UNIVERSITAS SEBELAS MARET
FACULTY OF TEACHER TRAINING AND EDUCATION
BACHELOR OF BIOLOGY EDUCATION STUDY PROGRAM
Building D 3rd Floor FTTE UNS Jl Ir. Sutami No. 36 A Kentingan Surakarta 57126 Indonesia
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Animal Embryology and Development

Undergraeduate Programme in Biology Education **Modul Handbook**

Module Name	Animal Embryology and Development
Module level	Undergraduate Programme
Course Code	02013143009
Abbreviation, if applicable	-
Courses included in the module, if applicable	Laboratory Activity
Semester/Term	5th
Module coordinator (s)	Dr. Harlita, S.Si., M.Si.
Lecturer (s)	Dr. Harlita, S.Si., M.Si. Dewi Puspita Sari, S.Pd., M.Sc.
Language	Bahasa Indonesia (Indonesian Language)
Classification within the curriculum	Compulsory/~~Elective~~
Teaching format/class hours per week during the semester	**Direct instruction/face to face/blended learning:** 26.7 hours / week / semester : lecture, discussion **Structured Activity:** 32 hours / week / semester (Through the analysis of journal articles, students learn to analyze the implantation-placentation, extra embryonic membran, neurulasi, organogenesis, regeneration, metamorphosis and terathology) **Self-study Activity:** 32 hours / Week / semester (Students learn various learning methods according to the demands of 21st century learning from various sources) **Practiucum in laboratory:** 28.3 hours / week/topic
Workload	

Type	CSU	Face to Face	Structured Activities	Self-study
T	2	26.7h (1.0 ECTS)	32h (1.21 ECTS)	32h (1.21 ECTS)
P	1	28.3 h (1.07 ECTS)		
Total	3	119 h (4.5 ECTS)		

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Credit Point	3 CSU (4.5 ECTS)
Requirements	Has taken courses in General Biologi, Animal Anatomy and Histology, Microtechnic
Learning goals/ competencies	PLO 2 They are able to **apply** the basic advance knowledge in biology to **solve** the problem in biology. PLO 5 They are able to **select and analyse** the proper technology and information or data in accomplishing tasks. PLO 6 They are able to **demonstrate** laboratory works, design and implement the experiment based on laboratory knowledge, skills, safety, environmental issue, and social ethics problem. PLO 7 They are able to **solve problem** and present the idea argumentatively. CLO 1 Applying concepts in the process of gametogenesis and fertilization to practicum activities. CLO 2 Applying cleavage process in animals, gastrulation and implantation-placentation in practicum activities. CLO 3 Applying concepts in extra embryonic membran, neurulasi and organogenesis in practicum activities. CLO 4 Applying the principle of problem solving regeneration, metamorphosis and terathology through mini research activities.
Learning Goals/Competencies	After taking this course, students are expected to be able to identify, understand, analyze, and apply knowledge about the process of vertebrate embryo formation and its development into new individuals.

CLO/ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO 10
CLO1		*			*	*	*			
CLO2					*	*	*			
CLO3		*			*	*	*			
CLO4		*			*	*	*			

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<table>
<tr><td>Content</td><td>1. Introduction to Embryology and Animal Development
2. Gametogenesis 1 (Spermatogenesis) 3.Gametogenesis 2 (Oogenesis)
4. Fertilization
5. Cleavage
6. Gastrulation
7. Implantation and Placentation
8. Extra Embryonal Membrane
9. Basic Organogenesis: Neurulation
10. Advanced Organogenesis
11. Metamorphosis
12. Regeneration
13. Abnormal development: Teratology
14. Research projects</td></tr>
<tr><td>Attribute Soft skill</td><td>1. Able to think conceptually, analitically, and logically
2. Have good communication skills</td></tr>
<tr><td>Study/exam achievements</td><td>Students are considered to complete the course and pass if they obtain at least 60% of maximum final score. The final score (FS) is calculated based on the following ratio:
<table>
<tr><th>Assessment</th><th>Proportion</th></tr>
<tr><td>Task/presentation/laboratorium activity</td><td>30%</td></tr>
<tr><td>Participation</td><td>10%</td></tr>
<tr><td>Mid-Term Test</td><td>30%</td></tr>
<tr><td>Final Exam</td><td>30%</td></tr>
<tr><td>Final Score</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Learning Methods</td><td>Lecturer, discussion, presentation, project-based, case studies, laboratorium activity</td></tr>
<tr><td>Form of Media</td><td>Power point slide, journal, specimens of chicken and frog eggs, spermatozoon of frog and mice, ect</td></tr>
</table>

