TQF 3 Course Specifications
Section 1 General Information

1. Course code and course title

Thai ICBI381 ชีววิทยาวิวัฒนาการ

English ICBI381 Evolutionary Biology

2. Number of credits 4 (4-0-8)

3. Program and type of subject
   3.1 Program Undergraduate Degree (International Program)
   3.2 Type of Subject Required

4. Course Coordinator and Course Lecturer
   4.1 Course Coordinator Asst. Prof. Ramesh Boonratana, Ph.D.
   4.2 Course Lecturer Asst. Prof. Ramesh Boonratana, Ph.D. (RB)
   Dr. Patsarin Wongkamhaeng, Ph.D. (PW)

5. Trimester/ Year of Study
   5.1 Trimester 1
   5.2 Course Capacity Approximately 30 students

6. Pre-requisite ICBI 211 Genetics and Molecular biology, ICBI 221 Animal biology, ICBI231 Plant biology

7. Co-requisites N/A

8. Venue of Study Mahidol University International College

Section 2 Goals and Objectives

1. Course Goals

According to Theodosius Dobzhansky, an evolutionary biologist, "*Nothing in biology makes sense except in the light of evolution*". In this light, the goal of this course is to provide students a comprehensive conceptual understanding of the genetic processes and selective forces as the drivers of evolutionary change, and to prepare students for higher biology courses that require an understanding of evolution. Students will gain insights into aspects of scientific research on evolutionary biology, which includes evolutionary genomics, evolutionary and behavioral ecology, and extinction and conservation.

2. Objectives of Course Development/Revision

2.1 Course Objectives

2.1.1 Gain a comprehensive knowledge of evolutionary biology.

2.1.2 Explore the mechanisms of evolution at both the individual and population levels.

2.1.3 Understand evolutionary processes, speciation and radiation.

2.1.4 Understand taxonomy and phylogeny.

2.1.5 Relate evolutionary biology to biogeography, ecology and conservation.

2.1.6 Apply knowledge of evolutionary biology to explain biological diversity and biological phenomenon.

2.2 Course-level Learning Outcomes: CLOs

By the end of the course, students will be able to (CLOs)

1. CLO1 Possess knowledge in Evolutionary Biology (1.1)
2. CLO2 Apply knowledge in Evolutionary Biology (1.2)
3. CLO3 Comprehend qualitative, quantitative data and/or ideas (2.1)
4. CLO4 Draw meaningful conclusions from the scientific data/materials (2.2)
5. CLO5 Retrieve relevant scientific information independently (2.3)
6. CLO6 Assess the scientific relevance of an information to the objective at hand (2.5)
7. CLO7 Demonstrate systematic and logical thinking (6.3)
8. CLO8 Understand the potential for knowledge transfer towards innovation (6.4)
9. CLO9 Develop a propensity for lifelong learning and skills to achieve it (6.5)

10.

Section 3 Course Management

1. Course Description

(Thai) ทฤษฎีธรรมชาติคัดสรรค์, กระบวนการทางวิวัฒนาการในระดับโมเลกุลและระดับจีโนม, สายพันธุ์และการเกิดใหม่ของสายพันธุ์, อนุกรมวิธานและต้นสายวิวัฒนาการ, กระบวนการทางวิวัฒนาการในระดับใหญ่, การวิวัฒนาการ, การวิวัฒนาการร่วมกัน, ไบโอจีโอกราฟฟี่ ชีววิทยาวิวัฒนาการและนิเวศวิทยา ชีววิทยาวิวัฒนาการและการอนุรักษ์

(English) Natural selection; molecular evolution; evolutionary genomics; species and speciation; taxonomy and phylogeny; macroevolution; evolution, coevolution and radiation; biogeography; evolutionary biology and ecology; evolutionary biology and conservation.

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
48	0	96

3. Number of hours that the lecturer provides individual counseling and guidance.
4 hours per week at 1 hour per day available at fixed schedule; and if required, students may schedule an appointment with the lecturer or walk in during office hours.

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to

1. CLO1 Possess knowledge in Evolutionary Biology (1.1)
2. CLO2 Apply knowledge in Evolutionary Biology (1.2)
3. CLO3 Comprehend qualitative, quantitative data and/or ideas (2.1)
4. CLO4 Retrieve relevant scientific information independently (2.3)
5. CLO5 Assess the scientific relevance of an information to the objective at hand (2.5)
6. CLO6 Demonstrate systematic and logical thinking (6.3)
7. CLO7 Understand the potential for knowledge transfer towards innovation (6.4)
8. CLO8 Develop a propensity for lifelong learning and skills to achieve it (6.5)

