



# DOCTOR OF PHILOSOPHY IN BIOCHEMISTRY

■ FACULTY OF MEDICAL SCIENCE

## DOCTOR OF PHILOSOPHY IN BIOCHEMISTRY

The Biochemistry Department at Naresuan University is a leader in lower northern Thailand in biochemistry, molecular biology, basic and advanced knowledge for biomolecules and metabolism, applied life science technology, omic technologies (genomics, proteomics, metabolomics) with multi-disciplinary research in a wide spectrum of medical biochemistry and biochemical technology. High-quality national experts serve as our faculty, especially in molecular biology, recombinant protein technology, bioinformatics, plant biochemistry, thalassemia, natural products, molecular biology of cancer, oxidative stress, environmental toxicology, signal transduction, nutrigenomic, biochemistry of neurodegenerative diseases, and related fields. Our ongoing research activities receive financial support from the university and other governmental agencies, such as the Thailand Research Fund (TRF) and the National Research Council of Thailand (NRCT).

The Doctoral Program in Biochemistry includes comprehensive knowledge or innovation in the biochemistry field and also prepares mid-career professionals for senior-level positions in both public and private organizations.



## Objectives

Our graduates are expected to have the following:

- Have thorough advanced knowledge in biochemistry.
- Be capable of systematic analysis and synthesis of data and information.
- Possess an inquiry mind, be competent in innovating on one's own, and cherish life-long learning in biochemistry.
- Be good at communications. Possess effective interactive skills with others as a team member.
- Adhere to morality and professional ethics, be acceptable as a role model in the society.

## 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

- Medical biochemistry and molecular biology
- Extraction and bioassay of Thai medicinal plants related to human diseases, including osteoarthritis, cancers, skin diseases, Alzheimer disease, and neuronal abnormalities
- Recombinant protein production for human diseases and biochemical technology
- Genetics and biochemistry of detection for avian influenza
- Biochemical toxicology and nanotechnology
- Biochemistry of thalassemia
- Biochemistry and molecular biology of cancer
- Cell signaling
- Plant biochemistry, molecular biology and signaling
- Plant proteomics
- Bioinformatics
- Neuronal stem cell
- Bioplastics

## Requirement for Graduation

In accordance with the Graduate School Rules and Regulations, with a departmental addition of paper presentation once a semester for at least four semesters in seminars organized by the department.

# Doctor of Philosophy in Biochemistry

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### 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
<b>Total</b>	<b>48</b>	<b>72</b>	<b>48</b>	<b>72</b>

\* Minimum credits required.

#### 2. Core Courses

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Advanced Biochemical Techniques and Instrumentation	-	-	-	-	418601	3	418601	3
Advanced Biochemistry	-	-	-	-	-	-	418502	3
Biochemistry, Cell and Molecular biology	-	-	-	-	-	-	422514	3
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>9</b>

## 3. Electives

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
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
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 Sciences	-	-	-	-	423633	3	423633	3
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>13</b>	<b>≥9</b>	<b>13</b>	<b>≥15</b>

#### 4. Required Non-credit Courses.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Research Methodology in Health Sciences	-	-	422510	3	-	-	422510	3
Seminar 1	418696	1	418696	1	418696	1	418696	1
Seminar 2	418697	1	418697	1	418697	1	418697	1
Seminar 3	418698	1	418698	1	418698	1	418698	1
Seminar 4	418699	1	418699	1	418699	1	418699	1
<b>Total</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>7</b>	<b>4</b>	<b>7</b>	<b>5</b>	<b>7</b>

#### 5. Dissertation Credit Requirements.

Requirements	Option 1.1		Option 1.2		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 1	418651	8	418661	9	418671	9	418681	8
Dissertation 2	418652	8	418662	9	418672	9	418682	8
Dissertation 3	418653	8	418663	9	418673	9	418683	8
Dissertation 4	418654	8	418664	9	418674	9	418684	8
Dissertation 5	418655	8	418665	9	-	-	418685	8
Dissertation 6	418656	8	418666	9	-	-	418686	8
Dissertation 7	-	-	418667	9	-	-	-	-
Dissertation 8	-	-	418668	9	-	-	-	-
<b>Total</b>	<b>6</b>	<b>48</b>	<b>8</b>	<b>72</b>	<b>4</b>	<b>36</b>	<b>6</b>	<b>48</b>

## Course Descriptions

### 418601 Advanced Biochemical Techniques and Instrumentation 3(1-6-5)

Principles, methodologies, and practices of current biochemical techniques with emphasis on the use of advanced biochemical research.

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

Practical experience 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 cell genetics, and cell engineering.



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

Introduction to concepts in stem cell 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.

**418502 Advanced Biochemistry****3(3-0-6)**

Current and selected topics in advanced biochemistry and related fields.

**418651 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.

**418652 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.

**418653 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.

**418654 Dissertation IV, Option 1.1****8Credits**

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

**418655 Dissertation V, Option 1.1****8Credits**

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.

**418656 Dissertation VI, Option 1.1****8Credits**

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

**418661 Dissertation I, Option 1.2****9Credits**

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.

**418662 Dissertation II, Option 1.2****9Credits**

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

**418663 Dissertation III, Option 1.2****9Credits**

Conducting an extensive research and taking the qualifying examination.

**418664 Dissertation IV, Option 1.2****9Credits**

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

**418665 Dissertation V, Option 1.2****9Credits**

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

**418666 Dissertation VI, Option 1.2****9Credits**

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

**418667 Dissertation VII, Option 1.2****9Credits**

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

**418668 Dissertation VIII, Option 1.2****9Credits**

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

**418671 Dissertation I, Option 2.1****9Credits**

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

**418672 Dissertation II, Option 2.1****9Credits**

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

**418673 Dissertation III, Option 2.1****9Credits**

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

**418674 Dissertation IV, Option 2.1****9Credits**

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

**418681 Dissertation I, Option 2.2****8Credits**

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.

**418682 Dissertation II, Option 2.2****8Credits**

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

**418683 Dissertation III, Option 2.2****8Credits**

Conducting an extensive research and taking the qualifying examination.

**418684 Dissertation IV, Option 2.2****8Credits**

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

**418685 Dissertation V, Option 2.2****8Credits**

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

**418686 Dissertation VI, Option 2.2****8Credits**

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

**418696 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 biochemistry.

**418697 Seminar II****1(0-2-1)**

Searching, reading, criticizing, and organizing information; oral presentation practice; and a seminar conducted among staff and students on selected recent topics in biochemistry.

**418698 Seminar III****1(0-2-1)**

Seminar on selected current trends and issues in biochemistry related to research proposals.

**418699 Seminar IV****1(0-2-1)**

Seminar on selected current trends and issues in biochemistry related to research proposals.

**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.

**422514 Biochemistry, Cell and Molecular Biology****3(3-0-6)**

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.

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

Applications of modern scientific instruments and good practices in research laboratory 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 nanometrical, 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 Sciences 3(2-3-5)**

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