

Program Specification
Doctor of Philosophy Program in Anatomy and Structural Biology
(International Program)
Curriculum Last Revised in 2017

(Approved by Mahidol University Council on 21 June 2017, and
started in the 1st semester of academic year 2017 onwards)

1. Program Title Doctor of Philosophy Program in Anatomy and Structural Biology
(International Program)

2. Degree Name Doctor of Philosophy (Anatomy and Structural Biology)
Abbreviation Ph.D. (Anatomy and Structural Biology)

3. Responsible Units

3.1 Teaching Unit: Department of Anatomy, Faculty of Science, Mahidol University
3.2 Awarding Unit: Faculty of Graduate Studies, Mahidol University

4. Philosophy of the Program

The Doctor of Philosophy program aims at producing graduates who have expertise in creating new body of knowledge of anatomy and structural biology via research activities, with a moral and ethical responsibility in the work.

5. Expected Learning Outcomes of the Program

Upon completion of the doctoral program, graduates must be able to:

5.1 Graduates exhibit honest, responsible, disciplined, and punctual behaviors including complying with regulations; and maintain ethical standards in academic and research contexts.

5.2 Graduates explain substantial body of knowledge, research processes, and the concept of research topics; and discuss on the latest developments including research techniques in anatomy and structural biology.

5.3 Graduates demonstrate their expertise in the use and application of research equipment in the field of anatomy and structural biology.

5.4 Graduates are able to analyze, synthesize, and evaluate scientific problems in a systematic and theoretical context; and able to take initiative in designing and carrying

out research or developing projects on their own, with wide and deep view in order to develop new knowledge and innovation in the field of anatomy and structural biology.

5.5 Graduates possess a good relationship with colleagues, receive and process feedback; and possess desirable attributes of leadership and society membership.

5.6 Graduates are able to analyze and process mathematical or statistical data involving in their research effectively, with the use of appropriate information and communications technology.

5.7 Graduates are able to utilize both oral and written communication skills to present their research outputs effectively via oral presentations and publications to international scientific community.

6. Admission Requirements

6.1 Plan 1

6.1.1 For graduate students with Master's degree:

- 1) Applicants must hold a Master of Science degree in Anatomy, Pathology, Physiology, Pharmacology, Microbiology, Biology, Medical Techniques, or other related biological sciences from institutions approved by the Office of the Higher Education Commission.
- 2) Applicants must get a cumulative grade point average of not less than 3.50, and
- 3) Applicants must have at least 1 research article published in national or international journals, with their name as the first author.
- 4) Applicants must have English language examination results passed the criteria of the Faculty of Graduate Studies, Mahidol University.
- 5) Those with qualifications other than the above criteria may be considered to apply for admission at the discretion of the Program Director and the Dean of the Faculty of Graduate Studies.

6.2 Plan 2

6.2.1 For graduate students with Master's degree:

- 1) Applicants must hold a Master of Science degree in Anatomy, Pathology, Physiology, Pharmacology, Microbiology, Biology, Medical Techniques, or other related biological sciences from institutions accredited by the Office of the Higher Education Commission.
- 2) Applicants must get a cumulative grade point average of not less than 3.50, or
- 3) Applicants must have at least 1 research article published in national or international journals, with their name as the first author.

- 4) Applicants must have English language examination results passed the criteria of the Faculty of Graduate Studies, Mahidol University.
- 5) Those with qualifications other than the above criteria may be considered to apply for admission at the discretion of the Program Director and the Dean of the Faculty of Graduate Studies.

6.2.2 For graduate students with Bachelor's degree:

- 1) Applicants must hold a Bachelor of Science degree or related fields, or hold a M.D., D.V.M., or D.D.S. from institutions accredited by the Office of the Higher Education Commission.
- 2) Applicants must get a cumulative grade point average of not less than 3.50.
- 3) Applicants must have English language examination results passed the criteria of the Faculty of Graduate Studies, Mahidol University.
- 4) Those with qualifications other than the above criteria may be considered to apply for admission at the discretion of the Program Director and the Dean of the Faculty of Graduate Studies.

7. Selection Methods

Applicants are selected based on their academic performance and research experience, and interview according to the regulations of the Faculty of Graduate Studies, Mahidol University. Foreign applicants may be interviewed by phone and must provide proof of financial support during the study period to be considered for enrollment. The final decision will be made under the consideration of the Program Committee with the approval of the Dean of the Faculty of Graduate Studies, Mahidol University.

