PORTFOLIO

COURSE:
GENERAL MICROBIOLOGY
(PTH 201217)

TEACHING TEAM:

Dr.rer.nat. Ir. Agus Wijaya, M.Si.
Dr. Ir. Parwiyanti, M.P
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AGRICULTURAL PRODUCT TECHNOLOGY
STUDY PROGRAM, FACULTY OF AGRICULTURE
UNIVERSITAS SRIWIJAYA

A. COURSE IDENTITY

Module designation	*General Microbiology*
Semester (s) in which the module is taught	3th semester/2nd year
Person responsible for the module	1. Dr.rer.nat. Ir. Agus Wijaya, M.Si. 2. Dr. Ir. Parwiyanti, M.P. 3. Dr. Ir. Tri Wardani Widowati, M.P.
Language	Indonesian
Relation to curriculum	Compulsory Course
Teaching method, contact hours	1. Face to face lecture (off line, e-learning (online)) 2. Structured assignment (i.e.: article reading and review) 3. The class size 40-75 students per class 4. Contact hours for lecture are 51.33 hours per semester 5. Total hours practical is 19.83 hours per semester
Workload (incl. Contact hours, self-study hours)	1. Lectures (2 x 50 minutes) per week or 51.33 hours per semester 2. Structured assignment (i.e.: article reading and review): 2 x 60 minutes per week or 24 hours per semester 3. Self-study: 2 x 60 minutes per week or 24 hours per semester
Credit points	3 credits (equivalent with 3.91 ECTS)
Requirements according to the examination regulations	A student must have attended the lecture at least 85% of total lectures and submitted all the assignments prior to join the final exam
Module objectives/intended learning outcomes CLO=Course Learning Outcomes	After completing this course, a student is expected to:
	CLO1 understand and be able to explain the history of microbiology, structural differences between procaryote and eukaryote cells, Sporulation, Germination and Sublethal injury
	CLO2 understand and be able to explain the morphological, physiological and isolation and identification methods differences among bacteria, yeast and mold
	CLO3 understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms
	CLO4 understand and be able to explain special mechanism in microorganism in order to survive the adverse environmental condition, including antibiotics
Content	1. History and development of microbiology 2. Identification of prokaryote and eukaryote cells 3. Morphology of bacteria 4. Physiology of bacteria 5. Morphology of yeasts and molds 6. Physiology of yeasts and molds 7. Isolation, identification and nomenclature of bacteria, yeasts and molds 8. Sporulation, Germination and Sublethal injury 9. Microbial Growth 10. Influencing factors for microbial growth

	11. Nutrient transport 12. Microbial metabolism 13. Antibiotics 14. Microbial communication
Examination forms	Individual essay, multiple choice exams, essay exams
Media employed	LCD, whiteboard, LMS Unsri, videos
Reading List	1. Madigan, M,T., Martinko, J. and Parker, J. 2003. Brock Biology of Microorganisms, 10th edition. Pearson Education, Inc., New Jersey 1019 pages + Appendix, Glossary and Index. 2. Ray, B, 2005, Fundamental Food Microbiology, 3rd edition, CRC Press, Boca Raton. 625 pages

B. STUDY LEARNING PLAN

Course Name : General Microbiology

Code/Credits : PTH201017

Course Status : Mandatory

Short Description

This course delivers history of microbiology development; cell structure of prokaryotic, eukaryotic and bacterial spores, yeasts, fungi and bacteriophages; morphology and physiology of bacteria, yeast, molds; isolation, identification and nomenclature; sporulation events, germination and sublethal injury; microbial growth curve and the factors that influence its growth, including antibiotics; transport of nutrients and metabolisms.

Objectives

After the completion of this course, students will be able to understand, describe and explain the knowledge regarding constituent general aspects of microbiology as follows: History and development of microbiology; identification of structure of prokaryotic and eukaryotic cells; identification of bacteria, yeasts and molds; morphology and physiology: methods for isolation, identification and classification of bacteria, yeasts and molds as well as microbial nomenclature; identification of microorganism sources and their growth characteristics; explain about spores from molds, yeasts and bacteria, and also sporulation, germination and sub–lethal injury; describe microbial growth curve and factors affecting growth; explain microbial nutrient transport on membrane system; describe microbial metabolism process; describe microbial communication.

Mapping of Course Learning Outcomes (CLO)-Program Learning Outcomes (PLO)

CLO	Description	PLO*			
		AV	KA	SC	GC
CLO1	understand and be able to explain the history of microbiology, structural differences between procaryote and eukaryote cells, sporulation, germination and sublethal injury	2, 8	2.1, 2.2	4	2
CLO2	understand and be able to explain the morphological, physiological and isolation and identification methods differences among bacteria, yeast and mold	2, 8	2.2, 2.5	4	2
CLO3	understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms	2, 8	2.2, 2.5	4	2
CLO4	understand and be able to explain special mechanism in microorganism in order to survive the adverse environmental condition, including antibiotics	2, 8	2.1, 2.2	4	2

AV= Attitude and Value; **KA**= Knowledge Ability; **SC**= Specific Capability; **GC**= General Capability
*Details are in the Study Program Curriculum file

Course Outlines:

Face-to-Face:

No.	Course materials	Duration (face-to-face) (minutes)	CLO 1	2	3	4
1	History and development of microbiology	110	√			
2	Identification of prokaryote and eukaryote cells	110	√			
3	Bacteria: morphology and physiology	110		√		
4	Isolation, identification and nomenclature of microorganism	110		√		
5	Sporulation, Germination and Sublethal injury	110	√			
6	Evaluation (lectures 1-5)	110	√	√		
7	Yeasts: morphology and physiology	110		√		
8	Molds: morphology and physiology	110		√		
9	Curve of microbial growth	110			√	
10	Intrinsic and extrinsic factors of microbial growth	110			√	
11	Evaluation (lectures 7-10)	110		√	√	
12	Membrane system and nutrient transport	110			√	
13	Microbial metabolism	110			√	
14	Antibiotics: mode of action and microbial resistance	110				√
15	Microbial communication	110				√
16	Evaluation (lectures 12-15)	110			√	√

Outcomes and Assessment

No.	Week	CLO	Sub-CLO	Assessment	Percentage of score weight to final score (%)
1	I	understand and be able to explain the history of micro-biology, structural differences between procaryote and eukaryote cells, sporulation, germination and sublethal injury	History and development of microbiology • Understand history of microbiology • Understand development of microbiology	Ask and answer question (face-to-face). At least 5% of students in the class are able to answer the question correctly	-
2	II	understand and be able to explain the history of micro-biology, structural differences between procaryote and eukaryote cells, sporulation, germination and sublethal injury	structural differences between procaryote and eukaryote cells • Identification of prokaryote cells and understand function of the cell organelle • Identification of eukaryote cells and understand function of the cell organelle	Ask and answer question (face-to-face). At least 5% of students in the class are able to answer the question correctly **Assignment:** hand drawing procaryote and eukaryote cells with function of their organel cells	5
3	III	understand and be able to explain the morphological, physiological; isola-tion and identify-cation methods differences among bacteria, yeast and mold	Bacteria: morphology and physiology • Understanding of bacteria morphology (shape and configuration of cells, movement tools, others specific organelle, bacterial spore, • Understanding of bacterial physiology (bacterial growth in different condition: temperature, pH, osmotic pressure, acidity, Aw)	Ask and answer questions (face-to-face). At least 5% of students in the class are able to answer the question correctly	-
4	IV	understand and be able to explain the morphological, physiological; isola-tion and identify-cation methods differences among bacteria, yeast and mold	Isolation, identification and nomenclature of microorganism • Understand of different methods of isolation • Understand of different methods of organism plating • Describe characteristic of microorganism	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-

