6

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Experiment 1 Genome-wide identification and selection of a family genes 1)All members of a gene family were predicted by using local BLAST program 2)Selection of the predicted proteins by using HMM online tool.	(1) To master the identification method of gene family by using local blast. (2) To master the selection method of identified proteins by using HMM.	4	Experiment	Course objectives 1, 2, 5
2	Experiment 2 Phylogenetic	(1) To master the method and	4	Experiment	Course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	relationship of the identified proteins 1) Multiple sequence alignment by using Clustal W. 2) Constructing a Neighbor-joining (NJ) tree by using MEGA 7.0 software	tool of multiple sequence alignment (2) To master the constructing method of phylogenetic tree (3) To understand their phylogenetic relationships.		nt	objectives 1, 3, 5
3	Experiment 3 Analysis of the gene structure and conserved motifs 1) Analysis of exon-intron structure of each gene 2) Prediction of the conserved motifs	(1) To master the analysis method of gene structure and the usage of GSDS online tool. (2) To master the usage of MEME online tool for predicting the conserved motifs.	4	Experiment	Course objectives 1, 3, 5
4	Experiment 4 Prediction and statistics of the cis-elements in the promoters of these protein coding genes via 1) Extraction of upstream regions (2000 bp before the translation start site) of all genes were extracted from genome sequence. 2) cis-elements of each gene were predicted using online tools	(1) to master the extraction of upstream regions for a gene by writing a computer program (2) to master the prediction method of cis-element.	4	Experiment	Course objectives 1, 3, 5
5	Experiment 5 Downloading, format conversion and filtering of RNA-seq data 1) downloading the RNA-seq datasets 2) Format conversion of RNA-seq datasets 3) quality filtering and adapter removing of the RNA-seq data	(1) To master the searching and download of RNA-seq data from NCBI SRA database (2) To master the conversion method from SRA to fastq format. (3) To master the method for quality filtering and adapter removing	4	Experiment	Course objectives 2, 3, 6
6	Experiment 6 Calculation of the transcriptional level for	(1) To master the assemble tool of RNA-seq data based reference	4	Experiment	Course objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	each gene 1) Assembly of transcriptomics 2) Calculation and normalization of the transcriptional levels for each genes	genome (2) To master the de novo assemble method of RNA-seq data. (3) To master the calculation method of transcriptional level of each gene based on the RNA-seq data			es 3, 6
7	Experiment 7 Analysis of expression patterns of the family genes in different tissues or in response to stress 1) comparing the expression level of identified protein coding genes in different samples by using DEseq 2) Draw the heat map based on the result of DEseq by using TBtool.	(1) To master the usage of DEseq (2) To master the usage of TBtool for drawing a heatmap.	4	Experiment	Course objectives 3, 5
8	Experiment 8 Computer aided drug molecular design 1) Prediction of a protein structure 2) molecular docking based on the predicted protein structure	(1) To master the prediction method of protein structure (2) To master the method of molecular docking	4	Experiment	Course objectives 4, 5

#### V Period Distribution and Teaching Modes

实验项目名称	内容提要	所用主要设备或实验环境	实验学时	每组人数	实验属性 (基本/综合/设计/研究创新)	开出要求(必做/选做)
Experiment 1 Genome-wide identification and selection of a family genes	1) All members of a gene family were predicted by using local BLAST program 2) Selection of the predicted proteins by using HMM online tool.	Computer and internet	4	2	Comprehensive experiment	Compulsory

Experiment 2 Phylogenetic relationship of the identified proteins	1) Multiple sequence alignment by using Clustal W. 2) Constructing a Neighbor-joining (NJ) tree by using MEGA 7.0 software	Computer and internet	4	2	Comprehensive experiment	Compulsory
Experiment 3 Analysis of the gene structure and conserved motifs	1) Analysis of exon-intron structure of each gene 2) Prediction of the conserved motifs	Computer and internet	4	2	Comprehensive experiment	Compulsory
Experiment 4 Prediction and statistics of the cis-elements in the promoters of these protein coding genes via	1) Extraction of upstream regions (2000 bp before the translation start site) of all genes were extracted from genome sequence. 2) cis-elements of each gene were predicted using online tools	Computer and internet	4	2	Comprehensive experiment	Compulsory
Experiment 5 Downloading. format conversion and filtering of RNA-seq data	1) downloading the RNA-seq datasets 2) Format conversion of RNA-seq datasets 3) quality filtering and adapter removing of the RNA-seq data	Computer and internet	4	2	Comprehensive experiment	Compulsory
Experiment 6 Calculation of the transcriptional level for each gene	1) Assembly of transcriptomics 2) Calculation and normalization of the transcriptional levels for each genes	Computer and internet	4	2	Comprehensive experiment	Compulsory
Experiment 7 Analysis of expression patterns of the family genes in different tissues or in response to stress	1) comparing the expression level of identified protein coding genes in different samples by using DEseq 2) Draw the heat map based on the result of	Computer and internet	4	2	Comprehensive experiment	Compulsory

		DEseq by using TBtool.					
Experiment 8 Computer aided drug molecular design		1) Prediction of a protein structure 2) molecular docking based on the predicted protein structure	Computer and internet	4	2	Comprehensive experiment	Compulsory

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Course paper	Not less than 3000 words. The paper focuses on the illustration and discussion of experiment result	80	Course objectives 1-5
Attendance and performance in class discussion	No unexcused absence from class. Extra points will be given to students for attending lectures and answering questions with positive thinking	20	Course objectives 1-5

## VII Textbooks and References

(1) Teaching materials: (list the titles, authors, publishing houses, etc.)

There is no textbook.

(2) Reference books: (list the titles, authors, publishing houses, etc.)

[1] Xu Jinfeng, Zhang Haihua, Jin Wweibo. Genome-wide identification, characterization, and expression profiles of auxin responsive GH3 gene family in *Salvia miltiorrhiza* involved in MeJA treatment. *Journal of Plant Biochemistry and Biotechnology*, 2021 (prepublish). DOI: 10.1007/s13562-021-00657-1

(3) Online resources: (online course website)

**Written by: Jin Weibo**

**Reviewed by: Nie Zuoming**

**Date: 2021/4/19**

## Syllabus of Plant Tissue Culture

**Course Name/Title:** Plant Tissue Culture      **Course code:** 86926

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 (32 Classroom Hours)

**Course Credit:** 2

### I Course Introduction

Plant tissue culture course is designed to understand structure, growth and function of plant and cells. Technology involved in cell and tissue culture, micro propagation, cell cloning and fusion, breeding and genetic engineering. The course concentrates on the different uses of tissue culture in plant studies. The establishment and requirements of plant tissue culture lab, the basic concepts of totipotency, organized growth, growth regulators types and functions and the different factors that affect the success of the culture will be emphasized in the theoretical part. In the laboratory part the establishment, maintenance and subculture of different types of plant cell / tissue culture will be a major task. Beside this the effect of different growth regulators types, concentrations and combinations will be studied. This course will focus on plant rapid propagation technology. Through learning of this course, the students will learn the principle and the latest technology progress of plant tissue culture.

### II Course Objective

**Course objective 1:** Students can produce some small plants, such as sterile vegetables, a bottle of *Dendrobium officinale* and pinellia callus. To obtain these sterile plants and callus, it is necessary to have rigorous aseptic operation and careful medium configuration. Students have a special sense of accomplishment when they get these little plants through their successful experimental techniques. Inspire a love of life through caring for small plants, and from an interest in understanding plant nutrition, knowledge of the chemistry associated with plants. The whole plant tissue culture experiment is not difficult, but success is not easy. Let the students know that treating surefooted to the simple experimental operation can be successful.

**Course objective 2:** Master the basic concept, methods, principles and techniques of plant tissue culture. Understand the rules and significance of organogenesis and organ differentiation in vitro. Master the principle and the latest technology progress of plant tissue culture and the application in practice.

**Course objective 3:** Possess the ability of sterilize and prepare of media independently. Possess the ability of tip meristem virus-free culture under heat treatment. Master the technique of cell suspension culture; Possess the ability of aseptic technique.

**Course objective 4:** Possess the ability of dialectical thinking. Possess the ability of practical and realistic attitude and innovation spirit. Possess the ability of good professional ethics. Possess the ability of good teamwork spirit.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	6. Through certain experimental and practical experience in biotechnology, proficient in the experimental skills of	Course Objective 1, 2, 3, 4

	related courses as well as relevant biological experimental data processing and analysis methods and understand the frontier technology and development trend of this field.	
Graduation Requirement 7	7. The ability to use various modern media technologies to actively acquire scientific research information and other knowledge; the ability to systematically master the basic experimental methods and skills in biotechnology and related fields, including the mastery of key technologies related to life sciences, including gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases, and basic bioinformatics analysis technology.	Course Objective 1, 2, 3, 4
Graduation Requirement 8	8. Have the ability to summarize, organize and analyze experimental results, and synthesize and apply the theoretical knowledge and skills acquired to engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability to practice biotechnology downstream engineering and technological innovation; have a strong scientific interest and critical thinking ability.	Course Objective 1, 2, 3, 4

#### IV Correlations between Course Content and Course Objectives (Period Distribution and Teaching Modes)

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Introduction: The history, development and prospects of plant tissue culture	<b>Course content:</b> 1. The concepts of plant tissue culture, explant, solid medium and liquid medium; 2. Totipotent in plant cell; 3. The history, development and prospect of plant tissue culture.	2	<b>Theory teaching part</b>	1. Know the concepts of plant tissue culture, explant, solid medium and liquid medium etc; 2. Understand the major theories of plant tissue culture and the concept and significance of totipotent; 3. Know the history,

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p><b>The focus part of the course:</b> The concepts of plant tissue culture and totipotent</p> <p><b>The difficult part of the course:</b> The different effect of nutrient element on plant and the phenotype of nutrient deficiency.</p>			<p>development and prospect of plant tissue culture;</p> <p>4. Understand the different effect of nutrient element on plant and the phenotype of nutrient deficiency. (Supporting course objective: 1,2, 4)</p>
2	The infrastructure and general technique in plant tissue culture lab	<p><b>Course content:</b></p> <ol style="list-style-type: none"> <li>1. The basic instrument and apparatus in plant tissue culture lab;</li> <li>2. Sterilization method;</li> <li>3. The common devices in chemistry experiment;</li> <li>4. The types of medium and their characteristic;</li> <li>5. The ingredient of medium.</li> </ol> <p><b>The focus part of the course:</b> The ingredients of medium and their actions, the preparation of medium, sterilization method</p> <p><b>The difficult part of the course:</b> Master the technical skills of sterilization.</p>	2	<b>Theory teaching part</b>	<ol style="list-style-type: none"> <li>1. Know the basic instrument and apparatus in lab;</li> <li>2. Know the basic composition and selection of medium;</li> <li>3. Possess common media preparation and sterilization;</li> <li>4. Possess the skill of aseptic technique. (Supporting course objective: 1,2,4)</li> </ol>
3	The totipotent and organogenesis	<p><b>Course content:</b></p> <ol style="list-style-type: none"> <li>1. Dedifferentiation;</li> <li>2. Redifferentiation;</li> <li>3. The patterns of proliferation in callus and callus status regulation;</li> <li>4. The major influence for callus differentiation;</li> <li>5. Three fundamental ways for regeneration plant via organogenesis;</li> <li>6. The influence for organ</li> </ol>	3	<b>Theory teaching part</b>	<ol style="list-style-type: none"> <li>1. Clear and definite the approach and significance of organogenesis;</li> <li>2. Master the characteristics of dedifferentiation, differentiation, morphogenesis and organogenesis;</li> <li>3. Master the patterns of proliferation in callus and callus status regulation. (Supporting course</li> </ol>

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>differentiation.</p> <p><b>The focus part of the course:</b> The way of morphogenesis and the characteristics of dedifferentiation, differentiation, morphogenesis.</p> <p><b>The difficult part of the course:</b> The major influence for organ differentiation.</p>			objective: 2,4)
4	Somatic embryogenesis	<p><b>Course content:</b></p> <p>1. Somatic embryo; 2. Major influence for somatic embryogenesis.</p> <p><b>The focus part of the course:</b> The basic principle, approach and precautions for tip meristem virus-free culture under heat treatment.</p> <p><b>The difficult part of the course:</b> The detection methods of detoxication effect.</p>	3	<b>Theory teaching part</b>	<p>1. Understand the pattern of somatic embryogenesis;</p> <p>2. Understand the development characteristics and structural features of somatic embryo;</p> <p>3. Know the major influence for somatic embryogenesis;</p> <p>4. Know the biochemical and molecular basis for somatic embryogenesis.(Supporting course objective: 3,4)</p>
5	Plant genetic transformation	<p><b>Course content:</b></p> <p>1. Genetically Modified Plant or Transgenic Plant; 2. The technology roadmap of transgenic technology in plants; 3. The functional region of Ti plasmid.</p> <p><b>The focus part of the course:</b> The transgenic technology of plants and the detection method for transgenic plants</p> <p><b>The difficult part of the</b></p>	2	<b>Theory teaching part</b>	<p>1. Know the transgenic technology of plants;</p> <p>2. Master the Agrobacterium-mediated method;</p> <p>3. Understand screening and assay of transgenic plants;</p> <p>4. Understand the genetic engineering of crops. (Supporting course objective: 2,3)</p>

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<b>course:</b> Agrobacterium-mediated method; the principle of transgenic silencing			
6	Media preparation, sterilization and aseptic manipulation	<b>Course content:</b> 1. The interactive system in lab; 2. The terms and conditions for plant tissue culture; <b>Requirement of the course:</b> Know the layout of tissue culture room; possess the operation and maintenance of the Clean Bench; submit the experiment report of tissue culture room maintenance and specification.	6	<b>Experiment teaching</b>	Know the ingredient of medium and their actions. (Supporting course objective: 1, 2, 4)
7	Sterile seedling culture of vegetable seeds	<b>Course content:</b> The methods, steps and significance of aseptic manipulation <b>Requirement of the course:</b> operate correctly and independently; submit the experiment report.	3	<b>Experiment teaching</b>	Master the methods and steps of aseptic manipulation; avoid the contamination due to incorrect operation. (Supporting course objective: 1, 2, 3, 4)
8	In vitro seedling growth of <i>Dendrobium officinale</i>	<b>Course content:</b> Shoot induction by using <i>Pinellia ternate</i> as explant. <b>Requirement of the course:</b> Master the method and principle of the rapid propagation technology in <i>Pinellia ternate</i> ; submit the	3	<b>Experiment teaching</b>	Understand the method and principle of shoot induction in <i>Pinellia ternate</i> . (Supporting course objective: 1, 2, 3, 4)

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		experiment report.			
9	Isolation, inoculation and culture of <i>Pinellia</i> tuber explants	<p><b>Course content:</b> The method of root induction in <i>Pinellia ternata</i>; the ingredients of root-inducing medium</p> <p><b>Requirement of the course:</b> Master the method of rooting culture in <i>Pinellia ternata</i>; know the differences between rooting medium and differentiation medium.</p>	3	<b>Experiment teaching</b>	Get to know the method and skills of root induction by using <i>Pinellia ternata</i> as explant. (Supporting course objective: 1,2,3,4)
10	Cell suspension culture and plant regeneration	<p><b>Course content:</b> The callus of suspension culture in <i>Pinellia ternata</i> and inducing regeneration plant</p> <p><b>Requirement of the course:</b> Master the method and principle of cell suspension culture; submit the experiment report.</p>	3	<b>Experiment teaching</b>	Get to know the method of cell suspension culture. (Supporting course objective: 2,3)

#### IV Period Distribution and Teaching Modes

The practice plan and requirements as the following table:

Lecture	Topic	Teaching Hours	Requirements
1	Introduction	2	Know the concepts of plant tissue culture, explant, solid medium and liquid medium
2	The infrastructure and general technique in plant tissue culture lab	2	Learn the preparation of medium, sterilization method
3	The totipotent and organogenesis	3	1. Know the way of morphogenesis; 2. Understand the development
4	Somatic embryogenesis	3	

5	Plant genetic transformation	2	characteristics and structural features of somatic embryo; 3. Master the Agrobacterium-mediated method
6	Experiment 1 and 2: Media preparation, sterilization and aseptic manipulation	6	Possess common media preparation and sterilization. Know the ingredient of medium and their actions
7	Experiment 3: Sterile seedling culture of vegetable seeds	3	Master the methods and steps of aseptic manipulation; avoid the contamination due to incorrect operation.
8	Experiment 4: In vitro seedling growth of <i>Dendrobium officinale</i>	3	Understand the method and principle of shoot induction in <i>Pinellia ternata</i> . Mastery the way to obtain aseptic materials
9	Experiment 5: Isolation, inoculation and culture of <i>Pinellia</i> tuber explants	3	Get to know the method and skills of root induction by using <i>Pinellia ternata</i> as explant. Master the method of plant genetic transformation avoid the contamination due to incorrect operation.
10	Experiment 6: Cell suspension culture and plant regeneration	3	Master the method of cell suspension culture
Total		32	

### V Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance and performance in class	20 points for 1 absent, 5 points for 1 late	10%	1,2,3,4
Oral presentation	4-5 students each group Other students will score the one that do oral presentation. PPT visibility, punctuality and verbal expression will be considered.	20%	1,2,3,4

Experiment reports	7 times	40%	2,3,4
Course papers	The content should be related to plant tissue culture (no less than 2000 words)	30%	1,2,3,4

Note: 1. Assessment will be based on performance in class, assignments, experiment reports, course papers and oral presentation.

2. The assessment methods will include experiment evaluation, course paper and requirements of project design.

3. The weight of the assessment refers to the proportion of the assessment method in the total grade.

### VII Suggestions for Teaching and Course Learning

1. This syllabus is the basic content of the course "Plant Tissue Culture " offered by the Life Sciences School. It is accomplished via lectures and experimental activities.

2. We need to use multimedia classroom, because the teaching process requires presenting a lot of pictures and videos. Experimental class will be performed in the greenhouse.

3. All the students registered for this course should have learned the content of biology, plant physiology, biochemistry and other specialized courses.

4. Curriculum assessment is divided into the evaluation of basic knowledge and skills training assessment. The basic knowledge adopts the mode of course paper. All students will be divided into 4 groups for oral presentations. The reporting topics will designate for each group. Students will prepare the PPT slides to present the experimental results and personal thoughts after finishing the experiments. Experimental skills assessment will be based on the experimental reports and the actual operation. The grades will be divided into four levels : excellent, good, pass and failed.

5. Course papers: students can determine the topics of the paper. The content should be related to plant tissue culture (no less than 2000 words). At least 3 references are required. Please use the format of Microbiological Research as a reference

### VIII Textbooks and References

#### 1. Textbooks

There is no suitable textbook at present.

#### 2. References book

[1] Robert N. Trigiano and Dennis J. Gray, Plant Tissue Culture, Development, and Biotechnology, CRC press, 2010.

[2] M. C. Gayatri and R. Kavyashree, Plant Tissue Culture: Propagation, Conservation and Crop Improvement, Springer, 2016.

[3] R. A. Dixon and Robert A. Gonzales, Plant Tissue Culture: Protocols in Plant Biotechnology, Alpha Science International, 2015.

[4] Keith Lindsey, Plant Tissue Culture Manual - Supplement 7. Fundamentals and Applications, Springer Netherlands, 2014.

[5] Loyola-Vargas, Victor, Ochoa-Alejo, Nefalí, Somatic Embryogenesis: Fundamental Aspects and Applications, Springer International Publishing, 2016.

