

Course Specification

Name of Institution Mahidol University
Campus/Faculty/Department Faculty of Veterinary Science

Section 1 General Information**1. Course Code and Title**

VSPA 748 Applied Biochemistry for Veterinary Biomedical Science

สปปส ๗๔๘ ชีวเคมีประยุกต์สำหรับชีวเวชศาสตร์ทางการสัตวแพทย์

2. Number of Credits

3 (2-1-4) Credits (lecture – laboratory – self-study)

3. Curriculum and Course Type

Program of Study Master of Science Program in Veterinary Biomedical Sciences

Course Type Core Required Electives

4. Faculty Member in Charge of this Course and Advisor of Internship**4.1 Faculty Member in Charge of this Course**

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4.2 Lecturers

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12. Nattarun Chaisilp (NC)

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5. Semester/The training experience required in the curriculum

Semester 1 / Class Level or year 1

6. Pre-requisite

None

7. Co-requisite

None

8. Venue of Study

Faculty of Veterinary Science, Mahidol University

9. Date of Latest Revision

30th July 2023

Section 2 Goals and Objectives

1. Course Goals

The Course of Applied Biochemistry for Veterinary Biomedical Science aims to achieve the following goals:

1. Advanced knowledge in Biochemistry: The course intends to provide students with in-depth knowledge of Biochemistry as it applies to veterinary biomedical science. This includes understanding the structure and function of biomolecules, production techniques, characterization methods, and analysis.
2. Wide range of applications: The course covers various applications of Biochemistry, ranging from health sciences to industry and analytical methods. Students will gain an understanding of how Biochemistry is utilized in different fields and industries.
3. Stay updated with scientific advancements: The course ensures that students remain up-to-date with the latest scientific advancements in Biochemistry. This includes learning about molecular regulation of cells,

genetic manipulation, biomarker discovery, and characterization. Students will be equipped with knowledge of cutting-edge techniques and developments in the field.

4. Specialization options: The course offers specialization areas to allow students to focus on a specific aspect of Biochemistry. By choosing a specialization in Analytical and Molecular Biochemistry, Biomedicine, or Biotechnology, students can tailor their education to their individual interests and career goals.
5. Job market readiness and further studies: The course aims to prepare students for the job market by providing them with advanced knowledge and specialized skills in Biochemistry. Additionally, the course serves as a foundation for students who wish to pursue further studies, such as Ph.D. programs, in the field of Biochemistry.

Overall, the Course of Applied Biochemistry for Veterinary Biomedical Science aims to equip students with a comprehensive understanding of Biochemistry and its diverse applications. By offering specialization options, the course allows students to develop expertise in specific areas, enhancing their readiness for their chosen career paths.

2. Objectives of Course Development/Revision Field Experience Course

The Course of Applied Biochemistry for Veterinary Biomedical Science is designed to educate professionals who possess advanced knowledge in the field of Biochemistry as it applies to veterinary biomedical science. The course covers a wide range of applications of Biochemistry, including health sciences, industry, and analytical methods. It aims to provide students with a strong foundation in key areas of Biochemistry, such as biomolecule structure and function, production techniques, characterization methods, and analysis. Moreover, the course ensures that students stay up-to-date with the latest scientific advancements, including molecular regulation of cells, genetic manipulation, biomarker discovery, and characterization.

By offering specialization options, the course allows students to focus on a particular area of Biochemistry, enhancing their readiness for the job market or further studies in PhD programs. The specialization areas include:

Analytical and molecular biochemistry: This specialization delves into the methods and techniques used for analyzing and studying biomolecules at the molecular level. It emphasizes the application of analytical tools and molecular approaches to Biochemistry.

Biomedicine: This specialization focuses on the application of Biochemistry principles to the field of biomedicine. Students gain knowledge about the biochemical basis of diseases, therapeutic interventions, and medical advancements.

Biotechnology: This specialization concentrates on the intersection of Biochemistry and biotechnology. Students learn about genetic engineering, manipulation of biomolecules for industrial purposes, and the development of biotechnological products.

Overall, the Course of Applied Biochemistry for Veterinary Biomedical Science equips students with a comprehensive understanding of Biochemistry and its diverse applications. Through specialization options, students can tailor their education to their specific interests and career goals.

