MIKROBIOLOGI

PERTEMUAN KE 2

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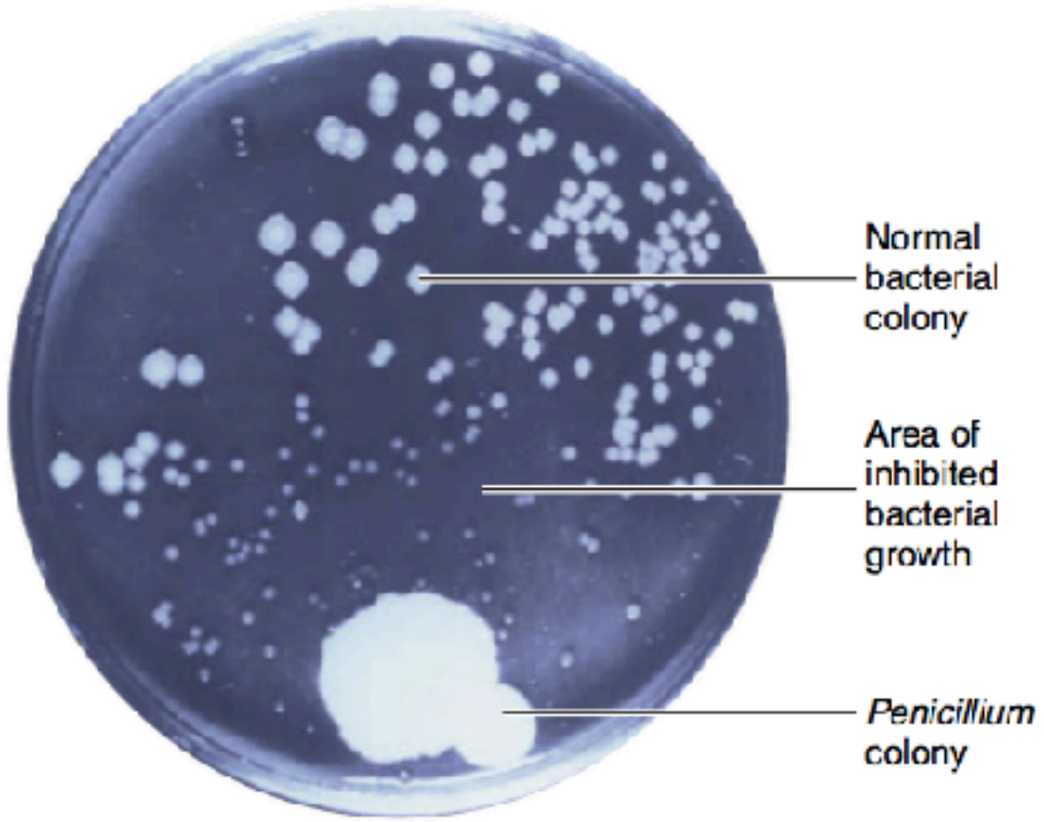


Figure 1.6 The discovery of penicillin. Alexander Fleming took this photograph in 1928. The colony of *Penicillium* mold accidentally contaminated the plate and inhibited nearby bacterial growth.

