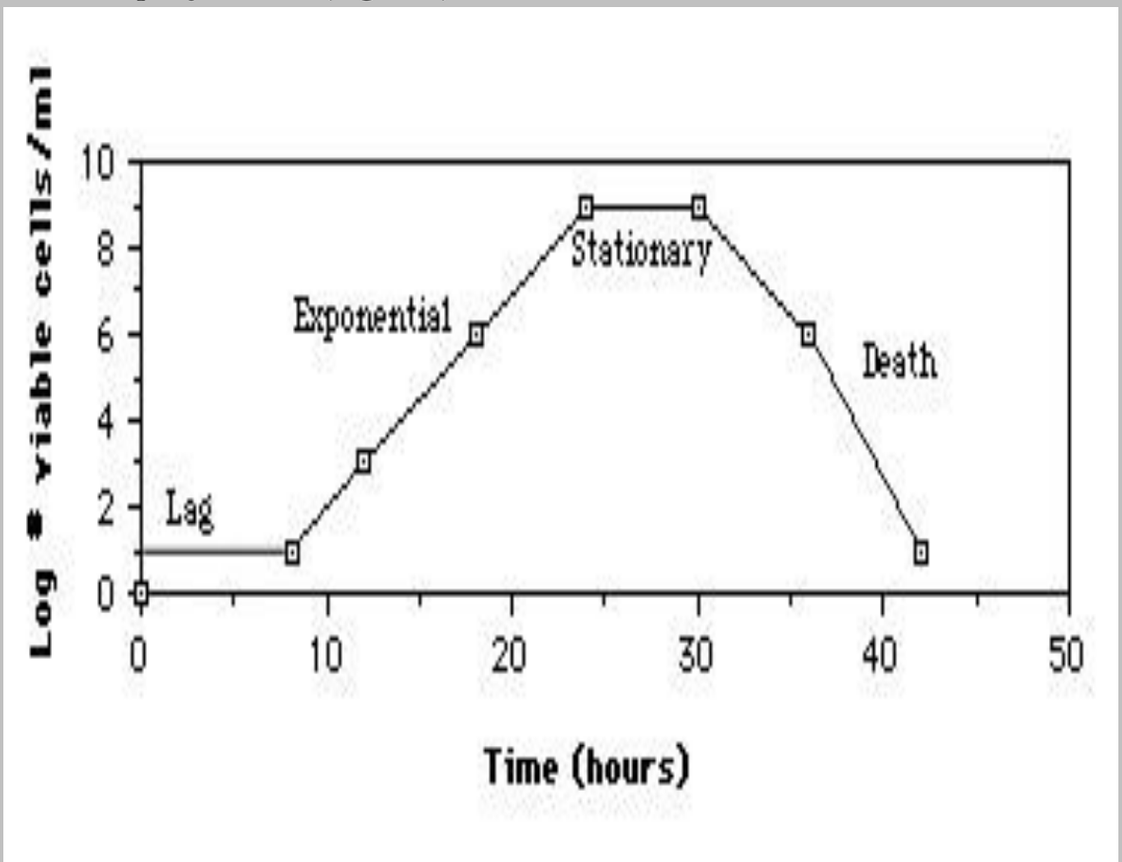
FASE PERTUMBUHAN KUMAN

Dosen : Jatnita Parama Tjita

Apabila kuman ditumbuhkan dalam media cair kemudian diukur jumlah selnya setiap jam, maka akan didapatkan gambaran pertumbuhan kuman sebagai berikut:

a. Fase penyesuaian (lag fase)



Berlangsung selama 2 jam, kuman belum berkembang biak, fase penyesuaian dengan lingkungan yang baru.

Persiapan sel membelah, peningkatan volume dan mass, peningkatan sintesa enzim-protein.

b. Fase pembelahan (fase logaritmik atau eksponensial)

Kuman berkembang biak dengan pembelahan secara binner fusion, pembelahan terjadi secara teratur, jumlah kuman meningkat reguler, kecepatannya geometric , umumnya berlangsung 18-24 jam. Pada fase ini pertumbuhan kuman sangat ideal, eksponensial growth disebut juga GENERATION TIME (doubling time)

Table 7 Generation times for some common bacteria under optimal conditions of growth.