3. Course-level Learning Outcomes: CLOs

This course aims to provide knowledge and abilities as follows:

1. Describe the structure and function of biomolecules and their relevance in veterinary medicine.
2. Explain the various production techniques and characterization methods used in Biochemistry.
3. Apply Biochemistry principles and techniques to solve problems and address challenges encountered in veterinary biomedical science.
4. Apply analytical tools and molecular approaches to analyze and study biomolecules at the molecular level.
5. Identify and explain the diverse applications of Biochemistry in veterinary biomedical science, including its relevance in health sciences, industry, and analytical methods.
6. Evaluate and critically analyze scientific literature and research findings related to Biochemistry in veterinary biomedical science.

Section 3 Course Management

1. Course Description

(Thai)	สปส ๗๔๘	ชีวเคมีประยุกต์สำหรับชีวเวชศาสตร์ทางการสัตวแพทย์
(English)	VSPA 748	Applied Biochemistry for Veterinary Biomedical Science

2. Credit Hours per Semester

Lecture	2	Hour
Laboratory/Field Trip/Internship	0	Hour
Laboratory	3	Hour
Self Study	4	Hour

3. Number of hours that lecturers provide counseling and guidance to individual student

Lecture	2	Hour
Laboratory/Field Trip/Internship	-	Hour
Laboratory	3	Hour
Self Study	4	Hour

Section 4 Development of Students' Learning Outcome

1. A brief summary of the knowledge or skills expected to develop in students; the course-level expected learning outcomes (CLOs) On completion of the course, students will be able to:

1. CLO1 Describe the structure and function of biomolecules and their relevance in veterinary medicine.
2. CLO2 Explain the various production techniques and characterization methods used in Biochemistry.
3. CLO3 Apply Biochemistry principles and techniques to solve problems and address challenges encountered in veterinary biomedical science.
4. CLO4 Apply analytical tools and molecular approaches to analyze and study biomolecules at the molecular level.

5. CLO5 Identify and explain the diverse applications of Biochemistry in veterinary biomedical science, including its relevance in health sciences, industry, and analytical methods.
6. CLO6 Evaluate and critically analyze scientific literature and research findings related to Biochemistry in veterinary biomedical science.

2. How to organize learning experiences to develop the knowledge or skills stated in number 1 and how to measure the learning outcomes

CLOs	Teaching and learning experience management		Learning outcomes measurements		
	Lecture	group work	MCQ and short answer	Group reports	Group presentation
CLO1	X	X	X	X	X
CLO2	X	X	X	X	X
CLO3	X	X	X	X	X
CLO4	X	X	X	X	X
CLO5	X	X	X	X	X
CLO6	X	X	X	X	X

Section 5 Teaching and Evaluation Plans

1. Teaching Plan

Week or No.	Topic	Hours			Teaching Methods / Media	CLOs	Lecturers
		Lecture	Laboratory	Self Study			
1	Biomolecular extraction and purification-1 <ul style="list-style-type: none"> RNA extraction 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	SB, BC
2	Biomolecular extraction and purification-2	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	SB, BC, SP
3	Gene and recombinant protein expression-1 <ul style="list-style-type: none"> Depletion of plasma albumin for proteomic analysis 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	BC, SB, SP
4	Gene and recombinant protein expression-2	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	BC, SB
5	Gene and recombinant protein expression-3	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	CJ, BC, SB
6	Biomolecular characterization-1	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	SB, BC
7	Biomolecular characterization-2 <ul style="list-style-type: none"> DNA electrophoresis 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	SB, BC
8	Biomolecular characterization-3 <ul style="list-style-type: none"> Protein analysis by Western blot 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	SP
9	Biochemical functions of micro and macronutrient-1	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	BC, SB
10	Biochemical functions of micro and macronutrient-2	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	BC, SB

11	Biochemical functions of micro and macronutrient-3 <ul style="list-style-type: none"> Determination of nutrient on ATP levels 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	BC, SB, SP
12	Applied biochemistry in veterinary diagnostics-1 <ul style="list-style-type: none"> Laboratory practices/demonstration 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	RS, SB, BC, NC
13	Applied biochemistry in veterinary diagnostics-2 <ul style="list-style-type: none"> Laboratory practices/demonstration 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	LS
14	Applied biochemistry in veterinary diagnostics-3 <ul style="list-style-type: none"> Laboratory practices/demonstration 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	PP, KP
15	Applied biochemistry in veterinary diagnostics-4 <ul style="list-style-type: none"> Laboratory practices/demonstration 	2	3	4	<ul style="list-style-type: none"> Discussion Assignment Practice 	1, 2, 3, 4, 5, 6	MT, WP, SC

