DOCTOR OF PHILOSOPHY PROGRAM IN **MEDICAL SCIENCE**

- FACULTY OF MEDICAL SCIENCE

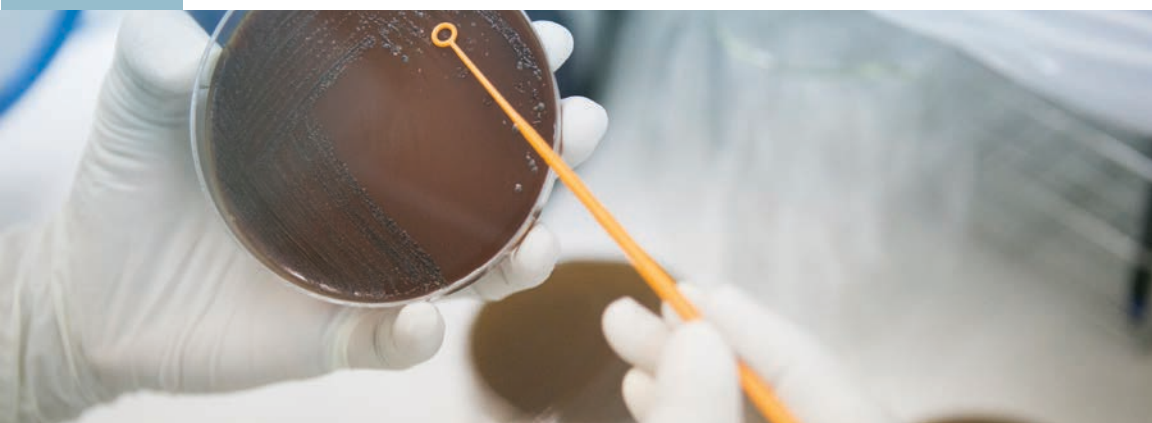
DOCTOR OF PHILOSOPHY PROGRAM IN MEDICAL SCIENCE

The program provides training which can lead to academic careers in universities or medical institutions or to a wide variety of research or administrative positions in both public and private sectors.

The program is multidisciplinary covering all areas within the medical sciences, such as biochemistry, microbiology, parasitology, physiology, and anatomy.

Knowledge and expertise gained from our training are applicable to conduct research in biotechnology, molecular biology, medical science technology, environmental health, health, bio-material technology, bioinformatics, nanotechnology, and bio-based industries. Students are encouraged to conduct their dissertation in a Routine-to-Research approach. Most applicants are already practitioners in the field, wishing to find solutions to their work through empirical inquiries.

Our faculty is well-funded from diverse research grants to support their student research projects, such as the Royal Golden Jubilee, Thailand Research Fund, National Research Council of Thailand, and National Science and Technology Development Agency. Networking with organizations both on campus, at home, and abroad enriches of our program, such as the Faculty of Sciences, the Faculty of Medicine, National Council of Sciences and Technology, and the Institute of Forensic Science in the University of Texas Health Science Center at Fort Worth.



Objectives

The desirable attributes of graduates are as follows:

- Research. Is responsible in carrying out research commitments.
- Ethics. Practices and encourages professional ethics.
- Team Member. Possess both leadership and followership, upholds rights and responsibilities, ready to listen to and accept different opinions.
- In-depth. Has an understanding of the core knowledge of the field.
- Innovation. Takes initiative in analysis and synthesis of significant issues and is able to create new knowledge and innovations from R&D.
- Academic Self-sufficiency. Is competent in searching for knowledge on one's own and capable of combining diverse approaches together from within the field as well as from other disciplines.
- Professional stand. Is equipped with self-confidence and presentation skills in supporting one's own stance and looked up to as a professional leader.
- Quantitative Prowess. Able to scrutinize and select mathematical and statistical data for use in important and complex problems.
- Technological Mastery. Is a proficient user of ICT in professional communications at international standards.

Admission

In accordance with the Graduate School Rules and Regulations. The program committee reserves the rights to require more qualifications as deemed appropriate.

Medium of Instruction

Thai and English

Research Focus

- Prevention and Control of Diseases
- Neuroscience
- Herbal Uses in Medicine

Requirement for Graduation

In accordance with the university Graduate School Rules and Regulations.