8. Language

English is used in teaching as well as in all evaluation processes.

9. Program Structure

9.1 The number of credits to be studied throughout the program

9.1.1 Plan 1

- For students with a master's degree: not less than 48 credits

9.1.2 Plan 2

9.3 Course Requirements

9.3.1 Required Course

		Credits (lecture-lab-self study)
For students with a Master's degree in Anatomy and Structural Biology or Anatomy:		
SCAN 606	Advanced Topics in Cellular and Structural Biology	1(1-0-2)
SCAN 615	Advanced Topics in Neuroscience	1(1-0-2)
SCAN 617	Seminar in Frontier Research of Anatomy and Structural Biology I	1(1-0-2)
SCAN 618	Seminar in Frontier Research of Anatomy and Structural Biology II	1(1-0-2)
SCAN 619	Seminar in Frontier Research of Anatomy and Structural Biology III	1(1-0-2)
SCID 502	Cell Science	2(2-0-4)
For students with a Master's degree in other fields:		
SCAN 502	Structural Neurobiology	3(2-3-5)
SCAN 522	Structural Biology of Cell and Tissue	3(2-3-5)
SCAN 606	Advanced Topics in Cellular and Structural Biology	1(1-0-2)
SCAN 617	Seminar in Frontier Research of Anatomy and Structural Biology I	1(1-0-2)
SCAN 615	Advanced Topics in Neuroscience	1(1-0-2)
SCAN 618	Seminar in Frontier Research of Anatomy and Structural Biology II	1(1-0-2)
SCAN 619	Seminar in Frontier Research of Anatomy and Structural Biology III	1(1-0-2)
For students with a Bachelor's degree:		
SCAN 502	Structural Neurobiology	3(2-3-5)
SCAN 521	Human Gross Anatomy Dissection	2(0-4-2)
SCAN 522	Structural Biology of Cell and Tissue	3(2-3-5)
SCAN 523	Structure and Development of Human Body	3(3-0-6)
SCAN 606	Advanced Topics in Cellular and Structural Biology	1(1-0-2)
SCAN 617	Seminar in Frontier Research of Anatomy and Structural Biology I	1(1-0-2)
SCAN 615	Advanced Topics in Neuroscience	1(1-0-2)
SCAN 618	Seminar in Frontier Research of Anatomy and Structural Biology II	1(1-0-2)
SCAN 619	Seminar in Frontier Research of Anatomy and Structural Biology III	1(1-0-2)
SCID 502	Cell Science	2(2-0-4)
SCID 514	Animal Experimentation in Biomedical Research	1(0-2-1)
SCID 518	Generic Skills in Science Research	1(0-2-1)
For students with M.D., D.V.M., or D.D.S.:		
SCAN 605	Advanced Topics in Cellular and Structural Biology	1(1-0-2)
SCAN 617	Seminar in Frontier Research of Anatomy and Structural Biology I	1(1-0-2)
SCAN 615	Advanced Topics in Neuroscience	1(1-0-2)
SCAN 618	Seminar in Frontier Research of Anatomy and Structural Biology II	1(1-0-2)
SCAN 619	Seminar in Frontier Research of Anatomy and Structural Biology III	1(1-0-2)
SCID 502	Cell Science	2(2-0-4)
SCID 503	Systemic Bioscience	3(3-0-6)
SCID 514	Animal Experimentation in Biomedical Research	1(0-2-1)
SCID 518	Generic Skills in Science Research	1(0-2-1)

9.3.2 Elective Courses

		Credits (lecture-lab-self study)
SCAN 607	Advanced Microscopy and Structural Biology	2(1-2-3)
SCAN 620	Selected Topics in Cellular Neuroscience	1(1-0-2)
SCAN 621	Essential Topics in Integrative Developmental Biology	1(1-0-2)
SCAN 622	Human Embryonic Development	2(2-0-4)

