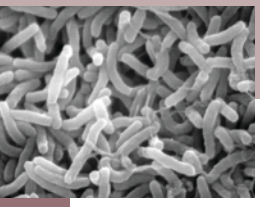

DOCTOR OF PHILOSOPHY PROGRAM IN **BIOMEDICAL SCIENCE**

- FACULTY OF ALLIED HEALTH SCIENCES

DOCTOR OF PHILOSOPHY PROGRAM IN BIOMEDICAL SCIENCE

The Faculty of Allied Health Sciences offers the cutting-edge doctoral program in Biomedical Sciences, focusing on in-depth inquiries into the cellular and molecular levels related to health sciences with systematic scientific processes. Through an innovative, practical and high-quality research-based programs, equipped with up-to-date medical tools, the students are encouraged and monitored to:

- Acquire advanced knowledge in research and inquiries in biomedical sciences,

- Create quality research findings beneficial to medical development, public health solutions and effective health maintenance at the national level.

- Disseminate, broaden and shave academic store of knowledge and accomplishments both in the national and international platforms.

Objectives

Graduates of the Doctoral Program in Biomedical Sciences are expected posses the following attributes:

- Competent, knowledgeable and possessing the academic leadership in advanced level of biomedical sciences. Capable of combining various knowledge together for useful applications.
- Able to apply biomedical science knowledge in creating research findings and state-of-the-art knowledge of systematic scientific methodologies.
- Proficient in research presentation, dissemination and sharing research accomplishments both nationally and internationally and capable as a team member in working with colleagues in different fields.
- Skillful in pursuing learning, research and scholarship on one's own in fundamental, applied and professional disciplines to support life-long education.
- Ethical adhering to research and professional codes of ethics. Responsibility to oneself, others and the society. Carrying out proper careers and live happily in the community.

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

- Infectious disease
- Molecular immunology
- Cellular and molecular hematology
- Cell and molecular biology of cancer
- Radiobiology
- Regenerative medicine (stem cell and tissue engineering)
- Biotechnology
- Cardiovascular sciences

Requirement for Graduation

In accordance with the Graduate School Rules and Regulations.

Doctor of Philosophy Program in **Biomedical Science**

■ FACULTY OF ALLIED HEALTH SCIENCES

Structure of the Program

1. Credit Requirements. *

Requirements	Option 1.1	Option 2.1	Option 2.2
Coursework	-	12	24
Core Courses	-	6	12
Electives	-	6	12
Required Non-credit Courses	3	3	9
Dissertation	48	36	48
Total	**48**	**48**	**72**

* Minimum credits required.

2. Core Courses

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Cell Biology and Cell Science	-	-	-	-	655501	3
Biostatistics in Biomedical Science	-	-	-	-	655504	3
Advanced Research Techniques in Cell Biology	-	-	656600	3	656600	3
Advanced Research Techniques in Molecular Biology	-	-	656601	3	656601	3
Total	**0**	**0**	**2**	**6**	**4**	**12**

3. Electives

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Determination of Antimicrobial Resistance	-	-	-	-	655524	2
Advance Biomedical Science Laboratory	-	-	-	-	655531	2
Radiation Dosimetry	-	-	-	-	655537	2
Advanced Radiation Protection	-	-	-	-	655538	2
Digital Image Processing	-	-	-	-	655539	2
Application of Image Processing Techniques	-	-	-	-	655540	2
Advanced Research Techniques in Musculoskeletal System	-	-	-	-	655541	3
Advanced Movement Sciences of Upper Extremities	-	-	-	-	655542	3
Advanced Movement Sciences of Lower Extremities	-	-	-	-	655543	3
Advanced Epidemiology	-	-	656610	2	656610	2
Medical Bioinformatics	-	-	656611	3	656611	3
Advanced Immunological Techniques	-	-	656612	2	656612	2
Review of Current Topics in Biomedical Sciences	-	-	656613	2	656613	2
Biomedical Sciences Laboratory Technique	-	-	656614	2	656614	2
Cellular and Molecular Physiology of Cardiovascular System	-	-	656615	3	656615	3
Research Techniques in Cardiovascular System	-	-	656616	3	656616	3
Advanced Radiation Biology	-	-	656617	3	656617	3
Molecular and Cellular Biology of Cancer	-	-	656618	3	656618	3
Research Techniques in Radiation Biology	-	-	656619	2	656619	2
Anatomy and Biomechanics in Musculoskeletal System	-	-	656620	3	656620	3
Total	**-**	**-**	**11**	**≥6**	**20**	**≥12**

