

Program: Doctor of Philosophy Program in Cellular and Molecular Science for Biomedical Applications (International Program)

Degree: Doctor of Philosophy (Cellular and Molecular Science for Biomedical Applications)

Study Plan:

1) Research Program (Scheme A 1.1)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	117891 Thesis	3	117891 Thesis	3	117891 Thesis	3
	117885 Colloquium 3		117886 Colloquium 4			
	Total	3	Total	3	Total	3
Year 2	117891 Thesis	6	117891 Thesis	6	117891 Thesis	6
	Total	6	Total	6	Total	6
	117891 Thesis	10	117891 Thesis	11	117891 Thesis	12
Total	10		Total	11	Total	12

2) Regular Program (Scheme A 2.1)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	Elective Course	5	Elective Course	4	Elective Course	4
			117991 Thesis	3	117883 Seminar 5	1
					117991 Thesis	3
Total	5		Total	7	Total	8
Year 2	117884 Seminar 6	1	117991 Thesis	3	117991 Thesis	8
	117991 Thesis	3				
	Total	4			Total	8
Year 3	117991 Thesis	8	117991 Thesis	8	117991 Thesis	9
	Total	8			Total	9

3) Regular Program (Scheme A 2.2)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	117601 Cellular and Molecular Science	4	Elective Course	8	Elective Course	6
	117602 Research Methodology and Biostatistics	4			117881 Seminar 3	1
					117992 Thesis	3
	Total	8			Total	10

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 2	Elective Course	4	Elective Course	3	117992 Thesis	6
	117882 Seminar 4	1	117883 Seminar 5	1	117884 Seminar 6	1
	117992 Thesis	3	117992 Thesis	3		
	Total	8	Total	7	Total	7
Year 3	117992 Thesis	5	117992 Thesis	5	117992 Thesis	5
	Total	5	Total	5	Total	5
Year 4	117992 Thesis	5	117992 Thesis	5	117992 Thesis	5
	Total	5	Total	5	Total	5
Year 5	117992 Thesis	5	117992 Thesis	5	117992 Thesis	5
	Total	5	Total	5	Total	5

Program: Doctor of Philosophy Program in Cellular and Molecular Science for Biomedical Applications (International Program)

Degree: Doctor of Philosophy (Cellular and Molecular Science for Biomedical Applications)

Course Description:

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
Core Course				
117601 Cellular and Molecular Science	4(4-0-12)	None	Studies of structures and functions of cells at molecular levels, including recent research advances in cell organelles, cell processes and applications of cell biology. Develop skills in applying scientific methods in research, and literature survey for scientific writing and presentation in topic related to Cellular and Molecular Science for Biomedical Applications	<ol style="list-style-type: none">1. explain the key concepts2. classify, organize, analyze and apply numeral and statistical data3. use scientific instruments appropriately and safety for experiments and analyze data correctly4. be responsible, disciplined, honest, respected other people and able to work with others5. utilize information technology for literature review6. analyze data systematically and rationally based on scientific process7. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately8. design a plan and conduct an experiment to support the hypothesis9. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117602 Research Methodology and Biostatistics	4(3-3-6)	None	<p>Definition, scope, methods and procedure research. Research planning. Literary review. Research design. Survey. Data collection, Data analysis and interpretation. Conclusion and writing a research report. Ethics in research. Referencing. Printing and publishing a research.</p> <p>This course focuses on selection of statistics use in research. Basic knowledge of biostatistics, measurement variable, central tendency and distribution, probability and distribution, sampling distribution, estimation, testing of hypothesis, parametric and nonparametric statistics, sample size calculation. Application of biostatistics in research. Use computer programs as tools in analyzing scientific data</p>	<ol style="list-style-type: none"> analyze data systematically and rationally based on scientific process design a plan and conduct an experiment to support the hypothesis apply knowledge from Cellular and Molecular Science for Biomedical Applications to solve problem and develop a research topic

Elective Course (Omics, Systems Biology and Gene Editing)