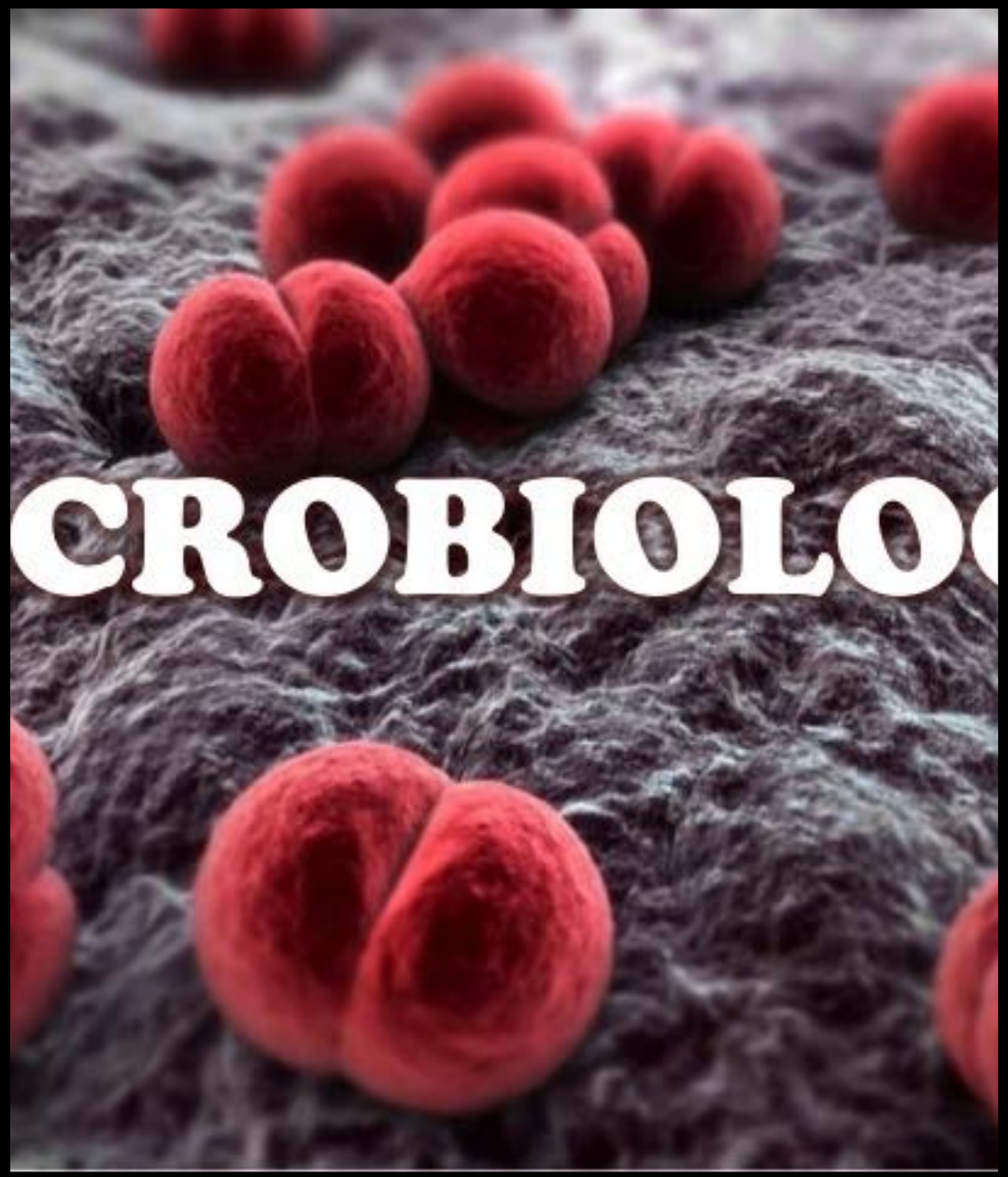
Q Why do you think penicillin is no longer as effective as it once was?

DUNIA MIKROBA & KITA

APA HUBUNGAN MIKROBA & KITA?

KONSEP KUNCI

- Mikroba di kehidupan kita
- Penamaan & Klasifikasi Mikroorganisme
- Sejarah singkat Mikrobiologi
- Mikroba & Kesejahteraan Manusia
- Mikroba & Penyakit manusia