**Written by:** Si Li

**Reviewed by:** Xu Tao, He Qiuling

**Date:** 6. May. 2021

## Syllabus of Comprehensive Field Practice of biology

**Course Name/Title:** Comprehensive Field Practice of biology      **Course code:** 86929

**Course Type:** (GSpecialized Course)(Compulsory Course)

**Total Teaching Hours:** 40 (Classroom Hours: 0 Laboratory Hours or Tutorial Hours)

**Course Credit:** 2.0

### I Course Introduction

《Biology comprehensive field practice》 is a compulsory course in specialty of biological technology. It is an important part of the teaching of Botany, zoology, microbiology and ecology, and an important link to consolidate and deepen the teaching content. The main contents of the course include four parts: Botany field practice, zoology field practice, microbiology field practice and ecological field practice.

### II Course Objective

#### 1. The knowledge objectives

**Course objective 1:** Identify many species of common wild plants through field practice.

**Course objective 2:** To master plant species diversity, ecological relationships among populations, genetic relationships among plant species through field practice.

#### 2. The ability objectives

**Course objective 3:** To learn the method for identifying, collecting, making and preserving plant specimens.

**Course objective 4:** Through practice, the use of plant classification tools to identify species, the correct classification method, and learn to apply and make up the plant key.

**Course objective 5:** Learn to fill out the practice log.

#### 3. The quality objectives

**Course objective 6:** Training the basic scientific research quality of life science.

**Course objective 7:** Develop students' ability to work independently and as a team.

**Course objective 8:** Cultivating students' awareness of nature and ecology.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Through the compulsory and elective courses, we will receive systematic professional theory and professional skills training, and master solid basic theory, basic knowledge and basic skills of biological science.	Course Objective 1,2
Graduation Requirement 6	Through a certain biological technology experiment, practical experience, master the experimental skills of related	Course Objective 3、4、5、6、7、8

	courses and related biological experiment data processing and analysis methods, understand the frontier technology and development trend in this field.	

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	The use and presentation of learning the tool of biology field practice.	To understand and master the use of field survey tools, including the specimen holder, absorbent paper (paper), branch scissors, small shovel, tweezers, magnifying glass, camera, altitude instrument, GPS, fast drying specimen boxes and other equipment and tools to use, and introduction of plant photography.	4	classroom teaching and group learning	Course Objective 1、 2、 3、 4、 5
2	Carry out biology field practice.	<p>1) Botany : To learn the observation of field plants, the collection of information and specimens, making specimens and shooting plant pictures, etc. To study the morphological characteristics and common plant species of common plant families, and to master the basic operation methods such as observation and collection of plant specimens, information collection, preservation, make specimen and so on. To know about the common plants of 40 families of 100-150 species (mainly seed plants, including a few spore plants). And to understand the scientific name and family of each plant. Master the key features and scientific names of 30 key families. In addition, each is required to make 2-3 qualified plant specimens.</p> <p>2) Zoology: To understand and master the usage of wild animal investigation tool; To learn animal specimens collection, fixed, preservation and other basic operating methods ; To identify 20-30</p>	22	classroom teaching and group learning	Course Objective 1、 2、 3、 4、 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		<p>animals and make 3-5 specimens ; Learning how to use the retrieval table, zoography and illustrated handbook to identify the animal sample and animal specimens.</p> <p>3) Microbiology: To understand the biological diversity of macromycetes, by the observation and identification of 15-20 species macromycetes in natural forest ecosystems; To master the commonly used classification terminology of macromycetes, learn how to collectly use the classification manuals. Learn to collect sampling and identifying the macromycetes, and preparing the retrieval table;To learn the methods of collecting and producing various kinds of macromycetes.</p> <p>4) Ecology:To learn the composition and structure of plant communities (the populations occurring in a defined area); quantitative characteristics of the community, the concept and measure of species diversity and internal competition, the dynamic characteristics of spatial and temporal variation of community and community factors and evolution of the related concepts and theories, plant taxonomy and plant ecology, plant community diversity, investigation and analysis of structural characteristics and the biomass investigation method.</p>			
3	Suppression and identification of collected specimens.	To learn suppression of animal, plant and microorganism specimens and identified these collected specimens using Key and other tools.	10	classroom teaching and group learning	Course Objective 3、 4、 5

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
4	Field practice examination and practice summary and reports.	Finish practice evaluation and practice summary and reports.	4	group examination	Course Objective 6、7、8

### V Period Distribution and Teaching Modes

A variety of teaching methods and a flexible range of activities are suggested to provide students with various learning experiences and encourage their initiatives. Special stress should be put on the introduction of modern educational technology with an optimal integration of various teaching media. Make reasonable use of presentation instruments, inquiring instruments, interaction instruments and design instruments to effectively improve the teaching quality.)

1. The curriculum arrangement of different practice route, to explain the plant characteristics and environmental characteristics of the practice route, and arrange students to know the plant species scientific name and its environment, and the characteristics of the population and the dominant population.

2. Guide students to study the relationship between plants and the environment, to understand the diversity of plant protection, conservation of plant resources, etc., to cultivate their ability to learn and innovate.

3. For the species with fruits and flowers, the students can use the key to identify the species independently and train their self-learning ability.

4. For the scientific research activities for research topics, students need to collect relevant data, and discuss the experimental steps of scientific research papers, for the material accumulation of practice report and the thesis writing in the latter practice period.

5. Practice also requires students to use digital cameras (digital mobile phones) on the plant and internship process for image, video capture, GPS positioning, information records, electronic records, prepare specimens of late practice exhibition etc.

### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Specimen examination	Closed-book examination	40%	To know about the common plants of 40 families of 100-150 species (mainly seed plants, including a few spore plants). And to understand the scientific name and family of

			each plant. Master the key features and scientific names of 30 key families.
Practice performance	All practice work have done	30%	Teamwork and work performance
Specimen making	Open-book	10%	Each made of qualified plant specimens 3-5 copies
Practice report	Open-book	20%	Each submit the practice report and assignment

## VII Textbooks and References

### 1. Textbooks

The guide of Comprehensive Field Practice of biology. Self-edited teaching material.

### 2. References

- 1) Bingyang Ding, Flora of Tianmushan, Zhejiang University press, 2010.
- 2) Zhi Wei, Yeqi He, Flora of Zhejiang, Zhejiang science and Technology Press, 1993.
- 3) Youfang Wang, Hongqing Li, Ruiliang Zhu, Atlas of common plants in Tianmu Mountain field practice, East China Normal University press, 2012.
- 4) Qixin Liu, Flora of Jiangsu, Jiangsu science and Technology Press, 2013.
- 5) Lingyun Liu and Guangmei Zheng, General zoology experiment instruction. Beijing, High Education Press, 2010.
- 6) Zhejiang zoography editorial board, Zhejiang Zoography, Hangzhou, Zhejiang Science and Technology Press, 1989.
- 7) Yuan sheng. Microbiology Field Practice in Tianmu Mountain . Beijing: Higher Education Press, 2010
- 8) Liu Xudong. Chinese wild macrofungi color illustrations. China Forestry Press, 2002
- 9) Biqian Fu. Principle and Method of Ecological Experiment. Science Press, China, 2006.

### 3. Web Resources

<http://www.eflora.cn/>

<http://www.plantphoto.cn/>

**Written by: Yang Zongqi**

**Reviewed by: Jiang Yonghou**

**Date: April 19, 2021**

# Syllabus of Comprehensive Experiment of Biotechnology

**Chinese name of course:** 生物技术综合实验

**Course code:** 86931

**English name of course:** Comprehensive Experiment of Biotechnology

**Classification and characteristic of the course:** (Specialized Course) (Compulsory)

**Total Teaching Hours:** 64 (Laboratory Hours or Tutorial Hours)

**Credit:** 4

**Prerequisite:** Cell Biology, Immunology

**Department (Room):** Department of Biotechnology

## 1、Introduction of the course

Experimental teaching is one important part of teaching in universities. Comprehensive experiment is good for students to improve their abilities to analyze problems, solve problems and innovate. The course uses a wide variety of experimental technology to obtain target products successfully. During the process of experiments, student's abilities to integrate theory with practice and team collaboration are strengthened largely. To be engaged in biotechnology engineering, genetic engineering, biochemistry related disciplines of work and continue to learn to lay the foundation. In view of the current situation of biomedicine development in China, ideological and political education should be introduced at any time to train students to be high-level talents who love the motherland and have high ideological and moral cultivation.

## 2、Course objective

### (1) Ideological and political objectives

Cultivate a group of new people who love the motherland and have high ideological, moral and cultural qualities. They have a strong sense of social responsibility, a sound personality and a strong sense of teamwork, have good professional ethics, and follow the professional spirit of academic norms, master solid basic theory and research methods of biological science, have the sense and spirit of seeking truth and innovation, in order to contribute to the development of China's biomedical technology.

### (2) Knowledge Objective

**Course objective 1:** Master the preparation of Potato Dextrose Agar (PDA) medium

**Course objective 2:** Master operation of activating strain

**Course objective 3:** Grasp the basic principle of designing optimal fermentation medium by orthogonal experimental design

**Course objective 4:** Grasp the basic structure and operation method of small fermenter

**Course objective 5:** Master the basic principle and process of amylase production by fermentation

**Course objective 6:** Master the enzymology properties analysis method

**Course objective 7:** Master the methods of adenovirus carrying Ad-IL24 tumor suppressor gene IL-24 infection in mammals

**Course objective 8:** Master analysis of the cell activity detected by crystal violet staining method

**Course objective 9:** Master the method of detecting cell apoptosis by flow cytometry

### (3) Competency Goals

To master the fundamental and procedures of Dot-immunobinding assay. The ability to apply the principle of double antibody sandwich method and master the way of making colloidal gold. Thinking from the point of view to produce HCG test reagent and interpret the result.

### (4) Quality Objective

Through learning of this course, students can practice combined with theory, learn to work with rigorous scholarship, innovative and pragmatic style of thinking and team spirit. Through the experiment, so that students can gradually improve the ability of the analyzing, thinking and solving problems independently.

### 3、The corresponding relationship between curriculum teaching objectives and graduation requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Comprehensive understand of the basic theory of biotechnology, and master the ability to use their analytical problems.	Course Objective 1,2,3,4,5,6,7,8,9,10,11,12
Graduation Requirement 5	Master the methods involved in the field of biotechnology, cell engineering, enzyme engineering, and fermentation engineering. With the comprehensive use of the theoretical knowledge and skills, engaged in biotechnology and related fields of product research and development capabilities, with biotechnology downstream engineering practice and technical innovation.	Course Objective 1,2,3,4,5,6,7,8,9,10,11,12
Graduation Requirement 6	Have practice experience of biological technology and understand the forefront of technology and development trend in this field.	Course Objective 1,2,3,4,5,6,7,8,9,10,11,12,13

### 4、The relationship between teaching content and curriculum objectives

The relationship of teaching content and objectives

No.	Teaching contents	Teaching requirements	hours	Methods	objectives
1	Preparation for <i>Aspergillus niger</i> seeds	(1) Master the preparation of Potato Dextrose Agar medium. (2) Master operation of activating strain to understand the basic concept of immunization and its development. (3) Group discussion on the achievements of Chinese scholars in biotechnology to stimulate students' feelings of home and country.	8	Demonstration operation	Course objectives 1,2
2	Optimization of solidstate fermentation edium of <i>Aspergillus niger</i> for amylase	(1) Grasp the basic principle of designing optimal fermentation medium by orthogonal experimental design. (2) To determine optimal carbon, nitrogen sources and water content by single factor experiment	8	Demonstration operation	Course objectives 1,2

No.	Teaching contents	Teaching requirements	hours	Methods	objectives
	production	(3) To determine optimal fermentation medium by orthogonal experimental design.			
3	Deep liquid fermentation for amylase production	(1) To learn and grasp the basic structure and operation method of small fermenter. Strain activation and Preparation of inoculation liquid. To learn the medium preparation and fermenter sterilization. (2) To master the basic principle and process of amylase production by fermentation. Inoculation and process control. Collection of the liquid and cleaning the fermenter.	8	Demonstration operation	Course objectives 1, 3, 4
4	Study of amylase enzymatic properties	(1) Master the enzymology properties analysis method (2) Optimum reaction temperature measurement and reaction pH determination. (3) Determination of pH stability, and determination of thermal stability of the enzyme.	8	Demonstration operation	Course objectives 2, 3, 4
5	Animal cell culture and cell count	(1) To learn and master the process of thawing cells. (2) To learn the passage of adherent cells. (3) To master the method of counting cells with a hemocytometer and microscope.	4	Demonstration operation	Course objectives 1, 2, 3
6	Transient expression of cytokine IL-24 in mammalian cells	(1) To learn and master cell culture. (2) Preparation of adenovirus Ad-IL24. (3) Master the methods of adenovirus carrying Ad-IL24 tumor suppressor gene IL-24 infection in mammals. Collecting of protein samples containing cytokine IL24. (4) To understanding the classification and functions of various of adhesion molecules.	4	Demonstration operation	Course objectives 1, 2
7	Crystal violet staining	(1) Master the measurement analysis of the cell activity detected by crystal violet staining method. (2) Master the principles of cell activity detected by crystal violet staining method. (3) Master the basic operation of crystal violet staining method and the analysis of the cell activity detected by crystal violet staining method. (4) Understand the meaning of microscopic observation of crystal violet staining results.	8	Demonstration operation	Course objectives 1, 3, 4

No.	Teaching contents	Teaching requirements	hours	Methods	objectives
8	Detecting the expression of IL-24 using Dot-immunobinding Assay	(1) Detecting the expression level of IL-24 secreted by human hepatoma cell BEL-7404. (2) Master the fundamental and procedures of Dot-immunobinding assay. (3) The principle of Dot-immunobinding assay; (4) Experimental procedure of Detecting the expression level of IL-24 using Dot-immunobinding Assay.	8	Demonstration operation	Course objectives 2, 3
9	Rapid test of HCG by sandwich method using double antibody	(1) Master the principle of double antibody sandwich method. (2) Master the procedure of Rapid test of HCG by using double antibody sandwich method. (3) Master the way of producing HCG test reagent and interpret the result. (4) Understand the result analysis of HCG test.	8	Cooperate with the assay company, Demonstration operation	Course objectives 1, 2, 3, 4

### 5、Practice Plan and Requirement

(1) Course time allocation (according to the order (units of knowledge or items) allocation of total hours, reasonable allocation of lectures, experiments, exercises, discussions, counseling and other teaching links required hours)

The practice plan and requirements as the following table:

No	Experiment title	Abstract of Content	Hours	Requirement
1	Preparation for <i>Aspergillus niger</i> seeds	1.To prepare Potato Dextrose Agar (PDA) medium. 2.To activating strain.	8	Observing much, thinking much and studying much.
2	Optimization of solidstate fermentation medium of <i>Aspergillus niger</i> for amylase production	1.To determine optimal carbon, nitrogen sources and water content by single factor experiment. 2.To determine optimal fermentation medium by orthogonal experimental design.	8	Observing much, thinking much and studying much.
3	Deep liquid fermentation for amylase production	1.To learn and grasp the basic structure and operation method of small fermenter. 2. To master the basic principle and process of amylase production by fermentation.	8	Observing much, thinking much and studying much.
4	Study of amylase enzymatic properties	1.To determine optimum reaction temperature and pH.	8	Observing much, thinking

		2.To analyse the pH stability and thermal stability of the enzyme.		much and studying much.
5	Animal cell culture and cell count	1. Thawing Cells 2. Passage of adherent cell lines (subculture) 3.Counting Cells with a Hemocytometer and a Microscope	4	Observing much, thinking much and studying much.
6	Transient expression of cytokine IL-24 in mammalian cells	1. Cell culture 2.Preparation of adenovirus Ad-IL24 3.Collecting of protein samples containing cytokine IL24	4	Observing much, thinking much and studying much.
7	Detecting the expression level of IL-24 using Dot-immunobinding Assay	Detect the expression level of IL-24 secreted by human hepatoma cell BEL-7404 using Dot-immunobinding assay.	8	Observing much, thinking much and studying much.
8	Rapid test of HCG by using double antibody sandwich method	Test HCG by using double antibody sandwich method	8	Observing much, thinking much and studying much.
9	Measurement and analysis of the biological activity of the cytokine IL-24 by crystal violet staining assay	The basic operation of crystal violet staining method	8	Observing much, thinking much and studying much.

## 6、 Suggestions for Teaching

1. Experimental preparation and Course preparation is very important for teacher having a good class.
2. Give the course preparation information to students before class.
3. Combination of professional knowledge and practical teaching.
4. During the multimedia teaching, a variety of methods, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be utilized to guarantee the teaching effectiveness. Homework will be assigned after the class.

## 7、 Suggestions for Course Learning

1. Preview before class.
2. In order to improve students' scientific-thinking, problems-analysing and problem-solving abilities. During the experimental teaching process, students are required to master the basic operating skills.
3. Students should grasp the experimental principle, be familiar with experimental methods, record experimental data in truth and integrity, analyze the experimental results scientifically and write standard experiment reports.

## 8、 Course Assessment

Method or means of assessment	Assessment equirements	Check weight	Corresponding course Objectives
classroom performance	On time and keep classroom discipline	20%	Course Objective 13
Experimental operation	Operating seriously	50%	Course Objective 1,2,3,4,5,6,7,8,9, 10,11,12,13
Experimental report	The handwriting is correct, neat and serious; the steps are detailed, the marking is clear, the concept is clear, the thinking is clear, the result is credible, and the analysis is reasonable.	30%	Course Objective 1,2,3,4,5,6,7,8,9, 10,11,12,13

## 9、 Recommended teaching materials and reference materials

Textbooks: Self-compiled lecture sheets

References <http://www.pubmed.org/>

Written by: Kan Chen

Reviewed by: Xiumei Zhou

Date: Apr. 10th, 2021

# Syllabus of Comprehensive Experiment of Protein and Enzyme Engineering

**Course Name/Title :** Comprehensive Experiment of Protein and Enzyme Engineering  
**Course code:** 86938  
**Course Type:** Specialized Optional Course  
**Total Teaching Hours:** 32 (Laboratory Hours or Tutorial Hours 32)  
**Course Credit:** 1.0

## I Course Introduction

Experimental teaching is an important part of cultivating students to master professional skills. Compared with the experimental unit, a comprehensive design experiment is more conducive to cultivating students' ability to analyze problems, solve problems and innovative consciousness, and is of great significance to the cultivation of high-quality talents. This course emphasizes the product as the main content, comprehensive use of various experimental techniques, so that students' theoretical knowledge and professional skills can consolidate related experiments, have an in-depth understanding of experimental techniques, strengthen theoretical knowledge and mastery, and cultivate students' learning ability. Cultivate students' team spirit and overall quality. Combining this new crown epidemic and the new crown vaccine, domestic and international situations, guide students to deepen their knowledge and understanding of national conditions, industry conditions, etc., guide students to establish a sense of competition, stimulate their sense of innovation and innovative spirit, so as to help college students to cultivate and innovate. Character development is conducive to the growth of innovative talents.

## II Course Objective

Through this course, students can achieve the following goals in knowledge, ability and quality:

### 1. Ideological and political goals

When talking about the price of enzyme preparations or biological products, combined with the gap between the best biological companies at home and abroad, it arouses students' strong feelings of home and country, and encourages students' professional interest and professional self-confidence.

### 2. Knowledge targets

Understand the general process and analysis strategy of protein pretreatment, rough classification and fine separation. Master the separation and purification of proteins related to the basic principles and operating methods of biochemical technology.