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
109703 Protein structure and Engineering	4(4-0-8)	109700 Graduate Biochemistry or Consent of the School	Basic review of the structures and properties of amino acid peptide bonds, peptides, polypeptides & proteins, concepts for protein engineering, protein detection, purification and evaluation, electrophoresis, size determination, quaternary structure evaluation, protein primary structure determination, electronic structures and properties of amino acid residues and their reactivities, chemical synthesis of peptides & proteins; biological nucleic acid and protein synthesis & posttranslational modifications, methods in genetic engineering of proteins, molecular evolution and the use of protein sequence alignment & analysis, physical basis of size and shape determination (e.g. diffusion, analytical centrifugation, light scattering, small angle X-ray scattering), spectroscopic evaluation of secondary structure and tertiary structure, protein structure determination by X-ray crystallography, NMR, & EM tomography, structural modeling and prediction, protein folding, protein interactions with ligands, proteins in membranes, student proposal on protein engineering	<ol style="list-style-type: none"> 1. explain the key concepts 2. utilize information technology for literature review 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. understand ethic in using animal and human in research and be able to conduct research under the legal framework
109707 Bioinformatics and Computer Usage	2(1-3-2)	None	Basic computing, operating systems, languages, basic UNIX commands, internet, searching principles, basics of molecular evolution, tools for nucleotide and protein sequence analysis, protein sequence alignment, database searching, multiple sequence alignment, tree generation and meaning, sequence and structure databases, display of macromolecular structural models	<ol style="list-style-type: none"> 1. explain principles of bioinformatics. 2. utilize information technology for literature review 3. analyze data systematically and rationally based on scientific process 4. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 5. understand ethic in using animal and human in research and be able to conduct research under the legal framework

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
109721 Advanced Bioinformatics and Biochemical Computing	3(3-0-6)	109705 Bioinformatics and Computer Usage or Consent of the School	Computer programs and programming concepts, molecular evolution and biological sequences sequence alignment strategies and implementation, structural analysis of proteins and molecular modeling, analysis of other types of biological/biochemical data, big data, and data management	<ol style="list-style-type: none"> 1. explain the key concepts 2. classify, organize, analyze and apply numeral and statistical data 3. use scientific instruments appropriately and safety for experiments and analyze data correctly 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
109724 Genomics, Functional Genomics	3(3-0-6)	109700 Graduate Biochemistry/109705 Bioinformatics and Computer Usage/Consent of the School	Definition of genomics, genome and genome components, DNA sequence in human genome, genetic variation in human genome (mutation and SNPs), genomics study with high throughput technology in DNA levels (Exom re-sequencing), transcription profiling (cDNA microarray, SAGE, EST, and real time RT-PCR), functional study for interested gene with mutagenesis and RNA interference; RNAi, and its applications disease and medical application	<ol style="list-style-type: none"> 1. use scientific instruments appropriately and safety for experiments and analyze data correctly 2. utilize information technology for literature review 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately
117711 Research Techniques in Omics Technology	4(1-9-9)	117601 Cellular and Molecular Science and 117602 Statistics for Research or Consent of the School	This course will introduce the techniques used for research related to omics technology including genomics, transcriptomics, metabolomics, and proteomic. We will aim to experiments at universal detection of genes (genomics), mRNA (transcriptomics), proteins (proteomics), and metabolites (metabolomics) in biological samples in a non-targeted and non-biases manner. This strategy will be used for many applications including greater understanding of normal physiological processes and also in disease processes. Extensive discussion of how to choose a proper omics technology to investigate the biological process will be made	<ol style="list-style-type: none"> 1. explain the key concepts 2. use scientific instruments appropriately and safety for experiments and analyze data correctly 3. analyze data systematically and rationally based on scientific process 4. design a plan and conduct an experiment to support the hypothesis 5. criticize, discuss and apply knowledge from molecular and cellular science and Medicine