		Credits (lecture-lab-self study)
SCAN 623	Selected Topics in Medical and Developmental Genetics	1(1-0-2)
SCID 506	Concepts of Molecular Bioscience	2(2-0-4)
SCID 507	Microscopic Technique	1(0-2-1)
SCID 508	Biomolecular and Spectroscopic Techniques	1(0-2-1)
SCID 509	Separation Techniques	1(0-2-1)
SCID 510	Immunological Methods	1(0-2-1)
SCID 511	Gene Technology	1(0-2-1)
SCID 513	Animal Cell Culture Techniques	1(0-2-1)
SCID 516	Biostatistics	3(3-0-6)
SCID 531	Microcomputer Applications	3(3-0-6)
SCID 532	Computer Programming	3(3-0-6)
SCID 533	Word Processing and Presentation Applications for Research	1(0-2-1)
SCID 534	Spreadsheet Application for Research	1(0-2-1)
SCID 535	Database Management for Research	1(0-2-1)
SCBC 610	Modern metabolism	2(2-0-4)
SCBC 611	Current Protocols in Biomolecular Research	1(1-0-2)
SCBT 502	Recombinant DNA Technology	3(2-3-5)

Note: Students can enroll in other courses offered by graduate programs of Mahidol University with approval from the program director and their major advisors.

9.3.3 Dissertation

		Credits (lecture-lab-self study)
Plan 1		
- For students with a Master's degree		
SCAN 898	Dissertation	48 (0-144-0)
Plan 2		
- For students with a Master's degree in Anatomy and Structural Biology or Anatomy		
SCAN 699	Dissertation	36 (0-108-0)
- For students with a Master's degree in other fields		
SCAN 699	Dissertation	36 (0-108-0)
- For students with a Bachelor's degree		
SCAN 799	Dissertation	48 (0-144-0)
- For students with M.D., D.V.M., or D.D.S.		
SCAN 799	Dissertation	48 (0-144-0)

9.3.4 Research Projects of the Program

(1) Cellular and molecular biology research related to:

1. Shrimp biotechnology
2. Molecular mechanisms of the adaptation of aquatic animals and excretory systems
3. Molecular interactions and related receptors on the cell surface
4. Interactions between virus and host cells in shrimp
5. Molecular studies in dengue-2 virus
6. Study of pathogenesis using a *C. elegans* cell model
7. Mechanism of organ injury using genetically modified mice

(2) Neuroscience research related to:

1. Mechanism of neurodegeneration at the cellular and molecular levels
2. Prevention of death of neurons in the model of Parkinson's disease
3. Neurotoxicology
4. Neurohormonal regulation of growth and reproduction in shrimp and shellfish
5. Gene expression related to neurological disorders

(3) Stem cells and embryo technology in mammals research related to:

1. Study of embryonic stem cell changes
2. Study of germ cells and embryo technology in animals
3. Application of stem cells in cell therapy
4. Tissue engineering studies and neuron transplantation in hearing research

(4) Reproductive biology and endocrinology in economic animals related to

1. Endocrine stimulation of the reproductive process in abalone and shrimp
2. Characteristics and distribution of neuropeptides in abalone and shrimp
3. Mechanism of germ cell growth
4. Reproductive biology in shrimp
5. Modification of genes in aquatic animals to accelerate reproduction

(5) Cancer research related to:

1. Cancer cell metastasis
2. Medicinal herb properties for anti-viral and anti-cancer effects

9.3.5 Definition of Course Codes

The 4-digit character has the following meaning:

The first 2 digits are the abbreviations for the faculty responsible for teaching and learning.

SC refers the Faculty of Science

The next 2-digit letter is the abbreviation of the department responsible for teaching and learning.

AN refers Department of Anatomy

BT refers the Department of Biotechnology

BC refers to the Department of Biochemistry

ID refers to the inter-departmental courses

The 3 numbers, 5xx, 6xx, 7xx and 8xx represents graduate course levels.

9.4 Study Plan

9.4.1 Plan 1 For graduate students with a Master's degree

Year	Semester 1	Semester 2
1	Preparation for Qualifying exam and Proposal presentation SCAN 898 Dissertation 8(0-32-0) Total 8 Credits	SCAN 898 Dissertation 8(0-32-0) Total 8 Credits
2	SCAN 898 Dissertation 8(0-32-0) Total 8 Credits	SCAN 898 Dissertation 8(0-32-0) Total 8 Credits
3	SCAN 898 Dissertation 8(0-32-0) Total 8 Credits	SCAN 898 Dissertation 8(0-32-0) Total 8 Credits