			(phenotype and genotype characteristic) • Describe of nomenclature of microorganism		
5	V	understand and be able to explain the history of micro-biology, structural differences between procaryote and eukaryote cells, sporulation, germination and sublethal injury	Sporulation, Germination and Sublethal injury of bacteria • Describe of process and condition of bacteria sporulation • Describe of process and condition of bacteria germination • Describe of condition of bacteria sublethal injure	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
6	VI	EVALUATION 1 (I - V)		Multiple choice exams	20
7	VII	understand and be able to explain the morphological, physiological; iso-lation and identi-fication methods differences among bacteria, yeast and mold	Yeasts: morphology and physiology • Understanding of yeast morphology (shape of cells, reproduction, etc) • Understanding of yeast physiology (various condition for optimal growth)	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
8	VIII	understand and be able to explain the morphological, physiological; iso-lation and identi-fication methods differences among bacteria, yeast and mold	Mold: morphology and physiology • Understanding of yeast morphology (vegetative & generative mycelium, sporangiophores, coni-diophores, reproduction) • Understanding of yeast physiology (various condition for optimal growth)	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
9	IX	understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms	Curve of Microbial growth • Describe phase of microbial growth • Explain condition factors that affect the microbial growth phase	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
10	X	understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms	Intrinsic and extrinsic factors of microbial growth • Describe intrinsic factor of microbial growth (pH, Aw, potential redox, inhibitor, nutrient composition)	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	5

				Assignment : take a summarized of lecture VII - X	
			● Describe extrinsic factors of microbial growth (temperature, RH, air composition)		
11	XI	EVALUATION 2 (VII - X)		Multiple choice exams	20
12	XII	understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms	Membrane system and nutrient transport ● Understand semi permeable membrane system on microorganism ● Understand passive nutrient transport on microorganism ● Understand active nutrient transport on microorganism	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
13	XIII	understand and be able to explain the growth, influencing factors of growth, nutrient transport mechanisms and metabolism in microorganisms	Microbial metabolism ● Understand Catabolism process on energy producing (respiration, fermentation) ● Understand anabolism process on biosynthesis of carbohydrate, lipide, protein, nucleic acid	Ask and answer questions (face-to-face). **Assignment** : take a quiz	5
14	XIV	understand and be able to explain special mechanism in microorganism in order to survive the adverse envi-ronmental condi-tion, including antibiotics	Antibiotics & bacteriosin: ● Identification difference of antibiotic and bacteriocin ● Understand mechanism/ mode of action antibiotics & bacteriocin ● Understand mechanism of microbial resistance	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
15	XV	understand and be able to explain special mechanism in microorganism in order to survive the adverse envi-ronmental con-dition, including antibiotics	Microbial communication ● Understand and explain mechanism of microbial communication	Ask and answer questions (face-to face). At least 5% of students in the class are able to answer the question correctly.	-
16	XVI	EVALUATION 3 (XII-XV)			20
			Total percentage for the lecture		75
			Total percentage for the practical work		25
			TOTAL		100

Assignment

No.	Week	Assignment Instructions	Submission Methods	Weight (%)
1	II	drawing by hand: prokaryotic and eukaryotic cells complete with cell organelles. The picture is equipped with a description and function of each cell organelle	Upload in E-Learning	5
2	X	Summarizing course material in week VII – X.	Upload in E-Learning	5
3	XIII	Take a quiz	Upload in E-Learning	5
	Weight score of evaluation (%)			15

Laboratory Practicum:

No.	Topics	Duration	CLO				Activities in Laboratory
			1	2	3	4	
1	Introduction of tools and Sterilization	170	√				Pre-test, explanation from assistant, practice according to the practical manual, writing the results in worksheet, approval by assistant.
2	Dilution technique	170		√			
3	Microbial counting: pour plate and spread plate	170		√			
4	Microbial counting: bacteria, yeast, mold	170	√			√	
5	Streak plate purification technique	170		√			
6	Isolation of specific microorganisms	170		√	√		
7	Observation of cell shape and configuration, Gram staining, catalase test	170		√			
8	Microbial curve observation	170			√	√	
	Distribution of weight in the lab practicum score: Pre-Test (20%), practicum report (20%), participation (10%), final practicum exam (50%). All student should have 100% of presence in the laboratory, and for those who are unable to attend lab practicum, she/he must take a follow-up practicum at another time. Percentage of score weight of laboratory practicum to final score is 25%.						

Contribution of Course Assessment to PLO

Course Assessment	AV	KA	SC	GC	Type
Assignments	**2, 8**	**2.1, 2.2, 2.5**	**4**	**2**	Formative
Questions in Quiz	**2, 8**	**2.1, 2.2, 2.5**	**4**	**2**	Summative
Questions in Mid-Term	**2, 8**	**2.1, 2.2, 2.5**	**4**	**2**	Summative
Questions in Final Exam	**2, 8**	**2.1, 2.2, 2.5**	**4**	**2**	Summative
Lab Practicum	**2, 8**	**2.1, 2.2, 2.5**	**4**	**2**	Formative

Assignment Assessment Rubric

No.	Criteria	Weight (%)	Score			
			≥ 86	71-85.99	56-70.99	40-55.99
			Excellent	Good	Enough	Bad
1	Format and presentation of written assignment	10	The assignment is presented in accordance with the instructions	There are parts (10%) of the assignment not in accordance with the instructions	There are parts (25%) of the assignment not in accordance with the instructions	There are haff of the assignment not in accordance with the instructions
2	Discussion in the written assignment	50	Information to support the discussion in the assignment is adequate, and the discussion is well organized	Information to support the discussion in the assignment is adequate; however the information is not well written	Information to support the discussion in the assignment is adequate; however the information is copied and pasted in the assignment without paraphrasing	There is not enough information in the assignment. It is just a compilation of information derived from internet searching
3	Publication year of literature cited in the assignment	15	Most of literatures cited are up-to date (≤ 5 years)	Most of literatures cited are between 5-10 years	Most of literatures cited are (≥ 10 years	There is no literature cited
4	Number of literatures cited in the assignment	15	There are ≥ 3 literature cited	There are ≤ 3 literature cited	One literature cited	There is no literature cited
5	Submission time	10	Assignment is submitted before the deadline	Assignment is submitted one day after the deadline	Assignment is submitted two days after the deadline	Assignment is submitted after two days from deadline

Benchmark for Scoring

No.	Range of Score	Grade	Description
1	86.00 - 100.00	A	Excellent
2	71.00 – 85.99	B	Good
3	56.00 – 70.99	C	Fair
4	40.00 – 55.99	D	Bad
5	<40.00	E	Worst

Benchmark for Evaluation of the achievement of CLO

No.	Performance of Evaluation	Criteria
1	Very satisfactory	If ≥ 80% of students in a class achieve Good and Excellent
2	Satisfactory	If 70-79,9% of students in a class achieve Good and Excellent
3	Fairly satisfactory	If 60-69.9% of students in a class achieve Good and Excellent
4	Unsatisfactory	If <60% of students in a class achieve Good and Excellent

Remedial Exam:

Students are allowed to join Remedial Exam if the score is under 60 out of 100.

