



## COURSE SYLLABUS

<b>Course</b>	<b>Exercise Physiology</b>		
<b>Code</b>	SCPS 362	<b>Credit</b>	2 (1-2-3)
<b>Prerequisite</b>	-		
<b>Academic year</b>	2024	<b>Semester</b>	2 <sup>nd</sup>
<b>Course Organizer</b>	Metaneeya Pилanthananond		
<b>Room</b>	B501/1, Department of Physiology, Faculty of Science, Mahidol University		
<b>Phone</b>	02-201-5517	<b>Email:</b>	metaneeya.pil@mahidol.ac.th

### Course Description

Effects of different modes of exercise and training conditions on muscular and cardiopulmonary responses and adaptations, metabolism, and energy transfer. Nutrition requirements in different types of exercise and trainings as well as in weight control. Influence of genetics on exercise and sport performance. Roles of different types of exercises in disease preventions and rehabilitations.

### Course Objectives

After completing this course, students should be able to

1. Explain how muscular and cardiopulmonary response and adapt to different types of exercise and training
2. Explain the impact of genetics on exercise and sport performances
3. Explain changes in body metabolism during exercise
4. Explain how different types of exercises benefit disease preventions and rehabilitations

### Course Organization

The course is comprised of two units as presented in the attached schedule. The first unit covers introduction of exercise physiology and career paths (L1) following by nutrition and body metabolism (L2-3 and 1 Lab) and responses of muscular and cardiopulmonary systems to exercises (L4-5 and 2 Labs). The second unit covers influences of genetics and environmental stresses on exercise and sport performances (L6-7 and 2 Labs) following by roles of exercise in disease preventions and rehabilitations (L8) and two field trips (2 Labs). The total lecture and activity hours for each unit are shown below:

	Lecture Hours	Activity Hours
Unit I: Career opportunity, Exercise metabolism, Muscular & Cardiopulmonary Adaptations	9	12
Unit II: Genetics, Exercise and environmental stress, Exercise in special population	6	18
<u>TOTAL</u>	15 (~33%)	30 (~67%)

The lesson plans of each lecture/activity (lab/student presentation), in which background & synopsis, learning objectives, content outline, learning organization, learning materials, suggested readings, as well as student assessment are included in this syllabus. For the class involving student presentation and laboratory participation, the responsible instructor will evaluate the student performance based on an appropriate rubric from attached herein.

### Teaching & Learning Methods

1. On-site lecture
2. Lab & discussion
3. Group presentation
4. Self-study
5. Participation and assignments

### Teaching media

1. Textbooks: variety of exercise physiology textbooks and reading materials assigned for each study unit and are specified by the responsible instructor of the topic.

### Classroom

B501/1 (Exercise Physiology Laboratory)

### Course Assessment

There are seven quizzes taken after the completion of each lecture (L2-L8). The quizzes mainly cover the contents from lectures and may require an integration of the knowledge with the weight score of 10 points for each lecture. There are seven assignments or discussions taken after the completion of each lab as scheduled with the weight score of 10 points with 50% contribution from assignments/discussion and another 50% from participation during the classes as summarized:

Lectures (points)	Activity (points)	
Quizzes	Assignments/ Discussion	Participation
70	35	35
70 (50%)	70 (50%)	

The score range for grading is set as follows:

<b>Grade</b>	<b>Score</b>
<b>A</b>	$\geq 80$
<b>B+</b>	$\geq 75$
<b>B</b>	$\geq 70$
<b>C+</b>	$\geq 65$
<b>C</b>	$\geq 60$
<b>D+</b>	$\geq 50$
<b>F</b>	$< 50$