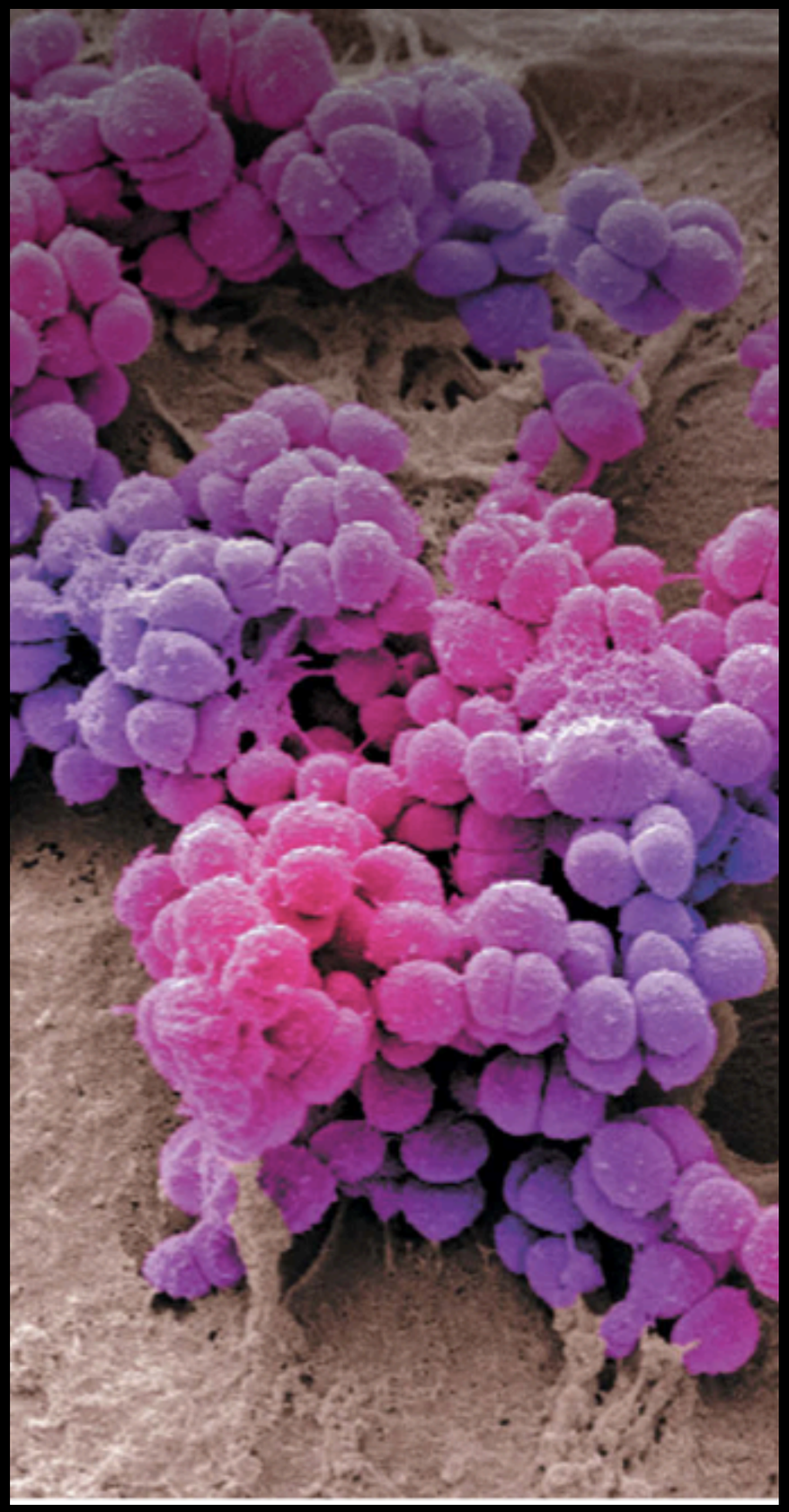
Mikroba dalam Hidup Kita

- kuman dan mikroba = sesuatu yang kecil. bentuknya apa sih?

- mikroba/mikroorganisme: mahluk hidup yang secara individu sangat kecil untuk dilihat mata telanjang

- terdiri dari: bakteri, fungi (ragi dan jamur), protozoa, alga, juga virus.

- aplikasi komersial mikroba: produk kimia, industri makanan & enzim



Mikrobioma

- orang dewasa mengandung 30 triliun sel tubuh dan 40 triliun sel bakteri.

- mikroba yang stabil hidup di & pada tubuh manusia disebut mikrobioma manusia/ mikrobiota. Fungsi: memelihara kesehatan, mencegah pertumbuhan patogen.

- Normal mikrobiota, transient mikrobiota

Menamakan & Klasifikasi Mikroorganisme

- Nomenklatur: genus, penanda spesies. Contoh: *Staphylococcus aureus*
- Tipe Mikroorganisme: Bakteri, Archaea, Fungi, Protozoa, Alga, Parasit Hewan Multiselular
- Klasifikasi Mikroorganisme:
  - Bakteria (dinding sel + peptidoglikan)
  - Archaea (dinding sel, -peptidoglikan)
  - Eukarya: Protista, Fungi, Tumbuhan, Hewan

