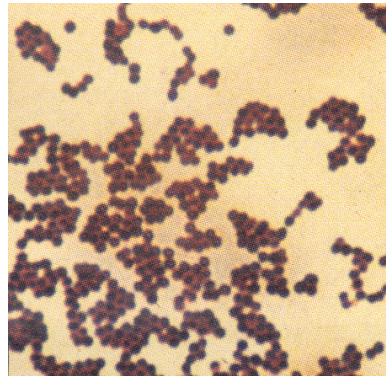


Cell Structure and Function

- Morphology: cocci, rods, spirilla, pleomorphic.
- Prokaryotic structures:
 - Plasma membrane
 - Inclusion bodies
 - Ribosomes
 - Nucleoid and genome organization
 - Endospores
 - Cell wall
 - Capsule
 - Fimbriae
 - Flagella and Chemotaxis

Bacterial Cell Shapes



Prokaryotic Cell Structure

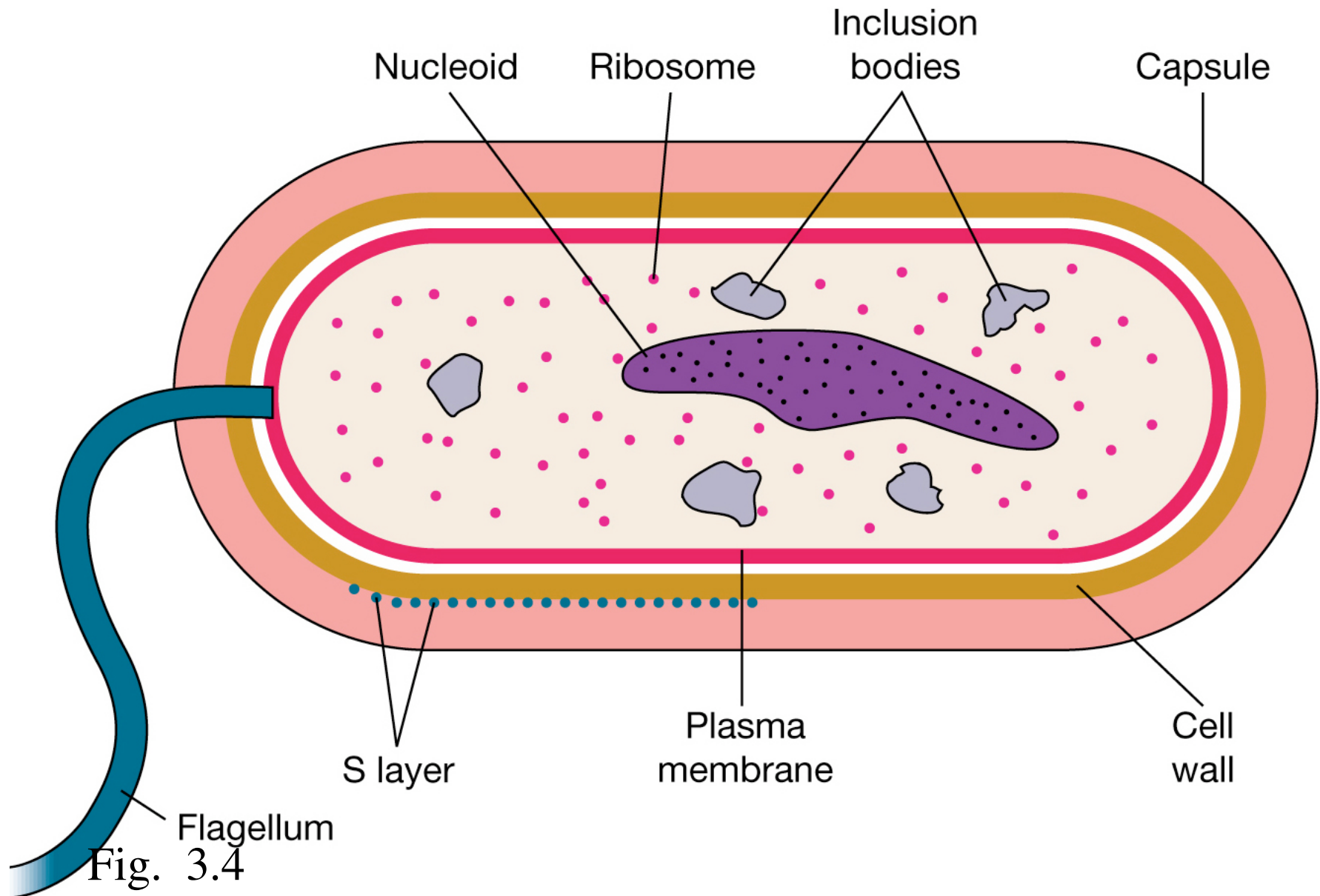


Fig. 3.4