### 3. Ability targets

Master the principles and techniques of commonly used experimental operations in biochemistry. Exercise students' practical ability and practical ability through the experiment process. Train students to record, observe and practice-related abilities. Cultivate students' teamwork spirit.

### 4. Quality targets

Have the ability of dialectical thinking. Have a realistic thinking and innovative style.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master solid basic theories, basic knowledge and basic skills of biological sciences	Course Objective 2,3
Graduation Requirement 6	Through certain biotechnology experiments and practical experience, master the experimental skills of related courses and related biological experimental data processing and analysis methods, and understand the cutting-edge technologies and development trends in this field	Course Objective 2,3
Graduation Requirement 7	Proficiency in using various modern media technologies to actively acquire scientific research information and other knowledge; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to master gene cloning and expression technology, microbial detection and diagnosis technology, and genetic modification technology , Early diagnosis technology for major diseases and basic bioinformatics analysis technology and other key technologies related to life sciences	Course Objective 1, 3, 4
Graduation Requirement 8	Have the ability to summarize, sort out and analyze experimental results, comprehensively use the theoretical knowledge and skills they have mastered, and be able to engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability of	Course Objective 1, 3, 4

	downstream engineering practice and technological innovation of biotechnology; have strong Scientific interest and critical thinking skills	
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#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Extraction of Superoxide Dismutase (SOD) from Pig Blood	Preparation of pig blood - soluble blood	8	Group experiment	1, 2, 3, 4
2	Separation and purification of superoxide dismutase (SOD)	Extraction of crude extract of SOD	8	Group experiment	1, 2, 3, 4
3	Determination of SOD activity by three phenol method	Determination of SOD activity	4	Group experiment	2, 3, 4
4	Protein concentration was determined by Coomassie brilliant blue method	Determination of SOD concentration	4	Group experiment	2, 3, 4
5	Determination of relative molecular mass of SOD by SDS-PAGE	Determination of molecular weight of SOD	8	Group experiment	2, 3, 4

#### V Period Distribution and Teaching Modes

Sub-group and by the team to complete the experimental task. Student independent operate and teacher timely inspire and guide. In the dominant position in the experiment, Student is the practitioner and explorer, so in the course of the experiment it needed to strengthen the student's subjective consciousness. In the full prerequisite to do the premise, reasonable arrangements for the various steps of the experiment according to the experimental manuals, orderly and efficiently complete the experimental task. In the student practice process, Teachers timely correct the students do not regulate the operation, and give the necessary theoretical guidance. In the teaching process, pay attention to heuristic, task-driven and other teaching methods. Improve students' enthusiasm for learning, improve learning efficiency and effectiveness.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Classroom performance	On time to the laboratory; strictly abide by the laboratory rules and regulations; carefully preview before the experiment; test in strict accordance with the procedures of operation equipment, equipment.	50	1, 2, 3, 4
Experimental report	Format specification, the rules are clear, the contents of the various parts integrity; no missing no excess data; can test the results of the correct treatment, in-depth discussion and evaluation.	50	1, 2, 3, 4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

## VII Textbooks and References

Self-edited experiment guide

**Written by: Lili Liu**

**Reviewed by: Jianyi Pan**

**Date: April 20, 2021**

# Syllabus of Immunological Detection Experiment Technology

**Course Name/Title:** Immunological Detection Experiment Technology

**Course code:** 86939

**Course Type:** Professional elective course

**Total Teaching Hours:** 20 (Classroom Hours: 20)

**Course Credit:** 1

## I Course Introduction

### Suggestions for Teaching

Students are requested to preview the text before each class. During the multimedia teaching, a variety of methods, such as elicitation method, question-and-answer method, association teaching, problem-based learning and case-based study, will be utilized to guarantee the teaching effectiveness. Homework will be assigned after the class. Students will be guided to search and read the latest papers for the cell engineering themes.

### Suggestions for Course Learning

Learning is actually a very autonomous process. To guarantee the quality of English lecturing, students need to preview the text before the class. Students are expected to solve immunological detection experiment technology problems based on the class learning. Scientific materials, which all available on the website teaching platform for students' autonomous learning. The goal is to help students develop their autonomy, horizon and practicality in the learning of immunological detection experiment technology.

## II Course Objective

Immunology, an important required course for biological students, poses difficulties to teaching because of its abstract and logical knowledge. Based on the characteristics of immunology and our teaching experience, we constructed this immunological detection experiment technology course and offered it to the students of our school. This course makes a brief introduction to the application of experiment skills based immunology course, and puts forward some new ideas for later-stage development and research of this course. Meet the biochemistry, molecular biology, cell biology, and other needs of biotechnology experiments. This study will make necessarily foundation for the study of biochemistry, molecularbiology, pharmacology and so forth.

### (i) Knowledge Goal

**Course Objective 1:** Be familiar with to separation lymphocyte from peripheral blood.

**Course Objective 2:** To learn E-rosette formation experimental principle.

**Course Objective 3:** To master the steps of tumor cells culture.

**Course Objective 4:** Learn about immunofluorescence.

**Course Objective 5:** To understand the vitality of tumor cells by crystal violet method.

### (ii) Ability Goal

**Course Objective 6:** Train students' experimental skills.

**Course Objective 7:** Train students' ability to write experiments.

### (iii) Quality objectives

**Course Objective 8:** Enhance students' cultural confidence, system confidence, road

confidence and national pride

**Course Objective 9:** To cultivate students' positive values and feelings of home and country

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	1) Receive systematic professional theories and skills training through compulsory and elective courses, and master solid basic theories, knowledge and skills of biological science; 2) Skilled in using various modern media technologies to proactively acquire knowledge such as scientific research information; 3) Ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key technologies related to life science, such as gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of major diseases and basic analysis technology of bioinformatics.	Course Objective 1,2,4, 7
Graduation Requirement 2	1) Through certain experience of biological technology experiment and practice, master the experimental skills of related courses and related biological experiment data processing and analysis methods, and understand the frontier technology and development trend of this field. 2) Ability to summarize, sort out	Course Objective 2,3,5, 8, 9

	<p>and analyze experimental results, comprehensively apply theoretical knowledge and skills mastered, and engage in scientific research in biological science, biotechnology and related fields;</p> <p>3) Have the basic ability of biotechnology downstream engineering practice and technological innovation;</p> <p>4) Strong scientific interest and critical thinking skills.</p>	
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#### IV Correlations between Course Content and Course Objectives

Num .	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<p><b>To separate lymphocyte from peripheral blood</b></p> <p>1. Collecting venous blood with 2 mL tubes, gently shake the tube, mixing, 5 min after adding Hank's 2mL liquid, hand gently shake. (blood dilution, peripheral blood: diluent =1:1).</p> <p>2. The anticoagulant all along the wall slowly added to another 2 mL lymphocyte separation tube on the surface, pay attention to keep the two liquid interface clear. (Ficoll: diluted blood = 1:1).</p> <p>3. After the tube was balanced, the centrifuge was centrifuged at 1500 rpm for 30 min.</p> <p>4. Carefully draw the plasma and stratified fluid at the interface of the lymphocyte layer with a capillary tube to a scale centrifuge tube. Add 5 times the volume of Hank's solution, manually rotate the tube to make the liquid mix, 1000 rpm centrifugal 10 min, discard the supernatant, the</p>	<p>1. Familiar with the composition of peripheral blood lymphocytes.</p> <p>2. Learning methods of peripheral blood lymphocytes separation.</p> <p>3. To master the principle and method of density gradient centrifugation.</p>	4	Teaching in class	Course Objective 1,6,7,8,9

Num .	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>precipitate that is mainly lymphocytes (or unit of nuclear cells). Add 10% inactivated calf serum Hank's solution 1 mL, count after mixing.</p> <p>5. Cell viability test: take 10 <math>\mu</math>L of lymphocyte suspension by adding 0.4% trypan blue staining solution 10 <math>\mu</math>L, mix. Take 10 <math>\mu</math>L into the blood cell count plate, standing for a moment, and then observed under microscopy at high magnification.</p>				
2	<p><b>E-rosette formation experiment</b></p> <p>1. Take EDTA anticoagulant 1mL, mix, separate the lymphocytes with the stratified solution and wash, with Hanks solution to adjust the cell concentration of <math>2-2.5 \times 10^6</math> / mL (this step followed by the experiment to separate the lymphocytes do).</p> <p>2. Take a small test tube by adding 1 mL lymphocyte suspension and 1% sheep red blood cells 0.1 mL, mix 37 <math>^{\circ}</math>C water bath 5 min.</p> <p>3. 800 ~ 1000 r/min low-speed centrifugal 5 min, put 4 <math>^{\circ}</math>C refrigerator 2h or overnight.</p> <p>4. Removing the most of the supernatant after removal) gently rotating the test tube to make the clumps mix, add 2 drops of 0.8% glutaraldehyde liquid, shake, room temperature for 10 min, so that E garland fixed.</p> <p>5. Take a drop of the suspension onto the slide and add the diluted Wright's dye to the slide for 3 min.</p> <p>6. Discard the dye solution, to be dry after the oil mirror observation, count 200 lymphocytes in the formation of garlic cell effect, calculate the percentage.</p>	<p>1. To master the T lymphocyte formation of E-rosette experimental principles and methods of operation.</p> <p>2. Familiar with T lymphocyte function detection method.</p>	4	Experiment	Course Objective 2,6,7,8,9

Num .	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
3	<p><b>Tumor cells culture</b></p> <p>1.Observe the cells with an inverted microscope to assess the growth status of the cells (lungs) and to confirm contamination without bacteria and fungi. To discard old culture broth: Remove or discard the old medium in the Petri dish.</p> <p>2.Rinse: add 1 mL of PBS in each dish to clean the monolayer cells, rinse the adherent cells once after draining</p> <p>3.Digestion: 1 mL of digestive solution was added to each dish (0.25% trypsin or 0.025 EDTA mixture 1:1), gently shake the culture dish, when the digestive solution covered with all the cell surface, we should observed the cells in the inverted microscope .And when the 1/2 cells are round, we should add appropriate amount of complete culture medium to terminate.</p> <p>4.Centrifuge: Centrifuge at 1000 rpm and centrifuge for 5 minutes to remove the medium (containing trypsin and EDTA)</p> <p>5.Cell count, calculate the number of cells.</p> <p>6.Cell plate (6-well plate), <math>2.5 \times 10^5</math> cells/well, volume 2 mL/well.</p>	<ol style="list-style-type: none"> <li>To master the adherent cell culture principle and the basic operation process.</li> <li>Familiar with the basic principles and methods of cell counting and plating.</li> <li>Understand the cell morphology of cancer cells.4</li> </ol>	4	Experiment	Course Objective 3,6,7,8,9
4	<p><b>Immunofluorescence technique (Hoechst 33342)</b></p> <p>1.Add the appropriate amount of Hoechst 33342 dye solution, pay attention to the dye solution should fully cover the sample . Usually six-well plate plus 1mL per hole, 96-well plate plus 100 <math>\mu</math>L per hole.</p> <p>2.Incubate in a 37 ° C incubator for 30 min (or room temperature).</p>	<ol style="list-style-type: none"> <li>Familiar with immunofluorescence technology and its application.</li> <li>Master the application of indirect fluorescence method</li> </ol>	4	Experiment	Course Objective 4,6,7,8,9

Num .	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>3.Carefully remove the staining solution, wash 2 times with 1 mL of PBS, then add 1 mL of PBS.</p> <p>4.Observed the cells under fluorescence microscope, 340 nm excitation light was used (select 2): In the fluorescence microscope, the living cells were diffuse uniform fluorescence, the apoptotic nuclei or cytoplasm can be seen dense stained dense particles of lump fluorescence. If you see 3 or more DNA fragments of DNA is considered to be apoptotic cells.</p>				
5	<p><b>Determination of cell vitality by crystal violet staining method</b></p> <p>1.Add 0.1 mL of culture solution containing <math>5 \times 10^4</math> adherent cells (RPMI-1640 medium containing 10% calf serum) in each well of a 96-well cell culture plate and incubate in a carbon dioxide incubator at 37° C in 5% CO<sub>2</sub> 2~3 h, let cell posts wall.</p> <p>2.The drug was diluted with RPMI-1640 medium and incubated for 24h.continue to cultivate 24 h.</p> <p>3.Remove the culture broth, carefully wash with PBS for once, 0.1mL of 10% methanol solution was added to each well for 30 s</p> <p>4. Remove the methanol solution, add 0.1mL of crystal violet dye per well, and room temperature placed in 20 minutes.</p> <p>5. Gently shake off the dye solution, with distilled water to wash the hole, the culture plate inverted on the absorbent paper to absorb moisture. Dry naturally or at 37°C.This plate can be stored at room temperature for long periods of time.</p> <p>6. Before the determination, add 0.1 mL of 33% acetic acid per well to decolorize the light absorption at 570 nm after full oscillation. The cell dilution was plotted against the absorbance (OD), calculating the cell viability.</p>	<p>1. Familiar with the principle of crystal violet method and application</p> <p>2. To grasp the method of indirect cell toxicity test</p>	4		Course Objective 5,6,7,8,9

## V Assessment

Assessment content and methods must correlate with course objectives.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Active participation	20%	1、2
In-class presentation	Active participation	15%	1、3、4
The experimental operation	Active participation	15%	1、2、3
Lab report	Active participation	50%	2、3、4

## VIII Textbooks and References

### i. Textbooks

Self-compiled lecture sheets

### ii. References

[1] Guozhi Xia, Xin Sun, Xiaopu Zheng, Junkui Wang. Decreased expression of programmed death 1 on peripheral blood lymphocytes disrupts immune homeostasis in peripartum cardiomyopathy. *International Journal of Cardiology*, 223(2016): 842-847.

[2] Philip George Eye, Laurence Davidson, Patrick J. Malafrente, Sarah Cantrell, Brett J. Theeler. PIK3CA mutation in a mixed dysembryoplastic neuroepithelial tumor and rosette forming glioneuronal tumor, a case report and literature review. *Journal of the Neurological Sciences*, 373(2017): 280-284.

[3] Fumio Kasai, Noriko Hirayama, Midori Ozawa, Masashi Iemura, Arihiro Kohara. Changes of heterogeneous cell populations in the Ishikawa cell line during long-term culture: Proposal for an in vitro clonal evolution model of tumor cells. *Genomics*, 107(2016): 259-266.

[4] Malek Moien Ansari, Mohammad Ansari. Nitric oxide involvement in pancreatic  $\beta$  cell apoptosis by glibenclamide. *Nitric Oxide*, 1(2006): 39-44.

[5] A.L. Di Virgilio, I. Maisuls, F. Kleitz, P.M. Arnal. A new synthesis pathway for colloidal silica spheres coated with crystalline titanium oxide and its comparative cyto- and genotoxic study with titanium oxide nanoparticles in rat osteosarcoma (UMR106) cells. *Journal of Colloid and Interface Science*, 394(2013): 147-156.

**Written by:** Yanfang Sun

**Reviewed by:** Yigang Wang

**Date:** 2021/4/19

# Syllabus of Experiments of Human Anatomy and Physiology

**Course Name/Title:** Experiments of Human Anatomy and Physiology    **Course Code:** 86940

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 hr (Classroom Hours: 0 hr, Laboratory Hours: 32 hr)

**Course Credit:** 1

## I Course Introduction

Human Anatomy and Physiology is a basic course to study the law of normal human life activities, which is established and developed on the basis of practice. Its experimental teaching plays an important role in the teaching of human anatomy and physiology. The experiment of human anatomy and physiology mainly introduces the basic operation technology of animal experiments, the equipment, physiology experiments, electrophysiological experiments, confirmatory experiments, and comprehensive experiments. Through the experimental teaching, the understanding and mastery of theoretical knowledge could be strengthened, guiding the students to observe the experimental phenomenon and to explore the relationship between the phenomenon and the essence, which will cultivate the students' practice ability, the spirit of exploration and innovation, and the ability to analyze and solve problems. In the process of teaching, ideological and political education will be incorporated in the whole course to guide students to love and revere life, enhancing their sense of responsibility and mission.

## II Course Objective

1. Encourage students' creative consciousness, cultivate their spirit of "reverence for life", and increase their sense of responsibility and mission.
2. Master the methods of physiological experiments and consolidate the theoretical knowledge of human anatomy and physiology.
3. Master the basic operation skills of physiological experiments.
4. Familiar with the working principle of experimental equipment and related knowledge.
5. Cultivate practical abilities and improve observation skills.
6. Cultivate the students' ability to analyze and solve problems.
7. Cultivate students' sense of teamwork and good communication skills.
8. Cultivate students' strong scientific interest, critical thinking ability, and innovative consciousness.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland and have high ideological, moral and cultural quality; have strong sense of social responsibility, sound personality, and strong team consciousness; have good professional ethics, follow the professional spirit of academic	Course Objective 1, 8

	norms, master solid basic theory and research methods of biological science, and have the consciousness and spirit of seeking truth and innovation.	
Graduation Requirement 4	Through the compulsory and elective courses, students should receive systematic professional theory and professional skill training, and master solid basic theory, basic knowledge, and basic skills of biological science.	Course Objective 2, 3, 4,5, 6
Graduation Requirement 6	Through biological technology experiments and practical experience, master experimental skills of related courses; master related biological experiment data processing and analysis methods; understand the frontier technology and development trend in this field.	Course Objective 2, 3, 4,5, 6
Graduation Requirement 8	Have the ability to summarize, sort out, and analyze the experimental results; comprehensively apply the theoretical knowledge and skills; have the ability to engage in scientific research in biological science, biotechnology, and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; have strong scientific interest and critical thinking ability.	Course Objective 5, 6, 7, 8

