



Universitas Negeri Surabaya
Faculty of Mathematics and Natural Sciences
Biology Undergraduate Study Program

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Fauna DNA Barcoding	4620102240	Animal Taxonomy	T=2	P=0	ECTS=3.18	6	June 14, 2022
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
	Dwi Anggorowati Rahayu, S.Si., M.Si		Reni Ambarwati, S.Si., M.Si			Dr. H. Sunu Kuntjoro, S.Si., M.Si.	

Learning model	Case Studies
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Program Learning Outcomes (PLO) PLO study program that is charged to the course

PLO-5	Able to communicate scientific ideas, both orally and in writing using appropriate communication media according to the target, as a means of lifelong learning for academic self-development.
PLO-7	Able to work independently and collaboratively, as well as responsibly, in completing various tasks in class, in the laboratory and in the field.

Program Objectives (PO)

PO - 1	Able to apply basic knowledge related to the concepts and basis of DNA Barcoding to understand current scientific phenomena and issues and apply it in solving problems related to identifying fauna types in everyday life.
PO - 2	Able to apply concepts and technology in the field of genetics and molecules in efforts to solve problems related to molecular species identification, conservation of genetic diversity, evolution, distribution of local fauna in the form of mini research.
PO - 3	Able to demonstrate the basic principles of software applications and instruments both virtual (Bioinformatics Software) and online via the Bold System database, Gene bank, Automatic Barcode Discovery Gap Discovery and standard analysis methods in the field of animal systematics
PO - 4	Able to apply logical, critical, systematic and innovative thinking in the context of developing or applying science and/or technology according to their field of expertise
PO - 5	Able to work independently, responsibly, both as an individual and in a group, and able to collaborate

PLO-PO Matrix

	P.O	PLO-5	PLO-7
	PO-1		
	PO-2		
	PO-3		
	PO-4		
	PO-5		

PO Matrix at the end of each learning stage (Sub-PO)

	P.O	Week																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	PO-1																	
	PO-2																	
	PO-3																	
	PO-4																	
	PO-5																	

Short Course Description This course discusses the basic concepts and applications of DNA Barcoding as a molecular tool for identifying Tropical Fauna, exploring DNA Barcoding databases (Bold System database, Gene bank, Automatic Barcode Discovery Gap Discovery), applying the basic concepts of DNA Barcoding with bioinformatics to manage Biological Resources, conservation and distribution of Tropical Fauna, as well as designing and discussing research relevant to the concept of DNA Barcoding. The material is delivered using a student-centered approach in interactive discussion activities and applying concepts in the form of mini projects.

References Main :

1. Faizah, U., Ambarwati, R & Rahayu, D.A. 2019. Teori dan Praktik Sistematika Hewan Jilid II. Surabaya: Unesa University Press.
2. Hebert, P. D. N, Cywinska, A., Ball, S. L. & deWaard, J. R. 2003. Biological Identifications through DNA Barcodes. The Royal Society, 270:313-321.
3. Rahayu, Dwi, A & Nugroho, Endik, D. 2016. Biologi Molekuler dalam Perspektif Konservasi. Yogyakarta: Deepublish.
4. Ratnasingham, S. & Hebert, P. D. 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes, 7:355-364.
5. Ubaidillah, R & Sutrisno, H. 2012. Pengantar Biosistematika: Teori dan Praktek. Jakarta: LIPI Press.
6. Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Teknik Analisis Molekular: Genetik A Work Book. Malang: Universitas Muhammadiyah Malang.