RESULTS OF ASSESSMENT

PALEMBANG CLASS

NIM	NAMA	Assignment*)	Evaluation 3	Evaluation 1	Lab work	Evaluation 2	Assignment	Lab work	Evaluation 3	Evaluation 1	Evaluation 2	NTR	NUTS	NUAS	Final score	Grade	Overall assessment
05031182025001	NYIMAS SINTA SATIA	70	80	88.6	88,61	100	not achieved	Achieved	achieved	achieved	achieved	31.72	16	37.72	85.44	B	achieved
05031282025042	ALIFIA ANGGRAINI	85	77	94.3	90,1	100	achieved	Achieved	achieved	achieved	achieved	35.02	15.4	38.86	89.28	A	achieved
05031381823050	TYAS DWI WIJAYANTI	75	83	80	90,38	100	achieved	Achieved	achieved	achieved	achieved	33.08	16.6	36	85.68	B	achieved
05031381823054	SULAIMAN	100	80	60	86,53	65	achieved	Achieved	achieved	not achieved	not achieved	37.31	16	25	78.31	B	achieved
05031381823055	NI MADE GALUH NADILA	100	80	60.4	87,48	70	achieved	Achieved	achieved	not achieved	not achieved	37.50	16	26.08	79.58	B	achieved
05031381823056	PERU IRAWAN	100	100	71.4	90,75	75	achieved	Achieved	achieved	achieved	achieved	38.15	20	29.28	87.43	A	achieved
05031381823058	MUHAMMAD ATHIEF GHUFRAN	100	100	66	87,6	86	achieved	Achieved	achieved	not achieved	achieved	37.52	20	30.4	87.92	A	achieved
05031381823060	FIRZA FAHLEFFI SUHARTO	100	90	80	91,93	80	achieved	Achieved	achieved	achieved	achieved	38.39	18	32	88.39	A	achieved
05031381823061	YOSAVAT TAMARO NAINGGOLAN	100	100	74.3	87,78	75	achieved	Achieved	achieved	achieved	achieved	37.56	20	29.86	87.42	A	achieved
05031381823064	UTARI PUTRI	100	100	60.3	89,84	90	achieved	Achieved	achieved	not achieved	achieved	37.97	20	30.06	88.03	A	achieved
05031381823065	WIJI LESTARI	100	95	85.7	89,25	86	achieved	Achieved	achieved	achieved	achieved	37.85	19	34.34	91.19	A	achieved
05031381823069	DERISA ROSALIA	100	85	74.3	89,48	95	achieved	Achieved	achieved	achieved	achieved	37.90	17	33.86	88.76	A	achieved
05031381823070	AYU WURIA NINGSIH	100	100	70.6	89,4	75	achieved	Achieved	achieved	not achieved	achieved	37.88	20	29.12	87.00	A	achieved
05031381823071	DEVY SYAHPUTRI	100	95	65.7	89,03	86	achieved	Achieved	achieved	not achieved	achieved	37.81	19	30.34	87.15	A	achieved
05031381823072	TAMILIA VAROKA	100	100	65.7	90,3	86	achieved	Achieved	achieved	not achieved	achieved	38.06	20	30.34	88.40	A	achieved
05031381823073	MEIKA TRIYA ANDANI	100	100	71.4	90,63	75	achieved	Achieved	achieved	achieved	achieved	38.13	20	29.28	87.41	A	achieved
05031381823078	AYU SEPTIANA	100	100	72.7	91,4	70	achieved	Achieved	achieved	achieved	not achieved	38.28	20	28.54	86.82	A	achieved
05031382025063	MUHAMMAD ALIF MUFLIH	100	100	91.4	87,55	100	achieved	Achieved	achieved	achieved	achieved	37.51	20	38.28	95.79	A	achieved
05031382025064	VALLENTIA PIDI ARTA MULIA	100	100	82.1	85,9	65	achieved	Achieved	achieved	achieved	not achieved	37.18	20	29.42	86.60	A	achieved
05031382025065	FERDINANTRI AKBAR	100	65	60.3	81,45	70	achieved	Achieved	not achieved	not achieved	not achieved	36.29	13	26.06	75.35	B	achieved
05031382025067	MUHAMMAD DAVID ALFARISI	100	90	75	85,2	86	achieved	Achieved	achieved	achieved	achieved	37.04	18	32.2	87.24	A	achieved
05031382025069	HANIFAH AULIA ANALYRA	100	75	85	86,26	95	achieved	Achieved	achieved	achieved	achieved	37.25	15	36	88.25	A	achieved
05031382025070	RICKY RIKARDO	100	100	74.3	84,46	75	achieved	Achieved	achieved	achieved	achieved	36.89	20	29.86	86.75	A	achieved
05031382025072	YOHANNES MANIK	100	75	68.6	81,1	55	achieved	Achieved	achieved	not achieved	not achieved	36.22	15	24.72	75.94	B	achieved