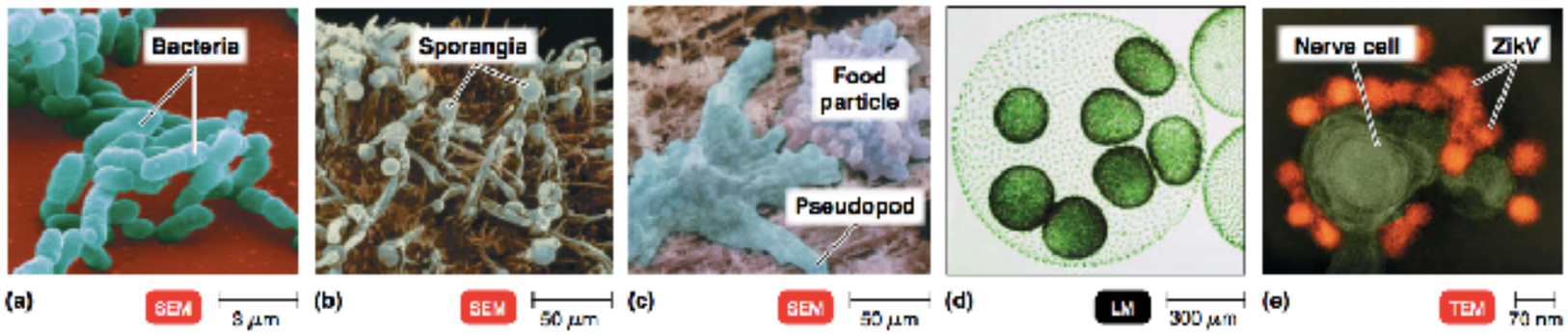
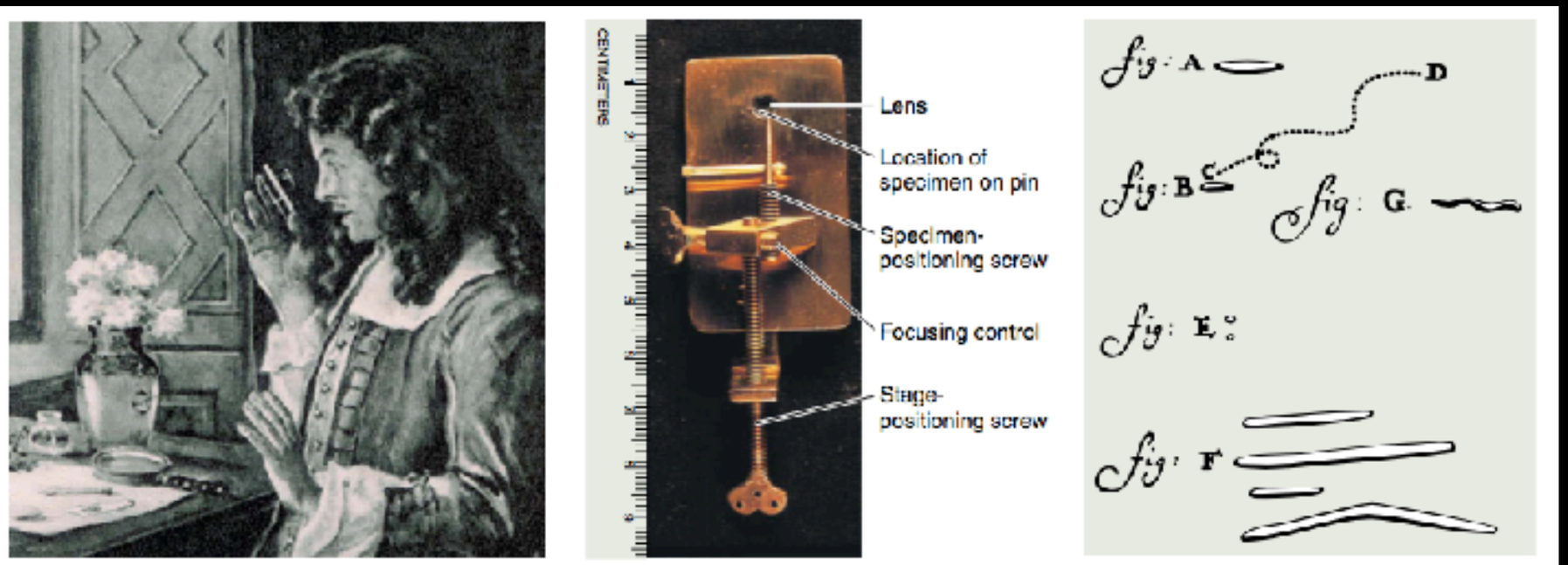


Figure 1.2 Types of microorganisms. **(a)** The rod-shaped bacterium *Haemophilus influenzae*, one of the bacterial causes of pneumonia. **(b)** *Mucor*, a common bread mold, is a type of fungus. When released from sporangia, spores that land on a favorable surface germinate into a network of hyphae (filaments) that absorb nutrients. **(c)** An ameba, a type of protozoan, approaching a food particle. **(d)** The pond alga *Volvox*. **(e)** Zika virus (ZikV). *NOTE:* Throughout the book, a red icon under a micrograph indicates that the micrograph has been artificially colored. SEM (scanning electron microscope) and LM (light microscope) are discussed in detail in Chapter 3.