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117611 Principles and Applications of Omics Technologies	4(4-0-8)	None	This course will introduce the basic principles of omics (genomics, transcriptomics, proteomic, and metabolomics). Each omics disciplines will have covered basic knowledge of each omics that contributes both molecular and biochemical components such as whole genome, transcriptome, SNPs, proteins, metabolites, and others. The application of each omics will also be included both in general and medicine. Students will gain enough materials for using in advance omics analyses	<ol style="list-style-type: none"> 1. explain the key concepts 2. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 3. Understand ethic in using animal and human in research and be able to conduct research under the legal framework
117612 Fundamental of Genome Editing	2(2-0-4)	None	Introducing of the revolutionary tools of genetic manipulations by both conventional methods and the recently develop TALE nucleases and the CRISPR/Cas system, which are making the manipulation of an ever-growing list of model and non-model organisms possible	<ol style="list-style-type: none"> 1. Understand the principle of gene editing technology 2. Design a plan and conduct an experiment to support the hypothesis 3. Apply gene-editing technologies to manipulate the genome of cells 4. Understand ethic in using animal and human in research and be able to conduct research under the legal framework
324521 Molecular Biology	4(4-0-9)	Consent of the school	The gene structures, function at molecular level and their applications. Chemical facts and principles, steps in protein synthesis, regulation of gene function, function of eukaryotic chromosomes. Development of recombinant DNA technology, new tools for studying genes, analysis of important biology process by recombinant DNA approaches, cloning technique and applications	<ol style="list-style-type: none"> 1. Understand gene structure and functions, and its applications 2. Describe the protein processing process 3. Describe the eukaryotic chromosome functions 4. Apply the DNA recombinant for protein productions
324522 Molecular Biology Techniques	2(0-6-6)	324521 Molecular Biology or Consent of the School	Basic technology in molecular biology, genomic DNA and plasmid extraction, biology of plasmid, DNA electrophoresis, construction of recombinant DNA, PCR, restriction enzyme digestion, transformation, identification of recombinant plasmid, gene expression, SDS-PAGE	<ol style="list-style-type: none"> 1. Understand the concepts of molecular biology techniques 2. Able to choose scientific instruments and techniques of molecular biology to prove the hypothesis 3. Criticize, discuss and apply knowledge from molecular biology

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
Elective Course (Stem Cell and Tissue Engineering)				
117821 Tissue Engineering Technology	4(3-3-12)	None	Knowledge of current tissue engineering technology and their applications in medical research and development, scaffold development, cell development, tissue regeneration	<ol style="list-style-type: none"> 1. explain the key concepts 2. analyze data systematically and rationally based on scientific process 3. design a plan and conduct an experiment to support the hypothesis 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
324533 Stem Cell Technology	4(4-0-12)	324531 Animal Biotechnology or Consent of the School	Essential knowledge of current stem cell technology and applications of stem cells research in animals and human. Types of stem cells; isolation and culture of stem cells; characterization of stem cells; induction of stem cells to be several cell types. Students will be able to compare advantages and disadvantages of embryonic and somatic stem cells, and be able to analyze the potential utilization of stem cell in medical treatment	<ol style="list-style-type: none"> 1. explain the key concepts 2. analyze data systematically and rationally based on scientific process 3. design a plan and conduct an experiment to support the hypothesis 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
324534 Animal Regenerative Biotechnology Research	4(0-12-12)	324533 Stem Cell Technology or Consent of the School	Student have chance to do research in both embryonic and somatic stem cells using mouse and rat as model. The students assigned to do research along with practice the basic hands on laboratory techniques including isolation and culture of stem cells; characterization of stem cells; induction of stem cells to be several cell types	<ol style="list-style-type: none"> 1. use scientific instruments appropriately and safety for experiments and analyze data correctly 2. analyze data systematically and rationally based on scientific process 3. design a plan and conduct an experiment to support the hypothesis

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
324633 Applied Animal Stem Cells	4(3-3-12)	324533 Stem Cell Technology or Consent of the School	Focusing on state of the art of stem cells knowledge which already tested in laboratory animals as a model for regenerative medicine. The following topics will be given to the students. Establishment and characterization of embryonic stem cells in mouse and rhesus monkey, establishment and characterization of mesenchymal stem cells from bone marrow and adipose tissue in rat, induction of mouse embryonic stem cells to be several cell types, induction of rat mesenchymal stem cells to be several cell types, Students will directly study in the laboratory on induction of rat mesenchymal stem cells to be dermis and muscle and also transplant the dermis and muscle to rat as a model of wound	<ol style="list-style-type: none"> 1. explain the key concepts 2. use scientific instruments appropriately and safety for experiments and analyze data correctly 3. analyze data systematically and rationally based on scientific process 4. design a plan and conduct an experiment to support the hypothesis
Elective Course (Assisted Reproductive Technology)				
117831 Human Research and Reproductive Technology	3(3-0-6)	None	Essential knowledge, principles and law of human research related to reproductive technology, including ethics in human research, good clinical practice, researcher responsibility, research integrity, rules and laws relating to human research, both in and outside of the country	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Analyze data systematically and rationally based on scientific process. 3. Understand ethic in using animal and human in research and be able to conduct research under the legal framework
117832 Infertility and Assisted Reproductive Technology	4(3-2-7)	None	Essential knowledge of infertility, including male and female reproductive systems, sex hormone system, causes of infertility in males and females, risk factors, related diseases that cause infertility, laboratory investigation, diagnosis and treatment of infertility that include treatment principles, ovarian stimulation, ovulation induction, intrauterine insemination, in vitro fertilization, ovarian pick up with ultrasound, embryo transfer, semen analysis, sperm freezing, embryo freezing, preimplantation genetic diagnosis and other assisted reproductive technology	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Analyze data systematically and rationally based on scientific process.