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

ICBI381	Teaching methods	Evaluation Methods
CLO1	Lecture, discussions, e-learning	Assignments, examinations
CLO2	Lecture, discussions, e-learning	Assignments, examinations
CLO3	Lecture, discussions, e-learning	Assignments, examinations
CLO4	Lecture, discussions, e-learning	Assignments, examinations, presentation
CLO5	Lecture, discussions, e-learning	Assignments, examinations, presentation
CLO6	Lecture, discussions, e-learning	Assignments, examinations
CLO7	Lecture, discussions, e-learning	Assignments, examinations
CLO8	Lecture, discussions, e-learning	Assignments, examinations, presentation

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Number of Hours		Teaching Activities / Media	Lecturer
		Lecture Hours	Lab / Field Trip / Internship Hours		
1	Research in Evolutionary Biology	4	0	Lecture, Class Discussion and Presentation	PW

2	Theory of Natural Selection - Hardy-Weinberg equilibrium - Models of Natural Selection - Genetic Polymorphism - Selection-Mutation Balance - Migration	4	0	Lecture and Quiz	PW
3	Random Events in Population Genetics - Genetic Drift - Founder Effect	4	0	Lecture, Paper Discussion and Presentation	PW
4	Molecular Evolution I - The Neutral Theory - Evidence of Positive and Negative Selection on DNA Sequence	4	0	Lecture and Assignment	PW
5	Molecular Evolution II - Codon Bias - Analysis of Buchnera Genome	4	0	Lectures and Workshops	PW
6	Evolutionary Genomics and Infection Phenomenon	4	0	Lectures	PW
7	Species, Species Concepts, and Intra-specific Variation Speciation and its Mechanisms	4	0	Lectures, e-Learning, Discussions	RB
8	Taxonomic Classification and Phylogeny Macroevolution	4	0	Lectures, e-Learning, Discussions	RB
9	Divergent, Convergent, and Parallel Evolution Coevolution and Adaptive Radiation	4	0	Lectures, e-Learning, Discussions	RB
10	Biogeography Evolutionary Biology and Ecology	4	0	Lectures, e-Learning, Discussions	RB

11	Extinction Evolutionary Biology and Conservation	4	0	Lectures, e-Learning, Discussions	RB
12	Why Sex? Sexual Selection	4	0	Lectures, e-Learning, Discussions	RB
	Total	48	0		

2. Plan for Assessing Course Learning Outcomes

2.1 Assessing and Evaluating Learning Achievement

a. Formative Assessment

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)
CLO1 Possess knowledge in Evolutionary Biology	Quiz	10
CLO2 Apply knowledge in Evolutionary Biology	Quiz	
CLO3 Comprehend qualitative, quantitative data and/or ideas	Presentations and Quiz	
CLO4 Draw meaningful conclusions from the scientific data/materials	Class assignments (presentations and discussions)	20
CLO5 Retrieve relevant scientific information independently	Class assignments (presentations and discussions)	
CLO6 Assess the scientific relevance of an information to the objective at hand	Class assignments (presentations and discussions)	
CLO7 Demonstrate systematic and logical thinking	Class assignments (presentations and discussions)	

CLO8 Understand the potential for knowledge transfer towards innovation	Class assignments (presentations and discussions)	5
CLO9 Develop a propensity for lifelong learning and skills to achieve it	Class assignments (presentations and discussions)	5
Total		40

b. Summative Assessment (Midterm 30% and Final examinations 30%)

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)
CLO1 Possess knowledge in Evolutionary Biology	Written Examination – quiz, MCQ, short responses & essays	15
CLO2 Apply knowledge in Evolutionary Biology	Written Examination – quiz, MCQ, short responses & essays	15
CLO3 Comprehend qualitative, quantitative data and/or ideas	Written Examination – short responses & essays	15
CLO7 Demonstrate systematic and logical thinking	Written Examination – short responses & essays	5
CLO8 Understand the potential for knowledge transfer towards innovation	Class assignments (presentations and discussions)	10
Total		60

(2) Grading System

Grade	Achievement	Final Score (% range)	GPA
A	Excellent	90-100	4.0
B+	Very good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly good	75-79	2.5
C	Fair	70-74	2.0
D+	Poor	65-69	1.5
D	Very poor	60-64	1.0
F	Fail	Less than 60	0.0

(3) Re-examination (If course lecturer allows to have re-examination)
N/A - (Not applicable with MUIC

3. Student Appeals According to MU rule and regulation

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials
    1) Urry L.A., Cain M.L. Wasserman S.A., Minorsky P.V., & Reece J.B. (2017). *Campbell Biology* (*11th Edition*). Boston: Pearson.
    2) Ridley, M. (2004). *Evolution* (*3rd Edition*). Oxford: Blackwell Publishing.

2. Recommended textbooks and/or other documents/materials
    1) Freeman, S., & Herron, J. C. (2007). *Evolutionary analysis*. Upper Saddle River, NJ: Pearson Prentice Hall.
    2) Imai S., Kobayashi K., Ohkubo Y., Yagi N., & Hasegawa E. (2016). Difference in evolutionary patterns of strongly or weakly selected characters among ant populations. *Scientific Reports* 6: 1-9.
    3) King, N. (2004). The unicellular ancestry of animal development. *Developmental Cell* 7: 313-325.