Q How are bacteria, archaea, fungi, protozoa, algae, and viruses distinguished on the basis of structure?

Sejarah Singkat Mikrobiologi

- Pengamatan Pertama: Robert Hooke (1665)-box kecil/sel pada potongan gabus
- Van Leeuwenhook (1673): animalcules dari lendir gigi



(a) Van Leeuwenhoek using his microscope

(b) Microscope replica

(c) Drawings of bacteria

Figure 1.3 Anton van Leeuwenhoek's microscopic observations. (a) By holding his brass microscope toward a source of light, van Leeuwenhoek was able to observe living organisms too small to be seen with the unaided eye. **(b)** The specimen was placed on the tip of the adjustable point and viewed from the other side through the tiny, nearly spherical lens. The highest magnification possible with his microscopes was about 300× (times). **(c)** Some of van Leeuwenhoek's drawings of bacteria, made in 1683. The letters represent various shapes of bacteria. C–D represents a path of motion he observed.

Q Why was van Leeuwenhoek's discovery so important?

Debat tentang Generasi Spontan

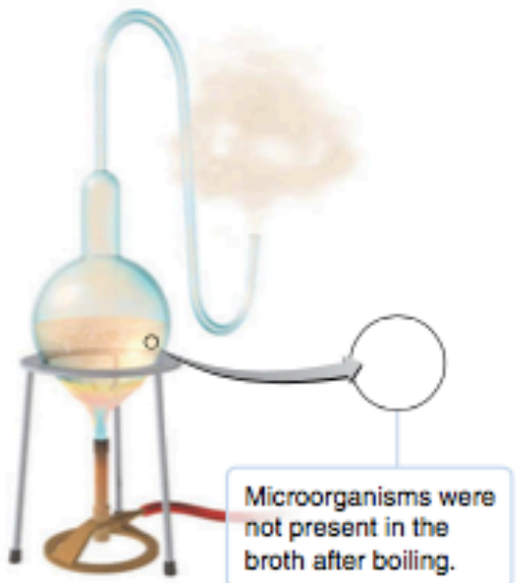
FOUNDATION FIGURE 1.4

Disproving Spontaneous Generation

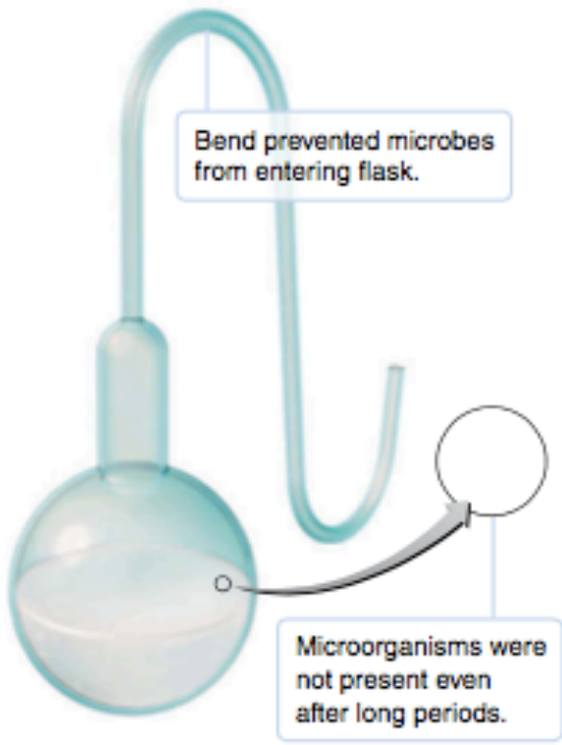
According to the hypothesis of spontaneous generation, life can arise spontaneously from nonliving matter, such as dead corpses and soil. Pasteur's experiment, described below, demonstrated that microbes are present in nonliving matter—air, liquids, and solids.

1 Pasteur first poured beef broth into a long-necked flask.

2 Next he heated the neck of the flask and bent it into an S-shape; then he boiled the broth for several minutes.



3 Microorganisms did not appear in the cooled solution, even after long periods.



Some of these original vessels are still on display at the Pasteur Institute in Paris. They have been sealed but show no sign of contamination more than 100 years later.

