

National Chiayi University

Department of Bioagriculture Science

(For freshmen of the academic year 2010)

(2010.01.11) Department Commission on Curriculum passed

(2010.01.27) College Commission on Curriculum passed

(2010.03.09) University Commission on Curriculum passed

(2010.04.20) Academic Affairs Committee passed

I. Development and features

The department is orientated towards the development of bioagriculture science, the cultivation of students with the knowledge of life science and basic agriculture, and the in-depth understanding on the practical operation and trainings of molecular biology and biotechnology to make students become talents of biotechnology with theories and practice, especially on the interdisciplinary integration of biotechnology, crop science, economic zoology, laboratory animal, and applied microbiology as well as develop creative studies on biotechnology applying to agriculture.

II. Goals

1. With broad basic knowledge of biology
2. With the knowledge of molecular biology, biochemistry, and physiology
3. With the knowledge of economic zoology and crop science
4. With the theories and practice of biotechnology

III. Basic competence indicators

1. Cross-knowledge of biology, economic zoology, and crop science
2. Knowledge of molecular biology, biochemistry, and physiology
3. The fabrication of laboratory animal and management ability
4. The interdisciplinary ability of integrating crops, production, breeding, and biotechnology
5. The interdisciplinary ability of integrating economic zoology, laboratory animal, and biotechnology
6. Tissue culture of animals and plants and gene transfer
7. The ability of biotechnology and genetic modification
8. The application of biotechnology to creative studies on agriculture

Academic requirements

Credits for graduation:

The completion of a minimum 128 credits course work is required, including
Professionally obligatory courses 62 credits, professionally optional courses 36 credits, and
General Education 30 credits

Others:

1. At least 21 credits of professionally optional courses of the department.
2. Off-campus internship is conducted in accordance with the Regulation of Off-campus Internship.
3. Over credits on General Education are not counted in academic requirements. (This is regulated in the Essentials of Course Selection, No.9.)

4. For students who give up Education, the education credits are not counted in academic requirements.
5. Credits of Physical Education in the third and the fourth academic years are not counted in academic requirements.

Department of Bioagriculture Science

Undergraduate Program

First Academic Year				
Compulsory Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Biology (I)	1	2.0	2	
	This is the first part of a two-semester sequence. Designed to provide the student with the basic principles of biology. The lecture will provide a broad introduction to the life of the cell, cellular reproduction and genetics, concepts of evolution, and the evolution of biological diversity. This course is intended to provide a foundation for further study in life sciences.			
Lab.of Biology (I)	1	3.0	1	
	This is the first part of a two-semester sequence. The laboratory portion of the course consists of topics correlating with lecture (Biology I). The laboratory topics include cells, tissues and an examination of the anatomy and physiology of plant and animal systems, simple biotechnology and gene manipulation.			
Chemistry	1	3.0	3	
Lab.of Chemistry	1	3.0	1	

Introduction of Agriculture	1	2.0	2	
	<p>This class will introduce the general concepts of modern agricultural biotechnology to the first year undergraduate students. The subjects include: (1) From DNA to proteins - DNA, gene, genetic code, regulation, (2) Recombinant DNA technology – cutting, joining, cloning, vector, transformation, molecular techniques, (3) Microbial biotechnology - foods, medicines, bioremediation, (4) Plant biotechnology - tissue culture, genetically engineering, (5) Animal biotechnology - gene transfer, transgenic animals, (6) Marine biotechnology - aquaculture, algal products, transgenic fish, conservation , (7) Medical biotechnology - gene therapy, stem cells, vaccines, tissue engineering, drug delivery, (8) Genomics and beyond - genomics, functional genomics, proteomics, metabolomics, system biology, bioinformatics, (9) DNA profiling, forensics, and other applications, (10) Regulation, patents, and society, and (11) Future directions.</p>			
Biostatistics	2	2.0	2	
Biology (II)	2	2.0	2	
	<p>We explore all of life, from molecules to ecosystems, while also trying to share the excitement of research breakthroughs. For beginning students confronting this avalanche of information, it can seem as important to memorize all the scientific terms and facts as it is to master and apply the major ideas.</p>			
Lab of Biology (II)	2	3.0	1	
	<p>Biology is a hands on science, and biology students are usually required to spend some time in the laboratory. The types of activities a student will perform vary depending on the exact field they are in. Plant geneticists, for example, sometimes spend time out in fields gathering plants, while molecular biologists may use complex equipment such as DNA sequencing machines. Even so, there are some basic techniques that all beginning lab students should understand.</p>			
Organic Chemistry	2	3.0	3	