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Literature (primary references)	1. Balinsky, B.I. 1981. *An Introduction to Embryology*, Fifth ed. Philadelphia: WB. Saunders. 3. Heffner, Linda J. And Schust, Danny J. At a Glance Sistem Reproduksi, ed 2. Alih bahasa Vidhia Umami. Jakarta: Erlangga 4.Jones, Richard E. 2006. Human Reproductive Biology, Third ed. Amsterdam: Elsevier Academic Press**.** 5. Rugh, 1971. *A Guide to Vertebrate Development*, Minneapolis: Burgers Publishing 6. Sadler, TW. 1988. *Embriologi Kedokteran*. Alih bahasa Irwan Susanto Ed 5. Jakarta: EGC 7. Yatim,W. 1990. Reproduksi dan Embriologi. Bandung: Tarsito 8. Harlita, Niken Satuti Nur Handayani, Mammed Sagi, Pudji Astuti. Acute Toxicity of Cashew Nut Shell Extract (*Anacardium occidentale* L.) In Albino Rat (*Rattus norvegicus* Berkenhout 1769). Pakistan Journal of Biological Sciences: Vol 19 (2) AnsiNet, 89-94 9. Harlita, Dewi Puspita Sari, Suwarno. Aktivitas Antifertilitas Ekstak Kulit Biji Mete (Anacardium occidentale L) terhadap Kadar Hormon Androgen Tikus Putih (Rattus norvegicus Berkenhout 1769). Prosiding Seminar Nasional Pendidikan Sains. 2017. P.Sains FKIP UNS. 310-313 10. Harlita, Riezky Maya Probosari, Joko Ariyanto. Perubahan Histologis Uterus Tikus Putih (*Rattus norvegicus*) Galur Wistar: Aktifitas Antifertilitas Ekstrak Kulit Biji Mete (*Anacardium occidentale* L.) 2015. Bioedukasi vol 8 (2): 1-4 11. Krisher, R. L., Heuberger, A. L., Paczkowski, M., Stevens, J., Pospisil, C., Prather, R. S., ... & Schoolcraft, W. B. (2015). Applying metabolomic analyses to the practice of embryology: physiology, development and assisted reproductive technology. *Reproduction, Fertility and Development*, 27(4), 602-620. Doi:10.1071/RD14359 12. Aguero, T., Kassmer, S., Alberio, R., Johnson, A., & King, M. L. (2017). Mechanisms of vertebrate germ cell determination. *Vertebrate development*, 383-440. 13. Chan, M. M., Smith, Z. D., Grosswendt, S., Kretzmer, H., Norman, T. M., Adamson, B. & Weissman, J. S. (2019). Molecular recording of mammalian embryogenesis. *Nature*, 570(7759), 77-82. Doi:10.1038/s41586-019-1184-5

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ASSESSMENT
ANIMAL EMBRYOLOGY ADN DEVELOPMENT WRITING EXAM QUESTION'S GRID (PLO 2 AND PLO 5)

No	CLO	QUESTION INDICATOR
1	Students can explain the concept of process of gametogenesis and fertilization	History of animal embryology Spermatogenesis Stages Hormones that play a role in spermatogenesis Various kinds of animal sperm Stages of Oogenesis Hormones involved in oogenesis Different types of eggs Egg cell structure Reproductive Cycle Estrus cycle External and internal fertilization Polyspermy Fertilization in frog and chicken embryos
2	Students can analyze the cleavage process in animals, gastrulation and implantation-placentation	Cleavage Fields and Types Mechanism of zygote division in Vertebrates Cleavage application: Cloning, stem cell, Twin Cleavage in chicken and frog embryos Types of movement patterns in Gastrulation Gastrulation in various animals Types of implantation Type of placenta
3	Students can analyze the extra embryonic membran, neurulasi and organogenesis	Extra-embryonic membrane function Types of extra-embryonic membranes in Vertebrates The process of neurulation (formation of the neural tube and neural crest) What does embryonic induction mean? Abnormalities in the process of neurulation and migration of the neural crest Ectoderm derivatives: nervous system Mesoderm derivatives: blood vessels, heart and urogenital Endoderm derivatives: digestive tract and its glands Abnormalities in hereditary ectoderm, mesoderm and endoderm
4	Students can analyze of problem solving regeneration, metamorphosis and terathology through mini research activities.	Regeneration Epimorphosis and morphaphylaxis Practicum: observation of regeneration Complete and imperfect metamorphosis Metamorphosis of Amphibia, Insecta and Puberty in Humans Practicum: metamorphosis observation Factors that cause developmental disorders Types of embryo development abnormalities