### List of Instructors

<b>Lecturer</b>	<b>E-mail</b>	<b>Room</b>	<b>Phone</b>
Assoc. Prof. Tepmanas Bupha-Intr, DVM., PhD	tepmanas.bup@mahidol.ac.th	B.508	0-2201-5506
Assoc. Prof. Ratchakrit Srikuea, PhD	ratchakrit.sri@mahidol.ac.th	B.502/2	0-2201-5518
Asst. Prof. Ioannis Papadimitriou, PhD	ioannis.pap@mahidol.ac.th	B.522/3	063-313-3484
Metaneeya Pilanthanonond, PhD	metaneeya.pil@mahidol.ac.th	B.522/4	02-201-5517

**SCPS 362: Exercise Physiology  
Class Schedule**

<b>Date</b>	<b>Act.#</b>	<b>Time</b>	<b>Topics</b>	<b>Instructor</b>
14 Jan		13.00-13.15	Orientation	MP
14 Jan	L1	13.15-13.45	Introduction and applications of exercise physiology: Career development and current trends in exercise	MP
	L2	13.45-15.00	Bioenergetics and exercise metabolism	IP
21 Jan	L3	13.00-15.00	Nutrition and weight control	IP
28 Jan	Lab 1	13.00-15.00	Body composition/ nutrition prescription for different training targets	IP
4 Feb	L4	13.00-15.00	Muscular adaptation to exercise training	RS
11 Feb	Lab 2	13.00-16.00	Muscular performance testing	RS
18 Feb	L5 & Lab 3	13.00-16.30	How genetics influence athletic Performance and Exercise genomics	IP
25 Feb	Lab 4	13.00-16.00	Field trip: Pilates Plus Bangkok Studio	MP
4 Mar			Midterm exam	
11 Mar	L6 & 7	13.00-16.00	Cardiopulmonary adaptation and exercise under environmental stress	IP
18 Mar	Lab 5 & 6	13.00-16.00	Evaluation of aerobic capacity and exercise stress test	IP
25 Mar	L8	13.00-15.00	Field trip: Exercise physiology laboratory at Sports Authority of Thailand (SAT)	TB
1 Apr	Lab 7	13.00-16.00	Exercise in special population	MP

**Assessment Rubric for Class Participation**  
**SCPS 362: Exercise Physiology**  
**Academic Year 2025**

Student Name .....

Instructor .....

Date .....

Criteria of Performance Assessment	Inadequate (1 point)	Developing (below expectations) (2 point)	Accomplished (meets expectations) (3 points)	Exemplary (reflects leadership) (4 points)	SCORE (PQF)
<b>Preparation (10%)</b>	- Lack of preparation in advance for class	- Insufficient preparation for the assigned materials before class	- Sufficient preparation for the assigned materials before class	- Well preparation for class - Having questions or initiating discussion beyond the assignment	
<b>Active Participation (30%)</b>	- No class contribution & discussion - No response to direct questions	- Barely active in contributions & discussion - Seldom volunteers in response to direct questions	- Frequently active in contributions & discussion - Asking questions & response to direct questions	- Proactive with regular class contribution & discussion - Initiate discussion on the related topics	
<b>Listener Skills (10%)</b>	- Not listen to others - Non-responsive comment to discussion	- Seldom listens carefully - Occasionally comments to discussion	- Appropriate listener - Appropriate response to others	- Good listener without inappropriate interruption - Expand response to others	

Criteria	Weight Factor (WF)	PQF	WF x PQF (%)
<b>Preparation</b>	10%		
<b>Active participation</b>	30%		
<b>Listener Skills</b>	10%		

(sum of WF x PQF)/4 = ..... ; FINAL POINTS = ..... out of 5

INSTRUCTOR SIGNATURE .....

DATE OF SUBMISSION .....

## **SCPS 362: Exercise Physiology Lesson Plan 2025**

<b>Topic</b>	<b>Lecture 1: Introduction and applications of exercise physiology: Career development and current trends in exercise</b>	
<b>Date</b>	January 14, 2025	Time 1:00-1.15 PM
<b>Room</b>	B501/1, Department of Physiology, Faculty of Science, Mahidol University	
<b>Lecturer</b>	Metaneeya Pилanthanonnd Department of Physiology, Faculty of Science Email metaneeya.pil@mahidol.ac.th	
<b>Student</b>	Undergraduate students in Biomedical Science Program	

### **Background & synopsis**

Exercise physiology is an interdisciplinary field involving different body system adaptations to acute physical bouts and long-lasting exercise training. Knowing the roles of exercise physiologist, newly developed tools and technologies, and fitness trends are mandatory to understand and further expand the career opportunities.