4. Required Non-credit Courses.

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Ethics in Biomedical Science Research	-	-	-	-	655502	1
Research Methodology in Health Sciences	-	-	-	-	655503	3
Seminar 1	-	-	-	-	655570	1
Seminar 2	-	-	-	-	655571	1
Seminar 3	656672	1	656672	1	656672	1
Seminar 4	656673	1	656673	1	656673	1
Seminar 5	656674	1	656674	1	656674	1
Total	**3**	**3**	**3**	**3**	**7**	**9**

5. Dissertation Credit Requirements.

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Cr.	Course No.	Cr.	Course No.	Cr.
Dissertation 1 Option 1.1	656680	9	-	-	-	-
Dissertation 2 Option 1.1	656681	9	-	-	-	-
Dissertation 3 Option 1.1	656682	9	-	-	-	-
Dissertation 4 Option 1.1	656683	9	-	-	-	-
Dissertation 5 Option 1.1	656684	6	-	-	-	-
Dissertation 6 Option 1.1	656685	6	-	-	-	-
Dissertation 1 Option 2.1	-	-	656686	6	-	-
Dissertation 2 Option 2.1	-	-	656687	9	-	-
Dissertation 3 Option 2.1	-	-	656688	9	-	-
Dissertation 4 Option 2.1	-	-	656689	6	-	-
Dissertation 5 Option 2.1	-	-	656690	6	-	-
Dissertation 1 Option 2.2	-	-	-	-	656691	6
Dissertation 2 Option 2.2	-	-	-	-	656692	6
Dissertation 3 Option 2.2	-	-	-	-	656693	9
Dissertation 4 Option 2.2	-	-	-	-	656694	9
Dissertation 5 Option 2.2	-	-	-	-	656695	9
Dissertation 6 Option 2.2	-	-	-	-	656696	9
Total	**6**	**48**	**5**	**36**	**6**	**48**

Course Descriptions

655501 Cell Biology and Cell Science 3(3-0-6)

A novel approach in molecular structure of cell biology and cell science, considering major biomolecules: carbohydrates, lipids, proteins, and enzymes. Study on cell structures, cellular processing and developing of cells, specific mechanisms of cells, adaptations of cells in pathophysiological status, and apoptosis including genes, DNA, gene expressions, genetic engineering, and its applications for diagnosis and prevention.

655502 Ethics in Biomedical Science Research 1(1-0-2)

Knowledge and understanding in medical research ethics. Ethics for research in humans and animals. Concepts and processes for research ethics approval.

655503 Research Methodology in Health Science (3-0-6)

Research definition, characteristics and goal, type and research process, research problem determination, variables and hypothesis, data collection, data analysis, proposal and research report writing, research evaluation, research application, ethics of researchers, and research techniques in health sciences.

655504 Biostatistics in Biomedical Science 3(2-2-5)

Definition of biostatistics and its application in biomedical science for research data analysis. Utilization of computer programs for data collection and analysis including the practicing of statistical practices.

655524 Determination of Antimicrobial Resistance 2(1-2-3)

Antimicrobial agents and mechanisms of antimicrobial resistance in various types of microbes: bacteria, fungus, viruses, and parasites, which have clinical significance. Distributions and epidemiology of the antimicrobial resistance, clinical problems in patients with antimicrobial resistance including concepts for problem solving and techniques involved in antimicrobial studies.

655531 Advance Biomedical Science Laboratory 2(0-4-2)

A short research project, laboratory techniques related to biomedical science research, introduction to research methodologies used in biomedical science research experiences and know how in research with the emphasis on working in the research lab, understanding the processes, concepts, rationality and capability in planning assigned mini research projects.

655537 Radiation Dosimetry 2(1-2-3)

Nuclear physics, interactions of radiation and particles with matter, basic principle of equipment and their applications in diagnostic imaging, nuclear medicine and radiotherapy, calibration and monitoring of the equipment including quality control, calculation of the dose distributions in the patients, computer applications in radiology, and radiation safety procedures.

655538 Advanced Radiation Protection 2(1-2-3)

Advanced knowledge of radiation hazards for all medical practice and radiation protection. Survey meters for radiation contamination and how to prevent radiation hazards for medical personnel and the local population. Transportation of radioactive materials and legal aspects.

655539 Digital Image Processing 2(1-2-3)

Principles of image processing and digital image fundamentals. Development of the basic image processing software. Basic applications of image processing techniques with medical imaging.

655540 Application of Image Processing Techniques 2(1-2-3)

Program MATLAB and its application, Fourier transform, image analysis and segmentation, image registration, image reconstruction, and image compression.

655541 Advanced Research Techniques in Musculoskeletal System 3(2-3-5)

Advanced techniques based on the knowledge of morphology, histology, and physiology for research of musculoskeletal system.