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<p>Lab. 1: Understanding the structure of human body</p> <p>1. Show and introduce main bones and skeletal muscles of the movement control system and the main components of each organ system.</p> <p>2. Each person completes a "drawing human anatomy "</p>	<p>1. Master: The structure of the heart; the composition of the digestive system; the composition of the respiratory system; the composition of the urinary system.</p> <p>2. Familiar: Deltoid, biceps, triceps, gluteus maximus, quadriceps, sartorius.</p> <p>3. Know: The morphological structure of limb bone and trunk bone; the composition of thorax; the main body surface markers of human skeleton.</p> <p>4. Students can feel the beauty of human body and life in the</p>	4 hr	Classroom teaching	Course Objective 1, 2, 8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		process of completing "drawing human anatomy", so as to cherish and revere life, realizing the organic integrity of intellectual education and life education.			
2	<p>Lab. 2: Relationships between the stimulation frequency, intensity and contraction in skeletal muscle</p> <p>1. Preparation of sciatic nerve gastrocnemius specimens.</p> <p>2. Record the maximum single twitch of the gastrocnemius.</p> <p>3. With the same stimulation intensity, change the stimulation frequency, record and observe the muscle contraction curve respectively.</p> <p>4. Analyze the relationship between stimulus frequency and muscle contraction and its mechanism.</p> <p>5. Analyze the stimulating conditions of summation and tetanus for skeletal muscle, understand the concepts of incomplete tetanus and complete tetanus, and the coupling relationship between action potential and contraction.</p>	<p>1. Master: The method of recording electrical stimulation and muscle contraction in neuromuscular experiment; the preparation of sciatic nerve gastrocnemius specimen of toad (frog); the characteristic that contraction can be compounded but action potential cannot be superimposed.</p> <p>2. Familiar: Preparation of toad (frog) sciatic nerve gastrocnemius muscle specimens <i>in vitro</i>; changes of muscle contraction caused by different frequency of suprathreshold stimulation</p> <p>3. Know: The summation of skeletal muscle contractions; three phases of single twitch; the mechanism of the relationship between stimulus frequency and muscle contractions.</p> <p>4. Emphasize 3R Principle for the welfare protection of animals used for scientific purposes to let students be kind to living animals, and feel that life science knowledge is no longer "cold", but "warm", and cultivate students' reverence for life.</p>	4 hr	Classroom teaching, group discussion, experiment	Course Objective 1, 2, 3, 4, 5, 6, 7, 8
3	Lab. 3: Osmotic fragility of	1. Master: The importance of	4 hr	Classroom	Course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	erythrocyte 1. Preparation of graded hypotonic solution. 2. Preparation of erythrocyte suspension. 3. Experimental observation: no hemolysis occurred, partial hemolysis, complete hemolysis.	osmotic pressure of extracellular fluid in maintaining normal cell morphology and function. 2. Familiar: Method of osmotic fragility test of erythrocytes.		teaching, group discussion, experiment	Objective 2, 3, 5, 6, 8
4	Lab. 4: Blood types and cross matching 1. Capillary Blood collection from fingertips or earlobes. 2. Mix the blood with the serum to observe the phenomenon of erythrocyte agglutination. 3. Analysis of erythrocyte agglutination to determine blood type.	1. Master: Measure ABO blood grouping by slide method. 2. Familiar: The significance of blood groups identification and blood group in clinical application. 3. Know: Blood agglutination phenomenon.	2 hr	Classroom teaching, group discussion, experiment	Course Objective 2, 3, 5, 6, 8
5	Lab. 5: Measurement of human blood pressure 1. The subjects are in the general sitting position. 2. Open the sphygmomanometer, loosen the nut of the sphygmomanometer rubber ball, lustrate the remaining gas from the cuff, and then fasten the nut. 3. Wind the cuff on the upper arm with proper tightness and the nether border of the cuff should be at least 2 cm above the elbow joint. 4. Wear stethoscope. 5. In the medial cubital fossa, first touch the pulse point of the humeral artery in the elbow fossa, and then put stethoscope chest device to contact the skin closely. 6. Measure systolic and diastolic	1. Master: The procedure of cuff measurement, the range of systolic and diastolic blood pressure in normal people. 2. Familiar: The principle of indirect measurement. 3. Know: The clinical classification of hypertension.	2 hr	Classroom teaching, experiment	Course Objective 2, 3, 5, 6, 8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	blood pressure.				
6	<p>Lab. 6: Premature systole and compensatory pause</p> <p>1. Expose toad (frog) heart and study how to record the contraction curve of the heart <i>in vivo</i>.</p> <p>2. Give stimulus at the different time point of the systolic and diastolic period with strong intensity, and observe the change of the contraction curve.</p> <p>3. Give stimulus at the different time point of the early, middle, and late diastolic period with strong intensity, and observe the change of the contraction curve.</p> <p>4. Analyze the mechanism of premature systole and compensatory pause.</p> <p>5. Analyze the change rule, characteristics and physiological significance of the excitability after excitation, and the relationship between the changes of excitability and the contraction curve of the heart.</p>	<p>1. Master: The method of tracing frog heart contraction curve <i>in vivo</i>; the change rule, characteristics and physiological significance of the excitability after excitation.</p> <p>2. Familiar: The concept and mechanism of premature systole and compensatory pause.</p> <p>3. Know: The mechanism of compensatory pause.</p> <p>4. After understanding the mechanisms of the premature systole and compensatory pause, students could feel the accurate control of the heart rate as well as the electrical conduction system of the heart, which cultivate students' reverence for life.</p>	4 hr	Classroom teaching, group discussion, experiment	Course Objective 1, 2, 3, 4, 5, 6, 7, 8
7	<p>Lab. 7: Neural and humoral regulation of arterial blood pressure in rabbits</p> <p>1. Anesthesia and supine immobilization of rabbits.</p> <p>2. Operation of rabbit neck (trachea intubation, identify and separate the common carotid artery and neck nerves, and intubation of carotid arteries, etc.).</p> <p>3. The method of recording the arterial blood pressure in rabbits</p>	<p>1. Master: The formation mechanism and influencing factors of arterial blood pressure.</p> <p>2. Familiar: The basic operation skills of mammals.</p> <p>3. Know: The method of recording the arterial blood pressure directly.</p>	4 hr	Classroom teaching, group discussion, experiment	Course Objective 2, 3, 4, 5, 6, 7, 8

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	<p>directly by pressure transducer.</p> <p>4. To observe the effects of common carotid artery stretch, common carotid artery clipping, stimulation of depressor nerve and vagus nerve, and intravenous injection of epinephrine, noradrenaline, and acetylcholine on blood pressure.</p> <p>5. Analyze the mechanisms of above factors affecting arterial blood pressure.</p>				
8	<p>Lab. 8: Factors influencing the urine formation in rabbits</p> <p>1. Anesthesia and supine immobilization of rabbits, trachea intubation, and separate the right vagus nerve.</p> <p>2. The usage of bladder cannula method of collecting urine.</p> <p>3. To observe the effects of common saline solution, noradrenaline, and 20% glucose on urine volume.</p> <p>4. Analyze the mechanisms of above factors affecting urine volume.</p>	<p>1. Master: The mechanisms and influence of neural and humoral factors on the formation of urine.</p> <p>2. Familiar: The bladder cannula method of collecting urine.</p>	4 hr	Classroom teaching, group discussion, experiment	Course Objective 2, 3, 4, 5, 6, 7, 8
9	<p>Lab. 9: Blood-brain barrier</p> <p>1. Experiment group: Subcutaneously inject 0.5 mL 1% trypan blue.</p> <p>2. Control group: without treatment.</p> <p>3. Mice dislocation of the cervical vertebra after 30 min, dissect the whole body, and observe the color of brain, spinal cord, and other organs, and compare them with corresponding organs in normal mouse.</p>	<p>1. Master: The method of measuring the blood-brain barrier permeability.</p>	4 hr	Classroom teaching, group discussion, experiment	Course Objective 2, 3, 5, 6, 8

## V Period Distribution and Teaching Modes

### Period Distribution:

Experiment Name	Practice Abstract	Instrument/Reagent	Hours	Number of Each Group	Property	Required
Lab. 1: Understanding the structure of human body	Understand the general structure and function of the human body.	Human skeleton model, human muscle model, human internal organs model.	4	4	Basic	Yes
Lab. 2: Relationships between the stimulation frequency, intensity and contraction in skeletal muscle	The relationship between the stimulation frequency of sciatic nerve and the contraction form of gastrocnemius muscle was observed under the condition of keeping the stimulation intensity unchanged.	A set of frog surgical instruments, Ringer's solution, BL-420N bio-signal acquisition and processing system, Nerve/Muscle chamber, tension transducer, iron-stand, double- concave clip, toads.	4	4	Basic	Yes
Lab. 3: Osmotic fragility of erythrocyte	Study the method of osmotic fragility test of erythrocytes, understand the importance of osmotic pressure of extracellular fluid in maintaining normal cell morphology and function.	Test tube (10 mL), test tube rack, dropper, pipette (1 mL), heparin, 1% NaCl, distilled water.	4	4	Basic	Yes
Lab. 4: Blood types and cross matching	Observe the phenomenon of erythrocyte agglutination, study the method of blood typing.	Biconcave slide, disposable blood taking needle, bamboo stick, 75% alcohol cotton ball, cotton ball, marking pen, pointed dropper, microscope, standard serum A, standard serum B,	2	1	Basic	Yes
Lab. 5: Measurement of human blood pressure	Measure the normal value of arterial pressure in human being indirectly.	People, sphygmomanometer, stethoscope.	2	1	Basic	Yes
Lab. 6: Premature	Observe the response of ventricular contractile	Toad or frog, surgical instruments for frog, frog	4	4	Basic	Yes

systole and compensatory pause	activity to additional stimulation.	board, frog heart clip, BL420N bio-signal acquisition and processing system, tension transducer, iron-stand, double-concave clip, dropper, double needle shaped rose stimulating electrode, culture dish (or small beaker), gauze, cotton thread, plasticine, Ringer's solution.				
Lab. 7: Neural and humoral regulation of arterial blood pressure in rabbits	Observe the effects of neural and humoral factors on cardiovascular activity.	Rabbit, rabbit operating table, BL-420N bio-signal acquisition and processing system, surgery instruments for rabbits, glass needle, surgical thread, hemostatic forceps, hair scissor, tissue scissors, ophthalmic scissors, iron-stand, double-concave clip, blood pressure transducer, protective electrode, tracheal cannula, arterial cannula, artery clamps, three-way tubing, syringe, latex tube, 20% ethyl carbamate, heparin, noradrenaline, acetylcholine, gauze, cotton ball, paraffin, normal saline solution.	4	4	Complex	Yes
Lab. 8: Factors influencing the urine formation in rabbits	Observe influencing factors on urine formation in rabbits, and analyze its mechanism.	Rabbit, rabbit operating table, BL-420N bio-signal acquisition and processing system, surgery instruments for rabbits, glass needle, surgical thread, hemostatic forceps, hair scissor, tissue scissors, ophthalmic scissors, double-concave clip, protective electrode, tracheal cannula, bladder cannula, artery clamps, transfusion device, syringe, tubes, cotton	4	4	Complex	Yes

		ropes, instrument of collecting urine, beaker, 20% ethyl carbamate, heparin, noradrenaline, 20% glucose solution, pituitrin, gauze, cotton ball, paraffin, normal saline solution.				
Lab. 9: Blood-brain barrier	Apprehend the physiological significance of the blood-brain barrier.	Mouse, 1 mL syringe, scissor, forceps, 1% trypan blue.	4	4	Basic	Yes

### Teaching Modes:

Experiment teaching for Human Anatomy and Physiology includes theory teaching and practice teaching. In the theory teaching, teachers should emphasize the teaching key points and difficulties in the experiments, combining teacher experimental demonstration, experimental video and multimedia courseware. In the practice teaching, student-oriented experimental teaching method should be established. Students operate experiments by themselves to verify the theory of physiology in practice, so as to master the purpose and principle of physiology experiment and grasp the experimental skills. Students' ability to analyze and solve problems can be cultivated by collecting experimental data, processing results, writing experimental reports as well as discussing and analyzing experimental results.

### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Experimental reports	Writing, procedures, results, and analysis	60%	Course Objectives 2, 3, 4, 5, 6, 8
Practical operation	Operation Specification	20%	Course Objectives 1, 2, 3, 4, 5, 6, 7, 8
Attendance	20 points of deduction for one absence, 5 points of deduction for one late	20%	Course Objectives 2, 3, 4, 5, 6

### VII Textbooks and References

#### Textbooks

Dan Wang, Jingjing Luo (2021) Experiment Manual for Human Anatomy and Physiology, Self-compiled teaching materials.

#### References

Liang Zhu, Jing Xu (2016) Textbook of Functional Experiment, Second Edition. Science Press.

Marieb EN, Smith LA (2019) Human Anatomy and Physiology Laboratory Manual, Twelfth Edition. Pearson.

**Written by:** Jingjing Luo

**Reviewed by:** Dan Wang

**Date:** April 19, 2021

## Syllabus for Innovation experiments in life sciences

**Course Name/Title:** Innovation experiments in life sciences

**Course code:** 86941-86944

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 64 h (Extracurricular practice Hours)      **Course Credit:** 2

### I Course Introduction

This course aims to take the natural process of scientific research as the main line. Let students understand the general rules of the scientific research process and receive some necessary skills training in the scientific research work. Through special lectures, extracurricular scientific and technological practice, and participation in the implementation of projects, students can learn and experience systematically in the aspects of literature review, reading translation, experimental design, data processing, literature review, opening report and summary report writing. This scientific training enables students to master the basic skills of engaging in scientific research, improve the efficiency and quality of scientific research, and lay the foundation for graduation design (thesis) and practical work. In the process of case analysis, ideological and political elements are naturally incorporated, and the purpose of curriculum ideological and political education is achieved in a subtle way.

### II Course Objective

Objective 1. In the special lecture of "Life Science Innovation Experiment", the outstanding achievements of Chinese scientists in the theoretical development or practical application of the corresponding knowledge points are demonstrated with examples, and inspires students' feelings of home and country, pride and sense of mission.

Objective 2. Understand the general laws and processes of scientific research.

Objective 3. Understand the meaning and skills of topic selection in scientific research.

Objective 4. Understand and master the innovative design and data analysis of scientific research.

Objective 5. Train the writing and report skill during project implementation.

Objective 6. Develop the habit of designing firstly and then experimenting.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland, have higher ideological and moral quality and cultural quality; Have good professional ethics, follow the professional spirit of academic norms, master solid basic theories and research methods of biological science, and have the consciousness and spirit of seeking truth and innovation.	Course Objective 1-6

Graduation Requirement 6	Through a certain biological technology experiment, practical experience, master the experimental skills of related courses and related biological experiment data processing and analysis methods, understand the frontier technology and development trend in this field.	Course Objective 4-6
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	Course Objective4-6
Graduation Requirement 8	Have the ability to summarize, organize and analyze experimental results, comprehensively use the theoretical knowledge and skills that they have mastered, and engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; develop strong scientific interest and critical thinking skills.	Course Objective4-6

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
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Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Requirements for research topic selection, literature review and research project writing	<p>(1) Master the principles and skills of topic selection</p> <p>(2) Understand the basic concept and the significance of the research topic</p> <p>(3) To master the retrieval methods of life science literature, especially the resources and retrieval methods of online literature information; make full use of various resources on and off campus to obtain the full text of relevant Chinese and English literature.</p> <p>(4) Through understanding the achievements of Chinese scholars in a certain field, students' patriotism Feelings, pride, and sense of mission will be inspired in the process of literature review.</p> <p>(5) Taking provincial and above scientific research fund project application forms as cases, some basic issues and precautions involved in various project application reports will be provided.</p>	4	Group discussion	1,2, 3,6
2	Write project proposal based on specific research topic	<p>(1) Master the writing method of project declaration</p> <p>(2) Introduce and discuss the project, and make clear the project schedule and stage results.</p> <p>(3) Carry out project research, report and discuss the experimental situation at</p>	12	Group discussion	2, 4,5,6

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		the end of the term, and evaluate the progress of the project.			
3	Frontiers of Non-coding RNA Research	1) Carry out project research (2) Carry out 2-3 academic exchanges or discussions per semester according to the schedule, and evaluate the progress of each project	44	Group discussion	2, 4,5,6
4	Project summary and evaluation	1) Carry out and complete all research contents according to the research program, make an objective evaluation of the research program, make a comprehensive analysis of the deficiencies, and propose an improvement program. (2) Write scientific research training reports	4	Group discussion	2, 4,5,6

#### V Period Distribution and Teaching Modes

Experimental Project Name	Content	The main equipment Or the experimental environment	Experimental classes	Each group of Numbers	The experimental properties	Requirements (Required/optional)
Innovation experiment	Conduct scientific research in supervisor's lab based on specific projects	Supervisor's lab	64	2-4	Research and innovation	Optional

Teaching methods include classroom teaching, online learning, group discussion and so on. We should pay attention to the application of modern educational technology.

According to the needs of project research, this course will be managed by the responsible teacher, and each project will be implemented independently under the guidance of the instructor. Through innovative scientific research training, students' learning enthusiasm will be aroused, and their ability to acquire information, solve problems and do practical work will be exercised.

#### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Project declaration	Determine the research objectives of the innovative project, and complete the project declaration in a novel and coherent way by the fourth week of the fifth semester	20%	1-6
Project progress report	According to the research progress in the project application, a project progress report will be submitted in 9 <sup>th</sup> week and 18 <sup>th</sup> week of each semester during the fifth to eighth semester of the project. The reason must be explained in detail in the progress report, if the project is not completed according to the schedule. The relevant progress must be completed in the next progress report.	60%	1-6
Project summary Report	Complete all the research contents of the project declaration, and complete the project summary report in the 18 <sup>th</sup> week of the 8 <sup>th</sup> semester	20%	1-6

## VII Textbooks and References

Mentors provide

**Written by: Wu Fangli, He Qiuling**

**Reviewed by: Jin Weibo**

**Date: 2021/4/26**

# Syllabus for Modern Instrumental Analysis and Operation

**Course Name/Title:** Modern Instrumental Analysis and Operation

**Course code:** 86945 **Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 32 h (Laboratory Hours) **Course Credit:** 1

## I Course Introduction

Modern Instrumental Analysis and Operation is a laboratory-based course designed to acquaint students with basic practical skills used in costly research equipment. This course will reinforce the basic theory and application of modern instruments. The laboratory experiments use chromatographic instrument, mass spectrometer, optical spectrum instrument, imaging system, analytical equipment, flow cytometer to study Molecular weight, isoelectric point, composition, structure, biological properties and secondary metabolites. Methods of data acquisition, analysis, and written presentation skills will also be covered during the course. Students are required to master the preparation of biological samples, the operation of a variety of large instruments, the analysis of test results.

## II Course Objective

Objective 1. Develop the spirit of patriotism. Enhance students' interest and understanding of science, improving the students' critical thinking skills and creating an innovative spirit in team work.

Objective 2. Use current techniques and model systems to explore the basic theory of modern instruments. Gain experience in the use of research equipment, data collection and analysis, interpretation of results, and experimental design.

Objective 3. Master the principle of analysis method.

Objective 4. Develop scientific writing and oral communication skills.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	Master the experimental skills of related courses and related biological experimental data processing and analysis methods, and understand the cutting-edge technologies and development trends in this field through certain biotechnology experiments and practical experience.	Course Objective 1, 2,
Graduation Requirement 7	The ability to proactively use various modern media technologies to acquire scientific research information; the ability to systematically master basic	Course Objective 1, 2, 3,4

	experimental methods and skills in biotechnology and related fields, including the ability to gene clone and expression technology, microbial detection and diagnostic technology, key technologies related to life sciences, such as genetically modified technology, early diagnosis technology for major diseases, and basic bioinformatics analysis technology;	
Graduation Requirement 8	Have the ability to summarize, organize and analyze experimental results, comprehensively use the theoretical knowledge and skills that they have mastered, and engage in scientific research in biological sciences, biotechnology and related fields; have the basic ability of downstream engineering practice and technological innovation of biotechnology; develop strong scientific interest and critical thinking skills.	Course Objective 1, 2, 3,4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Basic instrument operation and laboratory safety education in laboratory biology	(1) Specification for basic instrument operation. (2) Introduction to instrument operation safety knowledge. (3) Guide students to establish patriotic spirit and the importance of maintaining the stability of the nation.	4	Experiment in group	1, 2, 3, 4
2	Protein extraction from bacteria	(1) Application method of spectrophotometer. (2) Operation principle and maintenance method of	4	Experiment in group	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		centrifuge. (3) Working principle, using method and precautions of ELISA instrument.			
3	The operation and application of high performance liquid chromatograph	(1) The working principle of HPLC. (2) Operation of a high performance liquid chromatography system. (3) Common faults and treatment methods.	4	Experiment in group	1, 2, 3, 4
4	The operation and application of mass spectrometer	(1) Basic structure of mass spectrometer. (2) The analysis principle and concrete analysis case of mass spectrometer. (3) Performance indicators of mass spectrometers. (4) Care and maintenance of mass spectrometers.	4	Experiment in group	1, 2, 3, 4
5	Laser confocal microscope	(1) Basic principle of Laser scanning confocal microscope. (2) Operation process of laser confocal microscope. (3) Maintenance of laser confocal microscope.	4	Experiment in group	1, 2, 3, 4
6	Flow Cytometer	(1) Structure and working principle of flow cytometer (2) Care and maintenance of flow cytometer	4	Experiment in group	1, 2, 3, 4
7	Small animal living imager	(1) Principles of imaging system for living animals. (2) Operating procedure of imaging system for living animals in vivo. (3) Notes for the use of the instrument. (4) Application prospect of the instrument.	4	Experiment in group	1, 2, 3, 4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
8	PCR Amplifier/ Real-time PCR	(1) Principles of PCR Amplifier and Real-time PCR. (2) Operating procedure of PCR Amplifier and Real-time PCR. (3) Notes for the use of the instruments.	4	Experiment in group	1, 2, 3, 4

#### V Period Distribution and Teaching Modes

The course was given one 4-hour lab per week. In order to improve students' scientific-thinking, problems-analysing and problem-solving abilities, students are required to perform the cell culture experiments in groups in a whole month and write the laboratory report independently. We also provide the related experiment videos to extend and supplement the knowledge in class and help the students master basic operating skills.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Laboratory report	Label all data clearly, including relevant units. Results section includes the formal presentation of the analysis of raw data as graphs, summary tables, figures. The discussion was shown to the critical analysis.	70	2, 3, 4
Attendance	Attendance in labs is mandatory. 5 points will lose for each missed lab.	10	1, 2, 3, 4
Online learning	Assess the online learning time and the completion of exercises	20	1, 2, 3, 4

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches

take up in the total score.