Plasma Membrane

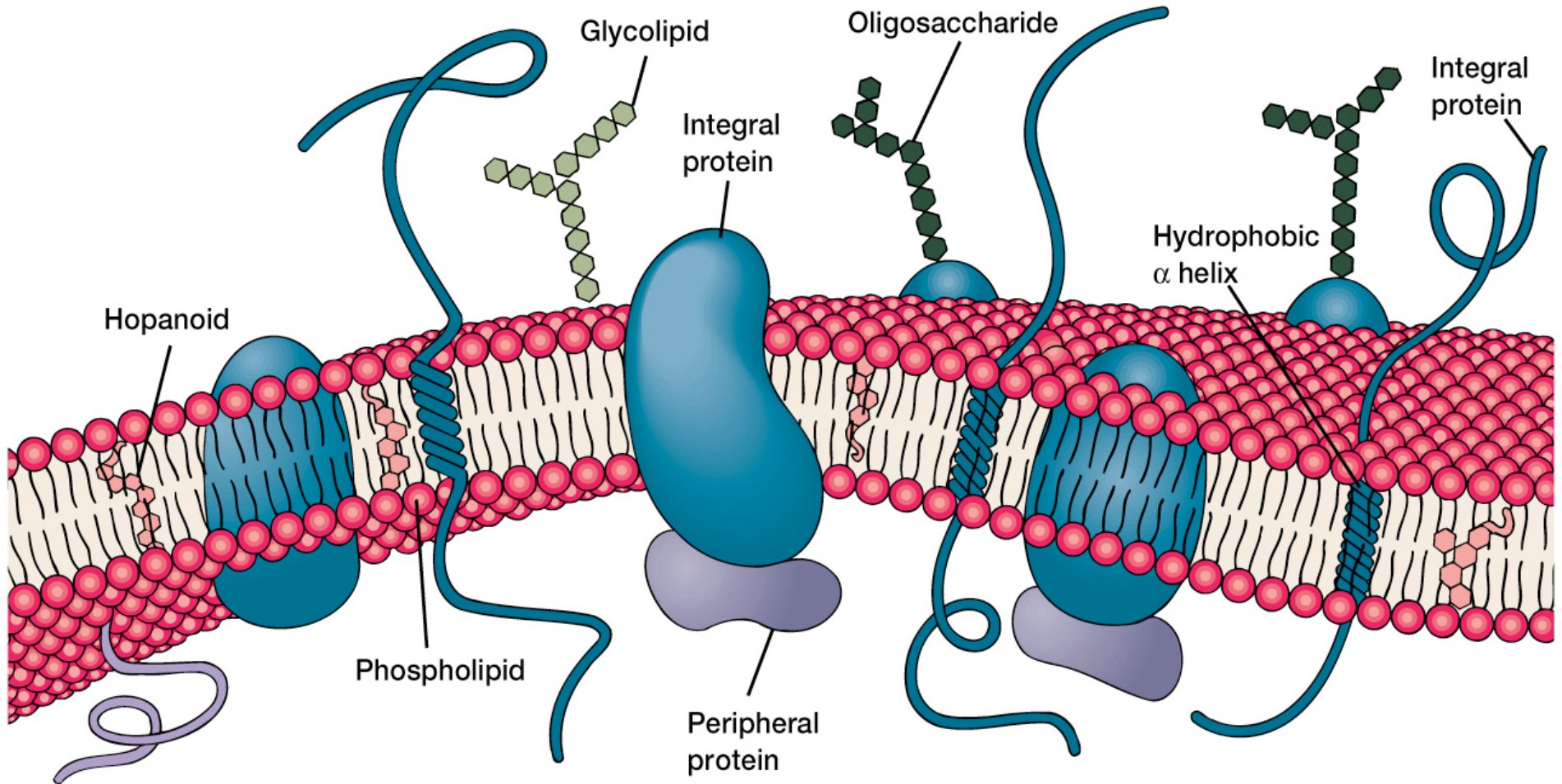


Fig. 3.7

Lipid Structure

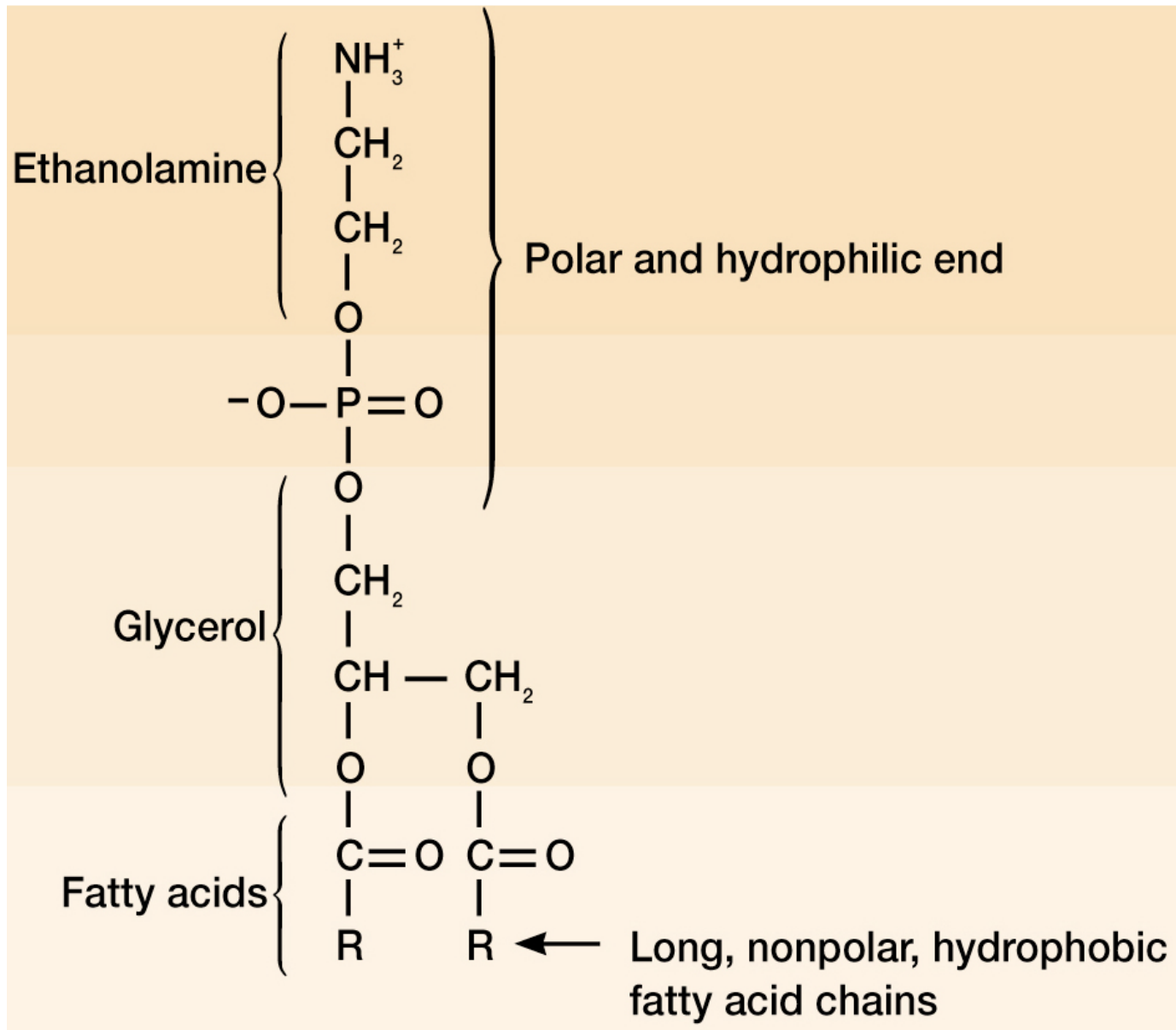
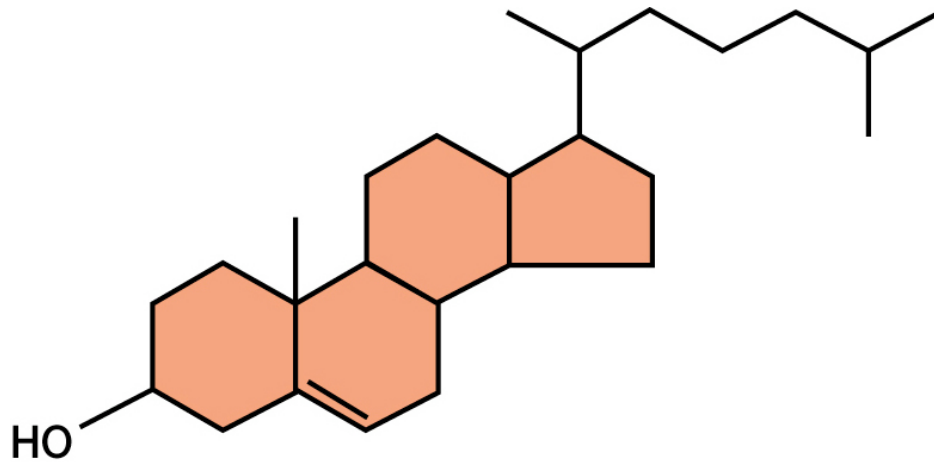
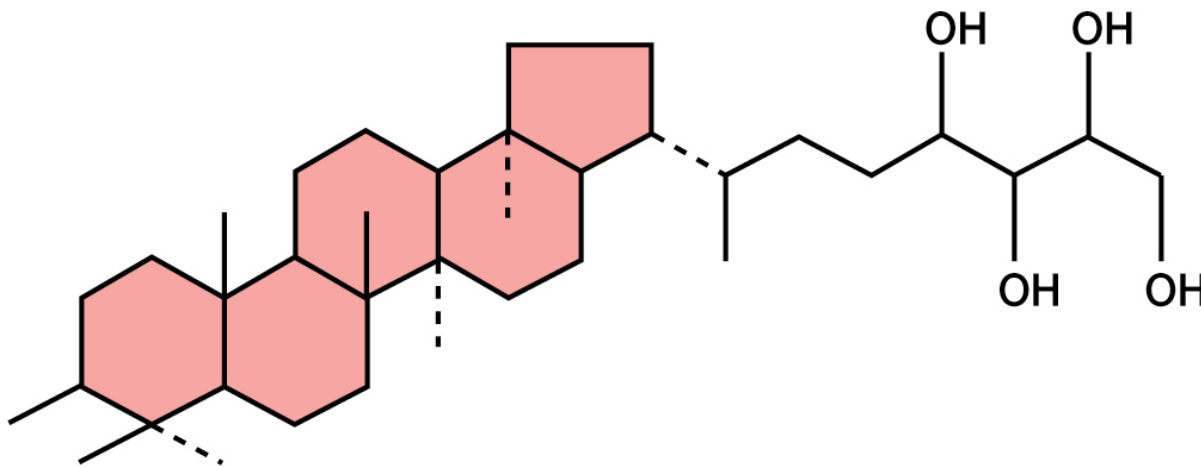