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ID	Name																
05031382025074	YUNI SARA MARISYAH	100	75	65	86,06	60	achieved	Achieved	achieved	not achieved	not achieved	37.21	15	25	77.21	B	achieved
05031382025076	ANNISA NUR SAFIRA WIJAYA	100	100	76	85,92	70	achieved	Achieved	achieved	achieved	not achieved	37.18	20	29.2	86.38	A	achieved
05031382025077	VICKY RIFANSYA	100	85	68.6	85,03	100	achieved	Achieved	achieved	not achieved	achieved	37.01	17	33.72	87.73	A	achieved
05031382025078	HIDAYATULLAH	100	100	79	81,61	70	achieved	Achieved	achieved	achieved	not achieved	36.32	20	29.8	86.12	A	achieved
05031382025080	AISYAH NURLIANI	100	70	65	82,91	60	achieved	Achieved	not achieved	not achieved	not achieved	36.58	14	25	75.58	B	achieved
05031382025081	FARHAN MUHARAM	100	54	70.6	83,86	75	achieved	Achieved	not achieved	not achieved	achieved	36.77	10.8	29.12	76.69	B	achieved
05031382025083	RADNA SEKAR KUSUMA NINGRUM	100	100	86	89	65	achieved	Achieved	achieved	achieved	not achieved	37.80	20	30.2	88.00	A	achieved
05031382025085	MUHAMMAD FARHAN	100	100	70.6	82,83	77	achieved	Achieved	achieved	not achieved	achieved	36.57	20	29.52	86.09	A	achieved
05031382025089	ANNISA KHALA NABILLAH	100	100	72	86,72	75	achieved	Achieved	achieved	achieved	achieved	37.34	20	29.4	86.74	A	achieved
05031382025090	OKO NENDAR YURIDA	100	75	68.7	53,1	65	achieved	not achieved	achieved	not achieved	achieved	30.62	15	26.74	72.36	B	achieved
05031382025091	INTAN NOVALIA	100	90	76.4	82,98	95	achieved	Achieved	achieved	achieved	achieved	36.60	18	34.28	88.88	A	achieved
05031382025098	FIKRI NAUFALDY DANANJAYA	100	100	65	81,96	86	achieved	Achieved	achieved	not achieved	achieved	36.39	20	30.2	86.59	A	achieved
05031382025099	KHAIDIR ALI	100	80	60.3	77,38	55	achieved	Achieved	achieved	not achieved	not achieved	35.48	16	23.06	74.54	B	achieved
Average		98,11	89,16	73,01	89	78,73											
							97.28% achieved	97,297% achieved	91.89% achieved	54.05% achieved	67.57% achieved						

*)Score of assignment: Average of 3 Assignment
NTR : 20% Lab. Work + 20% Assignment

NUTS: 20% Evaluation 3

NUAS: 20% Evaluation 2 + 20% Evaluation 1

CLO achievement is at least > 86.

.

Overall in class=100.00%

INDRALAYA CLASS

M	NAMA	Assignment	Evaluation 3	Evaluation 2	Lab work	Evaluation 1	Assign ment	Lab work	Evaluation 3	Evaluation 1	Evaluation 2	NTR	NUTS	NUAS	Final score	Grade	Overall assessment
05031181722057	ANISA MEILINDA	100	100	80	86	90	achieved	achieved	achieved	achieved	achieved	37.20	20	34	91.20	A	achieved
05031182025002	REVI RIANI	100	84	97.1	92,91	100	achieved	achieved	achieved	achieved	achieved	38.58	16.8	39.42	94.80	A	achieved
05031182025003	PUTRI WULAN DARI	100	86	86	90,55	95	achieved	achieved	achieved	achieved	achieved	38.11	17.2	36.2	91.51	A	achieved
05031182025004	VIONITA SEPTRIANI	100	90	80	91,26	86	achieved	achieved	achieved	achieved	achieved	38.25	18	33.2	89.45	A	achieved
05031182025005	ERIKA NANDA SYOFIANTI	100	87	90	90,47	95	achieved	achieved	achieved	achieved	achieved	38.09	17.4	37	92.49	A	achieved
05031182025006	NOFIANTO	100	94	100	94,21	100	achieved	achieved	achieved	achieved	achieved	38.84	18.8	40	97.64	A	achieved
05031182025007	HENI MARICO	100	87	85	90,81	95	achieved	achieved	achieved	achieved	achieved	38.16	17.4	36	91.56	A	achieved
05031182025008	CELCILIA ASRI PUTRI	100	92	91	90,25	100	achieved	achieved	achieved	achieved	achieved	38.05	18.4	38.2	94.65	A	achieved
05031182025009	FADILLA FEBRIANI	100	100	65.7	86,76	80	achieved	achieved	achieved	achieved	not achieved	37.35	20	29.14	86.49	A	achieved
05031182025010	FRISKA AZZAHRA	100	100	80	86,47	86	achieved	achieved	achieved	achieved	achieved	37.29	20	33.2	90.49	A	achieved
05031182025011	ANJELITA PRAMUDIA	100	57	65.7	84,51	75	achieved	achieved	not achieved	achieved	achieved	36.90	11.4	28.14	76.44	B	achieved
05031182025012	IIS ARISKA	100	70	82.9	83,85	55	achieved	achieved	not achieved	not achieved	achieved	36.77	14	27.58	78.35	B	achieved
05031182025013	ELIZA DWI PUTRI	100	77	90	92,45	100	achieved	achieved	achieved	achieved	achieved	38.49	15.4	38	91.89	A	achieved
05031182025014	ANA AMINAH	100	80	90	93,08	95	achieved	achieved	achieved	achieved	achieved	38.62	16	37	91.62	A	achieved
05031182025015	HANA OKTARIYANI	100	90	77.1	86,36	90	achieved	achieved	achieved	achieved	achieved	37.27	18	33.42	88.69	A	achieved
05031182025016	DELI SARTIKA	100	100	80	89,77	75	achieved	achieved	achieved	achieved	achieved	37.95	20	31	88.95	A	achieved
05031182025017	FERI NURMALA SARI	100	100	65.7	86,36	95	achieved	achieved	achieved	achieved	not achieved	37.27	20	32.14	89.41	A	achieved
05031182025018	CICI AMBARWATI	100	100	74	89,26	75	achieved	achieved	achieved	achieved	achieved	37.85	20	29.8	87.65	A	achieved
05031282025019	SANTANIA ALDITA KABAN	100	87	97.1	90,96	100	achieved	achieved	achieved	achieved	achieved	38.19	17.4	39.42	95.01	A	achieved
05031282025020	DELIA MAHARANI	100	89	85	89,8	90	achieved	achieved	achieved	achieved	achieved	37.96	17.8	35	90.76	A	achieved
05031282025021	MUHAMMAD RIZQI LIOGA PUTRA	100	100	77.1	89,46	70	achieved	achieved	achieved	not achieved	achieved	37.89	20	29.42	87.31	A	achieved
05031282025022	KRISNA RAMADHAN	100	87	85	92,31	100	achieved	achieved	achieved	achieved	achieved	38.46	17.4	37	92.86	A	achieved
05031282025023	SHAKIRA ALFISYAHRINI	100	84	100	90,86	100	achieved	achieved	achieved	achieved	achieved	38.17	16.8	40	94.97	A	achieved
05031282025024	M. FADLY WAHYUDHI	100	100	71.4	89,9	75	achieved	achieved	achieved	achieved	achieved	37.98	20	29.28	87.26	A	achieved
05031282025025	PANI ISMIRA	100	70	94.3	91,81	100	achieved	achieved	not achieved	achieved	achieved	38.36	14	38.86	91.22	A	achieved