### **VII Textbooks and References**

Wei Yu, Yanping Quan. Laboratory Manual of Cell Biology, Zhejiang Sci-tech University.

**Written by: YanRong Zhou**

**Reviewed by: MeiLan Yu**

**Date: 2021.4.20**

## Syllabus of General Biology Experiment

**Course Name/Title:** General Biology Experiment      **Course code:** 86946  
**Course Type:** (Specialized Course)(Compulsory Course)  
**Total Teaching Hours:** 32 (Classroom Hours:0 Laboratory Hours or Tutorial Hours:32)  
**Course Credit:** 1

### I Course Introduction

Experiment of General Biology, including botany and zoology, is an important basic course of biology science and independently obligatory and basic experimental course of students. It can improve, steady and deepen understanding on basic principles and concepts of botany and zoology. Also it will promote students to grasp the basic approaches of botany and zoology experiments and culture the practical, observation, literature reviewing, innovative thinking, expression and summarization and the report writing ability. Therefore, the pragmatic independent ability and basic research capability of students can be trained.

### II Course Objective

1. General Biology Experiment is a basic and early compulsory course for biology major. The purpose of this course is to enable students to master the basic methods and skills for botany and zoological research.
2. General Biology Experiment lay the foundation for subsequent course, such as physiology, ecology, genetics, cell biology and molecular biology.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Through the compulsory and elective courses, we will receive systematic professional theory and professional skills training, and master solid basic theory, basic knowledge and basic skills of biological science.	Course Objective 1,2
Graduation Requirement 6	Through a certain biological technology experiment, practical experience, master the experimental skills of related courses and related biological experiment data processing and analysis methods, understand the frontier technology and development trend in this field.	Course Objective 1,2

### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	The use of microscope and basic structure of the plant cells and the structure of the plant cell.	<p>1) Master the structure and use method of ordinary optical microscope; Understand the basic structure of the plant cells under optical microscope; Studying biology drawing method.</p> <p>2) Know the basic structure of the plant cell through observing the epidermis cell of plant leaves; Master the structure and function of every organelles of plant cell; Know the type of the plastids of the plant cell; Know the plasmodesma between the cells and the phenomenon of protoplasm flows; Grasp the technology of free hand sections.</p>	4	Experiment	Course Objective 1,2
2	Tissues of the plant cell and the structure of the root.	<p>1) To observe and learn to identify representative plant tissues and their functions in plants; Grasp the technology of free hand sections;</p> <p>2) To understand the structure of the root tip; Identify the areas of primary and secondary growth in the typical plant root of a monocot or dicot; Differentiate between the structures and functions of the vascular tissues.</p>	4	Experiment	Course Objective 1,2
3	The structure of plant stem and leaf.	<p>1) Understand the types of stems and buds; To understand the primary and secondary structure of the stems;</p> <p>2) Grasp the external morphology and internal anatomy of leaves; Compare the structures of internal leaves between the monocots and dicots.</p>	4	Experiment	
4	The anatomic structure of flower and plant seeds	<p>1) Grasp the composition of a typical flower; To study the male and</p>	4	Experiment	

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	and fruits.	female reproductive organs needed for sexual reproduction in flowering plants; 2) Grasp the seed structure and the basic seed types; Know the differences between the dicots and monocots; Understand what each structure of the seed will become in the seedling; Know the types of fruits; Know the method to identify fruit types.			
5	Dissection of earthworms and clams	Understand the basic characteristics and specialization of the phylum annelida and molluscs, class oligochaeta and bivalvia.	4	Experiment	Course Objective 1,2
6	Dissection of crayfishes and grasshoppers	Understand the basic characteristics and specialization of the phylum arthropod, subphylum crustacean and hexapod.	4	Experiment	Course Objective 1,2
7	Dissection of fishes and frog	Understand the basic characteristics and specialization of the phylum choradata, class amphibia, and major group of fishes.	4	Experiment	Course Objective 1,2
8	Dissection of chickens	Understand the basic characteristics and specialization of the phylum choradata, and class aves.	4	Experiment	Course Objective 1,2

#### V Period Distribution and Teaching Modes

The course was given one 4-hour lab per week. In order to improve students' scientific-thinking, problems-analysing and problem-solving abilities, students are required to perform the experiments in groups in a whole month and write the laboratory report independently. We also provide the related experiment videos to extend and supplement the knowledge in class and help the students master basic operating skills.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
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classroom performance	8 times/term	20%	Oral questioning
conventional assignments	8 times/term	30%	Observation of performance
final exam	close-book	50%	Written test

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

### **VII Textbooks and References**

**Textbooks:** Botany Experiment, handout by instructor

**References:**

[1]Zhou yi, 《Experiments of plant morphological anatomy》 Version 4,Beijing Normal University Press,2008

[2] Zhou yunlong, 《The spore plant experiment and practice》 Revised edition, Beijing Normal University Press,1993

[3] Yin zhoutang. 《Seed plants experiment and practice》 Version 3, Beijing Normal University Press,2009

**Written by: yang Zongqi**

**Reviewed by: Jiang Yonghou**

**Date: April 19, 2021**

# Syllabus of Experiment in Biostatistics and Experimental Design

**Course Name/Title:** Experiment in Biostatistics and Experimental Design

**Course code:** 86948

**Course Type:** Specialized Course (Optional Course)

**Total Teaching Hours:** 32 (32 Laboratory Hours)

**Course Credit:** 1

## I Course Introduction

This course is a professional elective course for students majoring in biology and it is also an important professional tool for life science and medical research. This course is not only complementary to the theoretical course of *Biostatistics and Experimental Design*, but also a relatively independent system. This course will focus on the application of software in biostatistics, such as data sorting, descriptive statistics t-test, analysis of variance, chi-square test, regression and correlation analysis, orthogonal test, etc. The course can cultivate students to master the statistical analysis methods of different data and the ability to correctly interpret the results of statistical software. The ideological and political elements is also integrated into teaching process, including respecting data, respecting science and caring for life to strengthen the professional ethics education of student and carry forward the spirit of people oriented. The course is helpful for students to develop exploratory thinking, reverse thinking, divergent thinking and critical thinking.

## II Course Objective

The biostatistics experiment includes three parts: basic experiment, comprehensive experiment and design experiment, which run through the principles of statistics, experimental methods, experimental procedures, experimental skills and techniques.

**Course objective 1:** The ideological and political elements, including respecting data, respecting science and caring for life, are integrated into teaching process to strengthen the professional ethics education of student and carry forward the spirit of people oriented.

### (4) Knowledge goal:

**Course Objective 2:** Understand the data management and basic operations of commonly used statistical software.

**Course Objective 3:** Master the methods of data sorting and analysis.

**Course Objective 4:** Master the method of t-test.

**Course Objective 5:** Master the method of chi-square test.

**Course Objective 6:** Master the method of variance analysis.

**Course Objective 7:** Master the method of non-parametric testing.

**Course Objective 8:** Master the methods of simple correlation and regression analysis.

**Course Objective 9:** Master the methods of multiple linear regression and curve regression analysis.

**Course Objective 10:** Be able to use the methods and principles to analyze test data scientifically.

**Course Objective 11:** Be able to correctly interpret the statistical software analysis results.

### (5) Ability goal:

**Course Objective 12:** Cultivate students' critical thinking ability.

**Course Objective 13:** Cultivate the ability to analyze and solve problems.

**(6) Quality goal:**

**Course Objective 14:** Cultivate students' interest in studying biotechnology.

**Course Objective 15:** Cultivate students' teamwork spirit.

**III Correlations between Course Objectives and Graduation Requirements.**

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	Love the motherland, have high ideological and moral qualities and cultural qualities. Have a strong sense of social responsibility, a sound personality and a strong sense of teamwork. Have a good professional ethics, follow academic standards. Master the solid basic theories and research methods, and have the sense of truth-seeking and innovation.	Course Objective 1, 2
Graduation Requirement 4	Obtain systematic professional theory and professional skills training through compulsory and elective courses. Master the solid basic theories, basic knowledge and basic skills of biological sciences.	Course Objective 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Graduation Requirement 6	Master the experimental skills of related courses, and can process and analysis related biological experimental data through certain biotechnology experiments and practical experience.	Course Objective 10, 11, 13
Graduation Requirement 7	Be able to use various modern media technologies to actively acquire scientific research information and other knowledge. Master basic experimental methods and skills in biotechnology and related fields, including gene cloning and expression technology, microbial detection and diagnosis technology, transgenic technology, early diagnosis technology of	Course Objective 10,11

	major diseases, and basic analysis technology of bioinformatics.	
Graduation Requirement 8	Can summarize, organize, and analyze experimental results. Be able to use the theoretical knowledge and skills to engage in scientific research in biological sciences, biotechnology and related fields.	Course Objective 12, 13, 14, 15

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	<b>Data management and basic calculations of commonly used statistical software:</b> (1) Excel basics (2) SPSS basics	(1) Understand the characteristics of Excel and SPSS statistical software and their role in biostatistics. (2) Familiar with the Chinese interface and basic operations of Excel and SPSS operating systems. (3) Master the data input format and operation method of Excel and SPSS statistical software. (4) Understand the common statistical methods of Excel and SPSS. (5) Master the basic methods of creating Excel formulas and the use of paste functions. (6) Master the methods of using SPSS for basic statistical calculations and data sorting. (7) Take premier Zhu Rongji's story of "not making false accounts" as an example and tell students that they can't modify the data at will in the experiment, practice fraud, and develop a down-to-earth work style.	4	Classroom presentation, computer operation	Course Objective 1, 2, 3, 14, 15
2	<b>Data sorting and analysis:</b> (1) Descriptive statistics (2) Sorting and	(1) Master the methods of using Excel and SPSS statistical software to group data, calculate basic characteristic values, and draw common statistical graphs.	4	Classroom presentation, computer	Course Objective 1, 3, 10, 11, 14, 15

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	grouping of data and drawing of frequency distribution map (3) Drawing of statistical graphics	(2) Be able to interpret and analyze output results. (3) Teachers can be role models to infect students with rigorous scientific research spirit in the process of scientific research, and guide students to invest in national scientific research.		operation	
3	<b>t-test:</b> (1) Single sample mean t-test (2) Unpaired data t-test (3) Paired data t-test	(1) Master the data input format and basic operation methods of using Excel spreadsheet and SPSS software to carry out the significance test of mean difference. (2) Be able to interpret and analyze statistical results.	4	Classroom presentation, computer operation	Course Objective 4, 10, 11
4	<b>Chi-square test:</b> (1) Suitability test (2) Independence test (3) Paired chi-square test	(1) Master the data input format and basic operation method of chi-square test using Excel spreadsheet and SPSS software. (2) Be able to interpret and analyze statistical results.	4	Classroom presentation, computer operation	Course Objective 5, 10, 11
5	<b>Variance analysis:</b> (1) One-factor variance analysis (2) Analysis of variance of two-factor data without repeated observations (3) Analysis of variance of repeated data such as cross-grouping	(1) Understand the basic concepts and principles of variance analysis. (2) Master the data input format and basic operation methods of using Excel spreadsheet and SPSS software to perform variance analysis. (3) Be able to interpret and analyze statistical results. (4) Describe how to speed up the development of new crown vaccines by controlling and reducing sampling errors or expanding sample sizes to reduce the probability of two types of errors.	4	Classroom presentation, computer operation	Course Objective 1, 6, 10, 11, 12, 13, 14, 15
6	<b>Non-parametric test:</b>	(1) Master the data input format and	4	Classroom	Course

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	(1) Nonparametric test of two samples (2) Nonparametric test of multiple samples	basic operation methods of using Excel spreadsheet and SPSS software for non-parametric testing. (2) Be able to interpret and analyze statistical results.		m presentation, computer operation	Objective 7, 10, 11
7	<b>Simple correlation and regression analysis:</b> (1) Simple correlation analysis (2) Simple regression analysis	(1) Master the basic process of simple correlation analysis and regression analysis using Excel spreadsheet and SPSS software. (2) Familiar with the format and basic operation methods of data input. (3) Be able to interpret and analyze statistical results.	4	Classroom presentation, computer operation	Course Objective 8, 10, 11, 12, 13
8	<b>Multiple linear and curvilinear regression analysis:</b> (1) Multiple linear regression analysis (2) Curve regression analysis	(1) Master the data input and operation steps of using Excel spreadsheet and SPSS software for multiple linear regression analysis and curve regression analysis. (2) Be able to interpret and analyze of statistical results.	4	Classroom presentation, computer operation	Course Objective 9, 10, 11, 14, 15

## V Period Distribution and Teaching Modes

(1) Course hours allocation

### Time allocation table for practical courses such as experimental courses, curriculum design:

Experiment name	Executive summary	Main equipment or experimental environment used	Experimental hours	Number of people in each group	Experimental attributes (basic/design/comprehensive/research innovation)	Requirements (required/optional)
Data management and basic calculations of commonly	1.Excel basics 2.SPSS basics	Computer room	4	2	basic	required

used statistical software						
Arrangement and calculation of data	(1) Descriptive statistics (2) Sorting and grouping of data and drawing of frequency distribution map (3) Drawing of statistical graphics	Computer room	4	2	basic	required
t-test	(1) Single sample mean t-test (2) Unpaired data t-test (3) Paired data t-test	Computer room	4	2	basic	required
Chi-square test	(1) Suitability test (2) Independence test (3) Paired chi-square test	Computer room	4	2	basic	required
Variance analysis	(1) One-way analysis of variance (2)	Computer room	4	2	basic	required

	Analysis of variance of two-factor data without repeated observations (3) Analysis of variance of repeated data such as cross-grouping					
Non-parametric test	(1) Nonparametric test of two samples (2) Nonparametric test of multiple samples	Computer room	4	2	basic	required
Simple correlation and regression analysis	(1) Simple correlation analysis (2) Simple regression analysis	Computer room	4	2	basic	required
Multiple linear regression and curvilinear regression analysis	(1) Multiple linear regression analysis (2) Curve regression	Computer room	4	2	basic	required

	analysis					
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(2) teaching method

The course is mainly focused on basic experiments. The teacher explains the experiment content demonstrates the operation of the software first, and then let the students do group experiments (two in groups). For the problems that arise in the experiment, the teacher will guide the students to analyze and solve them independently. After the experiment, students report the results of the experiment to the teacher.

Teachers must carefully review the experiment report, indicate any errors or imperfections, and finally give the score, and sign the name and date.

### VI Assessment

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance and classroom performance	20 points deducted for one absenteeism, 5 points deducted for one late arrival	20%	Course Objective 1, 12, 13, 14, 15
Experiment process and experiment report	The content of the report includes: experiment name, experiment purpose, experiment principle, software used, experiment procedure, experiment result and analysis	80%	Course Objective 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

### VII Textbooks and References

(1) Teaching materials:

Montgomery D C. Design and analysis of experiments. John wiley & sons, 2017.

(2) References

[1] Queen J P, Quinn G P, Keough M J. Experimental design and data analysis for biologists. Cambridge university press, 2002.

[2] McCormick K, Salcedo J. SPSS statistics for data analysis and visualization. John Wiley & Sons, 2017.

**Written by: Chen Cen**

**Reviewed by: Dai Qi**

**Date: 2021.7.19**

# Syllabus of “Comprehensive experiment of genetics and developmental biology ”

**Course Name/Title:** Comprehensive experiment of genetics and developmental biology

**Course code:** 86949

**Course Type:** (Specialized Basic Course)(Optional Course)

**Total Teaching Hours:** ( Laboratory Hours: 32 hours )

**Course Credit:** 1

**Prerequisite:** Genetics, molecular biology, genetic engineering, developmental biology

**Applicable profession:** Biotechnology

**Course opening Department (Office):** Department of Biotechnology

## I Course Introduction

Comprehensive experiment of genetics and developmental biology mainly use model organisms as experimental materials to study gene functions at the overall biological phenotype level. In recent years, the international research in this field has been changing with each passing day. The experiments involve development-related gene location, gene manipulation, gene mutation, gene expression, gene function and other fields. This experimental course takes model plant rice or Arabidopsis as the experimental object, and guides students to observe and analyze the main biological events in the process of plant development. It is an effective supplement to the theoretical course, further expands students' horizons, and improves scientific research and practical ability. At the same time, through the implementation of the curriculum, students will be cultivated with a rigorous scientific attitude and teamwork ability.

## II Course Objective

Course objective 1: To cultivate students' rigorous scientific spirit, innovative thinking and the ability to design biological experiments independently;

Course objective 2: To train students to master the developmental mechanism and growth regulation laws of plants in various states;

Course objective 3: To train students to master the basic experimental techniques and the latest research methods of developmental biology .

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	Receive more systematic professional theory and professional skills training through compulsory and optional courses, and master solid basic theories, basic knowledge and basic skills of biological science.	Course Objective 1,2

Graduation Requirement 5	Understand the molecular mechanisms of cell division cycle regulation, tissue differentiation, cell pluripotency and gene regulation.	Course Objective 2,3
Graduation Requirement 6	Grasp the embryogenesis, the molecular mechanism of development and the regulation theory of development, be familiar with the structure of plant floral organs and the process of floral organogenesis, and accurately understand the process of plant fertilization.	Course Objective 2,3
Graduation Requirement 7	Preliminary have the ability to use plant development theory to guide plant genetic improvement and regulate the growth of crops.	Course Objective 1,2,3
Graduation Requirement 8	Have the ability to summarize, sort and analyze experimental results, comprehensively use the theoretical knowledge and skills they have mastered, and engage in scientific research in biological sciences, biotechnology and related fields; Have the basic ability of downstream engineering practice and technological innovation of biotechnology; Have strong scientific interest and critical thinking skills.	Course Objective 1,2,3

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	SSR molecular markers map development-related genes	Understand SSR molecular markers and the principle of using SSR molecular markers for gene mapping; Master primer design, PCR experiment, agarose electrophoresis, population SSR molecular marker genotyping and	4	Experiment	Course Objective 1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
		gene location; Looking back on the development of molecular markers. In recent years, high-throughput sequencing technology has played an important role in the rapid discovery of molecular markers, enabling students to understand that advances in science and technology promote the rapid development of scientific research, and science and research complement each other and achieve each other.			
2	Rhythmic expression of circadian clock related genes	Understand the biological clock involved in the regulation of plant growth and development; Master the experimental skills of tissue RNA extraction, reverse transcription and fluorescent quantitative PCR, as well as quantitative PCR data analysis; Discuss the latest progress of Chinese scholars in the research of circadian genes, stimulate students' interest in scientific research, and build up national self-confidence and pride.	8	Experiment	Course Objective 1,2,3
3	Tail-PCR experimental technology	Understand the principle and application of tail-PCR experiment; Master semi-specific PCR, agarose electrophoresis, and sequencing analysis of nucleic acid sequence	8	Experiment	Course Objective 1,2,3
4	GUS staining to detect transient gene expression	Understand the principle of GUS staining. Master the Agrobacterium tumefaciens transgenic method, and use histochemical staining method to detect gene expression.	4	Experiment	Course Objective 1,2,3
5	Floral induction in plant reproductive	Understand the floral induction during plant reproductive	8	Experiment	Course Objective

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	growth	development; Grasp the principles of quantitative PCR and in situ hybridization technology, and carry out experiments in combination with the existing virtual simulation experiment software (the Arabidopsis thaliana floral induction virtual simulation experiment). Stimulate students' interest in traditional experiments and virtual simulation experiments, and establish interest in scientific careers.			1,2,3

#### V Period Distribution and Teaching Modes

(1) Allocation of course hours (allocate the total class hours according to the order list (knowledge unit or project), and reasonably allocate the class hours required for teaching, experiment, exercise, discussion, counseling and other teaching links).