Fig. 3.5

Hopanoids: the bacterial cholesterol



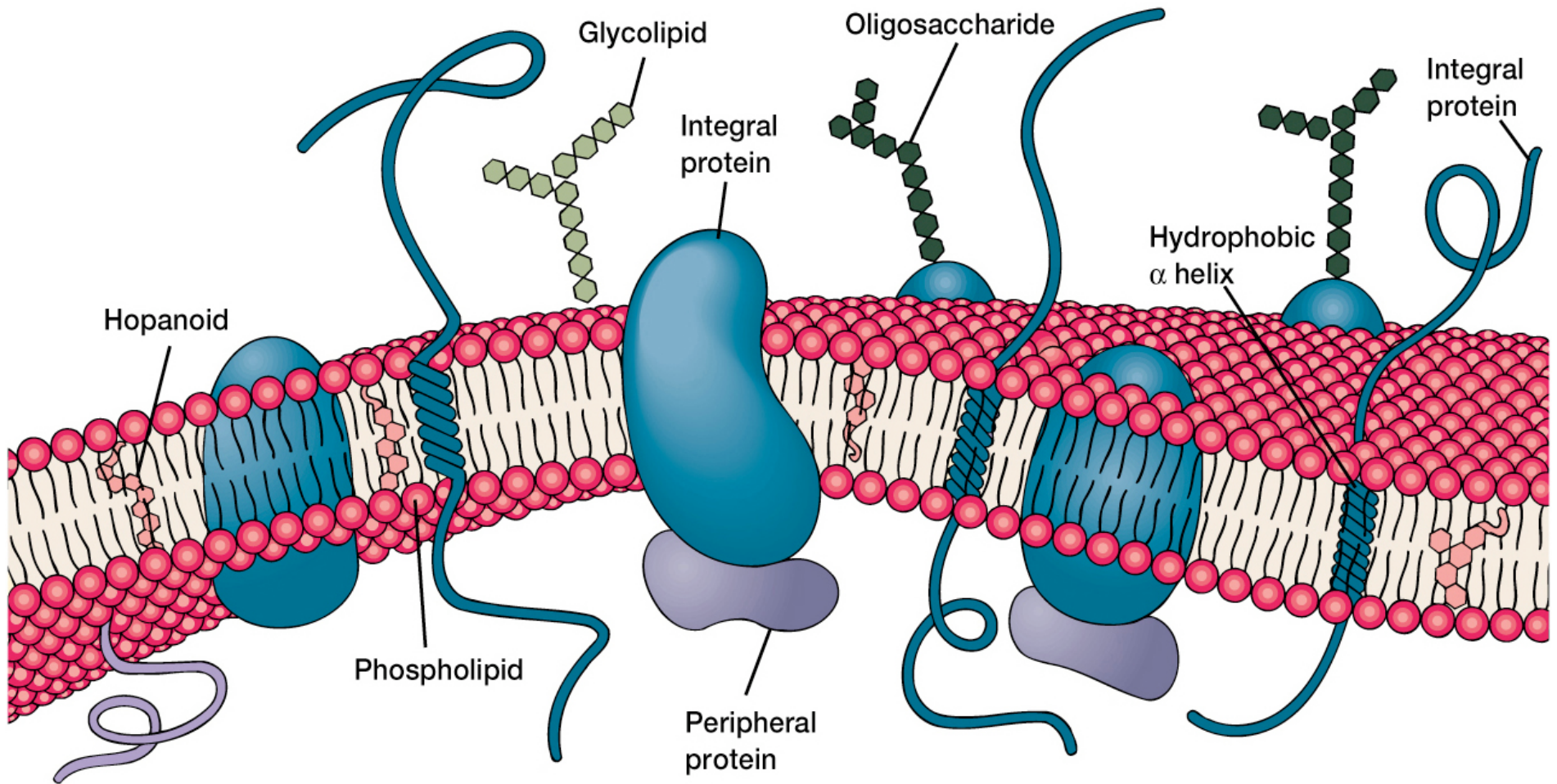
Cholesterol (a steroid)



A bacteriohopanetetrol (a hopanoid)