ID	Name																
05031282025026	NYAYU FITHRIAH AL KAMILAH	100	87	88.6	92,11	100	achieved	achieved	achieved	achieved	achieved	38.42	17.4	37.72	93.54	A	achieved
05031282025027	WILLY PERDANA	100	100	77.1	86,65	75	achieved	achieved	achieved	achieved	achieved	37.33	20	30.42	87.75	A	achieved
05031282025028	WIDYA ADENINGRUM	100	89	80	93,16	86	achieved	achieved	achieved	achieved	achieved	38.63	17.8	33.2	89.63	A	achieved
05031282025029	GRESSI PAKPAHAN	100	100	80	89,97	75	achieved	achieved	achieved	achieved	achieved	37.99	20	31	88.99	A	achieved
05031282025030	ELA ROSWASTI A. SYEBA GINTING	100	87	86	88,77	100	achieved	achieved	achieved	achieved	achieved	37.75	17.4	37.2	92.35	A	achieved
05031282025031	DIAN KURNIATI	100	93	71.4	88,62	85	achieved	achieved	achieved	achieved	achieved	37.72	18.6	31.28	87.60	A	achieved
05031282025032	JIHAN PUTRI NABILA	100	85	94.3	89,48	100	achieved	achieved	achieved	achieved	achieved	37.90	17	38.86	93.76	A	achieved
05031282025033	ARYA FEBRIAN	100	95	68.6	89,71	90	achieved	achieved	achieved	achieved	not achieved	37.94	19	31.72	88.66	A	achieved
05031282025034	NADYA RAHMA	100	100	74.3	89,78	100	achieved	achieved	achieved	achieved	achieved	37.96	20	34.86	92.82	A	achieved
05031282025035	IRA SALSABILA UTAMI SEMBIRING	100	90	88.6	91,7	100	achieved	achieved	achieved	achieved	achieved	38.34	18	37.72	94.06	A	achieved
05031282025036	SRI WAHYUNI	100	87	95	90,1	90	achieved	achieved	achieved	achieved	achieved	38.02	17.4	37	92.42	A	achieved
05031282025037	GEBY ZONA KHANSA	100	87	71.4	90,57	90	achieved	achieved	achieved	achieved	achieved	38.11	17.4	32.28	87.79	A	achieved
05031282025038	M. IQBAL AIDIL FITRI YR	100	85	90	91,11	90	achieved	achieved	achieved	achieved	achieved	38.22	17	36	91.22	A	achieved
05031282025039	TRIE AGMA YANSIH	100	83	85	89,76	90	achieved	achieved	achieved	achieved	achieved	37.95	16.6	35	89.55	A	achieved
05031282025040	MIFTAHUL JANNAH	100	90	85.7	89,8	90	achieved	achieved	achieved	achieved	achieved	37.96	18	35.14	91.10	A	achieved
05031282025041	MONA NOVELIA	100	85	88.6	92,13	80	achieved	achieved	achieved	achieved	achieved	38.43	17	33.72	89.15	A	achieved
05031282025043	MEILISA HAGAINA BR SITEPU	100	84	80	91,93	100	achieved	achieved	achieved	achieved	achieved	38.39	16.8	36	91.19	A	achieved
05031282025044	GITA IFANKA	100	86	82.9	92,65	90	achieved	achieved	achieved	achieved	achieved	38.53	17.2	34.58	90.31	A	achieved
05031282025045	REYNALDI CHRISTIAN PANE	100	92	100	89,58	60	achieved	achieved	achieved	not achieved	achieved	37.92	18.4	32	88.32	A	achieved
05031282025046	CINDANA CUCITRA SINAGA	100	91	94.3	91,8	80	achieved	achieved	achieved	achieved	achieved	38.36	18.2	34.86	91.42	A	achieved
05031282025047	DEFI NISTRISYAH	100	75	90	90,55	90	achieved	achieved	achieved	achieved	achieved	38.11	15	36	89.11	A	achieved
05031282025048	DONI IRAWAN	100	100	60	21,25	60	achieved	not achieved	achieved	not achieved	not achieved	24.25	20	24	68.25	B	achieved
05031282025049	SAMUEL MACNUSDAY SITINJAK	100	60	74.3	86,06	70	achieved	achieved	not achieved	not achieved	achieved	37.21	12	28.86	78.07	B	achieved
05031282025050	ILHAM MOECHAMMAD QODRI	100	93	72.9	91,25	90	achieved	achieved	achieved	achieved	achieved	38.25	18.6	32.58	89.43	A	achieved
05031282025051	SITI ZULYETTA SOFYA FINARTI A ABIDIN	100	80	88.6	90,46	95	achieved	achieved	achieved	achieved	achieved	38.09	16	36.72	90.81	A	achieved

ID	Name																
05031282025052	RIZKY MARULITUA RUMAHORBO	100	85	85	93,6	95	achieved	achieved	achieved	achieved	achieved	38.72	17	36	91.72	A	achieved
05031282025053	HISYAM DANY AL DAFFA	100	100	77.1	84,41	90	achieved	achieved	achieved	achieved	achieved	36.88	20	33.42	90.30	A	achieved
05031282025054	THARRA NISA RAFIQAH	100	87	90	94,41	95	achieved	achieved	achieved	achieved	achieved	38.88	17.4	37	93.28	A	achieved
05031282025055	VANESA INDAH WINARNO	100	100	65	89,7	90	achieved	achieved	achieved	achieved	not achieved	37.94	20	31	88.94	A	achieved
05031282025056	KASSANDRA DWIKI ANNISA	100	80	80	91,8	90	achieved	achieved	achieved	achieved	achieved	38.36	16	34	88.36	A	achieved
05031282025057	FIGO ARDIANSYAH	100	100	74.3	88,42	75	achieved	achieved	achieved	achieved	achieved	37.68	20	29.86	87.54	A	achieved
05031282025058	SAMUEL SILALAHI	100	84	90	92,58	100	achieved	achieved	achieved	achieved	achieved	38.52	16.8	38	93.32	A	achieved
05031282025059	ALGA MAWARA	100	100	65.7	90,61	86	achieved	achieved	achieved	achieved	not achieved	38.12	20	30.34	88.46	A	achieved
05031282025061	LAUREN F MANALU	100	87	95	92,23	95	achieved	achieved	achieved	achieved	achieved	38.45	17.4	38	93.85	A	achieved
05031382025062	MAULANA ARIF NUGRAHA	100	93	71.4	90,55	95	achieved	achieved	achieved	achieved	achieved	38.11	18.6	33.28	89.99	A	achieved
05031382025066	GALIH WICAKSANA	100	90	72.9	88,41	95	achieved	achieved	achieved	achieved	achieved	37.68	18	33.58	89.26	A	achieved
05031382025071	BUDI TRIANSYAH	100	87	82.9	90,46	90	achieved	achieved	achieved	achieved	achieved	38.09	17.4	34.58	90.07	A	achieved
05031382025073	ADYA APRILLANDI CAHYA	100	87	77	90,42	86	achieved	achieved	achieved	achieved	achieved	38.08	17.4	32.6	88.08	A	achieved
05031382025075	SONIA	100	100	77.1	90,42	95	achieved	achieved	achieved	achieved	achieved	38.08	20	34.42	92.50	A	achieved
05031382025079	DESMI HARTIKA	100	100	72	83,86	75	achieved	achieved	achieved	achieved	achieved	36.77	20	29.4	86.17	A	achieved
05031382025087	DEVI DESVIANA	100	100	72.9	88,16	75	achieved	achieved	achieved	achieved	achieved	37.63	20	29.58	87.21	A	achieved
05031382025088	TIAN NABILA MAHARANI	100	90	71.4	89,95	90	achieved	achieved	achieved	achieved	achieved	37.99	18	32.28	88.27	A	achieved
05031382025092	CINCIN	100	100	80	85,72	80	achieved	achieved	achieved	achieved	achieved	37.14	20	32	89.14	A	achieved
05031382025094	AGDELILLAH	100	40	85.7	81,05	86	achieved	achieved	not achieved	achieved	achieved	36.21	8	34.34	78.55	B	achieved
05031382025095	PEBRI WAHYUDI	100	70	61.4	83,6	70	achieved	achieved	not achieved	not achieved	not achieved	36.72	14	26.28	77.00	B	achieved
05031382025097	REILLY HAFIIDHA WANA PUTRI	100	100	70	88,36	75	achieved	achieved	achieved	achieved	not achieved	37.67	20	29	86.67	A	achieved
Average		100	88,66	81,33	86	87,69											
							100% achieved	98.59 achieved	91.54% achieved	91.55 achieved	88.73% achieved						