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PAPER ASSESSMENT RUBRIC

ASPECT	INDICATOR	SCORE
Background	All the descriptions in this section lead to the main problem and writing of the paper	4
	Just get to the point	3
	Irrelevant general statements	2
	No background	1
The aim of writing	The formulation of the purpose of writing is clear, pithy and systematic	4
	The formulation of the goal is long, but the goal is clear enough	3
	The formulation of objectives is stated in general and the purpose is not clear	2
	No goals written	1
Formulation of the problem	Problems are formulated in a clear, pithy and systematic way	4
	The formulation of the problem is prolonged, but the purpose is quite clear	3
	The formulation of the problem is stated in general terms and the purpose is not clear	2
	There is no written problem formulation	1
Writing Systematics	The systematics of logical writing follows the rules of writing scientific reports	4
	Systematic writing logical but not sequential	3
	Systematic writing is not logical and not in sequence	2
	There is no good writing systematic	1
Discussion	A systematic, logical, original and comprehensive discussion and presents the latest research results	4
	A systematic, logical, original and comprehensive discussion but does not present the latest research results	3
	The discussion is not systematic, logical and comprehensive and does not present the latest research results	2
	Short discussion and copy paste from the internet	1
Conclusion	Conclusions are drawn based on the discussion and the data presented in a clear, concise and systematic way	4
	Conclusions are not drawn based on the discussion and the data presented in a clear, concise and systematic way	3
	Conclusions are not drawn based on the discussion and the data presented are less clear, less concise and less systematic	2
	No conclusion written	1
Reference	Bibliography from trusted sources, following the rules of writing and up to date	4
	Bibliography from trusted sources, following the rules of writing, but not up to date	3
	The bibliography is not from a trusted source, does not follow the rules of writing and is not up-to-date	2
	There is no bibliography	1

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Assessment Instrument 06/LO 06 Have knowledge related to biological research methodology and its learning, can apply and publish the results

PRACTICUM PERFORMANCE ASSESSMENT

Practicum Performance Observation Sheet

No	Name	Aspects of Performance Assessment										Total Score	Note
		1	2	3	4	5	6	7	8	9	10		
1													
2													
3													
4													
5													
Dst													

Information:
1 = Practical equipment
2 = Physical appearance readiness
3 = Interpret
4 = Predict
5 = Applying the concept
6 = Planning an experiment
7= Doing an experiment
8 = Communicate

Practicum Performance Assessment Rubric

No	Aspect	Criteria	Score
Preparation			
1	**Practical equipment**	Bring/prepare all (100%) tools and materials.	4
		Not bringing 25% of the total tools/materials or 25% of the total tools/materials not in accordance with the provisions.	3
		Not bringing 50% of the total tools/materials or 50% of the total tools/materials not in accordance with the provisions	2
		Not bringing 75% of the total tools/materials or 75% of the total tools/materials not in accordance with the provisions	1
2	**Physical appearance readiness**	Lab coat worn and neat appearance.	4
		Wearing a lab coat and looking untidy (wearing t-shirts, shorts, or not wearing shoes)	3
		Do not wear a lab coat and look presentable.	2
		Not wearing a lab coat and looking untidy (wearing t-shirts, shorts, or not wearing shoes).	1
Using tools and materials			
3	**Discipline of practical tools/materials**	All tools/materials are taken neatly and not scattered.	4
		25% of the total tools/materials were taken untidy and scattered.	3
		50% of the total tools/materials were taken untidy and scattered.	2
		75% of the total tools/materials were taken untidy and scattered.	1
4	**Appropriateness of**	All tools/materials are taken as needed.	4

	practical tools/materials	Take 25% of the total tools/materials that are not as needed.	3
		Take 50% of the total tools/materials that are not as needed.	2
		Taking 75% of the total tools/materials that are not as needed.	1
5	**Correct operation of the tool**	All tools are operated properly.	4
		25% of the total tools are operated incorrectly.	3
		50% of the total tools are operated incorrectly.	2
		75% of the total tools are operated incorrectly.	1
6	**Practicum Procedure**	melakukan 100% langkah praktikum dengan benar.	4
		melakukan 75% langkah praktikum dengan benar.	3
		melakukan 50% langkah praktikum dengan benar.	2
		melakukan 25% langkah praktikum dengan benar.	1
Result			
7	**Practical result**	Using as many senses as possible in making observations and doing it carefully according to procedures	4
		Using few senses in making observations and doing it according to procedures	3
		Using as many senses as possible in making observations but not being thorough	2
		Observing the practical results at a glance	1
8	**Practical data**	Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (3 aspects are all fulfilled)	4
		Complete the table according to the results of observations, accompanied by pictures, or accompanied by additional data (information) on the results of the practicum (2 aspects are well fulfilled)	3
		Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (1 aspect is well fulfilled)	2
		Complete the table according to the results of observations, accompanied by pictures, and accompanied by additional data (information) on the results of the practicum (no aspect is fulfilled properly)	1
Closing			
9	**Cleanliness of tools that have been used**	All tools that have been used are cleaned properly and returned	4
		Clean all tools that have been used but are not completely clean and return them	3
		Only clean half of used tools and return them	2
		Only clean one or two tools and don't restore all tools	1
10	**Practice table cleaning**	Clean the table until it's really clean	4
		Cleaning the table but still leaving dirt or trash	3
		Only clean part of the side of the table	2
		The table is still dirty, but throw away the dirt or trash	1