Farm practice	2	3.0	1	
	The course provides a change of experiencing field practice of economic crops. Each student is responsible for growing a specific crop in the field. The field works include planting, watering, weeding and fertilization.			
Total			18	
Selective Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Physic	1	2.0	2	
	The course has 2 main units which are (A) Crop production system, organic farming system and tillage system. (B) Plant and climate, soil, fertilizer, plant nutrients, water and irrigation on agriculture. The contents: Chapter 1. Agricultural productivity Chapter 2. What is farm management Chapter 2. Agricultural Production systems Chapter 3. Organic crop production Chapter 4. Climate and weather Chapter 5. Soil and land Chapter 6. Plant nutrients and fertilizers Chapter 7. Plant and soil water Chapter 8. Tillage system and farm energy			
Introduction of Agricultural scienceand Technology	1	2.0	2	
	The course introduces agriculture which includes crop production principle, crop production, animal science, biotechnology, agricultural product processing, agricultural business and extension, and farmers' organizations. The Chapter of agricultural biotechnology introduces initiation of biotechnology, research, development, prospects of agricultural biotechnology.			
Principles of crop Production	2	2.0	2	

Calculus	2	2.0	2	
Total			8	
Total Credit Points of the First Academic Year			26	

Second Academic Year

Compulsory Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Biochemistry	1	3.0	3	
	<p>This course will teach the cellular, chemical, physical (thermodynamic), and genetic backgrounds to biochemistry and the overarching principle of evolution—the development over generations of the properties of living cells. As you study through the course, you may find it helpful to refer back to this book at intervals to refresh your memory of this background material.</p>			
Plant Physiology	1	2.0	2	
	<p>The purpose for this course is to introduce the basic principles for plant physiology and the effects of environmental factors on plant growth and development. The subjects included in this course contain (1). water and nutrition balance, (2). photosynthesis and respiration, (3). light and plant hormones in plant development and growth.</p>			
Lab. of Plant Physiology	1	3.0	1	
	<p>This course is to introduce basic experimental practice in plant physiology. The lab courses will include measuring of water potential, sugar contents, anthocyanin, lipid and enzyme activities, light effects in seed germination, hormonal effects in plant growth.</p>			
Genetics	1	3.0	3	
	<p>Genetics is the foundation of life science. Course starts from Mendel's research results and extends to cytogenetics, molecular genetics, developmental genetics, and population genetics. Students can learn the life science of genetics approaches initiating from the observation of phenotypes, designing the mating experiment, and analyzing the collected data to deduce the pattern of inheritance.</p>			
Lab. of Genetics	1	3.0	1	

	<p>The laboratory course includes Mendel genetic, molecular genetic, gene cloning and overexpression analysis. The contents:</p> <p>Exp. 1. Cooking <i>Drosophila</i> cultural Medium</p> <p>Exp. 2. Handling and examining <i>Drosophila</i></p> <p>Exp. 3. Cell Reproduction: mitosis of animal cell</p> <p>Exp. 4. Cell Reproduction: Meiosis in Angiosperms of lily</p> <p>Exp. 5. <i>Drosophila</i> Experiments in Genetics: Monohybrid Crosses</p> <p>Exp. 6. <i>Drosophila</i> Experiments in Genetics: Dihybrid Crosses.</p> <p>Exp. 7. Crossing Over using <i>Drosophila</i></p> <p>Exp. 8. Principle of probability and Chi-square test</p> <p>Exp. 9. Linkage and Crossing over</p> <p>Exp. 10. Examination of lily ovary and anther (pollen)</p> <p>Exp. 11. Polytene Chromosomes from <i>Drosophila</i> Salivary Glands</p> <p>Exp. 12. Human Chromosomes (female and male)</p> <p>Exp. 13. Sex check: A Study of Sex Chromatic in Human Cells</p> <p>Exp. 14. Locating an Unkown <i>Drosophila</i> Mutant in a Particular Chromosome (Cy^{+/+}Pm:D^{+/+}Sb)</p> <p>Exp. 15. Population Genetics: The Hardy-Weinberg Principle;</p> <p>Exp. 16. The Effects of Selection and Genetic Drift.</p>			
Molecular Biology	2	3.0	3	
	<p>This course is to introduce the basic concepts for molecular biology. The subjects included in this course are nucleic acid, DNA replication, gene transcription, translation, gene regulation of prokaryotic and eukaryotic cells, transposable elements and RNAi gene silencing.</p>			
Crops	2	3.0	3	