Fig. 3.6

Plasma Membrane



- Selectively permeable barrier
- Site of enzymatic reactions

Fig. 3.7

Cytoplasm: Packed with good stuff

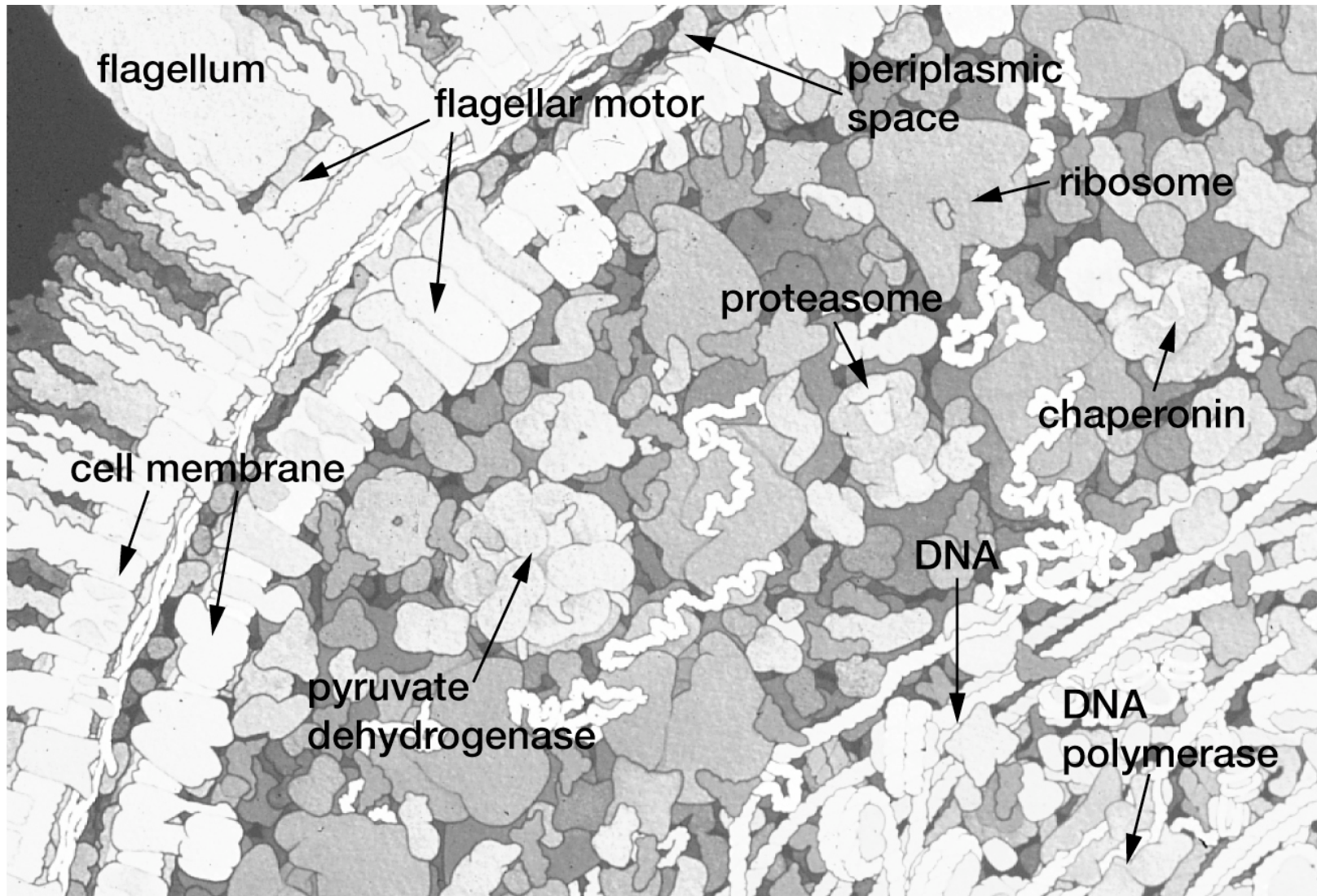


Fig. 3.10

Inclusion Bodies

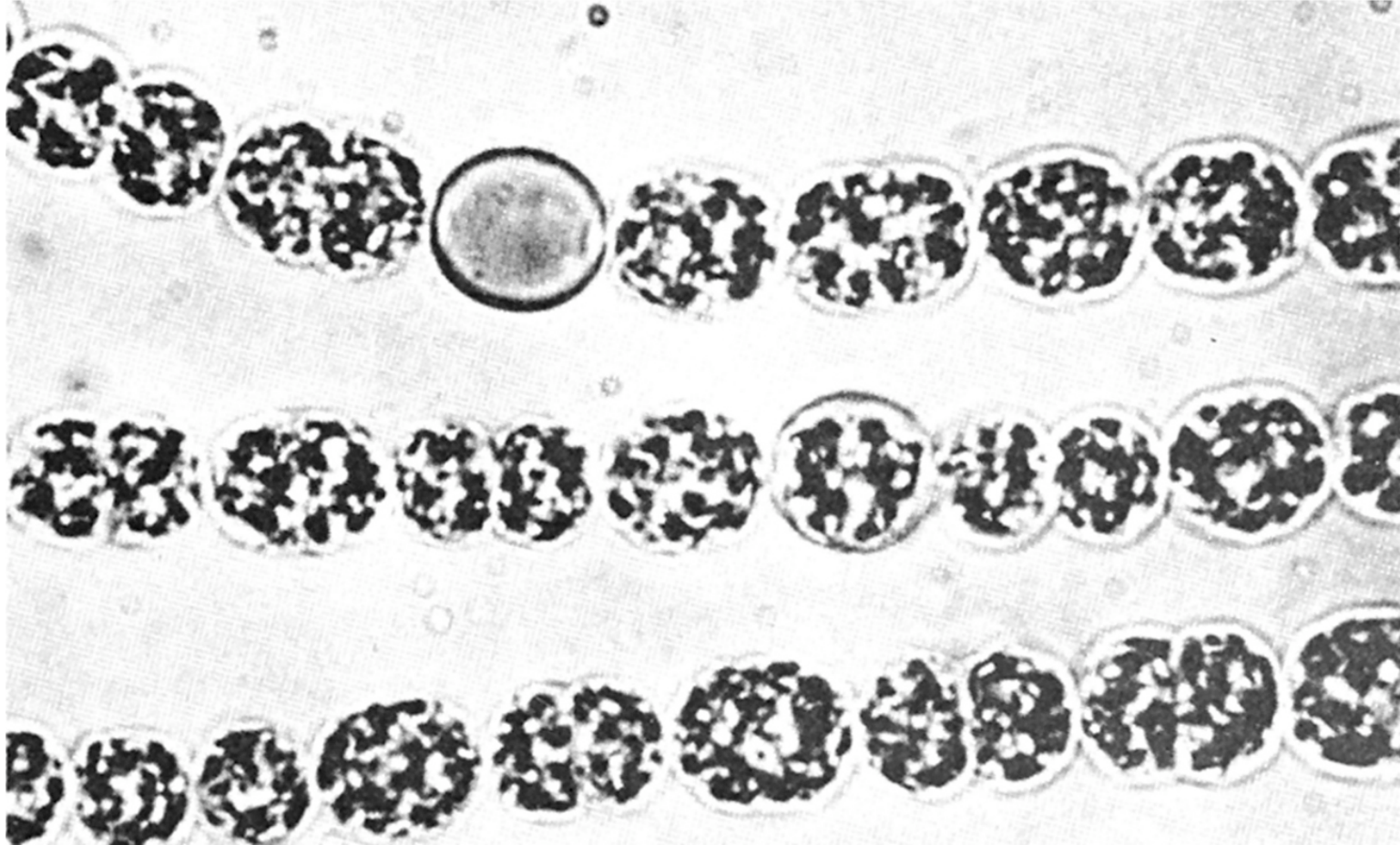