CLO achievement is at least >86.00
Overall in class=100%

NTR : 20% Lab. Work + 20% Assignment

NUTS: 20% Evaluation 3
NUAS: 20% Evaluation 2 + 20%
Evaluation 1   %
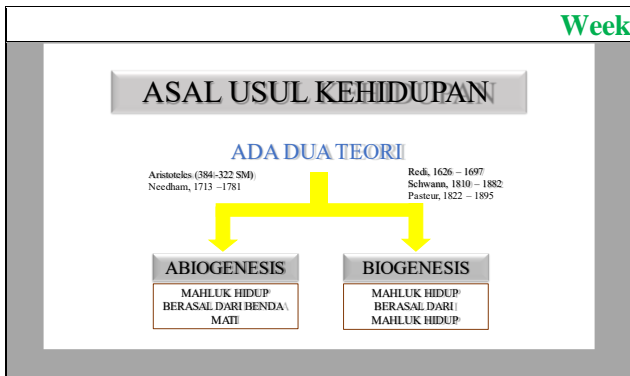
Percentage of CLO Achievement per Class

CLASS: PALEMBANG

No	Evaluation	Weight (%)	Score	CLO 1	CLO 2	CLO 3	CLO 4	Level of achievement
1	Assignment	15	98.11	97.28%	97.28%	97.28%	97.28%	Very satisfactory
2	Evaluation 3	20	89.16	91.89%	91.89%			Very satisfactory
3	Evaluation 2	20	78.73		67.57%	67.57%		Fairly satisfactory
4	Evaluation 1	20	73.01			54.05%	54.05%	Unsatisfactory
5	Lab. work	20	89	97.29%	97.29%	97.29%	97.29%	Very satisfactory

CLASS: INDRALAYA

No	Evaluation	Weight (%)	Score	CLO 1	CLO 2	CLO 3	CLO 4	Level of achievement
1	Assignment	15	100	100%	100%	100%	100%	Very satisfactory
2	Evaluation 3	20	88.66	91.54%	91.54%			Very satisfactory
3	Evaluation 2	20	81.33		88.73%	88.73%		Very satisfactory
4	Evaluation 1	20	87.69			91.55%	91.55%	Very satisfactory
5	Lab. work	20	86	98.59%	98.59%	98.59%	98.59%	Very satisfactory

Course materials in Power Point Slides

Week 1

ASAL USUL KEHIDUPAN

ADA DUA TEORI

Aristoteles (384 -322 SM)
Needham, 1713 – 1781

Redi, 1626 – 1697
Schwann, 1810 – 1882
Pasteur, 1822 – 1895

ABIOGENESIS
MAHLUK HIDUP
BERASAL DARI BENDA
MATI

BIOGENESIS
MAHLUK HIDUP
BERASAL DARI
MAHLUK HIDUP

Teori Tentang Asal Kehidupan

Teori Abiogenesis pelopornya seorang ahli filsafat zaman Yunani Kuno Aristoteles (384-322 SM) yang berpendapat bahwa makhluk hidup terjadi begitu saja pendapat ini masih terus bertahan sampai abad k e 17 -18

Anthony van Leenwenhoek (abad ke 18) berhasil membuat mikroskop dan melihat jasad renik di dalam air bekas rendaman jerami, penemuan Leeuwenhoek (salah seorang penganut teori abiogenesis) memperkuat teori generatio spontanea teori terbukti makhluk hidup berasal dari benda mati (jasad renik berasal dari air bekas rendaman jerarni)

Beberapa ahli berusaha mengadakan penelitian untuk menyangkal teori generatio spontanea antara lain **Franscesco Redi, Spallanzani dan Louis Pasteur.**

Abiogenesis vs Biogenesis

Abiogenesis	Biogenesis
Renaisance Period: Animacules (maggots) from dead bodies or spoiled flesh was thought to be due to spontaneous generation	**Redi 1665** animacules (maggots) in spoiled meat and fish could only appear if flies were allowed to contaminate them.
Needham, 1749: showed boilled meat following sotarge in covered flask showed the present within a short time	**Spallanzani, 1765**: showed the boiling meat infusion in broth in a flask and sealing the flask immediately prevented the appearant if maggot
Lavoiser: showed the need oxygen for life.	**Schulze, 1830** by passing air through acid, **Schwann, 1838** by passing air through red hot tube, and **Shroeder, 1854** by passing air through cotton, showed that bacteria failed to appear
	Louis Pasteur, 1864

Sejarah (TEORI ABIOGENESIS DAN BIOGENESIS)

➢ TEORI ABIOGENESIS Generasi Spontan
- Asal usul animalculus di alam diperdebatkan
- Teoria biogenesis: Animalculus timbul dng sendirinya dari bahan mati.

Life could arise from something nonliving
Kehidupan terjadi secara spontan berasal dari benda mati

Antonie Lavoiser 1743-1794 showed the need oxygen for life.

Pasteur Experiment (1859)
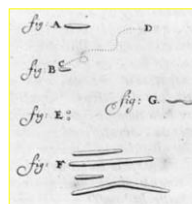
Pasteur mencoba memperbaiki percobaan Spallanzani dengan menggunakan tabung kaca berbentuk leher angsa atau huruf S untuk menutup labu walaupun labu tersumbat udara sebagai "sumber gaya hidup" dapat masuk ke dalam labu. Dengan percobaan ini Pasteur berhasil menumbangkan teori generatio spontanea.

➢ L. Pasteur :
(1) Udara mengandung mikrobia yg pembagiannya tidak merata,
(2) Pemanasan adalah cara pembebasan cairan/bahan dari mikrobia Merupakan dasar dari proses pasteurisasi dan sterilisasi

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Mikroskup Pertama

Robert Hooke, 1664

Week 2

The CELL
Prokariotik dan Eukariorik

Dr. Ir. Tri Wardani Widowati, M.P.