	<p>The course introduces food crops, fiber crops, vegetables, and fruit plants, also crop biodiversity, domestication, germplasm and classification included. The contents:</p> <p>Part. I. Crop biodiversity</p> <p>Chapter 1. Climatic and related classification</p> <p>Chapter 2. Origin of cultivated plants and domestication of plants</p> <p>Chapter 3. Crop germplasm</p> <p>Part II. Crop production</p> <p>Chapter 4. Field crop cultivation</p> <p>Chapter 5. Growth for food, fiber, fuel, and other industrial uses.</p> <p>Chapter 6. Vegetable cultivation</p> <p>Chapter 7. Growth for vegetable.</p> <p>Chapter 8. Flower plants</p> <p>Chapter 9. Fruit trees marketing.</p>			
Field Lab. of Crop Science	2	3.0	1	
	<p>The practical course includes 3 units of (A) plant growth and development, (B) plant structures and organs, and (C) agronomic calculation. The contents:</p> <p>PART I. PLANT GROWTH AND DEVELOPMENT</p> <p>1. Growth of Tomato, Sweet pepper and Cucumber in Green house</p> <p>2. Growth Stages of Tomato and Cucumber</p> <p>3. Effects of Light, Temperature, and Plant Nutrition on Crop Growth</p> <p>PART II. PLANT STRUCTURES AND ORGANS</p> <p>4. Seeds and Germination</p> <p>5. Vegetative Characteristics of Tomato and Cucumber</p> <p>6. Flowers and Fruits</p> <p>PART IV. AGRONOMIC CALCULATIONS</p> <p>7. Nutrient ion formula</p> <p>8. Pesticide Application</p>			
Animal Physiology	2	2.0	2	
<p>Introduction to the physical and chemical principles governing the lives of animals with an emphasis on understanding the physiological problems animals face, how those problems vary in relation to animals' environments, and the processes by which animals solve their problems. The laboratory focuses on independent investigation.</p>				
Lab. Animal Physiology	2	3.0	1	

	The laboratory experiences provided students to become familiar with many fundamental concepts of animal physiology. Clinically-oriented lab exercises heighten student interest and demonstrate the health applications of physiology.			
Microbiology	2	2.0	2	
	This course will teach the relationship between microbes (very small organisms that usually require a microscope to be seen) and our lives. This relationship involves not only the familiar harmful effects of certain microorganisms, such as disease and food			
Lab. of Microbiology	2	3.0	1	
	This course provides students an opportunity to operate the microbiological biotechnology including microbe's culture, as well as gene transformation, control of microbe's growth, microbe's catabolism, microbes genetic character. Virology biotechnology also involved in this practice course.			
Total			24	
Selective Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Animal Nutrition	1	2.0	2	
Plant Nutrition	1	2.0	2	
	Enzymes can catalyze many critical chemical reactions in the cell. Therefore, enzyme is the key player of living cells. Most enzymes are made of proteins. This course includes the introduction of proteins' structures, enzyme kinetics, functions of enzymes, and classification of enzymes. To pass this course, students are advised to understand the catalytic mechanisms of each enzyme class.			
Enzymology	1	2.0	2	
	This course is to introduce the mineral nutrition in plant. The subjects included in this course are introduction of mineral elements, uptake of mineral nutrition, metabolism of mineral nutrition in plant, environmental factors affecting mineral nutrition absorption, environmental stress.			
Ecology	2	2.0	2	

	<p>The goal of this course is to build a foundation of ecological knowledge around key concepts. These key concepts are listed after the chapter introduction to alert the student to the major topics to follow, and to provide a place where the student can find a list of the important point of each chapter. The sections in which concepts are discussed reinforce concepts with a focus on published studies. This case-study approach supports the concepts with evidence, and introduces students to the methods and people that have created the discipline of ecology.</p>		
Plant Growth Regulators	2	2.0	2
	<p>This course provides a board introduction to plant hormones and plant growth regulators. The objective of this course is to provide both a conceptual and factual foundation for botanical investigation, interpretation, and understanding. The student will be introduced to the basic principle of plant hormones and their role in controlling the way in which plants grow and develop and how they are synthesized and metabolized.</p>		
Total		12	
Total Credit Points of the Second Academic Year		36	