2. Evaluation Plan

Learning Outcomes	Evaluation Method				Weight (Percentage)
	Presentation	Answering and discussion	Class attention	MCQ and short answer	
CLO1 Describe the structure and function of biomolecules and their relevance in veterinary medicine.	10	5	2.5	5	22.5
CLO2 Explain the various production techniques and characterization methods used in Biochemistry.	10	5	2.5	5	22.5
CLO3 Apply Biochemistry principles and techniques to solve problems and address challenges encountered in veterinary biomedical science.	10	5	2.5	5	22.5
CLO4 Apply analytical tools and molecular approaches to analyze and study biomolecules at the molecular level.	5	-	2.5	5	12.5
CLO5 Identify and explain the diverse applications of Biochemistry in veterinary biomedical science, including its relevance in health sciences, industry, and analytical methods.	5	-	2.5	5	12.5
CLO6 Evaluate and critically analyze scientific literature and research findings related to Biochemistry in veterinary biomedical science.	5	-	2.5	-	7.5
Total	45	15	15	25	100

Note*

1. Show the methods/tools and weight for measuring and evaluating each CLO.
2. Total the weight from every tool and CLO to 100

3. Verify the information to be consistent with the evaluation methods shown in Section 4 Table.

3. Measurement and evaluation

The assessment is performed during the course to measure the progress and development of students' learning by observing the behavior change and improvement of students' behavior and performance. The assessment results will be notified to the students (feedback) so that the students are constantly able to improve themselves. The assessment results are not included with the test scores at the end of the course.

4. Students' Appeal

Should the students have any suspicion or appeals to the teaching and learning activities and the grade assessment, students could make the appeal by filling in the form at MUVS' Academic Affairs. The appeal will be proposed to the course coordinator to consider the request. If the appeal could not be addressed at this point, it will be further process by the program's Teaching and Learning Development Committee. In case that the committee suggested further investigation should be done, the appeal will be purposed to the faculty's appealing committee to address the issue.

Section 6 Teaching Materials and Resources

1. Textbooks and Main Documents

- Tan, Siun Chee, and Beow Chin Yiap. "DNA, RNA, and protein extraction: the past and the present." *BioMed Research International* 2009 (2009).
- Celie PH, Parret AH, Perrakis A. Recombinant cloning strategies for protein expression. *Curr Opin Struct Biol.* 2016 Jun;38:145-54. doi: 10.1016/j.sbi.2016.06.010.
- Chen G, Pramanik BN. LC-MS for protein characterization: current capabilities and future trends. *Expert Rev Proteomics.* 2008 Jun;5(3):435-44. doi: 10.1586/14789450.5.3.435.

2. Documents and Important Information

- Kurien, B.T., Aggarwal, R., Scofield, R.H. (2019). Protein Extraction from Gels: A Brief Review. In: Kurien, B., Scofield, R. (eds) *Electrophoretic Separation of Proteins. Methods in Molecular Biology*, vol 1855. Humana Press, New York, NY. https://doi.org/10.1007/978-1-4939-8793-1_40
- Pillai-Kastoori, Lakshmi, Amy R. Schutz-Geschwender, and Jeff A. Harford. "A systematic approach to quantitative Western blot analysis." *Analytical biochemistry* 593 (2020): 113608.
- Mullegama SV, Alberti MO, Au C, Li Y, Toy T, Tomasian V, Xian RR. Nucleic Acid Extraction from Human Biological Samples. *Methods Mol Biol.* 2019;1897:359-383. doi: 10.1007/978-1-4939-8935-5_30.
- Pagani S, Maglio M, Sicuro L, Fini M, Giavaresi G, Brogini S. RNA Extraction from Cartilage: Issues, Methods, Tips. *Int J Mol Sci.* 2023 Jan 20;24(3):2120. doi: 10.3390/ijms24032120.
- Rathore D, Faustino A, Schiel J, Pang E, Boyne M, Rogstad S. The role of mass spectrometry in the characterization of biologic protein products. *Expert Rev Proteomics.* 2018 May;15(5):431-449. doi: 10.1080/14789450.2018.1469982
- Chalikonda G, Merchant N, Lakkakula BVKS, Nagaraju GP. DNA Fingerprint Technology: Its Application in Detecting Pancreatic Cancer. *Crit Rev Oncog.* 2019;24(2):133-137. doi: 10.1615/CritRevOncog.2019031603.