Bacterium	Medium	Generation Time (minutes)
Escherichia coli	Glucose-salts	17
Bacillus megaterium	Sucrose-salts	25
Streptococcus lactis	Milk	26
Streptococcus lactis	Lactose broth	48
Staphylococcus aureus	Heart infusion broth	27-30
Lactobacillus acidophilus	Milk	66-87
Rhizobium japonicum	Mannitol-salts-yeast extract	344-461
Mycobacterium tuberculosis	Synthetic	792-932
Treponema pallidum	Rabbit testes	1980

Faktor yang berpengaruh :
- medium pertumbuhan
- kondisi inkubasi

c. Fase stationer (Stationary phase)
Dengan meningkatnya jumlah kuman, maka terjadi akumulasi jumlah hasil metabolisme yang bersifat toksik bagi kuman, bekurangnya ketersediaan nutrisi-biological space , saat ini banyak ditemukan kuman mulai mati, pertumbuhan terhambat. Pada suatu saat akan terjadi jumlah kuman yang hidup tetap sama. Dengan kondisi lingkungan yang memburuk
Mulai pembentukan spora

d. Fase kemunduran/penurunan (period of decline)
Jumlah kuman yang hidup berkurang dan menurun. Keadaan lingkungan menjadi sangat jelek. Pada beberapa kuman timbul bentuk-bentuk jelek. (bentuk involusi)

NOMENKLATUR, TAKSONOMI

NOMENKLATUR BINOMIAL

PEMBERIAN NAMA SECARA ILMIAH DENGAN MENGGUNAKAN BINAMIA (2 NAMA) ; LINNAEUS =>INTERNASIONAL

SATU SPESIES : 2 KATA

1. KATA PERTAMA (DULU) GENUS, KATA KE DUA EPITHETON SPECIFICUM

2. KATA PERTAMA DIMULAI HURUF KAPITAL/BESAR , KATA KEDUA HURUF KECIL

3. KATA PERTAMA DAN KE DUA DIRANGKAI MENJADI

4. KE DUA KATA SELALU ITALIC/UNDERLIN TIDAK BOLEH KEDUANYA

5. GENUS BISA DIPAKAI TUNGGAL SEDANGKAN E.S. TIDAK

6. GENUS MENERANGKAN SIFAT : NAMA BARU/PENEMU YANG DILATINKAN

7. GENUS DAPAT DISNGKAT,

TIDAK BOLEH DISINGKAT PERTAMA KALI DALAM PENULISAN SINGKATAN HARUS DIIKUTI E.S.

CONTOH :

(a) *Bacillus cereus*
(b) *Bacillus subtilis*
(c) *Balantidium coli* (an amoeba)
(d) *Bdellovibrio bacteriovorus*
(e) *Corynebacterium xerosis*
(f) *Mycobacterium tuberculosis*
(g) *Neisseria meningitidis*
(h) *Rickettsia rickettsii*
(i) *Saccharomyces cerevisiae* (a yeast)
(j) *Shigella dysenteriae*
(k) *Shigella sonnei*
(l) *Staphylococcus epidermidis*
(m) *Streptococcus mutans*

TAKSONOMI

ILMU YANG MEMPELAJARI TENTANG KLASIFIKASI ORGANISME

KLASIFIKASI : PENGGOLONGAN ORGANISME KE DALAM KELOMPOK TAKSA/TAXA BERDASARKAN KEMIRIPAN (HUBUNGANNYA)

TAKSA :

A. SATU KELOMPOK/SATU GOLONGAN ORGANISME YANG SALING BERKERABAT
B. TINGKATAN KELOMPOK DARI RENDAH => TINGGI
   TERENDAH ……SPESIES
   TERTINGG…….. DOMAIN
C. KUNCI KARAKTERISTIK TAXA :
   TAXA TINGKAT YANG LEBIH RENDAH (EX.SPESIES) ANTAR ANGGOTA DALAM KELMPOK
   LEBIH SIMILAR DIBANDINGKAN ANTAR ANGGOTA DALAM KLELOMPOK PADA TINGKAT TAXA YANG LEBIH TINGGI (EX. KINGDOM, DOMAIN)
D. TAXA : DINAMIC => PENGETAHUAN O DAN PERUBAHAN HUBUNGAN EVOLUSI

KLASIFIKASI (DASAR)
A.STRUKTUR/MORFOLOGI
…….MIKROSKOPIS(PEWARNAAN),MAKROSKOPIS (KOLONI)

B. FISIOLOGI …….KEBUTUHAN OKSIGEN, TEMPERATUR,Ph

C. BIOKIMIA……..SUSUNAN BIOKIMIA, METABOLIT

E.GENETIKA

Greek philosopher Aristotle (384-322 BC) grouped life forms as either plant or animal. Microscopic organisms were unknown.