### **Objectives**

#### **Students should be able to:**

1. Explain the scope of exercise physiology
2. State roles of exercise physiologist
3. Discuss career options associated with exercise physiology
4. Indicate tools and technologies recently used in researches and fitness industry
5. Recognize current fitness trends

### **Content Outline**

1. Scope of exercise physiology
2. Responsibilities and key skills needed as an exercise physiologist
3. Career opportunities related to exercise physiology
4. Tools and technologies used in researches, fitness industry, and physically active individuals
5. Current trends in fitness and sports industry

### **Learning Organization**

1. 20-minute lecture using PowerPoint presentation
2. 10-minute discussion

### **Learning Materials**

1. Lesson plan
2. PowerPoint presentation

**Suggested readings**

1. ACSM | *The American College of Sports Medicine*. (2023). ACSM\_CMS. Retrieved January 3, 2023, from <https://www.acsm.org/>

2. *Worldwide Survey of Fitness Trends for 2023 : ACSM's Health & Fitness Journal*. LWW. [https://journals.lww.com/acsm-healthfitness/Fulltext/2023/01000/Worldwide\\_Survey\\_of\\_Fitness\\_Trends\\_for\\_2023.6.aspx?context=FeaturedArticles](https://journals.lww.com/acsm-healthfitness/Fulltext/2023/01000/Worldwide_Survey_of_Fitness_Trends_for_2023.6.aspx?context=FeaturedArticles)

**Student Assessment**

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## **Topic Lecture 2: Bioenergetics and exercise metabolism**

<b>Date</b>	January 14, 2025	<b>Time</b>	1:45-3.00 PM
<b>Room</b>	B501/1, Department of Physiology, Faculty of Science, Mahidol University		
<b>Lecturer</b>	Asst. Prof. Ioannis Papadimitriou, PhD		
<b>Email</b>	ioannis.pap@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & Synopsis**

Bioenergetics is the study of biological energy transformations, which is concerned with how food is transformed into energy that can be utilized by cells to perform various kinds of work. Knowing how the energy is stored and understanding the systems that generate energy are essential to comprehend the impact of energy production and availability on exercise performance.

### **Objectives**

#### **Students should be able to:**

1. Explain fuel utilization during exercise at various intensities and durations
2. Discuss the hormones involved in fuel metabolism during exercise
3. Describe the effects of exercise training on regulation of energy producing systems

### **Content Outline**

1. Substrate utilization during exercise of different intensities and durations
2. Hormonal and non-hormonal control of metabolism during exercise
3. Exercise training and substrate metabolism
4. Paper Discussion: The Crossover Concept

### **Learning Organization**

1. 50-minute lecture using PowerPoint presentation
2. 25-minute group discussion on the Crossover Concept

### **Learning Materials**

1. Lecture handout

### **Suggested Readings**

1. ACSM's Advanced Exercise Physiology, 2nd ed. Lippincott Williams & Wilkins; 2013.
2. Koeppen BM, Stanton BA. Berne & Levy Physiology. 7th ed. Philadelphia: Mosby; 2018.
3. Powers SK, Howley ET. Exercise Physiology: Theory and Application to Fitness and Performance, 5th ed. New York, NY: McGraw-Hill, 2004.
4. Brooks GA, Fahey TD, Baldwin KM. Exercise Physiology: Human Bioenergetics and Its Applications. 4th ed. New York, NY: McGraw-Hill, 2005.



5. Brooks GA and Mercier J. Balance of carbohydrate and lipid utilization during exercise: the “crossover” concept. *J Appl Physiol* 1994, 76: 2253-2261.