Pendahuluan :

- Pengertian Mikrobiologi :
  Mikrobiologi adalah ilmu yang mempelajari mikrobia .
- Mikrobia : Jasad hidup yang ukurannya kecil shg. sukar dilihat dng mata biasa, juga mempunyai pengaturan kehidupan yang lebih sederhana dibandingkan dengan jasad tingkat tinggi
  Istilah lain : mikroba, mikroorganisma , jasat renik, protista
- Ukuran mikrobia dinyatakan dalam mikron (μ).
  1 mikron = 0,001 mm
- Sel mikrobia umumnya hanya dapat dilihat dengan alat pembesar atau mikroskop , walaupun demikian ada mikroba yang berukuran besar sehingga dapat dilihat tanpa alat pembesar.


Perbandingan Virus dan Organisme bersel

Struktur	Virus	Organisme bersel
Satuan struktur	Partikel (virion)	sel
Susunan : - Asam inti	DNA / RNA	DNA dan RNA
- Protein	ada (selubung)	ada, lengkap
- Lipida	tidak ada / ada	ada
- Polisakarida	tidak ada / ada	ada
- ATP / energi	tidak ada	ada
Sifat pertumbuhan:		
-Terbentuk dr bhn genetik saja	Ya	Tidak
- Bagian-bagian disintesis sendiri	Ya	Tidak
- Terbentuk langsung dari elemen struktur sejenis yg ada sebelumnya	Tidak	Ya

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Sel Prokariotik

CIRI – CIRI :
- Tidak terdapat membran internal yang memisahkan nukleus dari sitoplasma
- Tidak ada membran internal yang melingkungi struktur lain dibalam sitoplasma
- Pembagian nukleus ialah dengan pembelahan sederhana
- Dinding sel terdiri komponen kompleks mukopeptida yg memberikan sifat kaku pada struktur selnya
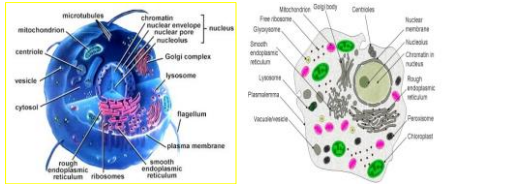
STRUKTUR SEL PROKARIOTIK
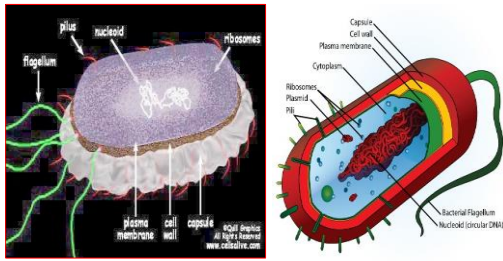
SEL EUKARIOTIK

CIRI UTAMA : adanya sistem membran internal yg ekstensif. Membran ini disebut retikulum endoplasma, yg meluas ke seluruh sitoplasma & bagian penyekat sel dng cara melingkungi struktur tertentu atau situs kegiatan biokimiawi. Struktur yg terikat membran ini dinamai organel.
- Sel eukariotik mempunyai inti sejati yg diselimuti membran inti.
- Nukleus/Inti sel : bagian sel yang sangat penting, berbentuk bulat dikelilingi oleh membran ganda (selaput nukleus) yg berkelanjutan dng retikulum endoplasma
  - Inti sel lokasi utama bhn genetis berupa genome/DNA yg berfungsi sbg pengendali sel. Seluruh bahan genetis tsb tersusun dlm suatu kromosom.
  - DNA kromosom berasosiasi dng protein yg disebut histon
  - Kromosom dapat mengalami pembelahan melalui proses yang dikenal sebagai mitosis.

STRUKTUR SEL EUKARIOTIK

Struktur	Prokariotik	Eukariotik
Macam mikrobia	Bakteri &Sianobakteria (Algae hijau-biru)	Algae umumnya, Fungi, Protozoa, Plantae, animalia
Ukuran sel	<1-2 x 1-4 μ (mikron)	> 5 μ (mikron)
Struktur genetik: - Membran inti	Tidak ada	ada
- Jml. kromosom	1 (siklis)	> 1
- Mitosis	tidak ada	ada
- DNA inti	tidak terikat histon	terikat histon
- DNA organel	tidak ada	ada
- % G+C DNA	28-73	± 40
Struktur dlm sitoplasma		
- Mitokondria	Tidak ada	Ada
- Kloroplas	Tidak ada	Ada / tidak ada
- Ribosom plasma	70 S*)	80 S*)
- Ribosom organel	tidak ada	ada (70 S*)
- Retikulum endoplasmik	tidak ada	ada
- Aparat golgi	tidak ada	ada
- Fagositosis	tidak ada	ada / tidak ada
- Pinositosis	tidak ada	ada / tidak ada

Ket. : *) S : konstante pengendapan Svedberg = 1 x 10^{-3} detik/dyne/gram

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Week 3

PROSES ISOLASI DAN IDENTIFIKASI bakteri
TRI WARDANI WIDOWATI
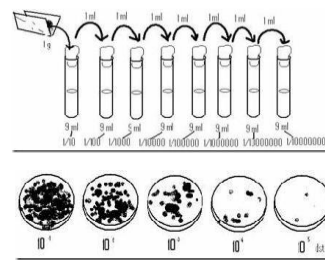
Teknik penanaman ini lanjutan dari pengenceran bertingkat. Pengambilan suspensi dapat diambil dari pengenceran mana saja tapi biasanya untuk tujuan isolasi (mendapatkan koloni tunggal) diambil beberapa tabung pengenceran terakhir. Cara : Spread plate, Pour plate

Spread Plate (agar tabur ulas)
Spread plate adalah menyebarkan suspensi bakteri di permukaan agar .
Cara:
- suspensi cairan sebanyak 0,1 ml kemudian teteskan diatas permukaan agar yang telah memadat
- Batang L atau batang drugal yg telah disemprot alkohol dan dibakar diatas bunsen beberapa saat, dan ditunggu dingin beberapa detik.
- Kemudian disebarkan dengan menggosokannya pada permukaan agar supaya tetesan suspensi merata, penyebaran akan lebih efektif bila cawan ikut diputar.
- Perlu diingat bahwa batang L yang terlalu panas dapat menyebabkan sel-sel mikroorganisme dapat mati karena panas.

Metode : Pour plate

Teknik ini memerlukan agar yang belum padat (>45oC) untuk dituang bersama suspensi bakteri ke dalam cawan petri kemudian dihomogenkan dan dibiarkan memadat.
Hal ini akan menyebarkan sel-sel bakteri tidak hanya pada permukaan agar saja melainkan sel terendam agar (di dalam agar) sehingga terdapat sel yg tumbuh dipermukaan agar yang kaya O2 dan ada yg di dalam agar yg tidak banyak begitu banyak mengandung oksigen.