655542 Advanced Movement Sciences of Upper Extremities 3(2-3-5)

Application of kinesiology and functions of anatomical concepts to the upper extremities. Application of knowledge gained in structure and function, dysfunction and disease, and exercise prescription.

655543 Advanced Movement Sciences of Lower Extremities 3(2-3-5)

Application of kinesiology and functions anatomical concepts to the lower extremities. Application of knowledge gained in structure and function, dysfunction and disease, and exercise prescription.

655570 Seminar 1 1(0-2-1)

A formal presentation of current topics in biomedical sciences with an emphasis on critical analysis of research papers.

655571 Seminar 2 1(0-2-1)

A formal presentation of current topics and reviews in biomedical science with an emphasis on researching, criticizing, and integrating knowledge from papers.

656600 Advanced Research Techniques in Cell Biology 3(2-2-5)

Advanced cell biology techniques, cell isolation, cell culture, karyotyping, transfection, cellular components and organelles fractionation, flow cytometry techniques, cellular microscopy by light microscope and fluorescence microscope, cell proliferation assay, cell death, cell cycle analysis, cytoskeleton and extracellular matrix, cell adhesion, intracellular protein trafficking, mitochondrial study, intracellular signal transduction technique, advance cellular biological research, and application of stem cells in regenerative medicine.

656601 Advanced Research Techniques in Molecular Biology 3(2-2-5)

Techniques in cellular and molecular biology including protein purification, qualitative analysis of proteins, analysis of protein mixtures and protein-protein interactions, handling technique of genome reactions and advanced techniques for manipulating and detection of genome, molecular cloning, gene identification in forward genetics, knock-out strategies, RNA interference, analysis of the transcriptome, methods for analyzing promoters, in vitro protein evolution, and applied technique for biotechnology.

656610 Advanced Epidemiology 2(2-0-4)

Epidemiologic processing and disease control including characteristics of diseases in the population. Study in behaviors and environments influencing disease outbreaks, particularly the tropical diseases due to bacterial, fungal, viral, and parasite infections. Emerging and re-emerging diseases, international communicable disease regulations, study design in advanced epidemiology, i.e., case-control study, cohort study, and longitudinal study. Application of laboratory techniques in epidemiology field and study on molecular epidemiology.

656611 Medical Bioinformatics 3(2-2-5)

Application of knowledge and bioinformatics databases in medical research. Searching, collecting, and data analysis of biological and genetic data using computation tools and the Internet, such as sequence based database search, sequence alignment of genes, phylogenetic analysis, gene structure and function prediction, and protein classifications.

656612 Advanced Immunological Techniques 2(1-2-3)

Advanced techniques in immunology and their applications for immunodiagnosis methods for detection of antibodies and antigens, immune cell char acterization and function, immunoglobulin preparation, antibody isotype and secretion, cytokine detection, immunohistological tools, immunological study using experimental models, *in vitro* and *ex vivo* assays, and modulation of the human immune response and its measurement.

656613 Review of Current Topics in Biomedical Science 2(1-2-1)

Current topics in biomedical science with the emphasis on the application of basic biomedical knowledge to the specific assigned topics. Capability in searching, describing, discussing and presenting orally using integrative aspects of the basic biomedical science, the experimental designation, and forecasting the expected outcomes.

656614 Biomedical Sciences Laboratory Technique 2(2-0-4)

General and advanced laboratory instruments or techniques used in biomedical and biomolecular research; their application in biomedical science research; advantages, limitation, and drawbacks of the techniques including centrifugation, electrophoresis, chromatography, labeling techniques, pH measurements, Pipettes and dispensers, HPLC/FPLC, immunochemisty techniques, fluorescent activated cell sorting, oligonucleotide synthesis, and DNA sequencing.

656615 Cellular and Molecular Physiology of Cardiovascular System 3(3-0-6)

Basic knowledge of molecular biology, cellular biology, molecular physiology and pharmacology of cardiovascular system including pathophysiology and abnormality in cardiovascular system. Analyzing, explanation and discussion by integrating of cellular and molecular biology principles.

656616 Research Techniques in Cardiovascular System 3(2-2-5)

Basic research techniques related to cardiovascular sciences, basic research and current techniques involving molecular biology, cellular biology, physiology, pharmacology of cardiovascular sciences in *in vitro,* animal models, and humans.

656617 Advanced Radiation Biology 3(3-0-6)

Mechanisms for radiation absorption on a cellular and molecular level. Effects on the DNA, genetic injuries, and cancer. Models for cell inactivation and dose rate dependence. Variations of cell cycles due to sensibility to radiation. Radiation modifying factors. The relation between radiation injuries and the regulation of cell growth and cell death. Bystander effects, and adaptive response to radiation.