3. Other Resources (If any)
    1) http://www.bbc.com/future/story/20170227-how-tibetans-survive-life-on-the-roof-of-the-world.
    2) Nicole King (UC Berkeley, HHMI) 1: The origin of animal multicellularity (UTube)
    3) Nicole King (UC Berkeley, HHMI) 2: Choanoflagellate colonies, bacterial signals and animal origins (UTube)

Section 7 Evaluation and Improvement of Course Management

1. Strategies for evaluating course effectiveness by students
   1.1 Student feedback of instructors, teaching methods and materials, and course content through MUIC student evaluation forms
2. Strategies for evaluating teaching methods
   2.1 Evaluation of effectiveness based on student evaluation scores and comments
   2.2 Evaluation through peer observations by co-instructor or other Division faculty
3. Improvement of teaching methods
   3.1 Adjustments based on student feedback, personal observations, comments from peer observations and discussions with supervisor and/or other Division faculty in one-on-one and/or group meetings as specified by MUIC guidelines
4. Verification process for evaluating students' standard achievement outcomes in the course
   4.1 Verification through student performance on assessments based on MUIC/Division standards
5. Review and plan for improving the effectiveness of the course
   5.1 Course instructors (and coordinator/supervisor) will meet to discuss results of student evaluations and student performance based on learning outcomes in order to identify point for improvement
   5.2 Strategy for improvement set according to MUIC/Division guidelines

Appendix

Alignment between Courses and Program

Table 1 The relationship between course and Program Learning Outcomes (PLOs)

Course Name Evolutionary Biology	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
(Course code) ICBI381.	M	P				P

Note: Indicate the level of CLOs by letter I, R, P or M. Using the information as shown in the Curriculum Mapping of TQF2

Table 2 The relationship between CLOs and PLOs

(Course code) ICBI381	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1 Possess knowledge in Evolutionary Biology	1.1					
CLO2 Apply knowledge in Evolutionary Biology	1.2					
CLO3 Comprehend qualitative, quantitative data and/or ideas		2.1				
CLO4 Draw meaningful conclusions from the scientific data/materials		2.2				
CLO4 Retrieve relevant scientific information independently		2.3				
CLO5 Assess the scientific relevance of an information to the objective at hand		2.5				
CLO6 Demonstrate systematic and logical thinking						6.3

CLO7 Understand the potential for knowledge transfer towards innovation						6.4
CLO8 Develop a propensity for lifelong learning and skills to achieve it						6.5

Table 3 The description of PLOs and Sub Los of the course

PLOs	SubPLOs
PLO1 Apply discipline-specific knowledge and technical skills in biological sciences	1.1 Possess knowledge in Evolutionary Biology
	1.2 Apply knowledge in Evolutionary Biology
PLO2 Appraise scientific information critically	2.1 Comprehend qualitative, quantitative data and/or ideas
	2.2 Draw meaningful conclusions from the scientific data/materials
	2.3 Retrieve relevant scientific information independently
	2.5 Assess the scientific relevance of an information to the objective at hand
PLO6 Able to integrate different disciplines to formulate solutions for novel situations	6.3 Demonstrate systematic and logical thinking
	6.4 Understand the potential for knowledge transfer towards innovation
	6.5 Develop a propensity for lifelong learning and skills to achieve it

1. Lesson Plan

Class	Topic/Details	Number of hours		Online Sessions	On-Campus	Instructors	Note
		In-Class sessions	Lab sessions				
1	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
2	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
3	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
4	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
5	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
6	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
7	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
8	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
9	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
10	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
11	Mon 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
12	Wed 8.00-9.50	2		X		Meng-Shin Shiao	Part-time Instructor
13	Mon 8.00-9.50	2		X		Ramesh Boonratana	
14	Wed 8.00-9.50	2		X		Ramesh Boonratana	
15	Mon 8.00-9.50	2		X		Ramesh Boonratana	
16	Wed 8.00-9.50	2		X		Ramesh Boonratana	
17	Mon 8.00-9.50	2		X		Ramesh Boonratana	

18	Wed 8.00-9.50	2		X		Ramesh Boonratana	
19	Mon 8.00-9.50	2		X		Ramesh Boonratana	
20	Wed 8.00-9.50	2		X		Ramesh Boonratana	
21	Mon 8.00-9.50	2		X		Ramesh Boonratana	
22	Wed 8.00-9.50	2		X		Ramesh Boonratana	
23	Mon 8.00-9.50	2		X		Ramesh Boonratana	
24	Wed 8.00-9.50	2		X		Ramesh Boonratana	
	Total	48					