	Plants	**Animals**
	Plants	Animals
	Fungi	

In 1735 Swedish naturalist Carolus Linnaeus formalized the use of two Latin names to identify each organism, a system called binomial nomenclature. He grouped closely related organisms and introduced the modern classification groups: kingdom, phylum, class, order, family, genus, and species. Single-celled organisms were observed but not classified.

Kingdom:	**Plantae**	**Animalia**
Organisms:	Plants	Animals
	Fungi	

In 1866 German biologist Ernst Haeckel proposed a third kingdom, Protista, to include all single-celled organisms. Some taxonomists also placed simple multicellular organisms, such as seaweeds, in Kingdom Protista. Bacteria, which lack nuclei, were placed in a separate group within Protista called Monera.

Kingdom:	**Protista**	**Plantae**	**Animalia**
Organisms:	All single-celled organisms, such as amoebas and diatoms, and sometimes simple	Plants	Animals

	multicellular organisms such as seaweeds.			

In 1938 American biologist Herbert Copeland proposed a fourth kingdom, Monera, to include only bacteria. This was the first classification proposal to separate organisms without nuclei, called prokaryotes, from organisms with nuclei, called eukaryotes, at the kingdom level.

	PROKARYOTES	**EUKARYOTES**		
Kingdom:	**Monera (Prokaryote)**	**Protista**	**Plantae**	**Animalia**
Organisms:	Bacteria	Amoebas, diatoms, and other single-celled eukaryotes, and sometimes simple multicellular organisms, such as seaweeds.	Plants Fungi	Animals

In 1957 American biologist Robert H. Whittaker proposed a fifth kingdom, Fungi, based on fungi's unique structure and method of obtaining food. Fungi do not ingest food as animals do, nor do they make their own food, as plants do; rather, they secrete digestive enzymes around their food and then absorb it into their cells.

Kingdom:	**Monera (Prokaryote)**	**Protista**	**Fungi**	**Plantae**	**Animalia**
Organisms:	Bacteria	Amoebas, diatoms, and other single-celled eukaryotes,	Multicellular, filamentous organisms that	Multicellular organisms that obtain food	Multicellular organisms that ingest

			and sometimes simple multicellular organisms, such as seaweeds.	absorb food	through photosynthesis	food	
In 1990 American molecular biologist Carl Woese proposed a new category, called a Domain, to reflect evidence from nucleic acid studies that more precisely reveal evolutionary, or family, relationships. He suggested three domains, Archaea, Bacteria, and Eucarya, based largely on the type of ribonucleic acid (RNA) in cells.							
	PROKARYOTES			**EUKARYOTES**			
Domain:	Archaea		Bacteria	Eucarya			
Kingdom:	Crenarchaeota	Euryachaeota		Protista	Fungi	Plantae	Animalia
Organisms:	Ancient bacteria that produce methane	Ancient bacteria that grow in high temperatures					

Diagram of the Modern Classification Scheme:

The information for each kingdom refers to the questions in "Format for Classification," seen below.

DOMAINS

- ☐ Bacteria
- ☐ Archaea
- ☐ Eukarya

KINGDOMS

Prokaryotes

-prokaryotic
-unicellular
-binary fission/transformation/ transduction/conjugation
-autotrophs (photo/chemo) heterotrophs (photo/chemo)

Monera

Eukaryotes

-eukaryotic
-uni/multi colonial
-asexual mitosis sexual meiosis
-heterotrophic absorption or photoautotrophic