Third Academic Year

Compulsory Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Biotechnology	1	2.0	2	
	Biotechnology is a field of applied biology that involves the use of living things in engineering, technology, medicine, and other useful applications. The concept encompasses a wide range of procedures for modifying living organisms according to human purposes - going back to domestication of animals, cultivation of plants, and "improvements" to these through breeding programs that employ artificial selection and hybridization.			
Lab. of Biotechnology	1	2.0	6	
	The laboratory experiences provided students to become familiar with many biotechnique. The concept encompasses a wide range of procedures for modifying living organisms according to human purposes - going back to domestication of animals, cultivation of plants, and "improvements" to these through breeding programs that employ artificial selection and hybridization.			
Animal reproduction and Breeding	1	2.0	2	
	Reproduction is a fundamental feature of all known life; each individual organism exists as the result of reproduction. This text is intended to give the undergraduate student majoring in animal or dairy science a complete overview of the reproductive processes. Designed to help students develop both the terminology to discuss and an understanding of the physiological processes controlling reproduction, and emphasize the application of the basic concepts to the management of reproduction in livestock.			
Cell Biology	1	2.0	2	
	It provides an accessible introduction to the fundamental concepts of cell biology - their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division and death. This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multicellular organisms like, for instance humans.			
Gene Manipulation and Tissue Culture of Plant	1	1.0	1	

	<p>This course includes two parts of gene manipulation and plant tissue culture. In the first part, it focuses on how a gene can be transferred into target organisms using different strategies such as Agrobacterium-mediated transformation, gene gun, or other methods. Moreover, the mechanisms for different transformation methods are included. For plant tissue culture, it contains many topics of plant tissue culture history, laboratory regulations, introduction of medium components and their biological activity, cell growth and differentiation, and environmental conditions for in vitro culture. Combination of gene manipulation and tissue culture, it can provide knowledge for students how to obtain regenerated plants or transgenic plants via different available tools and methods.</p>			
Lab. of Gene Manipulation and Tissue Culture of Plant	1	3.0	1	
	<p>The laboratory content just tries to train students how to practically use tissue culture methods to regenerate plants from sterile explants or use transformation strategies to generate transgenic plants. The training programs are indicated as followed:</p> <ol style="list-style-type: none"> 1. Introduction of Lab. 2. Medium preparation 3. Seed germination 4. Tobacco leaf culture 5. Rice embryo culture 6. Carrot embryo induction 7. Tobacco pollen culture 8. Cell suspension culture 9. protoplast culture 10. plant transformation 11. Team project 12. Overview and discussion 			
Gene Manipulation and Cell Culture of Animal	2	1.0	1	
	<p>This course will first introduce students to the growth of animal cells in culture, and understand the fundamental characteristics of animal cells. The advanced lectures of this course will assist student to understand the application of cell culture, including modern transgenic techniques, and aim to train students comfortable to use the cell culture techniques in life sciences research and application.</p>			
Lab. of Gene Manipulation and Cell Culture of Animal	2	3.0	1	
	<p>The goal of this experimental course is to establish students a solid training in animal cell culture and related techniques. Techniques will include at least aseptic techniques, medium preparation, growth of different types of cells, cell freezing for storing, measurement of the growth and death rate of cells, DNA transfection, and DNA microinjection to animal embryos.</p>			
Plant Breeding	2	3.0	3	

	<p>Plant Breeding is a very important course for students registered into agricultural training programs including Horticulture, Agronomy, and related plant science research. It introduces basic genetic concept, distribution of important biological resources, flower structure, genetic background of different crop plants, breeding methods (such as polyploidy breeding, disease breeding, mutation breeding, and others), patent application and maintenance of new cultivars, and breeding of different crops. Otherwise, new topics are added to extend from traditional breeding to modern breeding using new biotechnological tools. In the last few decades, molecular polymorphism detection has become an important process for increasing the efficiency of plant breeding. Therefore, the course includes the topic of marker-assisted selection for students how to use new era of modern techniques in breeding programs.</p>			
Lab. of Plant Breeding	2	3.0	1	
	<p>Laboratory works of Plant Breeding focuses on the training of students to do basic experiments for breeding programs. The content of lab works covers the anatomy of different flower species to molecular polymorphism. The detail is listed as followed: 1.investigation of flower structure 2.pollination 3.pollen activity 4.chromosome observation 5.genomic DNA isolation 6.molecular identification 7.chi square test 8.trait investigation 9.embryo rescue 10.molecular identification of a hybrid population</p>			
Laboratory Animals	2	2.0	2	
	<p>Laboratory animal science has developed as a research discipline much to meet the concerns over this dilemma. An important guiding principle is that of the 3Rs: Replacement, Reduction and Refinement. Following this principle, researchers should use non-animal methods whenever possible, should use as few animals as possible and should use methods which cause as little animal distress as possible.</p>			
Total			18	
Selective Required				
Courses	Session	Teaching Hours	Credit Points	Ref.
Biocatalysis	<p>Biocatalysis will teach in molecular terms of the structures, mechanisms, and chemical processes shared by all organisms and provides organizing principles that underlie life in all its diverse forms, principles we refer to collectively as <i>the molecular logic of life</i>. Although biochemistry provides important insights and practical applications in medicine, agriculture, nutrition, and industry, its ultimate concern is with the wonder of life itself.</p>			
	1	2.0	2	
Crop Physiology	1	2.0	2	