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117833 Preimplantation genetic diagnosis	3(3-0-6)	None	Essential knowledge of indications, principles, methods, advantages, disadvantages and risk of preimplantation genetic diagnosis include preimplantation genetic testing for monogenic (PGT-M), preimplantation genetic testing for structural rearrangements (PGT-SR), preimplantation genetic testing for aneuploidy (PGT-A) and other newly developing preimplantation genetic testing technologies	1. Students will be able to describe indications of preimplantation genetic diagnosis 2. Students will be able to describe principles and methods of preimplantation genetic diagnosis 3. Students will be able to plan preimplantation genetic testing in infertility couples
324531 Animal Biotechnology	4(4-0-12)	Consent of the school	Essential knowledge in animal biotechnology including estrus and ovulation synchronization; superovulation; embryo transfer; embryo freezing; sperm freezing; embryo sexing; sperm sexing; cloning; ovum-pickup using ultrasound; in vitro embryo production	1. explain the key concepts 2. analyze data systematically and rationally based on scientific process 3. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
324532 Animal Cloning Technology	4(4-0-12)	324531 Animal Biotechnology or Consent of the School	Animal cloning using embryonic and somatic cells; donor cell preparation; donor cell freezing; preparation of recipient cytoplasm; injection of donor cell; cell fusion; activation of oocyte after fusion; in vitro embryo culture; embryo transfer; recipient management before give birth; detecting gene expression in cloned embryo; mitochondrial DNA in cloned embryo; telomere in embryo and cloned offspring	Explain the key concepts.
324631 In vitro Embryo Production and Embryo Transfer in Farm Animals	4(3-3-12)	324531 Animal Biotechnology or Consent of the School	Techniques to produce farm animal embryos in vitro. This subject also focuses on essential knowledge to establish stable methods for in vitro maturation, in vitro fertilization, in vitro embryo culture; embryo transfer; embryo freezing ovum pick-up using ultrasound. Student's l directly study in the laboratory on in vitro embryo production using cattle as models	Explain the key concepts.