Supporters:

1. Ambarwati, Reni, Dwi A. Rahayu, Fida Rachmadiarti, dan Firas Khaleyla. 2021. "DNA barcoding of lamp shells (Brachiopoda: Lingula anatina) from Probolinggo, East Java, Indonesia." Biodiversitas 22(4): 1764–74.
2. Hebert, P. D. N, Cywinska, A., Ball, S. L. & deWaard, J. R. 2003. Biological Identifications through DNA Barcodes. The Royal Society, 270:313-321.
3. Hajibabei, M., Siregar, G., Hebert, P and Hickey, D.A. 2007. DNA Bar-coding: How it completes taxonomy, molecular phylogenetic, and population genetics. Trends In Genetics, xxx (x).
4. Rahayu, Dwi, A & Nugroho, Endik, D. 2016. Biologi Molekuler dalam Perspektif Konservasi. Yogyakarta: Deepublish.
5. Ratnasingham, S. & Hebert, P. D. 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes, 7:355-364.
6. Nugroho, Endik Deni, Daud Nawir, Mohamad Amin, dan Umie Lestari. 2017. "Dna barcoding of nomei fish (Synodontidae: Harpadon sp.) in Tarakan Island, Indonesia." AACL Bioflux 10(6): 1466–74.
7. Rahayu, Dwi Anggorowati, Endik Deni Nugroho, dan Dwi Listyorini. 2019. "DNA Barcoding Ikan Introduksi Khas Telaga Sari , Kabupaten Pasuruan DNA Barcoding of Introduced Typical Fishes in Telaga Sari , Pasuruan Regency Telaga Sari Purwodadi , Kabupaten Pasuruan keanekaragaman ikan introduksi yang hampir di seluruh belahan dunia mulai da." 7(2): 51–62.
8. Sari, Suci Y.P., Reni Ambarwati, dan Dwi A. Rahayu. 2021. "Molecular characteristics of Donax faba (Bivalvia: Donacidae) from Napa Beach, Madura, based on cytochrome oxidase subunit I gene sequences." AACL Bioflux 14(4): 2416–26

Supporting lecturer Reni Ambarwati, S.Si., M.Sc.
Dwi Anggorowati Rahayu, S.Si., M.Si.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (offline)	Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Describe the history of DNA Barcoding	1.a. Explain the meaning of DNA Barcoding 2.b. Explains the history of DNA Barcoding	Form of Assessment : Participatory Activities	Lecturer explains the history of DNA Barcoding Lecturer facilitates student-centered learning through group discussions and is responsible for finding concepts (based on literature review) regarding the history of DNA Barcoding through international journals as a reference	Lecturer explains the history of DNA Barcoding Lecturer facilitates student-centered learning through group discussions and is responsible for finding concepts (based on literature review) regarding the history of DNA Barcoding through international journals as a reference Synchronous with zoom Asynchronous with vivesa 100 minutes	Material: History of DNA Barcoding References: <i>Rahayu, Dwi, A & Nugroho, Endik, D. 2016. Molecular Biology in a Conservation Perspective. Yogyakarta: Deepublish.</i> Material: Understanding DNA Barcoding References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i> Material: DNA Barcoding Database Bibliography: <i>Ratnasingham, S. & Hebert, PD 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes, 7:355-364.</i> Material: The Role of DNA Barcoding References: <i>Ubaidillah, R & Sutrisno, H. 2012. Introduction to Biosystematics: Theory and Practice. Jakarta: LIPI Press.</i>	5%