9.4.2 Plan 2

9.4.2.1 For graduate students with a Master's degree in Anatomy and Structural Biology or Anatomy

Year	Semester 1	Semester 2
1	SCID 502 Cell Science 2(2-0-4) SCAN 617 Seminar in Frontier Research of Anatomy and Structural Biology I 1(1-0-2) Electives 2 Credits Total 5 Credits	SCAN 606 Advanced Topics in Cellular and Structural Biology 1(1-0-2) SCAN 615 Advanced Topics in Neuroscience 1(1-0-2) SCAN 618 Seminar in Frontier Research of Anatomy and Structural Biology II 1(1-0-2) Electives 3 Credits Total 6 Credits
2	SCAN 619 Seminar in Frontier Research of Anatomy and Structural Biology III 1(1-0-2) Preparation for Qualifying exam and Proposal presentation SCAN 699 Dissertation 9(0-36-0) Total 10 Credits	SCAN 699 Dissertation 9(0-36-0) Total 9 Credits
3	SCAN 699 Dissertation 9(0-36-0) Total 9 Credits	SCAN 699 Dissertation 9(0-36-0) Total 9 Credits

9.4.2.2 For graduate students with a Master's degree in other fields

Year	Semester 1	Semester 2
1	SCAN 617 Seminar in Frontier Research of Anatomy and Structural Biology I 1(1-0-2) Electives 5 Credits Total 6 Credits	SCAN 502 Structural Neurobiology 3(2-3-5) SCAN 522 Structural Biology of Cell and Tissue 3(2-3-5) SCAN 606 Advanced Topics in Cellular and Structural Biology 1(1-0-2) SCAN 618 Seminar in Frontier Research of Anatomy and Structural Biology II 1(1-0-2) Total 10 Credits
2	SCAN 615 Advanced Topics in Neuroscience 1(1-0-2)	SCAN 699 Dissertation 9(0-36-0)

	SCAN 619 Seminar in Frontier Research of Anatomy and Structural Biology III 1(1-0-2) Preparation for Qualifying exam and Proposal presentation SCAN 699 Dissertation 9(0-36-0) Total 11 Credits				Total 9 Credits
3	SCAN 699 Dissertation 9(0-36-0) Total 9 Credits	SCAN 699 Dissertation 9(0-36-0) Total 9 Credits			

9.4.2.3 For students with a Bachelor's degree

Year	Semester 1	Semester 2			
1	SCID 502 Cell Science 2(2-0-4) SCID 518 Generic Skills in Science Research 1(1-0-2) SCAN 523 Structure and Development of Human Body 3(3-0-6) SCAN 521 Human Gross Anatomy Dissection 2(0-4-3) Electives 3 Credits Total 11 Credits	SCAN 502 Structural Neurobiology 3(2-3-5) SCAN 522 Structural Biology of Cell and Tissue 3(2-3-5) SCAN 606 Advanced Topics in Cellular and Structural Biology 1(1-0-2) SCID 514 Animal Experimentation in Biomedical Research 1(0-2-1) Electives 2 Credits Total 10 Credits			
2	SCAN 617 Seminar in Frontier Research of Anatomy and Structural Biology I 1(1-0-2) SCAN 615 Advanced Topics in Neuroscience 1(1-0-2) Preparation for Qualifying exam and Proposal presentation SCAN 799 Dissertation 8(0-32-0) Total 10 Credits	SCAN 618 Seminar in Frontier Research of Anatomy and Structural Biology II 1(1-0-2) SCAN 799 Dissertation 8(0-32-0) Total 9 Credits			
3	SCAN 619 Seminar in Frontier Research of Anatomy and Structural Biology III 1(1-0-2) SCAN 799 Dissertation 8(0-32-0) Total 9 Credits	SCAN 799 Dissertation 8(0-32-0) Total 8 Credits			
4	SCAN 799 Dissertation 8(0-32-0) Total 8 Credits	SCAN 799 Dissertation 8(0-32-0) Total 8 Credits			

9.4.2.4 For students with M.D., D.V.M., or D.D.S.

Year	Semester 1	Semester 2			
1	SCID 502 Cell Science 2(2-0-4) SCID 503 Systemic Bioscience 3(3-0-6) SCID 518 Generic Skills in Science Research 1(1-0-2) Electives 4 Credits Total 10 Credits	SCAN 606 Advanced Topics in Cellular and Structural Biology 1(1-0-2) SCID 514 Animal Experimentation in Biomedical Research 1(0-2-1) Electives 6 Credits Total 8 Credits			
2	SCAN 617 Seminar in Frontier Research of Anatomy and Structural Biology I 1(1-0-2) SCAN 615 Advanced Topics in Neuroscience 1(1-0-2) Electives 2 Credits	SCAN 618 Seminar in Frontier Research of Anatomy and Structural Biology II 1(1-0-2) SCAN 799 Dissertation 8(0-32-0)			