**Student Assessment**

Post-class quiz 10 points

## **Topic Lecture 3: Nutrition and Weight Control**

**Date** January 21, 2025                      **Time** 1:00-3:00 PM  
**Room** B501/1, Department of Physiology, Faculty of Science, Mahidol University  
**Lecturer** Asst. Prof. Ioannis Papadimitriou, PhD  
**Email** ioannis.pap@mahidol.ac.th  
**Student** Undergraduate students in Biomedical Science Program

### **Background & Synopsis**

Fundamental knowledge of nutrition - weight control and how do they influence athletic performance.

### **Objectives**

#### **Students should be able to:**

1. Explain the essential concepts of basic nutritional principles that can be applied to exercise science

### **Content Outline**

1. Basics of metabolism
2. Weight control strategies applied to exercise science

### **Learning Organization**

1. Self-study of suggested reading materials before class
2. 100-minute lecture using visual presentation
3. 10 minutes questions and answers

### **Learning Materials**

1. Lesson plan, including the behavioral objectives
2. Handout of the lecture presentation

### **Suggested Readings**

1. Koeppen BM, Stanton BA. BERNE & LEVY Physiology. 6th ed., 2008.
2. Marieb EN, Hoehn K. Human Anatomy & Physiology. 9th ed., 2013.

### **Student Assessment**

Post-class quiz 10 points

## **Topic Lab 1: Body composition/ nutrition prescription for different training targets**

<b>Date</b>	January 28, 2025	<b>Time</b>	1:00-3:00 PM
<b>Room</b>	B501/1, Department of Biology, Faculty of Science, Mahidol University		
<b>Lecturer</b>	Asst. Prof. Ioannis Papadimitriou, Ph.D Department of Physiology, Faculty of Science, Mahidol University		
<b>Email</b>	ioannis.pap@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & Synopsis**

Fundamental knowledge of anthropometry and nutrition and how do they influence athletic performance.

### **Objectives**

#### **Students should be able to:**

1. Explain the basic principles of anthropometric measurements that can be applied to exercise science
2. Explain the essential concepts of basic nutritional principles that can be applied to exercise science

### **Content Outline**

1. Basics of anthropometry
2. Weight control strategies applied to exercise science.

### **Learning Organization**

1. Self-study of suggested reading materials before class
2. 100-minute lecture using visual presentation
3. 10 minutes questions and answers

### **Learning Materials**

1. Lesson plan, including the behavioral objectives
2. Handout of the lecture presentation

### **Suggested Reading:**

1. Koeppen BM, Stanton BA. BERNE & LEVY Physiology. 6th ed., 2008.
2. Marieb EN, Hoehn K. Human Anatomy & Physiology. 9th ed., 2013.

### **Student Assessment:**

1. Individual assignment 50% (5 points)
2. Class participation 50% (5 points)

**Topic Lecture 4:** Muscular adaptation to exercise training  
**Date** February 4, 2025 **Time** 1:00-3:00 PM  
**Room** B501/1, Department of Physiology, Faculty of Science, Mahidol University

**Topic Lab 2:** Muscular performance testing  
**Date** February 11, 2025 **Time** 1:00-4:00 PM  
**Room** B501/1, Department of Biology, Faculty of Science, Mahidol University  
**Lecturer** Assoc. Prof. Ratchakrit Srikuea, PhD  
Department of Physiology, Faculty of Science  
**E-mail** ratchakrit.sri@mahidol.ac.th  
**Student** Undergraduate students in Biomedical Science Program

### **Background & Synopsis**

Resistance training is routinely applied as an exercise regimen to increase muscle mass and strength. Adaptation of skeletal muscle to the resistance loads involves both neural and muscular adaptations. Resistance training induces changes in physiological responses, up-regulation of growth factors, and activation of skeletal muscle stem cell that contributing on skeletal muscle hypertrophic process. Alternatively, endurance training is a type of exercise that use to improve cardiorespiratory fitness. The effect of endurance training on skeletal muscle mainly involves angiogenesis and mitochondrial synthesis in the working muscle that subsequently increase exercise performance.