2	Describing the Development of DNA Barcoding (World & Indonesia)	a. Explaining the Fauna DNA Bank in Indonesia	Criteria: Explaining the Fauna DNA Bank in Indonesia Form of Assessment : Participatory Activities		Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature review) regarding Barcoding Developments through international journals as references Synchronous with zoom Asynchronous with vivesa 100 minutes	Material: Explanation of the importance of the bold system References: Ubaidillah, R & Sutrisno, H. 2012. <i>Introduction to Biosystematics: Theory and Practice</i> . Jakarta: LIPI Press. Material: DNA Bank Explanation Library: Rahayu, Dwi, A & Nugroho, Endik, D. 2016. <i>Molecular Biology in a Conservation Perspective</i> . Yogyakarta: Deepublish.	5%
3	The Role of DNA Barcoding for Life	1.Explain the considerations for using DNA Barcoding 2.Mention the Role of DNA Barcoding	Criteria: 1.LKM work 2.Actively discussing in the Forum Form of Assessment : Project Results Assessment / Product Assessment		Lecturers facilitate student-centered learning through group discussions and are responsible for discovering concepts (based on literature review) regarding the role of DNA Barcoding in life Synchronous with zoom Asynchronous with vivesa 100 minutes	Material: The Role of DNA Barcodes References: Hebert, PD N, Cywinska, A., Ball, SL & deWaard, JR 2003. <i>Biological Identifications though DNA Barcodes. The Royal Society, 270:313-321</i> . Material: DNA Barcode Analysis References: Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. <i>Molecular Analysis Techniques: Genetics A Work Book</i> . Malang: Muhammadiyah University of Malang.	5%
4	Primary Selection of Universal Barcoding Fauna	1.Explaining the meaning of primary 2.Mention the primary type of COI 3.Mention the specific primers for each taxa	Form of Assessment : Project Results Assessment / Product Assessment		Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature review) regarding the universal primary barcoding of Asynchronous Fauna with vivesa	Material: Barcode Primer Readers: Ambarwati, Reni, Dwi A. Rahayu, Fida Rachmadiarti, and Firas Khaleyta. 2021. "DNA barcoding of lamp shells (Brachiopoda: <i>Lingula anatina</i>) from Probolinggo, East Java, Indonesia." <i>Biodiversity</i> 22(4): 1764–74. Material: Coded primer Bibliography: Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. <i>Molecular Analysis Techniques: Genetics A Work Book</i> . Malang: Muhammadiyah University of Malang. Material: various types of barcode primers References: Rahayu, Dwi, A & Nugroho, Endik, D. 2016. <i>Molecular Biology in a Conservation Perspective</i> . Yogyakarta: Deepublish.	5%

5	Stages of work of Fauna DNA Barcoding (Extraction-Electrophoresis)	Form: Written Test Assignment (resume)	<p>Criteria: Indicators are achieved through independent assignments and structured tasks to explore information from journals</p> <p>Form of Assessment : Project Results Assessment / Product Assessment</p>		<p>Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature review) regarding the general stages of</p> <p>Asynchronous DNA Barcoding work with vinesa</p>	<p>Material: Stages of DNA Barcode work Library: <i>Rahayu, Dwi, A & Nugroho, Endik, D. 2016. Molecular Biology in a Conservation Perspective. Yogyakarta: Deepublish.</i></p> <hr/> <p>Material: Molecular analysis techniques References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i></p>	5%
6	Genetic Analysis of DNA Barcoding (Sequencing Results-DNA Barcode Analysis)	<ol style="list-style-type: none"> 1. Written Test Assignment (sequencing analysis results) 2. blast analysis 3. clustal x analysis 4. bioedit analysis 5. mega analysis 6. genetic distance analysis 	<p>Criteria: 1. Form: Written Test Assignment (sequencing analysis results) 2. Criteria: Indicators are achieved through independent assignments and structured tasks to explore information from journals</p> <p>Form of Assessment : Practice / Performance</p>		<p>Mention the stages of DNA Barcoding analysis</p> <ol style="list-style-type: none"> a. Understanding sequencing results b. Blast c. Bioedit d. Clustal X e. Mega X 	<p>Material: stages of bioinformatics analysis References: <i>Rahayu, Dwi, A & Nugroho, Endik, D. 2016. Molecular Biology in a Conservation Perspective. Yogyakarta: Deepublish.</i></p> <hr/> <p>Material: stages of phylogenetic analysis References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i></p>	5%
7	Species identification via Bold System and Blast DNA Barcoding Analysis via Automatic Barcode Discovery Gap Discovery	<ol style="list-style-type: none"> a. Bold System Analysis b. Identification stages through the Bold System c. Automatic Barcode Discovery Gap Discovery 	<p>Criteria: Form: Written Test Assignment (results of sequencing analysis) Criteria: Indicators achieved through independent assignments and structured assignments to explore information from journals</p> <p>Form of Assessment : Project Results Assessment / Product Assessment</p>		<p>Students analyze the results of</p> <p>synchronous sequencing with</p> <p>asynchronous zoom with Vinesa</p>	<p>Material: identification via Bold Library: <i>Ubaidillah, R & Sutrisno, H. 2012. Introduction to Biosystematics: Theory and Practice. Jakarta: LIPI Press.</i></p>	5%
8	UTS		<p>Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment</p>				15%