Protista

-eukaryotic
-multicellular
-sexual/asexual
-heterotrophic ingestion

Animalia

-eukaryotic
-multi/uni
-sexual/asexual
-heterotrophic

Fungi

-eukaryotic
-multi/uni
-sexual/asexual
-autotrophic: photosynthesis

Plantae

Earliest Organisms

KLASIFIKASI BAKTERI BERDASARKAN BERGEY'S MANUAL

Genera	Species	Category	Disease	
Treponema	*pallidum*	spirochete	syphilis	
Borrelia	*burgdorferi*	spirochete	Lyme disease	
Campylobacter		Aerobic, motile, helical, Gram-negative	[campylobacteriosis]	
Helicobacter	*pylori*	Aerobic, motile, helical, Gram-negative	peptic ulcer disease	
Pseudomonas	*aeruginosa*	Gram-negative aerobic rods and cocci	urinary tract infections, burns, and wounds	
Legionella		Gram-negative aerobic rods and cocci	pneumonia and other respiratory infections	
Neisseria	*gonorrhoeae*	Gram-negative aerobic rods and cocci	gonorrhea; meningitis & nasopharylngeal infections by other species	
Moraxella	*lacunata*	Gram-negative aerobic rods and cocci	conjunctivitis	
Bordetella	*pertussis*	Gram-negative aerobic rods and cocci	whooping cough (pertussis)	
Escherichia	*coli*	Facultatively anaerobic Gram-negative rods	opportunistic infections of colon and other sites	
Shigella	[*dysenteriae*, *sonnei*]	Facultatively anaerobic Gram-negative rods	bacillary dysentery	
Salmonella	*typhimurium*	Facultatively anaerobic Gram-negative rods	typhoid fever, enteritis, and food poisoning	
Klebsiella	*pneumoniae*	Facultatively anaerobic Gram-negative rods	respiratory and urinary tract infections	
Enterobacter	*aerogenes*	Facultatively anaerobic Gram-negative rods	opportunistic infections	
Serratia	*marcescens*	Facultatively anaerobic	opportunistic infections	

		Gram-negative rods		
Proteus	*vulgaris*	Facultatively anaerobic Gram-negative rods	urinary tract infections, especially nosocomial	
Yersinia	*pestis*	Facultatively anaerobic Gram-negative rods	plague	
Vibrio	*cholerae*	Facultatively anaerobic Gram-negative rods	cholera	
Pasteurella		Facultatively anaerobic Gram-negative rods		
Haemophilus	*influenzae*	Facultatively anaerobic Gram-negative rods	respiratory infections, meningitis, conjunctivitis	
Gardnerella		Facultatively anaerobic Gram-negative rods	vaginitis	
Bacteroides		Anaerobic Gram-negative rod	various infections from fecal contamination	
Rickettsia	[*prowazekii*, *rickettsii*]	Rickettsia and Chlamydiae	typhus, Rocky Mountain spotted fever	
Chlamydia	[*trachomatis*]	Rickettsia and Chlamydiae	trachoma, nongonococcal urethritis	
Mycoplasma	*pneumoniae*	Mycoplasmas	walking pneumonia	
Staphylococcus	*aureus*	Gram-positive cocci	skin abscesses, opportunistic infections such as toxic shock syndrome	
Streptococcus	[*pyogenes*]	Gram-positive cocci	strep throat and other infections, puerperal fever = childbirth fever	
[*Micrococcus*]	[*luteus*]	Gram-positive cocci		
Bacillus	*anthracis*	Endospore-forming Gram-positive rods	anthrax	

		and cocci		
Clostridium	[*botulinum*, *difficile*, *tetani*, *perfringens*]	Endospore-forming Gram-positive rods and cocci	botulism, tetanus, gas gangrene	
Corynebacterium	*diphtheriae*	Irregular nonsporing Gram-positive rods	diphtheria	
Mycobacterium	[*tuberculosis*, *leprae*, *paratuberculosis*]	Mycobacteria	tuberculosis, leprosy (Hanson's disease)	
Streptomyces		Streptomyces		

I. EUBACTERIA GRAM NEGATIF BERDINDING SEL …..GRACILICUTES

(2) Spirochetes

(a) Gram-negative, helical, move by axial filaments

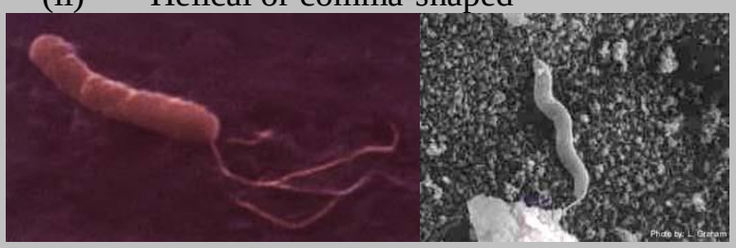
(b) [spiral forms] [**index**]

(3) Aerobic, motile, helical, Gram-negative bacteria

(a) Additional characteristics:

(i) Move by flagella (i.e., as opposed to axial filaments)

(ii) Helical or comma-shaped

(b) 

(c) [*Helicobacter pylori* is the causative agent of gastric and duodenal ulcers. Over 50% of the world is infected with *H. pylori*. It has also been implicated to play a role in stomach cancer. This bacterium lives deep in the mucous layer of the stomach but does not invade the gastric mucosa… *Campylobacter* is the most common bacterial cause of diarrheal disease in humans in North America. The most typical form of transmission is food-borne, through chicken products. The bacterium is a gram-negative, spiral-shaped rod that is flagellated on both ends to enable it to move through the thick viscid mucosa of the jejunum, allowing it to invade the instestinal epithelial cells.]