### **Objectives**

#### **Students should be able to:**

1. Describe how exercise training induces muscular adaptation
2. Explain the effects of resistance and endurance training on muscular adaptation
3. Conduct laboratory assessments on muscular performance testing

### **Content Outline**

1. Resistance training
  - a. Neuromuscular adaptation
  - b. Myonuclear domain hypothesis
  - c. Growth factors mediate muscle hypertrophy
2. Endurance training
  - a. Muscular adaptation
  - b. Angiogenesis and mitochondrial synthesis
3. Laboratory assessments on muscular performance testing

### **Learning Organization**

1. Self-study of suggested reading materials before class
2. 100-minute lecture using visual presentation
3. Conduct laboratory assessments on muscular performance testing

### **Learning Materials**

1. Lesson plan, including the behavioral objectives
2. Handout of the lecture presentation
3. Laboratory instruction manual

**Suggested Reading**

1. Powers SK and Howley ET. Exercise physiology: Theory and application to fitness and performance, 10th ed., 2018.

**Student Assessment**

1. Lecture a. Post-class quiz 10 points

2. Laboratory a. Assignment or discussion 50% (5 points)

b. Class participation 50 % (5 points)

## **Topic Lecture 5: How genetics influence athletic performance and exercise genomics**

**Date** February 18, 2025 **Time** 1:00-4:30 PM  
**Room** B501/1, Department of Biology, Faculty of Science, Mahidol University

### **Topic Lab 3: Exercise Genomics**

**Date** February 18, 2025 **Time** 1:00-4:30 PM  
**Room** B501/1, Department of Biology, Faculty of Science, Mahidol University  
**Lecturer** Asst. Prof. Ioannis Papadimitriou, PhD  
Department of Physiology, Faculty of Science  
**Email** ioannis.pap@mahidol.ac.th  
**Student** Undergraduate students in Biomedical Science Program

### **Background & Synopsis**

Athletic performance is a complex trait that is influenced by both genetic and environmental factors. Studies focused on similarities and differences in athletic performance within families, including between twins, suggest that genetic factors underlie 30% to 80% of the differences among individuals in traits related to athletic performance. Many studies have investigated variations in specific genes thought to be involved in these traits, involving athletes and non-athletes. Some gene polymorphisms have been linked with exercise performance. Changes in our genome can influence speed, strength and endurance performance as well.

### **Objectives**

#### **Students should be able to:**

1. Describe the influence of genetics on exercise performance
2. Apply the basic genetic laboratory procedures applied in exercise science
3. Define the major candidate genes and its effect on muscular performance

### **Content Outline**

1. Human genome and exercise performance
2. Candidate gene analysis on muscular performance
3. Single Nucleotide Polymorphisms (SNPs)
4. Conduct main genetic laboratory analysis

### **Learning Organization**

1. Self-study of suggested reading materials before class
2. 100-minute lecture using visual presentation
3. Conduct laboratory assessments on exercise genomics
4. 10 minutes questions and answers

### **Learning Materials**

1. Lesson plan, including the behavioral objectives
2. Handout of the lecture presentation

### **Suggested Readings**

1. Bray *et al.* The human gene map for performance and health-related fitness phenotypes: the 2006-2007 update. *Med Sci Sports Exerc.* 2009;41(1):35-73.
2. Malcolm Collins, *Genetics Med Sport Sci.* Basel, Karger, 2016
3. I. Papadimitriou, A. Lucia, Y. Pitsiladis, V. Pushkarev, D. Dyatlov, E. Orekhov, J. Guilherme, A. Lancha, V. Ginevičien P. Cieszczyk, A. Karłowska, M. Sawczuk, C. Muniesa, A. Kouvatsi, M. Massidda, C. Calò, F. Garton, G. Wang, K. Austin, V. Charlton, E. Morrison, A. Druzhevskaya, I. Astratenkova, I. Ahmetov ACTN3 R577X and ACE I/D gene variants influence specific performance phenotypes in elite sprinters: A study involved ten cohorts of Caucasian and African athletes, *European Journal of Human Genetics* Vol 23, p 336 June (2016)