Doctor of Philosophy Program in **Medical Science**

■ FACULTY OF MEDICAL SCIENCE

Structure of the Program

1. Credit Requirements. *

Requirements	Option 1.1	Option 1.2	Option 2.1	Option 2.2
Coursework	-	-	12	24
Core Courses	-	-	3	9
Electives	-	-	9	15
Required Non-credit Courses	4	7	4	7
Dissertation	48	72	36	48
Total	**48**	**72**	**48**	**72**

* Minimum credits required.

2. Core Courses

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Integrative Medical Science and Applications	-	-	-	-	423611	3	423611	3
Selected Topics in Medical Science	-	-	-	-	423694	3	423694	3
Cell Biology*	-	-	-	-	-	-	422513	3
Biochemistry, Cell and Molecular biology*	-	-	-	-	-	-	422514	3
Total	**0**	**0**	**0**	**0**	**2**	**6**	**3**	**9**

*Choose

3. Electives

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Medical Science:								
Application of Advanced Scientific Instrumentation	-	-	-	-	423620	3	423620	3
Advanced Protein Chemistry and Proteomics and Their Applications	-	-	-	-	423622	3	423622	3
Cutting-edge Technologies for Pharmacogenomics	-	-	-	-	423627	3	423627	3
Advanced Stem Cells in Health and Therapy	-	-	-	-	423628	3	423628	3
Modern Medical Nanotechnology	-	-	-	-	423629	3	423629	3
Advanced Biochemistry of Signal Transduction and Regulation	-	-	-	-	423632	3	423632	3
Advanced Cell Culture for Medical Science	-	-	-	-	423633	3	423633	3
Anatomy:								
Reproductive and Developmental Biology	-	-	-	-	419613	3	419613	3
Advanced Microscopic Studies for Cells and Tissues	-	-	-	-	419614	3	419614	3
Cytology of Immune System	-	-	-	-	419615	3	419615	3
Functional Human Anatomy	-	-	-	-	419616	3	419616	3
Research topics in Anatomy	-	-	-	-	419617	3	419617	3
Molecular Neurobiology	-	-	-	-	419621	3	419621	3
Two Dimensional and Three dimensional Studies of Body Structures	-	-	-	-	419631	3	419631	3

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Biochemistry:								
Research Project in Advanced Biochemistry	-	-	-	-	418611	2	418611	2
Advanced Protein Studies	-	-	-	-	418612	3	418612	3
Nutrigenomics and Proteomics	-	-	-	-	418613	3	418613	3
Biochemistry of Developmental biology and Regenerative medicine					418614	3	418614	3
Stem Cell Biology					418615	3	418615	3
Systems Biology					418616	3	418616	3
Medical Microbiology:								
Advanced Diagnostic Medical Microbiology	-	-	-	-	266611	3	266611	3
Advanced Microbial Forensics	-	-	-	-	266612	3	266612	3
Molecular Pathogenesis of Bacteria	-	-	-	-	266613	3	266613	3
Mechanism and Molecular Epidemiology of Drug-Resistant Bacteria	-	-	-	-	266614	3	266614	3
Advanced Medical DNA Technology	-	-	-	-	266615	3	266615	3
Applied Microbiology:								
Advanced Bioinformatics	-	-	-	-	266601	3	266601	3
Molecular Microbiology	-	-	-	-	266621	3	266621	3
System Microbiology	-	-	-	-	266622	3	266622	3
Molecular Biology of Microbial Photosynthesis	-	-	-	-	266623	3	266625	3
Advanced Microbial Biotechnology	-	-	-	-	266625	3	266625	3
Total	**0**	**0**	**0**	**0**	**30**	**≥9**	**30**	**≥15**

4. Required Non-credit Courses.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Research Methodology in Health Sciences	-	-	422510	3	-	-	422510	3
Seminar 1	423695	1	423695	1	423695	1	423695	1
Seminar 2	423696	1	423696	1	423696	1	423696	1
Seminar 3	423697	1	423697	1	423697	1	423697	1
Seminar 4	423698	1	423698	1	423698	1	423698	1
Total	**4**	**4**	**5**	**7**	**4**	**7**	**5**	**7**

5. Dissertation Credit Requirements.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Dissertation 1	423651	8	423661	9	423671	9	423681	8
Dissertation 2	423652	8	423662	9	423672	9	423682	8
Dissertation 3	423653	8	423663	9	423673	9	423683	8
Dissertation 4	423654	8	423664	9	423674	9	423684	8
Dissertation 5	423655	8	423665	9	-	-	423685	8
Dissertation 6	423656	8	423666	9	-	-	423686	8
Dissertation 7	-	-	423667	9	-	-	-	-
Dissertation 8	-	-	423668	9	-	-	-	-
Total	**6**	**48**	**8**	**72**	**4**	**36**	**6**	**48**

Course Descriptions

422510 Research Methodology in Health Sciences 3(3-0-6)

Definitions, characteristics, and goals of research; research methodologies, types of research; determination of research questions; variables and hypothesis; data collection; data analysis; research proposal and research report writing; research evaluation; research applications; ethics in research; and advanced research techniques in health sciences.