656618 Molecular and Cellular Biology of Cancer 3(3-0-6)

Fundamental aspects of oncology at the cellular and molecular levels; mechanisms of cancer initiation and progression, oncogene action, DNA damages and repairs, carcinogenesis by radiation, chemicals, and viruses; and tumor immunology. The molecular basis of cell functions and regulations. The processes of the cell division, cell regulation, cell death, intracellular signalling pathways, and molecular target of cancer therapies.

656619 Research Techniques in Radiation Biology 2(1-2-3)

Basic and advanced research techniques related to radiation biology, basic research and current techniques involving molecular biology, cellular biology, molecular mechanisms of the action of radiation modifier agents and chemotherapeutic drugs *in vitro,* animal models, and humans.

656620 Anatomy and Biomechanics in Musculoskeletal System 3(2-3-5)

Structure and function of the musculoskeletal system. Emphasis on joint structure and muscle function, and biomechanical considerations for movement, injury prevention, and rehabilitation, as well as laboratory techniques in the musculoskeletal field: morphology, histology, and physiology.

656672 Seminar 3 1(0-2-1)

A formal presentation of a set of current topics in biomedical science with an emphasis on research criticism, comments, discussions, and suggestions useful for academics and researchers.

656673 Seminar 4 1(0-2-1)

A formal presentation of a set of current topics in biomedical science related to the research proposal.

656674 Seminar 5 1(0-2-1)

A formal presentation of current topics related to the research proposal (Cont.).

656680 Dissertation 1, Type 1.1 9 Credits

The basic overview of the dissertation and its educational objectives, structure and formatting of the dissertation, identifying research proposal elements, and the theme of the dissertation.

656681 Dissertation 2, Type 1.1 9 Credits

Review of the literature in the area of the research, research methodology development including research design, type of data, method of data collection and analysis, and writing the research proposal.

656682 Dissertation 3, Type 1.1 9 Credit

Presenting a dissertation proposal to the thesis committee for approval from the committee, the graduate school, and the research ethics committee of Naresuan University.

656683 Dissertation 4, Type 1.1 9 Credits

Conducting the proposed research and selecting appropriate research methodology not less than fifty percent of work is expected.

656684 Dissertation 5, Type 1.1 6Credits

Performing proposed research and selecting appropriate research methodology not less than fifty percent of work is expected.

656685 Dissertation 6, Type 1.1 6Credits

Completion of research work and data analysis. Preparation and completion of a scientific manuscript for publication, writing the thesis following the thesis guidelines, presenting the thesis to the thesis committee. Passing the thesis defense and submitting the complete thesis to the graduate school.

656686 Dissertation 1, Type 2.1 6 Credits

The basic overview of the dissertation and its educational objectives, structure and formatting of dissertation, identifying research elements and the theme of the dissertation.

656687 Dissertation 2, Type 2.1 9 Credits

Review of the literature in the area of the research, developing in research methodology including research design, type of data, method of data collection, analysis and writing the research proposal. Presenting a dissertation proposal to thesis committee, approval from the graduate school and the research ethics committee of Naresuan University.

656688 Dissertation 3, Type 2.1 9 Credits

Conducting the proposed research and selecting appropriate research methodology.

656689 Dissertation 4, Type 2.1 6 Credits

Conducting the proposed research and selecting appropriate research methodology.

656690 Dissertation 5, Type 2.1 6Credits

Completion of research work and data analysis. Preparation and completion of a scientific manuscript for publication, writing the thesis following the thesis guidelines, presenting the thesis to the thesis committee. Passing the thesis defense and submitting the completed thesis to the graduate school.

656691 Dissertation 1, Type 2.2 6 Credits

The basic overview of the dissertation and its educational objectives, structure and formatting of the dissertation, identifying research elements, and the theme of the dissertation.

656692 Dissertation 2, Type 2.2 6 Credits

Review of the literature in the area of the research, developing the research methodology including research design, type of data, method of data collection and analysis, and writing the research proposal.

656693 Dissertation 3, Type 2.2 9Credits

Presenting a dissertation proposal to the thesis committee for approval from the committee, the graduate school, and the research ethics committee of Naresuan University.

656694 Dissertation 4, Type 2.2 9 Credits

Conducting the proposed research and selecting appropriate research methodology. Not less than fifty percent of work is expected.

656695 Dissertation 5, Type 2.2 9 Credits

Conducting the proposed research and selecting appropriate research methodology. Not less than eighty percent of work is expected.

656696 Dissertation 6, Type 2.2 9 Credits

Completion of research work and data analysis. Preparation and completion of a scientific manuscript for publication, writing the thesis following the thesis guidelines, presenting the thesis to the thesis committee. Passing the thesis defense and submitting the completed thesis to the graduate school.

Note : Electives are 655524, 655531, 656610-656620.