**Class hour allocation table of experimental course, course design, case and other practical courses or practical teaching contents:**

Experiment project	Executive summary	Main equipment or experimental environment	Experimental hours	Grouping	Experimental attributes	Requirement
SSR molecular markers map development-related genes	Use SSR molecular markers to carry out gene mapping / cloning, master primer design, PCR experiment, agarose electrophoresis, population	General molecular biology laboratory, equipped with microwave oven, pipette, desktop centrifuge, PCR instrument, agarose gel	4	4-6 person group	Comprehensive	Compulsory

	SSR molecular marker genotyping and gene mapping. Let students master the common techniques and experimental methods of cloning developmental genes.	electrophoresis, gel imager, etc.				
Rhythmic expression of circadian clock related genes	Use quantitative PCR technology to determine the rhythmic expression characteristics of genes through 24-hour continuous sampling, allow students to understand the dynamic expression of genes during development, enable students to master the experimental skills of tissue RNA extraction, reverse	General molecular biology laboratory, equipped with pipette, desktop centrifuge, quantitative PCR instrument, agarose gel electrophoresis, gel imager, etc.	8	4-6 person group	Comprehensive	Compulsory

	transcription and fluorescent quantitative PCR, as well as quantitative PCR data analysis method.					
Tail-PCR experimental technology	Tail-PCR technology is thermal asymmetric PCR. Under the premise of a known sequence on one side, the adjacent gene sequence can be separated, and the development of genes related to the T-DNA insertion site can be cloned, so that students can understand the principle and application of Tail-PCR experiment. Master semi-specific PCR, agarose electrophores	General molecular biology laboratory, equipped with pipette, desktop centrifuge, PCR instrument, agarose gel electrophoresis, gel imager, etc.	8	4-6 person group	Comprehensive	Compulsory

	is, sequencing analysis of nucleic acid sequences.					
GUS staining to detect transient gene expression	GUS ( $\beta$ -glucuronidase) is a hydrolase. GUS gene is widely used as the reporter gene of transgenic plants. This enzyme can hydrolyze X-Gluc to produce blue substance, which can be observed by naked eyes or under microscope. It is generally used to show the tissue expression pattern of a gene. Enable students to master the methods of histochemical staining and understand the tissue specificity of genes during development.	General molecular biology laboratory, equipped with pipette, water bath, electronic balance, desktop centrifuge etc.	4	4-6 person group	Comprehensive	Compulsory
Floral	Floral	General	8	4-6	Comprehensive	Compulsory

<p>induction in plant reproductive growth</p>	<p>induction is a key event of plant transformation from vegetative growth to reproductive growth, which is regulated by many factors such as temperature and sunshine length. Through quantitative PCR, in situ hybridization and other technologies, combined with virtual simulation software, students can understand the process of floral transformation and the process of gene expression and protein migration of florigen.</p>	<p>molecular biology laboratory, equipped with pipette, desktop centrifuge, quantitative PCR instrument, agarose gel electrophoresis, gel imager, etc. Virtual simulation experiment.</p>		<p>person group</p>	<p>sive</p>	<p>ry</p>
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(2) Teaching methods

The teaching methods include classroom teaching, online learning, group discussion and so on. Pay attention to the application of modern educational technology.

**VI Assessment**

<b>Assessment Methods or Approaches</b>	<b>Assessment Requirements</b>	<b>Assessment Weighting</b>	<b>Evaluation of Course Objectives</b>
Experimental operation	According to the experimental requirements, complete the experimental operation.	50	Course Objective 1,2,3
Experimental result	Whether to achieve the expected experimental results.	20	Course Objective 1,2,3
Experimental report	Write experimental report and analyze experimental results.	30	Course Objective 1,2,3

Note: 1. Assessment methods or approaches mainly include classroom performance, conventional assignments, unit tests, mid-term exam, final exam, big assignments, course paper, project design and works, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods or approaches take up in the total score.

#### **VII Textbooks and References**

(1) Textbooks:

[1] Yan Haiyan, Plant Development Biology, Wuhan University Press, 2015.

(2) References:

[1] Zhang Lei, Zhao Jie, Experimental Guide of Plant Developmental Biology, Wuhan University Press, 2010.

[2] Bai Shunong, Plant Developmental Biology, Peking University Press, 2003.

[3] Xu Zhihong, Liu Chunming, Molecular Mechanism of Plant Development, Science Press, 1998.

**Written by: Jia Qiaojun**

**Reviewed by: Wang Dekai**

**Date: 2020/04/25**

# The syllabus of the Genetic Diagnostics and Biological Therapy

## Experiment

**Course name:** Genetic Diagnostics and Biotherapy Experiment

**Course code:** 86951

**Course categories and nature:** Professional electives

**Total hours:**20 hours (where lectures 0 hours, experiments, on-machine, or extracurricular practice 20 hours).

**Credits:**1

**Basic course:** Cell Biology Experiment

**Associate professionals:** Biotechnology, biopharmaceutics, marine biological resources

**Department of Biotechnology**

### First, the course introduction

With the continuous development of human economy and society, the progress of modern science and technology, especially the rapid development of modern medical technology and biotechnology, people's research on gene therapy, stem cell differentiation, transplantation and molecular mechanism and its therapeutic effect is becoming more and more abundant and in-depth, which will bring about great changes in the diagnosis and treatment of human diseases. As a student of biological related majors, we should have a deeper understanding of the basic concepts and applications of gene diagnosis and gene therapy and biological therapy of diseases, and be able to grasp the basic principles and operations of experiments related to gene diagnosis and biological therapy.

Genetic Diagnosis and Biotherapy Experiment is an experimental course supporting Gene Diagnostics and Biotherapy, which complements and is relatively independent. This course focuses on basic experimental operations related to gene diagnosis and biological therapy, including amplification and identification of recombinant gene therapy vectors, detection of disease markers by enzyme-linked immunosorption assays, detection of disease markers by time-resolution immunofluorescence analysis, and detection of in vitro killing effects of tumor gene therapy. Through curriculum teaching, students' hands-on ability, observation, analysis and induction ability are enhanced, and students' innovative spirit, rigorous discipline and team spirit are cultivated to improve their comprehensive quality and lay a solid foundation for follow-up course learning. ns.

### Second, the curriculum teaching objectives

Course Objective 1:To enhance students' interest in learning their major and cultivate their national conditions. In the teaching of this course, will be integrated into the current global prevention and control of new crown epidemic, new crown vaccine research and development and other content, so that students know that the development of science and technology, biomedicine progress is the country's rapid development, people's healthy life is an important guarantee, will play an important role in China's cooperation and competition with other countries in the world.

Goal 2: Through this course, students are taught the basic experimental operations and principles related to gene diagnosis and biological therapy.

Goal 3: Through the study of knowledge in gene diagnosis and biological therapy, students can integrate experimental operations and theoretical knowledge in molecular biology, cell biology, immunology, etc.

Goal 4: Through the study of this course, stimulate students' sense of innovation, improve students' scientific research ethics, and cultivate students' correct academic ideas.

**Third, the corresponding relationship between the curriculum teaching objectives and graduation requirements**

<b>Graduation requirements</b>	<b>Graduation requirements indicator points</b>	<b>Course objectives</b>
Graduation requirements 1	Love the motherland, with high ideological and moral quality and cultural quality, with a strong sense of social responsibility, sound personality and strong sense of team, with a good professional ethics, follow academic norms of professionalism, master a solid basic biological science theory and research methods, have a sense of truth-seeking and innovation and spirit.	Course goals 1,4
Graduation requirements 2	Through compulsory and elective courses, more systematic professional theory and professional skills training, master a solid biological science basic theory, basic knowledge and basic skills.	Course goals 2,3
Graduation requirements 3	Through certain biotechnology experiments, practical experience, master the experimental skills of relevant courses and related biological experimental data processing and analysis methods, to understand the field of cutting-edge technology and trends.	Course goals 1,2,3,4
Graduation requirements 4	The ability to actively acquire scientific research information and other knowledge using a variety of modern media technologies, and the ability to systematically master basic experimental methods and skills in biotechnology and related fields, including key life science-related technologies including gene cloning and expression technology, microbiological detection and diagnostic techniques, genetically modified technologies, early diagnosis of major diseases, and bioinformatics basic analysis techniques.	Course goals 2,3

The relationship between teaching content and curriculum objectives

**The relationship between curriculum teaching content and curriculum objectives**

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
1	The amplification and identification of recombinant gene therapy vectors	(1) Master the principle and experimental operation of recombinant gene amplification. (2) Master the principle and experimental operation of gene expression vector construction. (3) Establish students' correct scientific ethics through a panel discussion on the Jiankui's "gene-edited baby" event.	5	Lectures, experiments	Course goals 1,2,3,4
2	Enzyme-linked immunosorption assays detect disease markers	(1) Master the principle and basic experimental operation of enzymatic immunosorption assay to detect disease markers. (2) Understand the methods and principles of other protein detection commonly used in clinical practice. (3) Through panel discussions on the prevention and treatment of new crown outbreaks and the development of new crown vaccines around the world, students can be made aware that the development of science and technology and advances in the field of biomedicine are important guarantees for national development and people's lives. Strengthen students' interest in learning this profession and cultivate students' national conditions.	5	Lectures, experiments	Course goals 1,2,3,4
3	Time-resolution immunofluorescence analysis detects disease markers	(1) Understand the principles and characteristics of time-resolution fluorescence immunoassays. (2) Preliminary grasp of the time-resolution fluorescence immunoassay method to detect the basic experimental operation of	5	Lectures, experiments	Course goals 1,2,3,4

serial number	Teaching content	Teaching requirements	Hours	teaching manner	The corresponding lesson target
		disease markers. (3) Stimulate students' sense of innovation and patriotism by teaching them the history and achievements of the industrialization of time-resolution fluorescence immunoassay by teaching them about the development of time-resolution fluorescence immunoassays.			
4	In vitro killing effect detection of tumor gene therapy	(1) Master the basic operation of tumor cell culture. (2) Experimental operation to master the principle of the ability of tantalum to detect cell proliferation. (3) Master the use of Graphpad Prism to analyze tumor cell viability.	5	Lectures, experiments	Course goals 1, 2, 3, 4

#### V. Distribution of course hours and teaching methods

(1) The allocation of course hours (the allocation of total school hours in order (knowledge units or projects) and the reasonable allocation of the teaching hours required for teaching, experimentation, exercises, discussion, tutoring, etc.).

#### Schedule of assignments for practical courses or practical teaching content such as experimental courses, curriculum design, cases, etc.:

The name of the lab project	The summary	The main one used equipment or experimental environment	Experimental time	Number of people per group	Experimental properties (basic / comprehensive / design / research innovation).	Make a request (do / choose to do.)
Item 1: Recombinant gene therapy vector	1. Recombinant extraction of viral genomes;	PCR instrument, centrifuge, nucleic acid electrophor	5	4	Comprehensive design	Must do

amplification and identification	<p>2. Designing primers and PCR amplification systems for the treatment of genes and wild poisons;</p> <p>3. Set the conditions for PCR amplification and expansion PCR;</p> <p>4. Enzyme cut identification of PCR products and electrophoresis of agar glyco gels.</p>	<p>esis instrument, ultraviolet observation instrument, water bath, ultra-clean workbench, PCR reagents</p>				
Item 2:Enzyme-linked immunosorption assays detect disease markers	<p>1. Preparation of standard products and drawing of standard curves;</p> <p>2. Optimize antibody incubation</p>	<p>Enzyme-linked immunosorption test kit, shaker, enzyme labeler</p>	5	4	Comprehensive design	Must do

	n time; 3. The enzymatic labeler detects the OD value of the sample and calculates the protein detection concentration.					
Item 3: Time-resolution immunofluorescence analysis to detect disease markers	1. Preparation package by antibodies, labeled antibodies; 2. Preparation of standards and drawing of standard curves; 3. Optimize the reaction conditions; 4. Measure the results and calculate the protein	Time-resolution immunofluorescence analysis and detection of related reagents, shakers, enzyme labelers	5	4	Comprehensive design	Must do

	concentration.					
Item 4: In vitro killing effect detection for tumor gene therapy	1. The culture of tumor cells; 2. Counting tumor cells and laying 96-well plates; 3. The recombinant gene therapy vector is used to detect the lethal effect of recombinant gene therapy vector on tumor cells.	Cell incubators, cell culture reagents and consumables, ultra-clean workbench, MTT reagents, enzyme labelers	5	4	Comprehensive design	Must do

(2) Teaching methods

According to the syllabus, under the guidance of the teacher, the students complete the experiments independently and write the experimental reports.

Master the experimental principles, familiar with the experimental methods, record the experimental data in a complete way, standardize the writing of experimental reports, and scientifically analyze the experimental results.

**Sixth, the course assessment**

The method or approach to the assessment	Assessment requirements	Assessment weights	Corresponding to course objectives
Attendance and classroom performance	Attend and listen carefully on time	30	Course objectives 1, 2, 3, 4
Experimental report	The experimental report requires concise, smooth, clear writing, clean	70%	Course objectives 1, 2, 3,

	writing, timely completion and submission, the main contents of the experimental report include:(1) name, major, class, group, date, temperature and humidity, etc.:(2) the experimental serial number and the experimental name;(3) the purpose of the experiment;(4) experimental methods and procedures;(5) Experimental data and results;(6) Analysis and discussion.		4
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7. Recommend teaching materials and reference materials

**teaching materials:**

Yang Tao et al., Gene Diagnostics and Cell Therapy, Science and Technology Literature Press, 1st edition,published in August2018.

Lu Jianxin, Editor-in-Chief, Wang Peichang, Testing and Clinical Diagnostics - Molecular Diagnostics, 1st Edition, May2010.

Liu Dazhao, Editor-in-Chief, Philosophy of Science and Technology, Higher Education Press, January2019.

**Reference book:**

Gu Jianren, Editor-in-Chief of Cao Xuetao, Gene Therapy, Science Press, 1st edition, published in February2001.

Editor-in-Chief, Molecular Biology of Modern Gene Therapy, Science Press, 2nd edition, published in September 2014.

**Written by: Jia Qiaojun**

**Reviewed by: Wang Dekai**

**Date: 2021/05/26**

# Syllabus of Inorganic & Analysis Chemistry Experiment

**Course Name/Title:** Inorganic & Analysis Chemistry Experiment

**Course code:** 86967

**Course Type:** Specialized Course (Compulsory)

**Total Teaching Hours:** 32 ( Laboratory Hours)

**Course Credit:** 2

## I Course Introduction

The course covers principles and applications of chemical laboratory techniques, including preparation and analysis of chemical materials, PH measurement, visible-ultraviolet spectrophotometry, kinetics, data analysis, and elementary synthesis. It adjusts for the basic education of such specialty: Biology Engineering, Pharmacy Engineering/Chemical Engineering and Technology/Materials Science and Engineering. The program is to prepare students to master theory and technology of inorganic chemistry, especial in the skills of experiment of inorganic chemistry, and equip them with basic knowledge including the property of common elements, preparation, separation and purification of inorganics.

The program prepares students for ability of scientific thinking and research skills. Comprehensive experiment and innovative experiment aim to cultivate and improve students' experimental design and the application of various experimental. Its organization offers flexibility to accommodate various requirements of the course and allows students to reference detailed theory sections for clarification during labs.

## II Course Objective

1. Think critically and creatively about experiments topics.
1. It helps train students' responsibility for learning and engaging in a scientific project.
3. Master the operation of quantitative determination method.
4. Understand the concepts of experimental error and stoichiometry as well.
5. Master the principle and methods of water hardness determination using complexometric titration.
6. Master the determination of the chemical reaction rate and activation energy
7. Master the principles and operational method to determine the concentration and purity of sulfosalicylic acid using UV-Spectrophotometry method.
8. Train the students' hands-on ability and observation ability in inorganic and analytical chemistry experiments.
9. Improve the abilities of students' experimental design, problems analysis, and ability of the reading references.
10. Cultivate the students' writing ability for research report.
11. Master the basic techniques of inorganic and analytical chemistry experiments.
12. Learn general laboratory safety knowledge and accident handling, and strictly obey the rules of the laboratory work.
13. Master the theory and technology of the inorganic and analytical Chemistry, especial in the skills of inorganic and analytical Chemistry Experiment such as glassware's washing and drying, PH test strips, liquid reagents or specimens' access and correct usage of pipette, burette, analytical balance, volumetric flask, weighing bottle and PH meter.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 3	Comprehensive master biological science and biotechnology and have the ability to analyze and solve problems.	Course Objective 1,2,3,4,8,9,10,11,12,13
Graduation Requirement 3	Have the ability to use the theoretical knowledge and skills to engage in the research and development of products associated with biotechnology and its related fields and have the basic ability of technical innovation in biotechnology and its related engineering practice.	Course Objective 1, 2,3,4,5,8,9,10,11,12,13
Graduation Requirement 2	Have some experience in biotechnology experiment, understand the frontier and development trend of biotechnology.	Course Objective,1,2,5,6,7,8,9,10,11,12,13

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Chapter 1 Introduction	Make clear how to study effectively and efficiently, clarifying requirements, course plan and styles of examinations	4	testify	1,2,8,9,10,11,12,13
2	Chapter 2 Preparation and standardization of NaOH	1、 Learn how to prepare and standardize NaOH. 2、 Learn to weigh by difference. 3、 Master the titration and determination of the endpoints.	4	testify	1,2, 3,4,8,9,10,11
3	Determination of a rate and activation energy	1、 To determine the reaction rate and activation energy of $(\text{NH}_4)_2\text{S}_2\text{O}_8$ (AP) with KI. 2、 To determine the effects of C,T and catalyst on reaction rate.	4	testify	1,2,5,7,8,9,10,11