### **Student Assessment**

1. Post-class quiz 10 points
2. Individual assignment 50% (5 points)
3. Class participation 50% (5 points)

## **Topic Lab 4: Field trip to Pilates Plus Bangkok Studio**

<b>Date</b>	February 25, 2025	<b>Time</b> 1:00-4:00 PM
<b>Room</b>	Pilates Plus Bangkok Studio	
<b>Lecturer</b>	Metaneeya Pилanthanonnd Department of Physiology, Faculty of Science, Mahidol University	
<b>Email</b>	metaneeya.pil@mahidol.ac.th	
<b>Student</b>	Undergraduate students in Biomedical Science Program	

### **Background & Synopsis**

Understanding the fundamental importance of exercise physiology in human movement, our field trip extends the Exercise Physiology module's practical application. Students observe Pilates instructors, bridging theoretical knowledge to both group and personalized exercise programs and appreciating exercise physiology's adaptability in private studio settings, emphasizing its practical relevance.

### **Objectives**

#### **Students should be able to:**

1. Explain the significance of practical application of exercise physiology
2. Discuss the objectives and principles of exercise session

### **Content Outline**

1. Pilates Plus Bangkok
2. Group and private exercise program design

### **Learning Organization**

1. Lecture 15 minute
2. Exercise demonstration and hand-on 150 minutes
3. Conclusion and discussion 15 minute

### **Learning Materials**

1. Pilates Plus Bangkok

### **Student Assessment:**

1. Individual assignment 50% (5 points)
2. Class participation 50% (5 points)



## **Topic Lecture 6 & 7: Cardiopulmonary adaptation and exercise under environmental stress**

<b>Date</b>	March 11, 2025	<b>Time</b>	1:00-4:00 PM
<b>Room</b>	B501/1, Department of Physiology, Faculty of Science, Mahidol University		
<b>Lecturer</b>	Asst. Prof. Ioannis Papadimitriou, PhD Department of Physiology, Faculty of Science		
<b>Email</b>	ioannis.pap@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & Synopsis**

During exercise, energy demand increases. Cardiovascular and respiratory system play almost role in nutrient and oxygen delivery to active muscles. Many mechanisms involve in increasing works of heart, blood vessel, and respiration during exercise. Moreover, chronic repeating work out induces many cardiovascular and respiratory adaptations to enhance deliver efficiency. In some occasions, body might face to environmental stress such as hot weather, cold temperature, low oxygen during exercise. Under those environmental conditions, body will response to balance homeostasis. However, during exercise, body needs more adjust than resting, and exercise performance under those conditions will be reduced. Therefore, understanding the body response to environmental stress will provide preventive methods in maintaining exercise performance under those stress conditions

### **Objectives**

#### **Students should be able to:**

1. Explain principle of heart and respiratory functions to terms of delivery system
2. Describe the change in the heart and vascular function during dynamic versus static exercises
3. Describe the change in respiratory activity during exercise
4. Describe mechanisms activating heart and respiratory functions during exercise
5. Describe body response to the heat stress during rest and exercise
6. Explain body acclimatization during exercise in the heat
7. Describe body response to the cold environment during rest and exercise
8. Discuss strategy to prevent heat and cold stress
9. Describe the effect of effect of air pollution on exercise physiology and performance

### **Content Outline**

1. Basic cardiovascular activity
2. Basic respiratory activity
3. Cardiovascular response to exercise
  - a. Response to dynamic exercise
  - b. Response to static exercise
4. Respiratory response during exercise
5. Mechanistic induction of cardio-respiratory response to physical movement
6. Heat stress on physical performance