9	Find a journal that matches the focus of the article plan to be developed. Conceptualize the article plan to be developed	Write down the name of the journal and the URL to which you will submit the article you have written	<p>Form of Assessment : Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> • Orientation to the problem of how to find journals that are suitable for articles written with criteria such as the desire to submit articles related to the taxon to be studied and DNA Barcoding characters • Planning the analysis stages that will be used, accessing gene banks for comparison species • Determining the time and target for journal results reference • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and reviewing them again 		<p>Material: DNA Barcode Research Bibliography: Hebert, PD N, Cywinska, A., Ball, SL & deWaard, JR 2003. <i>Biological Identifications though DNA Barcodes. The Royal Society, 270:313-321.</i></p> <hr/> <p>Material: Bold System Bibliography: Ratnasingham, S. & Hebert, PD 2007. <i>BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes, 7:355-364.</i></p> <hr/> <p>Material: DNA Barcode research concept References: Hajibabei, M., Siregar, G., Hebert, P and Hickey, DA 2007. <i>DNA Bar-coding: Hoe it completes taxonomy, molecular phylogenetics, and population genetics. Trends In Genetics, xxx (x).</i></p> <hr/> <p>Material: DNA Barcoding References: Hebert, PD N, Cywinska, A., Ball, SL & deWaard, JR 2003. <i>Biological Identifications though DNA Barcodes. The Royal Society, 270:313-321.</i></p> <hr/> <p>Material: DNA Barcode Research Readers: Ambarwati, Reni, Dwi A. Rahayu, Fida Rachmadiarti, and Firas Khaleyla. 2021. "DNA barcoding of lamp shells (Brachiopoda: <i>Lingula anatina</i>) from Probolinggo, East Java, Indonesia." <i>Biodiversity 22(4): 1764–74.</i></p>	5%
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10	Find a journal that matches the focus of the article plan to be developed. Conceptualize the article plan to be developed	Write down the name of the journal and the URL to which you will submit the article you have written	<p>Criteria: Individual project assignments</p> <p>Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> • Orientation to the problem of how to find journals that are suitable for articles written with criteria such as the desire to submit articles related to the taxon to be studied and DNA Barcoding characters • Planning the analysis stages that will be used, accessing gene banks for comparison species • Determining the time and target for journal results reference • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and reviewing them again 		<p>Material: DNA Barcode Bibliography: Hebert, PD N, Cywinska, A., Ball, SL & de Waard, JR 2003. <i>Biological Identifications through DNA Barcodes. The Royal Society</i>, 270:313-321.</p> <hr/> <p>Material: Bold syte, References: Ratnasingham, S. & Hebert, PD 2007. <i>BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes</i>, 7:355-364.</p> <hr/> <p>Material: DNA Barcoding Concept Bibliography: Hajibabei, M., Siregar, G., Hebert, P and Hickey, DA 2007. <i>DNA Barcoding: Hoe it completes taxonomy, molecular phylogenetics, and population genetics. Trends In Genetics</i>, xxx (x).</p>	10%
11	Analyze sequencing results and advanced DNA Barcoding analysis	DNA Barcoding analysis results	<p>Criteria: Individual project assignments</p> <p>Form of Assessment : Participatory Activities</p>	<ul style="list-style-type: none"> • Orientation on the problem of how to analyze DNA barcoding according to the appropriate analysis stages • Planning the analysis stages to be used, accessing gene banks for comparison species • Determining the time and target for analysis results • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and Review 		<p>Material: DNA barcoding Bibliography: Ratnasingham, S. & Hebert, PD 2007. <i>BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes</i>, 7:355-364.</p>	5%