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
324634 Selected Research in Animal Cloning Technology	1(0-3-6)	324531 Animal Biotechnology or Consent of the School	This subject students will do animal cloning in laboratory using somatic cell as donor cell including donor cell preparation; donor cell freezing; preparation of recipient cytoplasm; injection of donor cell; cell fusion; activation of oocyte after fusion; in vitro embryo culture	Explain the key concepts.
Elective Course (Targeted Cancer Therapy)				
117641 Cancer Cell Biology and Genetics	4(4-0-8)	None	Definition of cancer cells, multistep carcinogenesis, cancer cell metabolism, cell cycle and regulation, cell death, cancer invasion and metastasis, cancer signaling pathways, oncogenes, tumor suppressor genes, genomic stability and DNA repair, cancer epigenetics, cancer genome	1. Explain the key concepts 2. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117642 Targeted Cancer Treatments	4(4-0-8)	None	Biological concepts behind targeted cancer treatments. Cell communication and cancer. Treatments for solid tumors that block cell communication pathways (monoclonal antibodies and kinase inhibitors). Communicating to patients about targeted cancer treatments. Side effects of treatments and how they impact patients' quality of life. The unique properties of blood cancers and the targeted therapies used to treat them. The relationship between cancer and the immune system. Various immunotherapy strategies including checkpoint inhibitors, adoptive cell transfer and cancer treatment vaccines. How immunotherapy is reported in the news and managing patient expectations of treatment. The challenges of drug resistance and the implementation of biomarker tests. The future of targeted cancer treatments	1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Utilize information technology for literature review. 4. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117643 Molecular Mechanisms of Drug Action	4(4-0-8)	None	Study of chemical and biological concepts underling molecular pharmacology essential to understanding drug actions and reactions; including the entry, distribution, and elimination of drugs, pathway of drug metabolism, pharmacologic selectivity, pharmacogenetics, drug allergy, drug resistance, drug tolerance and dependence and chemical teratogenesis, emphasis of its important place within the biomedical sciences	<ul style="list-style-type: none"> 1. explain the key concepts 2. be responsible, disciplined, honest, respected other people and able to work with others 3. utilize information technology for literature review 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117741 Nanotechnology in Targeted Cancer Therapy	3(3-0-6)	None	This course will focus on approaches for targeted drug delivery and advanced nanotherapeutics. Highlighting several areas of opportunity where current and emerging nanotechnologies could enable novel classes of therapeutics. The course provides with an easy and effective way, the challenges and general trends in pharmaceutical nanotechnology, and explores new strategies to overcome limitations in drug delivery. Different types and shapes of nanoparticles used in targeted cancer therapy will be explored. This course teaches effectively, the recent developments in the use of nanoparticles as delivery systems to treat a wide variety of diseases	<ul style="list-style-type: none"> 1. explain the key concepts 2. be responsible, disciplined, honest, respected other people and able to work with others 3. utilize information technology for literature review 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 5. apply knowledge from Cellular and Molecular Science for Biomedical Applications to solve problem and develop a research topic
117841 Personalized Medicine	3(3-0-6)	117641 Cancer Cell Biology and Genetics or consent of school	Design, use, and interpretation of genetic studies of human populations and diseases. It will cover principles of genetics underlying associations between genetic variants and disease susceptibility and drug response. Topics include: genetic and environmental risk factors for complex genetic disorders; design and interpretation of whole genome association studies; full genome sequencing for disease gene discovery; pharmacogenetics; use of personal genetic information in clinical medicine	<ul style="list-style-type: none"> 1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others 3. Utilize information technology for literature review 4. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117842 Advanced in Cancer Diagnosis	3(3-0-6)	117641 Cancer Cell Biology and Genetics or consent of school	Essential knowledge in cancer diagnosis including symptomatology, radiology, laboratory investigation and pathology. Explore molecular markers in tumor cells and understand their roles in cancer progression and diagnosis	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others 3. Utilize information technology for literature review 4. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
Elective Course (Nutraceuticals and Functional Foods)				
335521 Nutraceuticals and Functional Foods	4(4-0-8)	Consent of the school	Relationship of food, nutrition, and health. Dietary supplements, pre- and probiotics, phytochemical, bioactive molecules, and functional food for selected populations. Product quality and shelf life, safety, efficacy and regulatory issues	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others 3. Utilize information technology for literature review 4. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately
335522 Cell-Based Assays for Functional Foods	4(2-6-4)	Consent of the school	Concept of cell culture, cell survival, cell proliferation, cell cycle, cell apoptosis, cell differentiation, cell autophagy, cell oxidative stress, anti-aging, anti-inflammation, anticancer and tumorigenesis, neuroprotection and neurogenesis	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Use scientific instruments appropriately and safety for experiments and analyze data correctly 3. Be responsible, disciplined, honest, respected other people and able to work with others 4. Utilize information technology for literature review 5. Analyze data systematically and rationally based on scientific process 6. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 7. Design a plan and conduct an experiment to support the hypothesis

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
335612 Microbial Metabolites for Food Industry	3(3-0-6)	Consent of the school	Microbial metabolites production in food industry. Primary and secondary metabolites production based on kinetic growth of microorganism in fermentation system. Traditional fermentations and genetics improvement of microorganisms. Design and preparation of media for bioprocess. Screening, development and storage for industrial level. Production of food ingredients, food additives or food biopreservatives and others metabolites related to food, health and agricultural products	1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others C5 Utilize information technology for literature review C6 Analyze data systematically and rationally based on scientific process C7 Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately
335613 Risk Assessment of Microbiological Safety in Food Industry	3(3-0-6)	Consent of the school	Recent emerging pathogens related to food safety. Microbiological contaminants in food and plant environment. Emerging pathogens related to food safety. Microbiological contamination level in foods and its severity to human consumption. Control of the biological safety of food. Microbiological criteria and risk assessment in HACCP system. Microbiological risk analysis methodology	1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Utilize information technology for literature review 4. Analyze data systematically and rationally based on scientific process 5. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
335621 Instrumental Analysis of Food	4(3-3-6)	Consent of the school	Principles and application of spectroscopy, mass spectroscopy, chromatography, electrophoresis, textural and flow analysis, thermal analysis and immunological techniques and microscopy for food analysis and the related laboratory practices	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Classify, organize, analyze and apply numeral and statistical data 3. Use scientific instruments appropriately and safety for experiments and analyze data correctly 4. Be responsible, disciplined, honest, respected other people and able to work with others. 5. Utilize information technology for literature review 6. Analyze data systematically and rationally based on scientific process. 7. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 8. Design a plan and conduct an experiment to support the hypothesis 9. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 10. Understand ethic in using animal and human in research and be able to conduct research under the legal framework 11. Apply knowledge from Cellular and Molecular Science for Biomedical Applications to solve problem and develop a research topic