422513 Cell Biology 3(3-0-6)

Introduction to cells, cell organization and functions, biomolecules, cytoskeleton, cell membranes, enzymes, cellular metabolism and bioenergetics, genetics information and regulation, cell communications, cell signaling, cell cycles, cell pathology and programmed cell death, and selected topics in cell biology.

422514 Advanced Biochemistry, Cell and Molecular Biology 3(3-06)

Cells and cell cycles, properties and structures of major biomolecules, protein structures and functions, enzymes and kinetics, bioenergetics and metabolism of biomolecules, genomes organization, replications, DNA damage and repair, transcription and translation processes, bioinformatics, molecular biology, biochemistry of endocrines, and significant perspectives in biochemistry.

423611 Integrative Medical Science and Applications 3(2-3-5)

Integrated study of human growth and development; structural, physiological and molecular basis of cells, tissues, organs and systems functions of human body; homeostasis and regulation of normal physiology functions of human body; and clinical correlations and laboratory practices.

423620 Applications of Advanced Scientific Instrumentation 3(2-3-5)

Comprehensive study of applications of modern scientific instruments and good practices for research laboratory administration and management.

423622 Advanced Protein Chemistry and Proteomics and their Applications 3(2-3-5)

Extensive investigation of applications of microarrays in proteomics, clinical proteomics, protein, profiling, high throughput technology of proteomics, Nano medicine, proteomics applications, mass spectrometry in proteomics, and elements of bioinformatics.

423627 Cutting-edge Technologies for Pharmacogenomics 3(3-0-6)

Sequencing genetic variations, genetic variances based on heteroduplex analysis, Temperature Gradient Capillary Electrophoresis (TGCE), Chemical Cleavage of Mismatch (CCM), Microplate Array Diagonal Electrophoresis (MADGE), and cutting-edge approaches in genetic variance detection.

423628 Advanced Stem Cells in Health and Therapy 3(3-0-6)

Hematopoietic stem cells, stem cells in neurogenesis, stem cells and gene therapy, stem cells for tissue reengineering, characteristic of leukemic stem cells, stem cells and cancers, and applications of stem cells technology to modern therapy.

423629 Modern Medical Nanotechnology 3(3-0-6)

Applications of modern nanotechnology in medicine, importance in medical diagnosis, pathways to molecular manufacturing, molecular transports, nanofabrication, biological functionalization of nanometrics, nanopower, nanomolecular communication, nanoscale manipulation and control, and nanorobots for medical applications.

423632 Advanced Biochemistry of Signal Transduction and Regulation 3(3-0-6)

Structural and biochemical properties of signaling molecules and their regulation, the interactions of signaling proteins at the various levels of signal transduction, and basic principles of cellular communications and their applications.

423633 Advanced Cell Culture for Medical Science 3(2-3-5)

Comprehensive study of cell culture techniques and their applications in advanced medical science research.

423651 Dissertation I, Option 1.1 8 Credits

Identifying the research question, writing a research proposal describing the significance and purposes of the study, and research methodologies in brief including an extensive review of the literature.

423652 Dissertation II, Option 1.1 8 Credits

Submission of the dissertation supervisory committee to the Graduate School and submission of the dissertation title to advisors.

423653 Dissertation III, Option 1.1 8 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the qualifying examination.

423654 Dissertation IV, Option 1.1 8 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the dissertation proposal defense examination.

423655 Dissertation V, Option 1.1 8 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and preparing a scientific manuscript for publication under a standard peer-review process.

423656 Dissertation VI, Option 1.1 8 Credits

Summarizing all research data, passing the dissertation defense, complying with dissertation corrections if any, and submitting the completed dissertation to the Graduate School.

423661 Dissertation I, Option 1.2 9 Credits

Identifying the research question, writing a research proposal describing the significance and purposes of the study, and research methodologies in brief including an extensive review of the literature.

423662 Dissertation II, Option 1.2 9 Credits

Submission of the dissertation supervisory committee to the Graduate School and submission of the dissertation title to advisors.