	Preparation for Qualifying exam and Proposal presentation SCAN 799 Dissertation 8(0-32-0) Total 12 Credits		Total 9 Credits
3	SCAN 619 Seminar in Frontier Research of Anatomy and Structural Biology III 1(1-0-2) SCAN 799 Dissertation 8(0-32-0) Total 9 Credits	SCAN 799 Dissertation 8(0-32-0)	Total 8 Credits
4	SCAN 799 Dissertation 8(0-32-0) Total 8 Credits	SCAN 799 Dissertation 8(0-32-0)	Total 8 Credits

10. Dissertation requirements

Research topics for dissertation must be related to anatomy and structural biology, to create new knowledge and in-depth. Dissertation work must be published in journals.

10.1 Evaluation process

10.1.1 Plan 1

1) Students must pass the qualification examination with the approval of the Program Committee, and then present the dissertation proposal.

2) During the dissertation process, there is an evaluation of the progress twice a year.

3) After completing the thesis, students submit a request for dissertation defence.

The defence committee shall consist of not less than 5 persons, with one external expert acting as the chairman.

4) Research thesis must be published at least 2 papers in international academic journals.

10.1.2 Plan 2

1) Students pass the exam in all courses required in the Program.

2) Students must pass the qualification examination with the approval of the Program Committee, and then present the dissertation proposal.

3) During the dissertation process, there is an evaluation of the progress twice a year.

4) After completing the thesis, students submit a request for dissertation defence.

The defence committee shall consist of not less than 5 persons, with one external expert acting as the chairman.

5) Research thesis must be published at least one paper in international academic journals.

11. Graduation criteria

11.1 Plan 1

- 1) The duration of the study is in accordance with the study plan.
- 2) Must complete the thesis according to the number of credits required.
- 3) Must pass the English language examination according to the criteria of the Faculty of Graduate Studies, Mahidol University
- 4) Must pass the Qualifying Examination
- 5) Must participate in soft skill activities according to the criteria of the Faculty of Graduate Studies, Mahidol University
- 6) Must submit a dissertation, and conduct a final oral examination, which is open for interested parties to listen.
- 7) Must have at least 2 research papers published in peer-reviewed international journals, with the student's name as the first author.

11.2 Plan 2

- 1) The duration of the study is in accordance with the study plan.
- 2) Must study the course and complete the thesis according to the number of credits required
- 3) Must have a grade point average of at least 3.00
- 4) Must pass the English language examination according to the criteria of the Faculty of Graduate Studies, Mahidol University
- 5) Must pass the Qualifying Examination
- 6) Must participate in soft skill activities according to the criteria of the Faculty of Graduate Studies, Mahidol University
- 7) Must submit a dissertation, and conduct a final oral examination, which is open for interested parties to listen.
- 8) Must have at least one research paper published in peer-reviewed international journals, with the student's name as the first author.

12. Appeal Procedure

Students can appeal directly to the Dean of the Faculty of Graduate Studies, either in the form of self-contact or as a document.

13. Teaching and learning activities

Teaching and learning activities are organized by linking and integrating knowledge using various teaching materials and educational technology. Teaching methods include:

- (1) Lecture
- (2) Laboratory practice
- (3) Self-study
- (4) Group seminars and academic seminars

14. Learning Resources

14.1 The Faculty of Science has a library, a computer room and electronic database in the field of the Program. There is computer network system that can be accessed locally or remotely.

14.2 The department has enough laboratory space in addition to the central facilities provided by the Faculty of Science.

14.3 There are classrooms, teaching media, educational materials, with audio-visual equipment that are sufficient for teaching such as multimedia projectors, computers, WI-FI high speed internet, etc.

14.4 Environment and atmosphere are conducive to effective learning.

15. Job opportunity

- Academic staff in anatomy and structural biology in educational institutions
- Researchers in medical science and related science in public and private academic institutions, including international organizations
- Local or international consultants in anatomy and structural biology