Cara :
- Siapkan cawan steril, tabung pengenceran yg akan ditanam dan media padat yang masih cair (>45oC)
- Teteskan 1 ml secara aseptis,suspensi sel kedalam cawan kosong
- Tuangkan media yg masih cair ke cawan kemudian putar cawan untuk menghomogenkan suspensi bakteri dan media, kemudian diinkubasi.
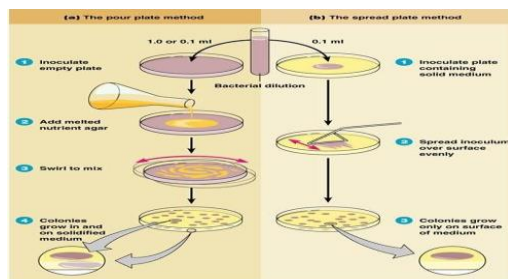
PENGHITUNGAN POPULASI

Contoh hasil penghitungan :
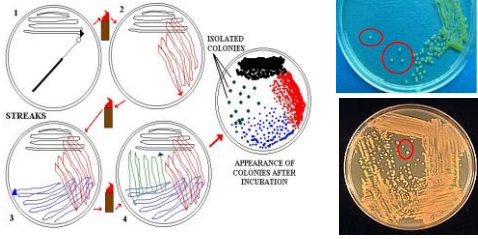 pd pengenceran 10^{-4} , jml sel dlm petri : 75
- Pour plate : sampel 1 ml
  populasi = 75 x 1/ 10^{-4} x 1 ml = 75 x 10^4 = 7,5 10^5
- Spread plate : sampel 0,1 ml
  populasi = 75 x 1/ 10^{-4} x 0,1 ml= 75 x10^5 = 7,5 10^6

Proses Pemurnian isolat
streaks plate / metoda gores

TAHAPAN IDENTIFIKASI MIKROBA

Week 15

Quorum Sensing: Cara mikroba berkomunikasi

Pendahuluan
③

- Bentuk-bentuk sinyal ini dapat kita temukan pada organisme tingkat tinggi.
- Tetapi adakah komunikasi terjadi pada organisme tingkat rendah seperti pada bakteri dan kalau memang ada bagaimana komunikasi itu terjadi?

Bitter facts
⑥

- Dibutuhkan waktu 50 tahun sampai ditemukannya antibiotika untuk memerangi bakteri patogen. Tuberkulosis, kholera, diphteri dkk. tampaknya telah dapat dikalahkan. Tetapi ternyata dugaan itu tidak sepenuhnya benar.
- Sejak tahun 1980-an, bahkan di negara-negara industri, terdapat peningkatan kasus timbulnya penyakit Tuberkulosis yang menyebabkan kematian.
- Di Jerman sendiri pada tahun 2001 terdapat hampir 8000 kasus baru penyakit ini.
- Di seluruh dunia, sebanyak 3 juta jiwa meninggal dunia setiap tahun akibat Tuberkulose ini.

The essence of microbial communication

- Bila bakteri mengorganisir seluruh komunitas "kota lendir", maka tentu bakteri dapat berkomunikasi dengan sesamanya dan jenis mikroba lainnya.
- Bahwa mikroba pada dasarnya mampu bertukar informasi pada dasarnya telah diketahui para ahli mikrobiologi pada tahun 1960-an pada *Leuchtbakterien* laut dari jenis *Vibrio fischeri*. Bakteri ini hidup sebagai parasit dalam organ lampu ikan cumi-cumi dan sebagai gantinya bakteri ini bertindak sebagai lampu sorot bagi inangnya.

Quorum sensing
⑰

- Jawaban pertanyaan ini telah ditemukan sejak tahun 1990-an. Bakteri menggunakan sejenis komunikasi kimia untuk menghitung jumlah sesamanya. Cara ini disebut *quorum sensing*.

New strategies
㉔

- Usaha untuk membasmi bakteri adalah strategi yang keliru. Sejak diketahui bahwa *quorum sensing* adalah awal dari aktivitas mikroba yang tak terkalahkan, para ahli menduga telah menemukan senjata baru untuk memerangi bakteri patogen: mengganggu komunikasi mereka.
- Bila bakteri ini tidak memiliki akses terhadap senyawa sinyal ini maka bakteri ini tidak menimbulkan efek berbahaya meskipun tetap terdapat dalam tubuh.

Examples of Questions

Berikut merupakan definisi pertumbuhan populasi mikrobia A) Proses pertambahan ukuran dan jumlah sel mikrobia B) Proses pembelahan sel secara biner C) Peningkatan massa sel mikrobia D) Perubahan jumlah sel persatuan waktu E) Pembentukan sel baru dari sel induk Waktu generasi paling lama terjadi pada A) Kapang B) bakteri C) khamir D) *Saccharomyces cereviasiae* E) *Staphylococcus* 3. Data yang tidak diperlukan untuk menghitung waktu generasi suatu bakteri: A) Genus bakteri B) Jumlah sel /massa pada awal C) Jumlah sel /massa pada akhir D) waktu dari awal sampai akhir percobaan E) jumlah sel awal, jumlah sel akhir, waktu pengujian	The following statement is definition for microbial growth: A. a process of the increase in microbial size and number B. A process of cellular binary division C. the increase in microbial cell mass D. change in cell number per time unit E. Formation of daughter cells from maternal cell The longest generation time occurs on: A. molds B. bacteria C. yeasts D. *Saccharomyces cereviasiae* E. *Staphylococcus* The following data not needed for calculating bacterial generation time is: A. bacterial genus B. cell mass/starting cell mass C. cell mass/final cell mass D. time from beginning to end of trial E. start of cell number, end of cell number, time of experiment
Jawab TRUE jika pernyataan Benar dan FALSE jika pernyataan salah Perubahan dari sel vegetatif menjadi bentuk spora disebut dengan proses sporulasi Selongsong sel (tubul) adalah senyawa logam tidak larut yang mengendap di sekitar sel sebagai produk dari kegiatan metabolic Sistem Reticulum Endoplasmik terdapat dalam mikroorganisme yang tergolong prokariotik	True or false statement The change of vegetative cell into spore form is called sporulation Cellular sleeve (cellular tubule) is non soluble metal sedimented around cell as product of metabolic activity. Endoplasmic reticulum occurs inside prokaryotic cells.

Pada bakteri yang resisten terhadap antibiotika, tetrasiklin dapat diatasi dengan cara:
A. hidrolisis enzimatis
B. modifikasi enzimatis
C. modifikasi reseptor sel
D. pompa efflux
 	
Falsafah baru dalam memerangi mikroba patogen adalah:
   A. penggunaan antibiotika
   B. sterilisasi
   C. mengganggu komunikasi
   D. kill them all!
	On antibioc-resistant bacteria, tetrasiklin could be unharmed by:
	a. Enzymatic hydrolisis
	b. Enzymatic modification
	c. Cell receptor modification
	d. Efflux pump
	
	New philosophy to combat pathogenic microbes is:
	a. The use of antibiotcs
	b. sterilization
	c. to avoid communication
	d. kill them all!