3. Documents and Recommended Information

- Carregari VC. Protein Extraction and Sample Preparation Methods for Shotgun Proteomics with Central Nervous System Cells and Brain Tissue. *Adv Exp Med Biol.* 2022;1382:1-15. doi: 10.1007/978-3-031-05460-0_1. PMID: 36029400.
- Wiseman DN, Otchere A, Patel JH, Uddin R, Pollock NL, Routledge SJ, Rothnie AJ, Slack C, Poyner DR, Bill RM, Goddard AD. Expression and purification of recombinant G protein-coupled receptors: A review. *Protein Expr Purif.* 2020 Mar;167:105524. doi: 10.1016/j.pep.2019.105524.
- Noor Z, Ahn SB, Baker MS, Ranganathan S, Mohamedali A. Mass spectrometry-based protein identification in proteomics-a review. *Brief Bioinform.* 2021 Mar 22;22(2):1620-1638. doi: 10.1093/bib/bbz163.

Section 7 Evaluation and Improvement of Course Management

1. Strategies for Evaluation of Course Effectiveness by Students

At the end of each course, it is required for the students to assess the teaching of each instructor based on the following criteria: punctuality, good role model, application of morals and ethics for the instruction, ability to convey knowledge and encourage students to learn, giving opportunities for students to ask questions and to comment during the study.

The overall outcomes of each course will also be assessed by the students for the following issues: the instructor's knowledge and competency, the course's effectiveness, student's satisfaction with the study, and other comments from students. The evaluation is conducted through online platform.

2. Strategies for Evaluation of Teaching Methods

The instructors or the course coordinators are assigned to conduct the evaluation as follows.

2.1 the students' evaluation for the instruction and overall outcomes of the course in accordance to criteria mentioned in No. 1 – Strategy for Course Effectiveness by Students.

2.2 The instructors must perform self-assessment for the following criteria.

- (1) Appropriate time spent to prepare for the teaching.
- (2) The instructor's satisfaction with the teaching results.
- (3) Solutions or recommendations for the program's teaching improvement or self-improvement for the next class/academic year.

3. Improvement of Teaching Methods

Prior to each academic year, there are meetings/seminars for the instructors of each course to plan to improve the course's teaching and learning management based on the following information.

- (1) the students' academic performance
- (2) the students' evaluation results
- (3) the instructors' assessment results

4. Verification of Students' Learning Outcome

The verification of the standard of the Learning Outcome for the Course is conducted by the course coordinators based on the following aspects.

- (1) The goals of the learning outcomes are clear and feasible.
- (2) The learning experience is aligned with the expected goals.
- (3) The learning experience encourages the students to research and practice self-learning skills.
- (4) The evaluation methods are appropriate to assess the expected goals and learning experience.
- (5) The program applied the educational theory and the results from the previous evaluation to plan for improvement.

At the end of each academic year, the course coordinators, instructors, the Program Committee, and the Teaching and Learning Development Committee will consider the assessment results and the Learning Outcome for the Course to plan for the improvement of the next academic year.

5. Review and Plan to Improve Course Effectiveness

After the course evaluation and verification, the course effectiveness will be improved through the following:

- (1) The course is revised every 3 years according to the evaluation and verification.
- (2) Rotation or changing of instructors so students get different research points of view.

Appendix

Relations between the course and the program

Table 1 Relations between the course and the PLOs

	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
VSPA 748 Applied Biochemistry for Veterinary Biomedical Science 3 (2-1-4)	-	P	P	-	P	-

Program Learning Outcomes (TQF.2)

PLO 1 Manage ethical and moral problems in field practice with evidence-base approaches and leadership together with appropriate logic and value.

PLO 2 Prioritize scientific information in biomedical veterinary science and apply the beneficial output to develop laboratory practice and research study.

PLO 3 Integrate the theory and experiences together with scientific evidences to develop the new knowledge in veterinary science through research study.