(d) [spiral forms] [**index**]

(4) Gram-negative aerobic rods and cocci

(a) Additional characteristics:

(i) Some are obligate parasites

(5) Facultatively anaerobic Gram-negative rods

(a) Additional characteristics:

(i) Many can be distinguished by their characteristic fermentation reactions

(b) [the *E. coli* index (The University of Birmingham)] [frequently asked questions about plague] [**index**]

(6) Anaerobic Gram-negative rods

(7) Rickettsia and Chlamydiae

(a) Additional characteristics:

(i) Intracellular parasites

(b) [Rickettia literature] [**index**]

II. EUBAKTERIA TIDAK BERDINDING/SEDIKIT BERDINDING ….TENERICUTES

(8) Mycoplasmas

(a) Additional characteristics:

(i) Lack cell walls

(ii) Extremely small

III. EUBAKTERIA GRAM POSITIF BERDINDING SEL…….FURMICUTES

(9) Gram-positive cocci

(a) Additional characteristics:

(i) Non-spore forming

(ii) Pyogenic (pus-forming)

(10) Endospore-forming Gram-positive rods and cocci

(a) Additional characteristics:

(i) Aerobic to strictly anaerobic

(b) [endospore stain of genus *Bacillus*] [endospore stain of *Clostridium tetani*] [**index**]

(11) Irregular nonsporing Gram-positive rods

(a) Additional characteristics:

(i) Pleomorphic or club-shaped

(12) Mycobacteria/Molicutes

(a) Additional characteristics:

(i) Gram-positive (evolutionary relationship)

(ii) Acid fast (staining characteristic)

(b) [acid-fast cell wall] [**index**]

(13) Streptomyces…..Actinomycetes

(a) Additional characteristics:

(i) Gram-positive

(ii) Filamentous [image, filamentous bacterium]

(iii) Antibiotic producer

KLASIFIKASI GENETIK …….HOMOLOGI GENETIK ANTAR ORGANISME
HUBUNGAN EVOLUSI =>FILOGENETIK

- BASE COMPOSITION
- DNA& RNA SEQUENCING
- DNA HYBRIDIZATION

TAKSONOMI NUMERIK (KOMPUTER, FENETIK , TAKSOMETRIK)

-MENGEMBANGKAN PERSAMAAN, KEMIRIPAN, DAN PERBEDAAN KARAKTERISTIK ANTAR STRAIN DALAM
SATU SPESIES

-MENGGUNAKAN KOMPUTER

-DASAR KARAKTERISTIK SECARA GENETIKA

- PHILOGENETIC TREE /DICHOTMOUS TREE

- JACCARD SIMILARITY COEFFICIENT (SJ)

$$Sj = \frac{A}{A + B + C}$$

- SIMPLE MATCHING COEFFICIENT (Ssm)

$$Ssm = \frac{A}{A + B + C + D}$$

A JUMLAH SIFAT* YANG ADA PD KE 2 STRAIN
B ----------,,---------- PD STRAIN I SAJA
C ----------,,---------- PD STRAIN 2 SAJA
D ----------,,----------TIDAK ADA PD KE 2 STRAIN

-TEHNIK : PHAGA TYPING
PROTEIN PROFILE (SDS PAGE : ELEKTROPHORESIS AKRILAMID GEL NATRIUM DUODESIL SULFAT)
IMMUNOLOGICAL REACTION (EX; REAKTIVITAS ANTIBODI MONOKLONAK DGN EPITOP LPS)
PFGE (PULSE FIELD GEL ELECTROPHORESIS)
SOUTHERN BLOT (ENDONUKLEASE=> AGAROSE GEL ELEK.=>SELAPUT NITROSELULOSE/NILON
RFLPs (RESTRICTION FRAGMEN LENGT POLIMORFISM)=> PENANDA 16s, 23 s RNA

TIPE STRAIN …..AMERICAN TYPE CULTURE COLLECTION /ATCC