- a. Prevention of heat stress during exercise
- b. Acclimatization to repeated heat stress
- 7. Cold stress on physical performance
  - a. Prevention of cold stress
  - b. Acclimatization to repeated cold stress
- 8. The effect of air pollution on exercise physiology and performance

### **Learning Organization**

- 1. 160-minute lecture using visual presentation
- 2. 20-minute questions and answers session

### **Learning Materials**

- 1. Lecture handout

### **Suggested Readings**

- 1. William D. McArdle, et. al. Exercise Physiology: Nutrition, Energy, and Human Performance. Lippincott Williams and Wilkins
- 2. Rodman J.R. · Haverkamp H.C. · Gordon S.M. · Dempsey J.A. Cardiovascular and Respiratory System Responses and Limitations to Exercise. Clinical Exercise Testing. Prog Respir Res. Basel, Karger, 2002, vol 32, pp 138-158.
- 3. Micah Zuhl. Exercising in Hot and Cold Environments. ACSM brochure.
- 4. Hannes Gatterer, et. al. Practicing Sport in Cold Environments: Practical Recommendations to Improve Sport Performance and Reduce Negative Health Outcomes. Int. J. Environ. Res. Public Health 2021, 18, 9700.
- 5. Giorgini, P. et. al. Air Pollution and Exercise: a review of the cardiovascular implications for health care professionals. Journal of Cardiopulmonary Rehabilitation and Prevention: 2016 - Volume 36 - Issue 2 - p 84-95

### **Student Assessment**

Post-class quiz 20 points

## **Topic Lab 5 & 6: Evaluation of aerobic capacity and exercise stress test**

<b>Date</b>	March 18, 2025	<b>Time</b>	1:00-4:00 PM
<b>Room</b>	B501/1, Department of Biology, Faculty of Science, Mahidol University		
<b>Lecturer</b>	Asst. Prof. Ioannis Papadimitriou, PhD Department of Physiology, Faculty of Science		
<b>Email</b>	ioannis.pap@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & Synopsis**

Cardiorespiratory fitness indicates exercise endurance capacity. In order to compare, cardiorespiratory fitness, maximum oxygen consumption is a gold standard. There are many methods that can measure or estimate maximum oxygen consumption. In addition, measurement of oxygen consumption can also indicate energy expenditure. In terms of pathological condition, many persons with cardiovascular problem do not recognize themselves that they have the disease due to silencing sign and symptom during rest and light activity. Exercise stress test is clinical ministration that help to indicate those silencing defects by increasing the work of the heart. During exercise, defect of the heart will show their effect leading to clinical and measurement sign.

### **Objectives**

#### **Students should be able to:**

1. Explain the benefit of knowing individual oxygen consumption
2. Describe parameters that are required for determining oxygen consumption
3. Discuss factors influencing change in oxygen consumption
4. Explain the relationship between oxygen consumption and carbon dioxide production
5. Explain how to measure oxygen consumption using gas and air flow analyzer
6. Explain the concept of exercise stress test to determine cardiac function
7. Discuss which signs and/or conditions that is required exercise stress test
8. Explain how to perform exercise stress test

### **Content Outline**

1. Oxygen consumption data and its usefulness
2. Factors affecting amount of body oxygen consumption
3. Measurement parameters involve in calculating oxygen consumption
4. Oxygen consumption, carbon dioxide production and respiratory exchange ratio
5. The concept of using exercise stress test to determine cardiac activity
6. Sign and conditions that are recommended to test with exercise stress
7. Measurement of ECG at rest and during exercise

### **Learning Organization**

1. Lecture 30 min
2. Laboratory practice 150 min
3. Individual assignment or take home

### **Learning Materials**

1. Lecture handout

2. Gas analyzer (Vmax)
3. Cycling ergometry
4. ECG monitor (ADInstrument)
5. Treadmill

### **Suggested reading**

1. J B Stoker, C T Kappagoda, P N Thenabadu, and R J Linden. A simple method for measurement of oxygen consumption. J. Applied Physiology, vol.35 No5. 1973, p 748-75
2. Kathryn K. Garner, William Pomeroy, & James J. Arnold. Exercise Stress Testing: Indications and Common Questions. Am Fam Physician. 2017 Sep 1;96(5):293-299A.