423663 Dissertation III, Option 1.2 9 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the qualifying examination.

423664 Dissertation IV, Option 1.2 9 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the dissertation proposal defense examination.

423665 Dissertation V, Option 1.2 9 Credits

Conducting an extensive research and reporting progress of the research to the dissertation advisors.

423666 Dissertation VI, Option 1.2 9 Credits

Conducting an extensive research and reporting progress of the research to the dissertation advisors.

423667 Dissertation VII, Option 1.2 9 Credits

Conducting an extensive research and preparing a scientific manuscript for publication under a standard peer-review process.

423668 Dissertation VIII, Option 1.2 9 Credits

Summarizing all research data, passing the dissertation defense, complying with dissertation corrections if any, and submitting the completed dissertation to the Graduate School.

423671 Dissertation I, Option 2.1 9 Credits

Submission of the dissertation supervisory committee to the Graduate School and submission of the dissertation title to advisors.

423672 Dissertation II, Option 2.1 9 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the qualifying examination.

423673 Dissertation III, Option 2.1 9 Credits

Conducting an extensive research, reporting progress of research to the dissertation advisors, taking the dissertation proposal defense examination, and preparing a scientific manuscript for publication under a standard peer-review process.

423674 Dissertation IV, Option 2.1 9 Credits

Summarizing all research data, passing the dissertation defense, complying with dissertation corrections if any, and submitting the completed dissertation to the Graduate School.

423681 Dissertation I, Option 2.2 8 Credits

Identifying the research question, writing a research proposal describing the significance and purposes of the study, and research methodologies in brief including an extensive review of the literature.

423682 Dissertation II, Option 2.2 8 Credits

Submission of the dissertation supervisory committee to the Graduate School and submission of the dissertation title to advisors.

423683 Dissertation III, Option 2.2 8 Credits

Conducting an extensive research and taking the qualifying examination.

423684 Dissertation IV, Option 2.2 8 Credits

Conducting an extensive research, reporting progress of the research to the dissertation advisors, and taking the dissertation proposal defense examination.

423685 Dissertation V, Option 2.2 8 Credits

Collecting research data and preparing a scientific manuscript for publication under a standard peer-review process.

423686 Dissertation VI, Option 2.2 8 Credits

Summarizing all research data, passing the dissertation defense, complying with dissertation corrections if any, and submission of the completed dissertation to the Graduate School.

423694 Selected Topics in Medical Sciences 3(1-2-3)

Current knowledge and interesting research in medical sciences, relationship of fundamental knowledge to the development of the current knowledge and their applications.

423695 Seminar I 1(0-2-1)

Extensive practice in searching, reading, critical thinking, and organization of information from articles or published papers; and oral presentation practice on selected and current topics in medical science.

423696 Seminar II 1(0-2-1)

Comprehensive seminar on selected and current trends in biological sciences.

423697 Seminar III 1(0-2-1)

Seminar on selected and current trends in biological science.

423698 Seminar IV 1(0-2-1)

Extensive seminar on advanced research in biomedical sciences.

418611 Research Project in Advanced Biochemistry 2(0-6-3)

Practical experiences in laboratory techniques and applications to research projects in advanced biochemistry.

418612 Advanced Protein Studies 3(3-0-6)

Advanced concepts and principles of proteins with regards to structures, folding, post-translational modifications, interactions, chemistry, engineering, modifications, purifications, structure determination methods, and advanced protein bioinformatics.

418613 Nutrigenomics and Proteomics 3(2-3-5)

Roles of nutrients or dietary components on gene expression and protein synthesis modulation of transcription factors including the effects of nutrients analysis of nutrient-responsive genes and protein expression.

418614 Biochemistry of Developmental Biology and Regenerative Medicine 3(2-2-5)

The molecular mechanism of human organ development injury repair and regeneration; recent and advanced biochemistry to cure diseases arising from developmental biology, such as organ regeneration, stem cells genetic, and cell engineering.

418615 Stem Cell Biology 3(2-3-5)

Introduction to concepts in stem cells studies, biology of embryonic and adult stem cells, molecular mechanisms underlying pluripotency and self-renewal, cell-fate determination and differentiation of stem cells or progenitor cells into particular lineages, research in molecular biology of stem cells, current techniques in stem cell studies, cell culture techniques for expansion and differentiation, and applications of stem cells for research and regenerative medicine.

418616 Systems Biology 3(2-3-5)

Various methods used to obtain data about interactions between components of biological systems and their effects to biological systems, and manipulation representation usages and analysis of the data using various methods.