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
335628 Advanced Food and Nutrition	4(4-0-8)	Consent of the school	Integration of metabolism including general overview of all metabolism, protein metabolism, carbohydrate metabolism, lipids metabolism, and bioenergetics. Diet, health and diseases including diabetes and designed diets, coronary heart disease and designed diets, obesity and designed diets, childhood and adult gout under nutrition, protein/energy malnutrition, phenylketonuria (PKU) and designed diets, in born errors of metabolism and designed diets, allergy/food intolerance and designed diets, cancer and designed diets, cystic fibrosis multiple sclerosis anemia and designed diets, osteoporosis and osteomalacia and designed diets, fad diets/modern day dieting trends, menu formulation and analysis of therapeutic diets. Nutrition research methodology including dietary assessment, biological marker, quantitative/qualitative, biological sample analysis	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Use scientific instruments appropriately and safety for experiments and analyze data correctly 3. Be responsible, disciplined, honest, respected other people and able to work with others 4. Utilize information technology for literature review 5. Analyze data systematically and rationally based on scientific process. 6. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 7. Design a plan and conduct an experiment to support the hypothesis 8. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 9. Understand ethic in using animal and human in research and be able to conduct research under the legal framework 10. Apply knowledge from Cellular and Molecular Science for Biomedical Applications to solve problem and develop a research topic
335629 Foods for Immune System	2(2-0-2)	Consent of the school	Study the basic immune system of human, causes of changes in immune system and diseases related to changes in immune system, foods for maintaining the immune system and their mechanisms, trends in application of foods for treating diseases caused by changes in immune system	<ol style="list-style-type: none"> 1. Explain the key concepts 2. Be responsible, disciplined, honest, respected other people and able to work with others
Elective Course (Anti-aging Innovation)				

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117761 Anti-Aging Agents Food and Drugs	4(4-0-8)	None	Integration of knowledge about hypnotics, sedative and anxiety disorder drugs. Drug therapy of Inflammation: autacoids; analgesic, antipyretic agents; pharmacotherapy of gout and asthma, histamine, bradykinin, serotonin, and their antagonists, clinical pharmacology of eicosanoids, platelet-activating factor, and nitric oxide. Pharmacologic manipulation of hypercholesterolemia, hyperlipidemia, and obesity. Agents affecting mineral ion homeostasis and bone turnover. Treatment of central nervous system degenerative disorder; alzheimer's drugs, parkinson's drugs, huntington's drugs, etc. special aspects of geriatric pharmacology. botanicals ("Herbal Medications") & nutritional supplements; antioxidants for health and beauty. Journal topics of anti-aging agents and drugs. Journals presentation	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Utilize information technology for literature review. 4. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately. 4. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications.
117662 Aging Process	4(4-0-8)	None	This course provides an in-depth analysis of the physiology of aging, building up from changes occurring at the molecular and cellular level and analyzing the consequences at the organism level. In addition, the influence of these age-related changes in what are commonly considered a disease of aging, such as neurodegeneration, diabetes, etc, will also be discussed. Topics will include : theories of aging, experimental models used to study of aging and longevity, impact of oxidative stress in cell and organ function, the metabolic syndrome of aging, functional changes in the immune, musculoskeletal and central nervous systems, genetic instability and genetics of aging and longevity	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Utilize information technology for literature review. 4. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately. 5. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications.