### **Student Assessment**

1. Individual assignment 50% (10 points)
2. Class participation 50% (10 points)

## **Topic Lab 7: Field trip to exercise physiology laboratory at Sports Authority of Thailand (SAT)**

<b>Date</b>	March 25, 2025	<b>Time</b>	1:00-4:00 PM
<b>Room</b>	Exercise physiology laboratory, Sports Authority of Thailand (SAT)		
<b>Lecturer:</b>	Assoc. Prof. Tepmanas Bupha-Intr, DVM., PhD Department of Physiology, Faculty of Science, Mahidol University		
<b>Email</b>	tepmanas.bup@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & Synopsis**

In sport, peak exercise performance is request. In order to find, athletes who have best performance and ready for competition, all athletes are subjected to do the test. There are many test systems based on physiological and biomechanical activity including muscle strength, muscle power, reaction time, speed and agility, flexibility, cardiorespiratory system, etc. Sports Authority of Thailand (SAT) provides tests for nation team athletes. In addition, SAT used basic science for treatment and rehabilitation of injured athlete.

### **Objectives**

#### **Students should be able to:**

1. Explain the significance of sport science department, Sports Authority of Thailand
2. Discuss the relation between each measurement equipment and physiological knowledge
3. Discuss the benefit of each measurement parameter to specific sport

### **Content Outline**

1. Department of Sport Science, Sport Authority of Thailand
2. Exercise Physiology laboratory and performance testing unit
3. Indoor exercise training facility
4. Rehabilitation unit

### **Learning Organization**

1. Lecture 15 minute
2. Exercise testing demonstration and hand-on 180 minutes
3. Conclusion and discussion 45 minute

### **Learning Materials**

1. Sport science facility, Sport Authority of Thailand

### **Student Assessment:**

1. Individual assignment 50% (5 points)
2. Class participation 50% (5 points)

## **Topic Lecture 8: Exercise in special population**

<b>Date</b>	April 1, 2025	<b>Time</b>	1:00-3:00 PM
<b>Room</b>	B501/1, Department of Physiology, Faculty of Science, Mahidol University		
<b>Lecturer</b>	Metaneeya Pилanthanon Department of Physiology, Faculty of Science		
<b>Email</b>	metaneeya.pil@mahidol.ac.th		
<b>Student</b>	Undergraduate students in Biomedical Science Program		

### **Background & synopsis**

Exercise has been used as a part of disease prevention and treatment strategies. This lecture focuses on factors to consider for individuals with specific health conditions; pregnancy, diabetes, asthma, cancer, and coronary heart disease, addressing contraindications, suitable exercise types, precautions, and physiological explanations in a concise and practical manner.

### **Objectives**

#### **Students should be able to:**

1. Explain the roles of different types of exercises in disease prevention
2. Explain the limitations of exercises for a certain disease or health condition
3. Describe the goals and beneficial effects of exercises in different pathological and health conditions
4. State the examples of exercise recommendations for each special population

### **Learning Organization**

1. Self-study of suggested reading materials before class
2. 100-minute lecture using visual presentation
3. 10 minutes questions and answers

### **Learning Materials**

1. Lesson plan
2. Handout of the lecture presentation

### **Learning Materials:**

1. PowerPoint presentation

### **Suggested readings**

1. McArdle, W. D., Katch, V. L., & Katch, V. L. (2010). *Exercise Physiology: Nutrition, Energy, and Human Performance*. Lippincott Williams & Wilkins.
2. Powers, S., & Howley, E. (2018). *Exercise Physiology: Theory and Application to Fitness and Performance* (10th ed.). McGraw Hill.

### **Student Assessment**

Post-class quiz 10 points