Fig. 3.12

The *E. coli* Ribosome

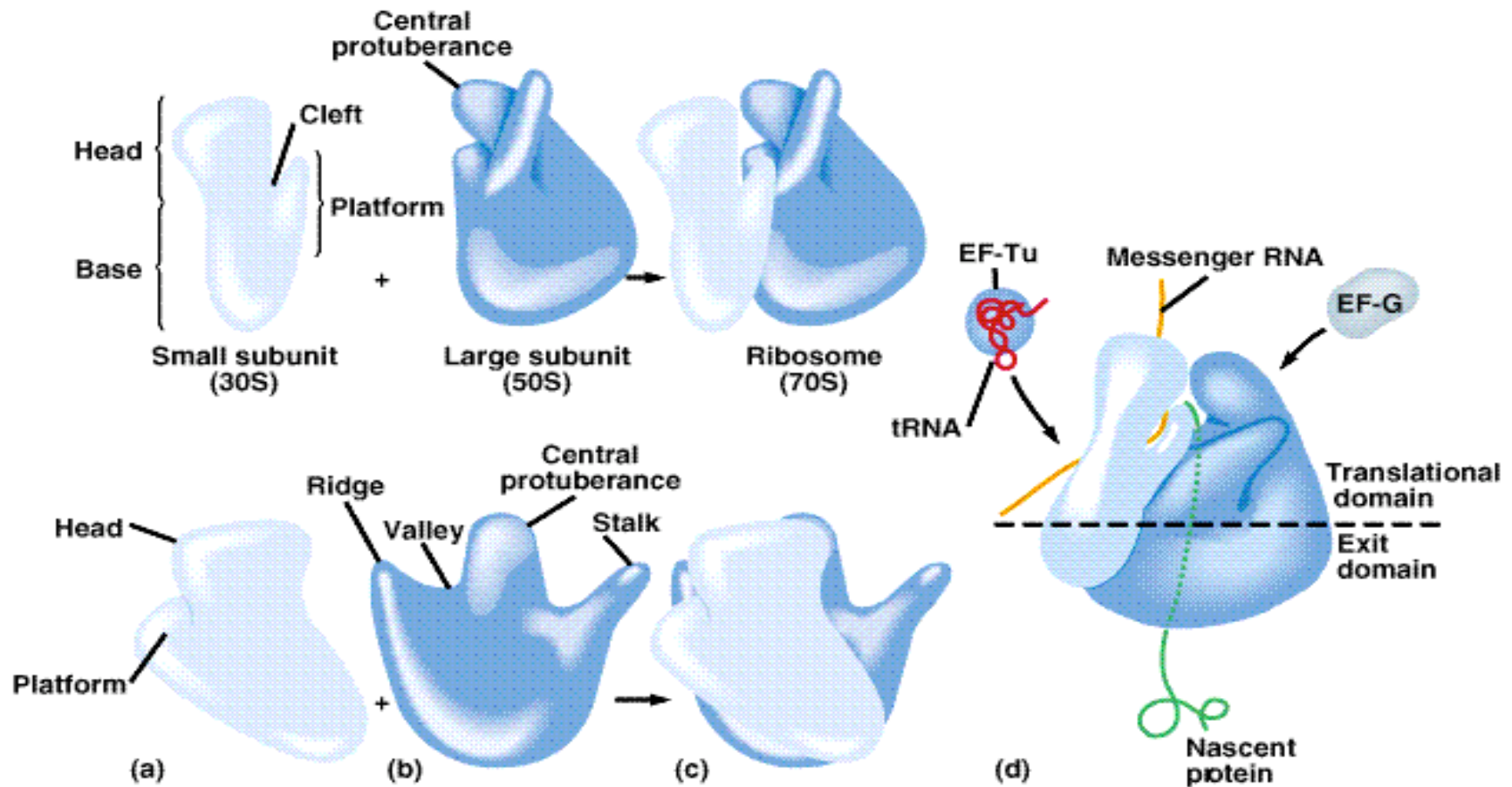
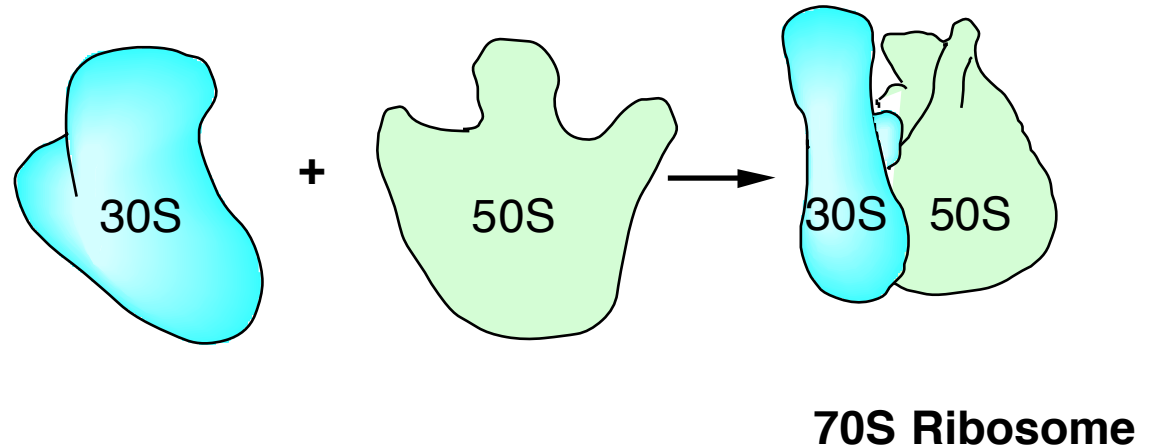