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117761 Anti-Aging Agents Food and Drugs	4(4-0-8)	None	Integration of knowledge about hypnotics, sedative and anxiety disorder drugs. Drug therapy of Inflammation: autacoids; analgesic, antipyretic agents; pharmacotherapy of gout and asthma, histamine, bradykinin, serotonin, and their antagonists, clinical pharmacology of eicosanoids, platelet-activating factor, and nitric oxide. Pharmacologic manipulation of hypercholesterolemia, hyperlipidemia, and obesity. Agents affecting mineral ion homeostasis and bone turnover. Treatment of central nervous system degenerative disorder; alzheimer's drugs, parkinson's drugs, huntington's drugs, etc. special aspects of geriatric pharmacology. botanicals ("Herbal Medications") & nutritional supplements; antioxidants for health and beauty. Journal topics of anti-aging agents and drugs. Journals presentation	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Utilize information technology for literature review. 4. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately. 5. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications.
117762 Psychoneuroimmunology	3(3-0-6)	None	Integration the interaction knowledge of the body and mind between psychology, neurology and immunology which emphasis on psychoneuroimmunology (PNI) interaction in stress, depression, anxiety, mood, fatigue, pain, relaxation, happiness and clinical applications both in cellular and molecular levels	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others. 3. Criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications.
117763 Holistic Lifestyle Improvement	3(3-0-6)	None	Development the quality of holistic life by Integration the knowledge of the body health and mental health together which emphasis on development the healthy mind by mind immunization, development quality of sleep, exercise, nutrition, the effective use of music therapy and naturopathy and clinical applications both in cellular and molecular levels	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others.

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117764 Healthy Aging Medicine	4(4-0-8)	None	Holistic care in aging regarding physical mental social and spiritual health. Integration of geriatrics medicine in order to be healthy aging about, oral medicine, skin, musculoskeletal, cardiovascular and respiratory, gastrointestinal system, nutrition and supplements, hormone changing in aging and diabetes, reproductive system, cancer in aging and palliative care, common neurological problems, epidemiology of molecular and innovation in aging, psycho and social support for aging, basic communication for aging, exercise and sport for aging, and first aids for aging. Emphasis concept of caring and surveillance for the good quality of aging life	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Be responsible, disciplined, honest, respected other people and able to work with others.
Elective Course (Research Promotion and Entrepreneurship)				
117871 Selected Topics in Cellular and Molecular Science and Medicine 1	2(2-0-4)	None	Selected topics of current interest in Cellular and Molecular Science and Medicine	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. utilize information technology for literature review 3. analyze data systematically and rationally based on scientific process 4. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 5. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117872 Selected Topics in Cellular and Molecular Science and Medicine 2	2(2-0-4)	None	Selected topics of current interest in Cellular and Molecular Science and Medicine	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. utilize information technology for literature review 3. analyze data systematically and rationally based on scientific process 4. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 5. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
205501 Entrepreneurship and Innovation	2(2-0-4)	None	Study of entrepreneurship, innovation and technology business, open innovation, attitudes and motivation of innovative entrepreneurs and social entrepreneurs, characteristics of successful entrepreneurs, new venture process, business model generation and business plan, business frost & sullivan feasibility and problems of new ventures	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Utilize information technology for literature review. 3. Analyze data systematically and rationally based on scientific process 4. Communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 5. apply knowledge from molecular and cellular science and medicine to solve problem and develop a research topic
205503 Intellectual Property Strategies	2(2-0-4)	None	Concepts and principles of intellectual property management, intellectual property from research and development, patent searching, intellectual property laws and methods of intellectual property protection, intellectual property valuation and method in creating return on intellectual properties	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Utilize information technology for literature review.
205511 Legal Aspects of Entrepreneurship	2(2-0-4)	None	Introduction to laws, person and property, juristic acts, contract, obligation, wrongful acts, sale, hire of property, hire purchase, surety ship, pledge, mortgage, bills and cheques, partnership, limited company, shares, stock exchange, employment laws, tax laws, electronic commerce and unfair contract terms	<ol style="list-style-type: none"> 1. Explain the key concepts. 2. Utilize information technology for literature review