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
4	Chapter 4 Determination of ionization degree and ionization constant for acetic acid	1、 To determine ionization degree and ionization constant of acetic acid 2、 To study how to use PH meter.	4	testify	1,2,3,6,8,9,10,11
5	Chapter 5 Determination of the Vitamin C (Ascorbic acid)	1.To grasp the preparation and preservation of $\text{Na}_2\text{S}_2\text{O}_3$ and $\text{I}_2$ solution. 2. To understand the procedure of iodimetry. 3. To properly judge endpoint.	4	testify	1, 2, 3,8,9,10,11
6	Chapter 6 Determination of $\text{Na}_2\text{CO}_3$ - $\text{NaHCO}_3$ - $\text{NaOH}$ unknown	1、 Understand pH changes during the process of titrating mixed bases . 2 、 Know the function of double-indicator.	4	testify	1,2,3,4,8,9,10,11,12,13,14
7	Chapter 7 Standardization of EDTA and determination of water hardness	1.Know the characteristic of complexometric titration and metal indicator 2. Master the principle and methods of preparation and standardization of standard EDTA solution 3.Master the principle and methods of water hardness determination	4	testify	1, 2, 3, 8,9,10,11,12
8	Chapter 8 Spectrophotometric Determination of Iron using 1,10-Phenanthroline	1、 To master the principle and method using 1,10-Phenanthroline as chromogenic agent. 2、 To master how to use a spectrophotometer.	4	testify	1, 2, 3, 6, 8, 9, 10, 11, 12, 13, 14

#### V Period Distribution and Teaching Modes

##### (1) Period Distribution

Experiment	Abstract	Students	Feature	Required	Hours
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		/ group			
Chapter 1 Introduction	Safety, operation	4	Verification	Yes	4
Chapter 2 Preparation and standardization of NaOH	Preparation and titration of sodium hydroxide solutions with primary standard substances.	4	Verification	Yes	4
Determination of a rate and activation energy	Titration of hydrochloride acid solution using sodium carbonate as the primary standard substance	4	Verification	Yes	4
Chapter 4 Determination of ionization degree and ionization constant for acetic acid	Determination of the masses of sodium carbonate and sodium hydrogen carbonate in the original mixture by the double – indicator method	4	Verification	Yes	4
Chapter 5 Determination of the Vitamin C (Ascorbic acid)	Determination of ionization degree and ionization constant of acetic acid using PH meter.	4	Comprehensive	Yes	4
Chapter 6 Determination of Na <sub>2</sub> CO <sub>3</sub> -NaHCO <sub>3</sub> -NaOH unknown	Determination of the reaction rate and activation energy of (NH <sub>4</sub> ) <sub>2</sub> S <sub>2</sub> O <sub>8</sub> (AP) with KI. Determination of the effects of C,T and catalyst on reaction rate	4	Comprehensive	Yes	4
Chapter 7 Standardization of EDTA and determination of water hardness	Complexometric titration Titrate the total concentration of calcium and magnesium ions with EDTA using eriochrome black T as indicator. Determination of the water hardness	4	innovative	Yes	4
Chapter 8 Spectrophotometric Determination of Iron using 1,10-Phenanthroline	Determination of the absorption coefficients according to beer's law.	4	Comprehensive	Yes	4

## (2) Teaching approach

This course mainly uses PPT, video and other multimedia to carry out classroom teaching. The teacher shows lab protocols, assignment guidelines, grading rubrics, and other helpful

documents on blackboard. Then the students will perform the experiments according to the protocols. In the course of the experiment, the teacher will observe the operation of each student, and promptly pointed out and correct the mistakes appeared in the process of operation. The assignments will be assigned weekly in the course focused on getting student to think more deeply about the experiment. Feedback on the assignments should be incorporated in the laboratory report. Details about each individual assignment will be discussed in class.

#### VI Assessment

The teaching of Inorganic & Analysis Chemistry Lab is divided into three phases: previewing, conducting and reporting. Firstly, students should pay attention to previewing to make themselves own a preliminary understanding and a grasp process. Secondly, in class, students must conduct experiments with instructor's assist and discussion. Finally, students must do corresponding report.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Deduct 20 or 5 points per once absence or late, respectively	10%	,1,2, 14
Question	Score 0,1,2,3 according to the exactitude of answers.	10%	1,2,3,4,5,6,7,8,9, 10,11,12,13
Practical Operation	10 times	30%	1,2,3,4,5,6,7, 8,9,10
Experimental Report	Based on writing, procedures, markers, results, and analysis	40%	1,2,3,4,5,6,7,8,9, 10,11,12,13
Summary Paper	Based on understanding the project	10%	1,2,11,12,13

#### VII Textbooks and References

(一) Textbook:

[1] Experimental Manual in Biochemistry. Compiled by Zhao Xueqin. Edition in 2020.

(二) References:

[1] Herman Schlundt. Laboratory Experiments in General Chemistry, Createspace Independent Publishing Platform, 2016.

[2] Theodore E. Brown, H. Eugene LeMay, Bruce E. Bursten, et al. Laboratory Experiments for Chemistry: The Central Science, 14th Edition, Prentice Hall press, 2017.

(三) Web sources:

[1]课堂派: <https://www.ketangpai.com/>

[2]科学网: <http://www.sciencenet.cn/>

[3]赛先生: <http://chuansong.me/account/iscientists>

**Written by: Zhao Xueqin**

**Reviewed by: Yu meilan**

**Date: May 23<sup>th</sup>, 2021**

# Syllabus of Experimental Biochemistry

**Course Name/Title:** Experimental Biochemistry

**Course code:** 86983

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 64 ( Laboratory Hours)

**Course Credit:** 2

## I Course Objective

This is a project-driven course to provide an advanced training in biochemical laboratory. This experimental course primarily focuses on the isolation of biochemical substances and the study of their properties, including the identification of proteins and amino acids, the determination of enzyme properties and activities, as well as the isolation and characterization of biological macromolecules such as RNA, DNA, vitamin C, glucose and casein. The overall goal of the course is for students to understand and master the principles and approaches of biochemistry experiments as well as improve the abilities of analyzing problems, solving problems and performing projects independently. Students are expected to be familiar with the techniques and equipments commonly used in a biochemistry laboratory. Students are also asked to answer open questions based on previously learned biochemical knowledge and skills in biochemistry. At the end of the course, students will develop the skills necessary for success in their future professional careers. This course is designed as three categories, the basic authentication experiments, the comprehensive experiments and the innovative experiments. The task of basic authentication experiments is for students to strengthen further understanding of biochemistry principles and acquire basic research skills in biochemistry. Both comprehensive experiments and innovative experiments aim to cultivate and improve the students' abilities of design and application of biochemical experiment. The arrangement of these experiments offers more flexibility to accommodate various requirements of the course, and allows students to reference detailed theory sections for clarification during laboratory classes. This is a specialized laboratory course in College of Life Science and Medicine, involving in many important scientific disciplines such as biology, chemistry, physics, and so on. Prerequisite courses include General Biology, Biochemistry, Microbiology, and their related experimental courses.

### 1. Knowledge objectives

**Course objective 1:** To master the principles and methods of qualitative and quantitative analysis of proteins and amino acids, especially for using SDS-PAGE to determine the protein molecular weight.

**Course objective 2:** To master the principles and methods of testing enzyme properties.

**Course objective 3:** To master the principles and operations of round paper chromatography as well as understand the process of transamination.

**Course objective 4:** To master the principles and methods of extraction and quantitation of the nucleotides (RNA and DNA).

**Course objective 5:** To master the principles and methods of purifying recombinant HIS-tagged proteins.

**Course objective 6 :** To master the determination of the enzyme activity, especially for protease and lipase.

**Course objective 7:** To master the principles and methods of extraction and quantitation of plant Vitamin C.

**Course objective 8:** To master the principles and methods of quantitation of blood glucose.

**Course objective 9:** To master the principles and methods of preparation of milk casein.

**Course objective 10 :** To master the method of orthogonal experimental design for experimental optimization.

### 2. Ability objectives

**Course objective 11 :** Training the students' hands-on ability and observation ability in biochemical experiments.

**Course objective 12:** Improving the students' abilities to design experiment, analyze and solve problem, and read related literature.

**Course objective 13:** Cultivate the students' writing ability for research report.

### 3. Quality objectives

**Course objective 14:** To apply previously learned biochemical knowledge to master new laboratory techniques.

**Course objective 15:** To think critically and creatively about biochemical topics.

**Course objective 16:** To take responsibility for learning and engaging in a scientific project.

## II Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	Have some experience in biotechnology experiment, understand the frontier and development trend of biotechnology.	Course Objective 1,2,3,4,5,6,7,8,9,10,12,13, 15
Graduation Requirement 7	Have the ability to use the theoretical knowledge and skills to engage in the research and development of products associated with biotechnology and its related fields, and have the basic ability of technical innovation in biotechnology and its related engineering practice.	Course Objective 1,2,3,4,5,6,7,8,9,10,11,14,16
Graduation Requirement 8	Have the ability to summarize, organize and analyze experimental results, synthesize the theoretical knowledge and skills acquired, and engage in scientific research in biological sciences, biotechnology and related fields; they have the basic	Course Objective 1,2,3,4,5,6,7,8,9,10, 13,14

	ability to practice biotechnology downstream engineering and technological innovation; they have a strong scientific interest and the ability to think critically.	
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### III Course Content

Plan	Content	Course Objectives
Content 1: Identification and analysis of protein and amino acid	<ol style="list-style-type: none"> <li>1. Identification of the properties of protein and amino acid using color reactions and precipitation reactions.</li> <li>2. Quantitation of protein using Lowry method, ultraviolet spectrophotometer method, Micro-Kjeldahl method, BCA method, and Bradford method.</li> <li>3. The transamination by aminotransferase using round paper chromatography.</li> <li>4. Determination of the molecular weight of protein by SDS-PAGE.</li> <li>5. Purification of the recombinant HIS-tagged protein using affinity chromatography.</li> </ol>	Course Objective 1,3,5,11,12,13,14,16
Content 2: Identification and analysis of the properties and activities of enzyme	<ol style="list-style-type: none"> <li>6. Identification of the properties of enzyme such as high efficiency and specificity, effect of temperature, pH, agitator and inhibitor on enzymatic activity.</li> <li>7. Identification of the activity of protease and lipase.</li> <li>8. Determination of the optimal reaction conditions of trypsin.</li> </ol>	Course Objective 2,6,10,11,12,13, 14,15,16
Content 3: Preparation and measurement of nucleic acids	<ol style="list-style-type: none"> <li>9. Extraction of total RNAs and DNA from yeast and animal liver, respectively.</li> <li>10. Identification of nucleic acids using UV-Spectrophotometry method and Agarose Gel Electrophoresis.</li> </ol>	Course Objective 4,12,13,15,16
Content 4: Preparation and analysis of Vitamin C, blood glucose and casein	<ol style="list-style-type: none"> <li>11. Extraction and determination of Vitamin C from vegetables and fruits.</li> <li>12. Isolation and determination of glucose from rabbit blood using Alkaline Copper Reduction method.</li> <li>13. Preparation and identification of casein from milk.</li> </ol>	Course Objective 7,8,9,11,13, 17,16

### IV Practical Plan and Requirement

The practical plans and requirements were listed as the following table:

Experiment	Abstract	Students per group	Feature	Required	Hours
Experiment 1: The properties of protein and amino acid	Identification of the properties of protein and amino acid using color reactions and precipitation reaction.	3	Verification	Yes	4
Experiment 2: Properties of enzyme	Identification of enzyme specificity and high efficiency and the effect of temperature, pH, agitator and inhibitor on enzymatic activity.	3	Verification	Yes	4
Experiment 3: Transamination	Determination of the transamination by aminotransferase using round paper chromatography.	3	Verification	Yes	4
Experiment 4: Quantitation of protein: Lowry method and ultraviolet absorption method	Quantitation of protein using Lowry method (Folin-phenol reagent method) and ultraviolet spectrophotometer method.	3	Verification	Yes	4
Experiment 5: Quantitation of protein: Micro-Kjeldahl method, BCA method and Bradford method	Quantitation of protein using Micro-Kjeldahl method, BCA method, and Bradford method.	3	Verification	Yes	4
Experiment 6: SDS-PAGE— assay molecular weight of protein	Determination of the molecular weight of protein by SDS-PAGE.	3	Comprehensive	Yes	4
Experiment 7: Preparation and determination of Vitamin C	Extraction and determination of Vitamin C from vegetables and fruits.	3	Comprehensive	Yes	4
Experiment 8: Exaction of DNA from animal liver	Extraction and determination of DNA from animal liver.	3	Comprehensive	Yes	4
Experiment 9: Exaction of RNA	Extraction and determination of total	3	Comprehensive	Yes	4

from yeast	RNAs from yeast.				
Experiment 10: Identification of nucleic acids	Identification of nucleic acids using UV-Spectrophotometry method and Agarose Gel Electrophoresis.	3	Design	Yes	4
Experiment 11: Purification of the recombinant HIS-tagged proteins	Purification of the recombinant HIS-tagged protein using Ni-NTA agarose beads.	3	innovative	Yes	4
Experiment 12: The activity of enzyme: assay the activity of protease	Identification of the activity of protease.	3	Comprehensive	Yes	4
Experiment 13: The activity of enzyme : assay the activity of lipase	Identification of the activity of lipase using pNPP method and Copper Soap method.	3	Comprehensive	Yes	4
Experiment 14: The optimal reaction conditions of trypsin	Determination of the optimal reaction conditions of trypsin.	3	Comprehensive	Yes	4
Experiment 15: Determination of blood glucose	Determination of glucose from rabbit blood using Alkaline Copper Reduction method	3	Verification	Yes	4
Experiment 16: The preparation and analysis of casein from milk	Preparation and identification of casein from milk according to its pI.	3	Verification	Yes	4

### V Suggestions for Teaching

The PPT and other multimedia are mainly used in the course to carry out classroom teaching. The teacher shows lab protocols, assignment guidelines, grading rubrics, and other helpful documents on blackboard. Then the students will perform their experiments according to the protocols. In the course of the experiment, the teacher will observe the operation of each student, and promptly point out and correct the mistakes appeared in the process of operation. The assignments will be assigned weekly in the course focused on getting student to think more deeply about the experiment. Feedback on the assignments should be incorporated in the laboratory report. Details about each individual assignment will be discussed in class.

## VI Suggestions for Course Learning

Students should prepare relevant theoretical knowledge before experiment. Another suggestion includes but is not limited to weekly written assignments, laboratory reports, and data collection. If the students have any questions happening in the experiments, they should discuss with the teacher immediately. All laboratories will be opened to provide students with research innovation, research establishment place. Permit students to design experiments based on their knowledge.

## VII Assessment

1. Assessment approaches mainly include classroom performance, conventional assignments, attendance, question, practical operation, experimental report, summary paper, etc.

2. Assessment requirements include frequencies of assignments, assessment methods (open-book, close-book), and project design requirements, etc.

3. Assessment Weighting refers to the percentage that assessment methods take up in the total score.

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	Deduct 20 and 5 points per once absence and late, respectively	10%	Course Objectives 16
Question	Score 0,1,2,3 according to the exactitude of answer.	10%	Course Objectives 1,2,3,4,5,6,7,8,9, 10, 14,15
Practical Operation	10 times	30%	Course Objectives 1,2,3,4,5,6,7,8,9, 10, 11,14
Experimental Report	Based on writing, procedures, markers, results, and analysis	40%	Course Objectives 1,2,3,4,5,6,7,8,9, 10, 12,13,15
Summary Paper	Based on understanding the project	10%	Course Objectives 12,13,14,15

## VIII Textbooks and References

### 1. Textbooks

[1] Qing Sheng, Zuoming Nie, Caiying Jiang, Qin Chen, Jianyi Pan, Ting Ye, Experimental Manual in Biochemistry. Edition in 2020.

### 2. References

[1] Yu Hong, Huang Xinxiang, Experimental Manual in Medical Biochemistry, the first Edition, Wuhan University Press, 2008.

[2] Rodney F. Boyer, Modern Experimental Biochemistry, the 3rd Edition, Prentice Hall Press, 2000.

[3] Rodney F. Boyer, Biochemistry Laboratory: Modern Theory and Techniques, the 2nd Edition, Pearson Press, 2011.

[4] Michael R. Green, Joseph Sambrook, Molecular Cloning: A Laboratory Manual, the 4th Edition, Cold Spring Harbor Laboratory Press, 2012.

[5] Cindy Applegate, Mary Beth Neely, Michael Sakuta, Laboratory Manual for General, Organic, and Biological Chemistry, the 1st Edition, McGraw-Hill Education Press, 2016.

[6] William G. O'Neal, Exercises for the General, Organic, and Biochemistry Laboratory, the 1st Edition, Morton Publishing Company, 2015.

### **3. Web Resources**

[1] Shuke: <http://www.wechat-class.com>

[2] MosoTeach: <https://www.mosoteach.cn/>

**Written by:** Zuoming Nie

**Reviewed by:** Caiying Jiang

**Date:** May 24, 2021

# Syllabus of Detection and Analysis of active components in natural products

**Course Name/Title :** Detection and Analysis of active components in natural products

**Course code:** 86991

**Course Type:** Basic Course, Compulsory Course

**Total Teaching Hours:** 20

**Course Credit:** 1

## I Course Introduction

The subjects of the experiment of "Detection of Active Ingredients in Natural Products" are biotechnology majors. It is a compulsory and comprehensive experimental course which closely integrates the theory course of natural product separation technology according to the allocation of class hours and the requirements of teaching. It is an important part of the overall knowledge structure and ability of relevant professional talents. Students are required to have basic knowledge of Botany, Natural Medicinal Chemistry, Inorganic and Analytical Chemistry, and Instrumental Analysis.

Through the experiment, students can learn and master the basic operation skills of extraction, separation and verification of effective components of natural products, and improve students' ability to analyze and solve problems. To cultivate students' practical ability, rigorous scientific attitude and good working style. So that it has engaged in the production of natural products and chemical research of the initial ability.

## II Course Objective

Objective 1: Strengthen the "four consciousness", firm the "four self-confidence" throughout the whole process of professional personnel training.

Objective 2: Master the basic operation skills of extraction, separation and verification of active ingredients of natural products.

Objective 3: Cultivate students' practical ability and comprehensive ability to analyze and solve practical problems.

Objective 4: Familiar with the comprehensive qualitative and quantitative testing methods of active ingredients of natural products, and have a comprehensive understanding of the development of natural drug development and other related industries.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1	A comprehensive understanding of biological science and biological technology, mathematical statistics, biological engineering principles and other basic theories, understanding of biological industry and other aspects of theoretical knowledge, and grasp the ability to use it to analyze problems	Course Objective 1,2

Graduation Requirement 2	Have certain experience of biotechnology experiment and practice, understand the frontier technology and development trend in this field	Course Objective 3、 4
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#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Crude extraction and content determination of tea polyphenols from tea leaves 1. Pretreatment of dried tea leaves 2. Crude extraction and qualitative detection of tea polyphenols 3. The configuration and content determination of tea polyphenol solution 4. Test the experimental results--draw the standard curve of tea polyphenols	1. Understand and be familiar with the elemental composition, structural composition and physicochemical properties of tea polyphenols. 2. Master the principle and operation of crude extraction of tea polyphenols by solvent extraction. 3. Master the principle and operation of iron tartrate colorimetric determination of tea polyphenols. 4. Understand the use of spectrophotometer and precautions.	8	Lectures, LABS, etc	1,2
2	Extraction and determination of flavonoids from tea 1. Draw a standard curve 2. Extraction of flavonoids from tea leaves 3. The absorbance of flavonoids was determined at 510 nm	1. To understand the pharmacological and health care effects of flavonoids on human body. 2. Master the method of extracting flavonoids from tea. 3. Master the method of determining the content of flavonoids.	10	Lectures, LABS, etc	2
3	Determination of pyrethroid residues in tea by spectrophotometry 1. Preparation of related solutions 2. Colour reaction and colorimetric	1. To understand the structural composition and chemical properties of pyrethroids containing cyanogen. 2. To master the experimental principle of spectrophotometry for the determination of pesticide residues containing cyanopyrethroids in tea leaves.	12	Lectures, LABS, etc	1,2,3

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	determination of tea samples 3. Draw standard solution calibration curve 4. Calculate the content of cyhalothrin	3. Get familiar with the use of spectrophotometer.			