419613 Reproductive and Developmental Biology 3(3-0-6)

Normal and abnormal processes and regulatory mechanisms of human reproduction, development of stem cells biology, and molecular approaches in reproductive and developmental biology.

419614 Advanced Microscopic Studies for Cells and Tissues 3(3-0-6)

Advanced techniques in the study of cells and tissues with various types of microscopes, the application for research and pathological diagnosis, and microscopic application for molecular biological studies.

419615 Cytology of Immune System 3(3-0-6)

Fundamentals of immunology, anatomy and cytology of the immune system and immunological responses, immunological disorders, and analytical techniques used in laboratory including its applications for clinics and research.

419616 Functional Human Anatomy 3(3-0-6)

Studies of the regional functional anatomy of the human body with regards to human characteristics of postures and movement with emphasis on normal activities and dysfunctions.

419617 Research topics in Anatomy 3(3-0-6)

Review of selected, current and advanced research in anatomical sciences.

419621 Molecular Neurobiology 3(3-0-6)

Genetics and molecular biology of the nervous system with the emphasis on the functions of the nervous system in nerve impulse transmission, neurotransmitters and receptors.

419631 Two and Three Dimensional Studies of Body Structures 3(3-0-6)

Morphometric and stereological methods for two dimensional, dimensional studies quantitatively and qualitatively of the body structures of the cells into tissues and organs.

266601 Advanced Bioinformatics 3(2-3-5)

Evaluation of the biological data using bioinformatics techniques including collection, data analysis, data alignment, information technology applications in experimental designs, laboratory diagnosis, genetic relationship of organisms, protein identification, molecular modeling, methods to determine protein structures and their aspects, and to become knowledgeable in performing such analysis.

266611 Advanced Diagnostic Medical Microbiology 3(2-3-5)

Advanced techniques in the identification of various pathogenic microorganisms and the applications of molecular and immunological techniques in laboratory diagnosis of infectious diseases.

266612 Advanced Microbial Forensics 3(2-3-5)

Chain of custody for microbiological evidentiary materials, molecular methods and techniques used for biotherat detection, and procedures for working in high biosafety levels.

266613 Molecular Pathogenesis of Bacteria 3(3-0-6)

Recent aspects of bacterial pathogenesis with emphasis on molecular and genetic determinants, bacterial toxins, secretion systems, interaction with host bacterial cells and tissues, immune evasion, genetic regulation, exchange of virulence genes, the micro biome, antibiotic resistance, vaccine, and bioterrorism.

266614 Mechanism and Molecular Epidemiology of Drug Resistant Bacteria 3(3-0-6)

Mechanisms and molecular epidemiology of important drug-resistant bacteria with emphasis on gram negative bacteria producing extended-spectrum beta-lactamase (ESBL), Methicilin-resistant *Staphylococcus aureus* (MRSA), Penicillin-resistant *Streptococcus pneumonia* (PRSP), multiple drug-resistant of diarrheal pathogens *Pseudomonas aeruginosa* and *Acinetobacter* species.

266615 Advanced Medical DNA Technology 3(2-3-5)

Principles of DNA technology in therapeutics and diagnostics; applications of molecular biology techniques and recombinant DNA technology including genes cloning, gene expressions, animal models and PCR-based techniques in diagnosis and gene therapy; key ideas of the recent research on gene transfer, vector development, and pre-clinical research.

266621 Molecular Microbiology 3(2-3-5)

Microorganisms at molecular level in biochemistry, physiology, classifications and identifications, laboratory diagnosis, and their applications using advanced DNA technology.

266622 System Microbiology 3(2-3-5)

Integrated and basic biological knowledge of microorganisms in biochemistry, genomics, transcriptomics, metabolomics and proteomics, descriptions of microbial cells functions with emphasis on the balance between microbes and humans.

266623 Molecular Biology of Microbial Photosynthesis 3(2-3-5)

Photosynthetic patterns in various groups of microorganisms, cellular structure of photosynthetic apparatus, molecular structure and biosynthesis of photosynthetic pigments, mechanisms of electron flow in electron transport chain, bioenergetics and metabolic processes, and regulations and genes involved in microbial photosynthesis.

266625 Advanced Microbial Biotechnology 3(2-3-5)

Microbial importance in advanced biotechnology, strain selection and improvement, fermentation processes, bio separation of microbial products, applications of microorganisms and their products in industry, environment, pharmacy, medicine, agriculture, and alternative energy production.