KEY CONCEPTS

- Pasteur demonstrated that microbes are responsible for food spoilage, leading researchers to the connection between microbes and disease.
- His experiments and observations provided the basis of aseptic techniques, which are used to prevent microbial contamination, as shown in the photo at right.

Kejayaan Pertama Mikrobiologi

First Golden Age of MICROBIOLOGY

1857	**Pasteur**—Fermentation
1861	**Pasteur**—Disproved spontaneous generation
1864	**Pasteur**—Pasteurization
1867	**Lister**—Aseptic surgery
1876	**Koch***—Germ theory of disease
1879	**Neisser**—*Neisseria gonorrhoeae*
1881	**Koch***—Pure cultures
	Finlay—Yellow fever
1882	**Koch***—*Mycobacterium tuberculosis*
	Hess—Agar (solid) media
1883	**Koch***—*Vibrio cholerae*
1884	**Metchnikoff***—Phagocytosis
	Gram—Gram-staining procedure
	Escherich—*Escherichia coli*
1887	**Petri**—Petri dish
1889	**Kitasato**—*Clostridium tetani*
1890	**von Bering***—Diphtheria antitoxin
	Ehrlich*—Theory of immunity
1892	**Winogradsky**—Sulfur cycle
1898	**Shiga**—*Shigella dysenteriae*
1908	**Ehrlich***—Syphilis treatment
1910	**Chagas**—*Trypanosoma cruzi*
1911	**Rous***—Tumor-causing virus (1966 Nobel Prize)

Louis Pasteur (1822–1895)
Demonstrated that life did not arise spontaneously from nonliving matter.

Joseph Lister (1827–1912)
Performed surgery under aseptic conditions using phenol. Proved that microbes caused surgical wound infections.

Robert Koch (1843–1910)
Established experimental steps for directly linking a specific microbe to a specific disease.

Kejayaan Kedua Mikrobiologi

Second Golden Age of MICROBIOLOGY

1940s
Fleming, Chain, and Florey—Penicillin

1950s
Waksman—Streptomycin
H. Krebs—Chemical steps of the Krebs cycle
Enders, Weller, and Robbins—Poliovirus cultured in cell cultures
Beadle and Tatum—Genetic control of biochemical reactions

1960s
Medawar—Acquired immune tolerance

1980s
Sanger and Gilbert—Techniques for sequencing DNA
Jerne, Köhler, and Milstein—Technique for producing monoclonal (single pure) antibodies
Tonegawa—Genetics of antibody production
Bishop and Varmus—Cancer causing genes (oncogenes)

Third Golden Age of MICROBIOLOGY

1990s
Murray and Thomas—First successful transplants using immunosuppressive drugs
Fischer and E. Krebs—Enzymes that regulate cell growth (protein kinases)
Roberts and Sharp—Genes can be present in separated segments of DNA
Mullis—Polymerase chain reactions that amplify (make multiple copies of) DNA
Doherty and Zinkernagel—Cell-mediated immunity

2000s
Agre and MacKinnon—Water and ion channels in plasma membranes
Marshall and Warren—*Helicobacter pylori* as the cause of peptic ulcers

2010s
Barré-Sinoussi and Montagnier—Discovery of HIV
Ramakrishnan, Steitz, and Yonath—Detailed structure and function of ribosomes
Beutler, Hoffmann, and Steinman—Innate immunity; dendritic cells in adaptive immunity
Tu—Treatment for malaria

César Milstein (1927–)
Fused cancerous cells with antibody producing cells to produce a hybrid cell that grows continuously and produces therapeutic antibodies.

Françoise Barré-Sinoussi (1947–)
Discovered a virus in a patient with swollen lymph nodes; the virus was human immunodeficiency virus.

Youyou Tu (1930–)
Extracted artemisinin from a Chinese sage plant. Artemisinin inhibits the malaria parasite.

Figure 1.7 Second and Third Golden Ages of Microbiology. All researchers listed are Nobel laureates.

Q What advances occurred during the Second Golden Age of Microbiology?

Kejayaan Ketiga Mikrobiologi

Genomic

Rekombinan DNA

Mikroba & Kesejahteraan Manusia

- Daur Ulang elemen penting
- Treatment rumput laut: menggunakan mikroba untuk daur ulang air
- Bioremediasi: Menggunakan Mikroba untuk membersihkan polutan
- kontrol hama serangga oleh mikroba
- Bioteknologi dan Teknologi Rekombinan DNA

Mikroba & Penyakit Manusia

- Biofilm
- penyakit infeksi
- penyakit Outbreak

DAFTAR PUSTAKA

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