#### Teaching Suggestions

This course uses PTT multimedia teaching. Students are required to preview according to the experimental instruction book and design a comprehensive experimental preview report. At the same time, it is suggested that the instructor review and guide the experimental design scheme of each group of students, and explain the key problems and matters needing attention in the experiment. In addition, the content and results of the classroom experiment are required to be recorded in the designed preview report. After the experiment is over, the teacher will be instructed to check the original data, phenomena and explain the experimental results.

#### V Period Distribution and Teaching Modes

##### (1) Experimental preview

Every week, students are required to preview before the experiment, complete the design of the experimental form in advance, and finish the thinking questions after the experiment. Excurricular experiment preview is an important link to guide students to study and check the effect of experimental teaching, and it is also a sign that reflects the curriculum requirements. The selection of thinking questions should focus on the requirements of experimental teaching to select some key contents that can not only consolidate the knowledge learned, but also trigger students to think deeply.

##### (2) Independent learning

Improving students' self-study ability and acquiring knowledge ability is an important link. Students are assigned to teach experimental content before the experiment, so as not to prescribe drugs according to the prescription.

##### (3) Review after class

Timely submission of experimental reports after class helps to consolidate classroom knowledge, master experimental skills, reflect on and solve problems encountered in the experimental process in time, and truly master the extraction, separation and identification skills of active ingredients of natural products.

#### VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Preview before class	Students are required to finish the questions after the experiment in	15%	Course objectives 1, 2,

	advance		
The experimental operation	Operation standard, accurate	50%	Course objectives 1,2,3
Classroom performance	Ask questions actively	10%	Course objectives 2,3
Lab report	It is required to submit the experiment report in time after each experiment	25%	Course objectives 1, 2,3

#### VII Textbooks and References

##### (一) Textbook:

- [1] 中药与天然活性产物分离纯化和制备. 杨义芳等. 科学出版社, 2011年9月. (主编人写前面)
- [2] 天然产物分离技术. 王振宇、卢卫红等. 中国轻工业出版社, 2012年1月.
- [3] 茶园常用农药在成品茶中的残留监测试验. 石春华、朱俊庆、商建农等. 2001年.
- [4] 茶叶有效成分的综合提取分离实验研究. 张名娥、杨乔中、陈兴荣等. 2009年.

##### (二) References:

- [1] 《天然产物活性物质检测》\*实验册 (自编讲义)

**Written by: Yanfang Sun**

**Reviewed by: Xianfeng Ding**

**Date: 2021.4.17**

# Syllabus of Detection and analysis of environmental microorganisms

**Course Name/Title:** Detection and analysis of environmental microorganisms

**Course code:** 86992      **Course Type:** Optional Course

**Total Teaching Hours:** 20 (Laboratory Hours or Tutorial Hours 20)      **Course Credit:** 1

## I Course introduction

Practice for detection and analysis of environmental microorganisms is a basic optional course. This course serves as an introduction and overview of the field of environmental microbiology. Students in their sophomore year or junior year should be adequately prepared for this course. More importantly, this course could lay a solid foundation for their further research and study.

## II Course Objective

**Course Objective 1:** Microbes exist in every corner of society and develop in harmony with each other. Human beings should also learn to tolerate each other, learn to diversify development, and create a better life together.

**Course Objective 2:** To provide an overview of environmental microbiology and to underpin the basic knowledge of microbiology.

**Course Objective 3:** This course introduces environmental processes and the influence of human activities upon them. Topics include ecological concepts, population growth, natural resources, and a focus on current environmental problems from scientific, social, political, and economic perspectives.

**Course Objective 4:** Emphasis is placed on laboratory and field experience. Upon completion, students should be able to demonstrate a practical understanding of environmental interrelationships and of contemporary environmental issues.

**Course Objective 5:** To provide an overview of environmental microbiology and to underpin the basic environmental knowledge of microbiology.

**Course Objective 6:** To allow hands-on experience in standard research techniques and grasp the basic research approaches

## II Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 4	With the comprehensive use of the theoretical knowledge and skills, engaging in biotechnology and related fields of product development, engineering practice and technical innovation	Course Objective 1,2,3, 6
Graduation Requirement 5	Master the method, framework and tools of gene engineering, microbiological engineering, fermentation engineering.	Course Objective 2,3,4,5

	Master the theoretical knowledge and have the basic technological innovation ability of related fields.	
Graduation Requirement 6	Have certain experiment practice experience and understand the forefront of technology and development trend of this field.	Course Objective 1, 2,3,4,6

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Isolation microbes producing gellan lyase from environment	(5) Understand the biochemistry underlying the gellan lyase; (6) Understand the theoretical basis for differential staining procedures; (7) Perform a satisfactory Gram staining;	10	Classroom explanations, independent experiments	Course Objective 1,2,3,4,6
2	Screening of high-efficiency hyaluronate lyase producing bacteria from environment	(4) Observing the bacterial morphology. (5) Familiar to microbiological culture media preparation and sterilization; (6) Understand and master the principle and precautions of dry heat sterilization, high-pressure steam sterilization, ultraviolet sterilization; (7) Sampling, inoculation, cultivation and determination of microorganisms in different environments.	10	Classroom explanations, independent experiments	Course Objective 1,2,3,4,5,6

#### V Period Distribution and Teaching Modes

##### Suggestions for Teaching

The lecture is performed mainly by teachers' teaching, while students' self-study is a good supplement. In teaching process, heuristic method, method of discussion and other effective ones are adopted to strengthen communication between teachers and students, guide students to think independently, to mobilize the enthusiasm of students, and to train students on the ability to obtain information to solve problems.

Teaching means is by using multimedia courseware, making full use of the advantages of acoustic image, and then supplemented by the necessary writing on the blackboard, so as to strengthen the teaching content, point out the key part, explain the difficulties.

##### Suggestions for Course Learning

Extracurricular exercise is assigned for students to practice after each class. Extracurricular exercise is an important link to guide students to check the teaching effect, but also reflect the signs of the course requirements. The homework should focus on teaching exercises that can consolidate the knowledge, but also can lead the students to think deeply, improve the comprehension ability of each class.

It is an important link for students to improve their ability of self-study and knowledge acquirement by using reference materials such as online information, which requires students to preview before class, and to arrange the teaching contents of the students themselves. All this will stimulate the students to find problems and try to solve the problem of active consciousness.

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Quizzes	call-over in the classroom and questions	20%	1,2,4,5,6
Class discussion and presentations	After each class	20%	2,3,6,
Assignment	After each class	20%	2,3,6,
Laboratory assessment	After each class	40%	3,4

## VIII Textbooks and References

There is no set text assigned to this course and you will receive recent articles on relevant topics throughout the course.

### Recommended journals for extra reading

The ISME Journal

Microbial Biotechnology

Aquatic Microbial Ecology

Microbial Ecology

Advances in Microbial Ecology

Current Opinions in Microbiology

Applied and Environmental Microbiology

Trends in Biotechnology

Trends in Microbiology

Environmental Microbiology

Journal of Bacteriology

FEMS Microbiology Ecology

Molecular Microbiology

Marine Ecology Progress Series

PNAS

**Written by: OuLi**

**Reviewed by: Zhouhang Gu**

**Date: 19, May, 2021**

# Syllabus of the Experiments of Gene Engineering

**Course Name/Title:** The Experiments of Gene Engineering      **Course code:** 87902

**Course Type:** Specialized Course, Compulsory Course

**Total Teaching Hours:** 32

**Course Credit:** 1

## I Course Introduction

Gene engineering technology has penetrated into all branches of biology, medicine, agriculture and forestry, and is rapidly changing their appearance. Mastering the experimental technology of genetic engineering has become the common demand of these disciplines to reveal the mystery of life at a new height and level. The experimental skills of genetic engineering can only be effectively mastered through hands-on practice. The purpose of this experiment course is to introduce the basic experimental technology and method principle of genetic engineering to students, introduce the current cutting-edge technology and development trend of genetic engineering, and stimulate students' learning enthusiasm. This experimental course takes the cloning and expression of target gene as the main line, integrating various conventional experimental techniques of recombinant DNA, and requires students to systematically master the basic principles and basic skills of genetic engineering experiments, be able to independently apply various experimental techniques, reasonably design experimental schemes, and dialectically analyze problems, so as to lay the foundation for cultivating biotechnology talents with solid foundation and strong adaptability.

## II Course Objective

Course Objective 1: Ideological and political education aim is that students learn this course through the experimental design, reasonable analysis of the experimental results so as to develop a rigorous experimental attitude and scientific spirit to seek truth.

Course Objective 2: Knowledge education aim is to get students professionally training by learning basic experimental technology and operation skills commonly used in gene engineering, understanding the principle of genetic engineering experimental technology, and understanding the latest progress of gene engineering field.

Course Objective 3: Ability education aim is to train students to independently apply various gene engineering experimental technology, skilled operation of conventional experimental instruments; And design the experiment plan reasonably according to the purpose and analyze the experiment results correctly.

Course Objective 4: Quality education aim is to train students to get preliminary ability to dialectically think and to analyze and solve problems correctly.

## III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 6	Master the experimental skills of	1,2,3

	related courses and the data processing and analysis methods of biological experiments, and understand the cutting-edge technology and development trend in this field.	
Graduation Requirement 7	The ability to systematically master basic experimental methods and skills in biotechnology and related fields, including mastering key technologies related to life science, including gene cloning and expression technology.	1,2,3
Graduation Requirement 8	Have the ability to summarize, organize and analyze the experimental results, comprehensively use the theoretical knowledge and skills, and engage in scientific research in biological science, biotechnology and related fields.	1,2,3,4

#### IV Correlations between Course Content and Course Objectives

This experimental course takes the cloning and expression of GFP gene as a comprehensive experiment, which is divided into three parts

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Part I Acquisition of the gene of interest (1) PCR amplification of GFP gene and preparation of cloned fragments. (2) Preparation of expression vector fragment. (3) DNA fragments were detected by electrophoresis. (4) The ligation of the target fragment and the	(1) Master the routine operation skills of molecular biology experiment, including the use of pipette, the use of gun head and reagent, electrophoresis point and sample filling, etc. (2) Understand PCR instrument and application program settings; Learn to prepare electrophoresis gel. Learn to use gel imager to observe electrophoresis results. Learn to use the kit to purify DNA fragments; Learn how to connect and transform DNA; Understand the principle of molecular cloning operation such as PCR. (3) By setting different controls in PCR	12	experiment	1,2,3,4

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
	transformation of the ligation product.	amplification experiment, students can understand the importance of control in experiment design, and develop rigorous scientific attitude and practical scientific spirit.			
2	Part II Construction and identification of recombinant expression constructs (1) Culture PCR identification of the recombinant clones. (2) Extraction of plasmid DNA. (3) Double enzyme digestion identification of the recombinant plasmid	(1) Master the operation skills of spot picking and inoculation of transformation coating board; (2) Learn how to extract plasmid DNA and analyze electrophoresis results; Learn to identify recombinant plasmid by PCR amplification and double enzyme digestion; Understand the principle of plasmid DNA extraction and the design of experimental scheme. (3) By setting up different controls in double enzyme digestion experiment, students can understand the importance of control for experimental design, so as to develop a rigorous scientific attitude and practical scientific spirit.	8	experiment	1,2,3,4
3	Part III Induction expression and identification of the gene of interest (1) Induction expression (2) SDS-PAGE analysis (3) Western Blotting	(1) Master the operation skills of induced expression, protein electrophoresis and Western blotting. (2) Understand the principles of induced expression, protein electrophoresis and Western blotting; Learn to prepare various reagents related to experiments. (3) By setting different controls in the induced expression experiment, students can understand the importance of control in the experiment design, so as to develop a rigorous scientific attitude and the scientific spirit of seeking truth from facts.	12	experiment	1,2,3,4

#### V Period Distribution and Teaching Modes

Experimental project	Abstract	Instruments	Period	People number	Experimental properties	Setting up
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				r per group		
Acquisition of the gene of interest	PCR amplification of GFP gene Preparation of target gene and its expression vector Ligation and transformation of target gene and expression vector fragment Nucleic acid electrophoresis analysis	PCR machine Water incubator Biochemical incubator Nucleic acid electrophoresis apparatus Electrophoresis power supply High speed centrifuge Gel imager	12	3	complex	Compulsory
Construction and identification of recombinant expression constructs	Plaque culture of clones Culture PCR Extraction of plasmid DNA DNA digestion and identification	Incubator shaker High speed centrifuge Super clean table Nucleic acid electrophoresis apparatus Electrophoresis power supply Gel imager	8	3	complex	Compulsory
Induction expression of the gene of interest and identification of expressed products	Preparation of competent cells and transformation of recombinant plasmid DNA Induction of target gene SDS-PAGE and staining	Incubator shaker High speed centrifuge Super clean table Nucleic acid electrophoresis apparatus Electrophoresis power supply	12	3	complex	Compulsory

	analysis Western blotting analysis	supply Gel imager				
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## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Attendance	To test arrival late, leaving early and absence	10%	1,4
Experimental operation	On site inspection: the correct use of various instruments and equipment related to the experiment; Operate correctly according to the experimental design	30%	2,3
Experimental report	To assess the writing standardization and accuracy of experimental report. The writing should be correct, neat and serious; The steps are detailed and clearly marked; Clear concept and clear thinking; The results are credible and the analysis is reasonable	60%	1, 2, 3, 4

## VII Textbooks and References

### (1) Textbooks

Chen Jian, editor in chief: Lecture Notes on gene engineering experiments, self-compiled, published in 2018.

### (2) References

M.R. Green, J. Sambrook editor in chief: Molecular cloning: A laboratory manual (Fourth Edition), 2012, Cold Spring Harbor Laboratory Press, NewYork, USA

**Written by: Jian Chen**

**Reviewed by: Nie ZuoMing**

**Date: April 28, 2021**

## Syllabus of Graduation Practice

**Course Name/Title:** Graduation practice      **Course code:** 86950

**Course Type:** Specialized Course (Compulsory Course)

**Total Teaching Hours:** 3W;

**Course Credit:** 3

### I Course Introduction

Graduation practice is the students in the completion of the professional theory courses related to the study of the theoretical knowledge in practice using the practical process to further strengthen the students learn the theoretical knowledge and practice of the combination of understanding the needs and development of society, Improve students' theoretical application level and ability to solve practical problems, so that students get valuable practical experience and skills, in order to broaden the channels of employment and to lay a solid foundation for the community. At the same time so that students understand the graduation design or the paper to achieve the results and requirements, in order to do a good job in graduation thesis, and to prepare to ensure that the completion of graduation design or thesis for the community to lay the foundation. Students should understand and familiarize themselves with the various aspects of the thesis stage, consult the relevant literature, familiarize themselves with the experimental equipment used, understand the engineering background of the thesis, etc., specifically for different graduation thesis content practice.

### II Course objective

Course objective 1: Through the skill training of the graduation practice, enable students to master professional knowledge and practical skills, while integrating the education of socialist core values into the curriculum teaching, and combine the research and exploration of related scientific research projects in the field of biotechnology to cultivate students' Basic scientific literacy.

Course objective 2: According to the content and requirements of graduation thesis topic selection, reasonable selection of relevant experimental content as the content of graduation internship, so as to improve the basic experimental skills related to biotechnology and related biological experimental data processing and analysis methods.

Course objective 3: Enable students to familiar with the ability to actively acquire scientific research information and other knowledge using various modern media technologies, and have a preliminary understanding of the cutting-edge technologies and development trends in this field.

Course objective 4: Enable students to comprehensively use the theoretical knowledge and skills mastered to initially understand and master the ability to summarize, organize, and analyze experimental results.

### III Correlations between Course Objectives and Graduation Requirements

Graduation Requirements	Graduation Requirements Index Point	Course Objectives
Graduation Requirement 1		Course Objective 1
Graduation Requirement 4		Course Objective 2

Graduation Requirement 6		Course Objective 2
Graduation Requirement 7		Course Objective 3
Graduation Requirement 8		Course Objective 3、 4

#### IV Correlations between Course Content and Course Objectives

Num.	Course Content	Teaching Requirement	Period	Teaching modes	Course Objectives
1	Graduation practice planning	Fill in the "Student's Off-campus Graduation Internship Commitment Letter" and fill in the graduation internship plan form to understand and master the ability to formulate experimental plans.	5	Group discussion	Course Objective 1、 2、 3
2	Experimental skill training	Carry out a five-week basic experimental skill training, and report to the college instructor on the progress of the graduation internship every week.	60	Experiment	Course Objective 1、 3
3	Graduation practice diary	Carefully record the graduation practice situation every day, record in detail the internship content, experience, and discussions and opinions on some issues on the day. Earnestly do a good job in accumulating and organizing various materials, including listening to lectures and situations. The introduced notes, relevant materials, etc. The diary should be in correct handwriting, fluent in sentences, and simple and clear.	25	Experiment	Course Objective 2、 4
4	Graduation practice report	Seriously summarize and review the whole process of the internship, and write a complete written report. The main content of the internship report should include: (1) Internship overview: including the internship time, location, internship unit, basic information about the project or unit visited and studied; (2) the main content of the internship; (3) internship experience. The report should state my attitude, performance and main experience and gains during the graduation practice, write down my knowledge and ideas, put forward opinions on this graduation practice, and make suggestions for future graduation practices.	10	Group discussion	Course Objective 4

## V Period Distribution and Teaching Modes

### ● Period Distribution

Practice project name	Content	Main equipment Or experimental environment	Period	Number of each group	Practice attributes (basic/comprehensive/design/research innovation)	Open request (Compulsory/optional)
Graduation practice planning	Internship planning	Practice Base	5	1	Comprehensive、 Design	Compulsory
Experimental skill training	Experimental skill training	Practice Base	60	1	Comprehensive	Compulsory
Graduation practice diary	Keep an internship diary	Practice Base	25	1	Comprehensive、 Design	Compulsory
Graduation practice report	Writing an internship report	Practice Base	10	1	Comprehensive	Compulsory

### ● Teaching Modes

According to the basic requirements of the graduation practice syllabus, prepare an internship plan, and then carry out a five-week basic experimental skills training in the internship base or laboratory. The teaching methods used include experimental skills practice training, group seminars (analysis and discussion of experimental results and graduation practice reports) Writing) and so on.

## VI Assessment

(Assessment content and methods must correlate with course objectives.)

Assessment Methods or Approaches	Assessment Requirements	Assessment Weighting	Evaluation of Course Objectives
Graduation practice planning	The selection of internship content meets the professional requirements of biotechnology, the workload is moderate, the thinking is clear, the goal is clear, the technical route is practical, and the requirement is more than 800 words.	10%	Course objective 1、 2、 3
Graduation practice diary	During the internship period, it is required to carefully record the internship situation every day according to the basic requirements	60%	Course objective 2、 4

	of the internship syllabus, and record in detail the content of the internship, experience, and discussions and opinions on some issues.		
Graduation practice report	The graduation practice report is one of the main basis for evaluating students' internship performance and reflects the main content of the students' internship. The internship report should be written in correct handwriting, with smooth art and science, both pictures and texts. The total number of words should not be less than 2000 words. The internship report must be written in the school's unified internship report book.	30%	Course objective 4

**VII Textbooks and References**

According to the specific practice program, consult the relevant references.

**Written by:** Haimin Chen

**Reviewed by:** Weibo Jin

**Date:** Apr 18, 2021