PLO 4 Communicate efficiently with multidisciplinary academic colleagues and staff by using the communicate appropriately with the individual groups, both in academic and professional

PLO 5 Utilize digital and information technology (IT) to encourage working network communication, data analysis together with presentation and research publication.

PLO 6 Evaluate principles, purposes, strong critical-thinking with problem-solving skills, to utilizing veterinary science literacy as integral part of the thought process.

Table 2 Relations between CLOs and PLOs

CLOs	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1 Describe the structure and function of biomolecules and their relevance in veterinary medicine.		P	R		P	
CLO2 Explain the various production techniques and characterization methods used in Biochemistry.		P	R		P	
CLO3 Apply Biochemistry principles and techniques to solve problems and address challenges encountered in veterinary biomedical science.		R	R		P	
CLO4 Apply analytical tools and molecular approaches to analyze and study biomolecules at the molecular level.		R	R		P	
CLO5 Identify and explain the diverse applications of Biochemistry in veterinary biomedical science, including its relevance in health sciences, industry, and analytical methods.		P	P		P	
CLO6 Evaluate and critically analyze scientific literature and research findings related to Biochemistry in veterinary biomedical science.		M	M		P	

Course schedule

Week or No.	Date	Topic	Hours			Teaching Methods / Media	Lecturers
			Lecture	Laboratory	Self Study		
1	9/1/2024 (10.00-12.00) (13.00-16.00)	Lecture: Biomolecular extraction and purification-1 (RNA) Lab: RNA extraction (6 th floor)	2	3	4		SB, BC
2	16/1/2024 (13.00-16.00)	Lecture: Biomolecular extraction and purification-2 (DNA)	2	3	4		SB, BC
3	23/1/2024 (10.00-12.00) (13.00-16.00)	Lecture: Gene and recombinant protein expression-1 Lab: Depletion of plasma albumin for proteomic analysis (6 th floor)	2	3	4		BC, SB, SP
4	30/1/2024 (13.00-16.00)	Lecture: Gene and recombinant protein expression-2	2	3	4		BC, SB
5	6/2/2024 (10.00-12.00) (13.00-16.00)	Lecture: Gene and recombinant protein expression-3	2	3	4		CJ
6	13/2/2024 (10.00-12.00)	Lecture: Biomolecular characterization-1	2	3	4		SB, BC
7	20/2/2024 (10.00-12.00) (13.00-16.00)	Lecture: Biomolecular characterization-2 Lab: DNA electrophoresis (6 th floor)	2	3	4		SB, BC, SP
8	27/2/2024 (10.00-12.00) (13.00-16.00)	Lecture: Biomolecular characterization-3 Lab: Protein analysis by Western blot (9 th floor)	2	3	4		SP
9	5/3/2024 (10.00-12.00) (13.00-16.00)	Lecture: Biochemical functions of micro and macronutrient-1	2	3	4		BC, SB
10	12/3/2024 (13.00-16.00)	Lecture: Biochemical functions of micro and macronutrient-2	2	3	4		BC, SB
11	19/3/2024 (10.00-12.00) (13.00-16.00)	Lecture: Biochemical functions of micro and macronutrient-3 Lab: Determination of nutrient on ATP levels (9 th floor)	2	3	4		BC, SB, SP
12	26/3/2024 (10.00-12.00) (13.00-16.00)	Lecture: Applied biochemistry in veterinary diagnostics-1 Laboratory practices/demonstration (9 th floor)	2	3	4		RS, SB, BC, NC

13	2/4/2024 (10.00-12.00) (13.00-16.00)	Lecture: Applied biochemistry in veterinary diagnostics-2 Laboratory practices/demonstration (9 th floor)	2	3	4		LS
14	9/4/2024 (10.00-12.00) (13.00-16.00)	Lecture: Applied biochemistry in veterinary diagnostics-3 Laboratory practices/demonstration (9 th floor)	2	3	4		PP, KP
15	23/4/2024 (10.00-12.00) (13.00-16.00)	Lecture: Applied biochemistry in veterinary diagnostics-4 Laboratory practices/demonstration (9 th floor)	2	3	4		MT, WP, SC
		รวม	30	45	60		

Venue

1. Lecture: Library 3rd floor, seminar room no.1
2. Practice: Laboratory room 6 and 9th floor