	<p>The basic physiological and biochemical processes of crop growth will be taught in this class. The subjects include: (1) Plant organ and cell structure, (2) Photochemistry and C₃, C₄, CAM modes of photosynthesis, (3) Transport and partitioning – sucrose, starch, source, sink, partitioning, harvest index, remobilization, (4) Plants and water relation: uptake, movement, water stress and osmotic adjustment, water use efficiency, (5) Mineral nutrition, absorption and transport - function, sources, availability, uptake, interactions, (6) Biological nitrogen fixation - ammonia, biological N₂ fixation, <i>Rhizobium</i>, nodulation, (7) Plant growth regulators – functions, application, (8) Growth and development – apical, lateral, vegetative, reproductive, harvest index, (9) Seeds and germination - germinability, dormancy, (10) Root growth, (11) Vegetative growth: leaf initiation, emergency, senescence, (12) Flowering and fruiting - photoperiodism, vernalization, pollination, fruit setting, (13) Responses to stress – excess light, chilling, heat, drought, salinity, flooding, heavy metals.</p>		
Animal Pathology	1	2.0	2
Immunology	2	2.0	2
	<p>This course will initially introduce the various immune systems of living organisms.</p> <p>The development and functions of the immune cells and effectors in the defense system will be addressed in this course.</p> <p>Applications of immunology to treat cancers, viral, and bacterial infections are also included.</p>		
Total			15
Total Credit Points of the Third Academic Year			33

Fourth Academic Year

Compulsory Required

Courses	Session	Teaching Hours	Credit Points	Ref.
Seminar (I)	1	3.0	1	
	This course is train student for the ability of presenting scientific topics proficiently. The course combines oral presentation and discussion.			
Seminar (II)		3.0	1	
	This course is train student for the ability of presenting scientific topics proficiently. The course combines oral presentation and discussion.			
Total			2	

Selective Required

Courses	Session	Teaching Hours	Credit Points	Ref.
Molecular Diagnosis		2.0	2	
Bioinformatics		2.0	2	
	The course teaching student 1. DNA sequencing and blast, alignment. 2. Application of LC/MS/MS in protein sequencing and mass spectrometry, search in mascot database ° 3. Microarray data processing, and using software in gene annotation, clustering and metabolomics ° 4. Prediction of protein structure and function in dry lab.			
Scientific Paper Writing and Reading		2.0	2	

	<p>This course aims to demystify the writing process and teach the fundamentals of effective scientific writing. Instruction will focus primarily on the process of writing and publishing scientific manuscripts.</p> <p>Lectures will mainly introduce:</p> <ul style="list-style-type: none"> • The formats of semester report, thesis writing and manuscripts for journal publication. • The application of electronic documents. • The writing ethics • The detail procedure for graduate thesis writing 			
Quality Control of Laboratory Animal		2.0	2	
	<p>The course of how to improve the quality of management, genetics and health of laboratory. Including animal procurement: newly acquired animals can introduce disease into established colonies. In addition, production colonies maintained by suppliers occasionally experience outbreaks of disease. The system of monitors animal health quality from different suppliers and maintains quality control data provided by vendors. This information can be provided to investigators to assist in choosing appropriate sources of animals.</p>			
Genomics	2	2.0	2	
	<p>The course will provide a broad introduction to genomics. Designed to provide the student with the basic principles of genomics, including scientific method, various sources of information, gene expression and regulation and genetics.</p>			
Total			18	
Total Credit Points of the Fourth Academic Year			20	