12	Analyze sequencing results and advanced DNA Barcoding analysis	DNA Barcoding analysis results	<p>Criteria: Individual project assignments</p> <p>Form of Assessment : Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> • Orientation on the problem of how to analyze DNA barcoding according to the appropriate analysis stages • Planning the analysis stages to be used, accessing gene banks for comparison species • Determining the time and target for analysis results • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and Review 			5%
13	Write scientific articles related to taxa and DNA barcoding	create scientific articles related to taxon DNA Barcoding	<p>Criteria: Individual project assignments</p> <p>Form of Assessment : Project Results Assessment / Product Assessment</p>	<ul style="list-style-type: none"> • Orientation on the problem of how to analyze DNA barcoding according to the appropriate analysis stages • Planning the analysis stages to be used, accessing gene banks for comparison species • Determining the time and target for analysis results • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and Review 		<p>Material: DNA Barcoding Concept Bibliography: <i>Ratnasingham, S. & Hebert, PD 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). Molecular Ecology Notes, 7:355-364.</i></p> <hr/> <p>Material: DNA Barcoding Concept Bibliography: <i>Hajibabei, M., Siregar, G., Hebert, P and Hickey, DA 2007. DNA Barcoding: Hoe it completes taxonomy, molecular phylogenetics, and population genetics. Trends In Genetics, xxx (x).</i></p> <hr/> <p>Material: Introduction to Phylogenetics Bibliography: <i>Ubaidillah, R & Sutrisno, H. 2012. Introduction to Biosystematics: Theory and Practice. Jakarta: LIPI Press.</i></p>	5%

14	Write scientific articles related to taxa and DNA barcoding	Scientific articles related to DNA Barcoding taxa	<p>Criteria: Individual project assignments</p> <p>Form of Assessment : Practice / Performance</p>	<ul style="list-style-type: none"> • Orientation on the problem of how to analyze DNA barcoding according to the appropriate analysis stages • Planning the analysis stages to be used, accessing gene banks for comparison species • Determining the time and target for analysis results • Sharing analysis results through presentations • Giving each other input on the analysis results as presented and Review 	<p>Material: DNA Barcoding Concept Bibliography: <i>Hebert, PD N, Cywinska, A., Ball, SL & de Waard, JR 2003. Biological Identifications through DNA Barcodes. The Royal Society, 270:313-321.</i></p> <p>Material: stages of bioinformatics analysis References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i></p>	5%
15	Presenting the results of scientific articles that have been produced	Scientific articles related to DNA Barcoding taxa	<p>Criteria: Present the results of the scientific articles produced</p> <p>Form of Assessment : Project Results Assessment / Product Assessment</p>		<p>Material: Stages of DNA Barcoding analysis References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i></p>	5%
16	Presenting the results of scientific articles that have been produced	Scientific articles related to DNA Barcoding taxa	<p>Criteria: Present the results of the scientific articles produced</p> <p>Form of Assessment : Project Results Assessment / Product Assessment, Test</p>		<p>Material: Stages of DNA Barcoding analysis References: <i>Listyorini, D., Winaris, N., Pratiwi., Kartikasari, Nila & Rahayu, Dwi.A. 2019. Molecular Analysis Techniques: Genetics A Work Book. Malang: Muhammadiyah University of Malang.</i></p>	10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	27.5%
2.	Project Results Assessment / Product Assessment	57.5%
3.	Practice / Performance	10%
4.	Test	5%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.

9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.