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
Seminar Course				
117881 Seminar 3	1(1-0-6)	None	Selecting topics or issues, planning seminars in advance Cellular and Molecular Science and Medicine, presentation, discussion, clarifying for questions related to recently research publication in the field of interest	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117882 Seminar 4	1(1-0-6)	117881 Seminar 3 or Consent of the School	Selecting topics or issues, planning seminars in advance Cellular and Molecular Science and Medicine, presentation, discussion, clarifying for questions related to recently research publication in the field of interest	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117883 Seminar 5	1(1-0-6)	117882 Seminar 4 or Consent of the School	Selecting topics or issues, planning seminars in advance Cellular and Molecular Science and Medicine, presentation, discussion, clarifying for questions related to recently research publication in the field of interest	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117884 Seminar 6	1(1-0-6)	117883 Seminar 5 or Consent of the School	Selecting topics or issues, planning seminars in advance Cellular and Molecular Science and Medicine, presentation, discussion, clarifying for questions related to recently research publication in the field of interest	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117885 Colloquium 3	1(1-0-6)	None	The series of four colloquium courses aim to develop scientific communication skills of students. The class is designed to simulate the environment of an international academic conference: a student delivers a formal scientific presentation in English about a topic of interest and then entertains questions and discussion from an audience or peers. In this course, students acquire basic skills for giving effective scientific presentations and build self-confidence as public speakers. Joint seminars with other institutes will be organized (field trips required). Grade: Satisfactory and Unsatisfactory	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
117886 Colloquium 4	1(1-0-6)	117885 Colloquium 3 or Consent of the School	The series of four colloquium courses aim to develop scientific communication skills of students. In this course, student will enhance their ability to give effective scientific presentations and will also learn basic skills for writing articles in scientific journals. Joint seminars with other institutes will be organized (field trips required). Grade: Satisfactory and Unsatisfactory	<ul style="list-style-type: none"> 1. utilize information technology for literature review 2. analyze data systematically and rationally based on scientific process 3. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 4. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications
Thesis Course				

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117891 Ph.D. Thesis Scheme 1.1	60(0-0-0)	None	Creating hypothesis, thesis proposal writing, research, science interpretation data, and report writing on a specific topic relevant to the field of interest in Cellular and Molecular Science for Biomedical Applications under the supervision of the thesis advisory committee	<ul style="list-style-type: none"> 1. use scientific instruments appropriately and safety for experiments and analyze data correctly 2. be responsible, disciplined, honest, respected other people and able to work with others 3. utilize information technology for literature review 4. analyze data systematically and rationally based on scientific process 5. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 6. design a plan and conduct an experiment to support the hypothesis 7. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 8. apply knowledge from Cellular and Molecular Science for Biomedical Applications to solve problem and develop an advance research topic 9. develop new knowledge and research topic in Cellular and Molecular Science for Biomedical Applications for publication

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117991 Ph.D. Thesis Scheme 2.1	45(0-0-0)	None	Creating hypothesis, thesis proposal writing, research, science interpretation data, and report writing on a specific topic relevant to the field of interest in Cellular and Molecular Science for Biomedical Applications under the supervision of the thesis advisory committee	<ul style="list-style-type: none"> 1. use scientific instruments appropriately and safety for experiments and analyze data correctly 2. be responsible, disciplined, honest, respected other people and able to work with others 3. utilize information technology for literature review 4. analyze data systematically and rationally based on scientific process 5. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 6. design a plan and conduct an experiment to support the hypothesis 7. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 8. apply knowledge from cellular and molecular science and medicine to solve problem and develop an advance research topic 9. develop new knowledge and research topic in Cellular and Molecular Science for Biomedical Applications for publication

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
117992 Ph.D. Thesis Scheme 2.2	60(0-0-0)	None	Creating hypothesis, thesis proposal writing, research, science interpretation data, and report writing on a specific topic relevant to the field of interest in Cellular and Molecular Science for Biomedical Applications under the supervision of the thesis advisory committee	<ul style="list-style-type: none"> 1. use scientific instruments appropriately and safety for experiments and analyze data correctly 2. be responsible, disciplined, honest, respected other people and able to work with others 3. utilize information technology for literature review 4. analyze data systematically and rationally based on scientific process 5. communicate scientific knowledge in different forms, such as oral presentation and article, effectively and appropriately 6. design a plan and conduct an experiment to support the hypothesis 7. criticize, discuss and apply knowledge from Cellular and Molecular Science for Biomedical Applications 8. apply knowledge from cellular and molecular science and medicine to solve problem and develop an advance research topic 9. develop new knowledge and research topic in Cellular and Molecular Science for Biomedical Applications for publication