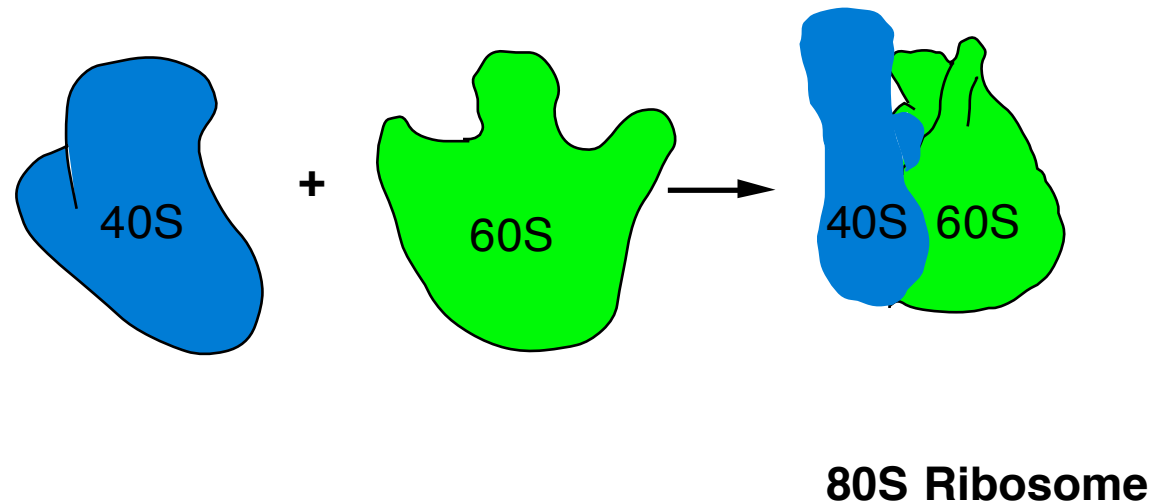
Fig. 12.12

Prokaryotic vs. Eukaryotic

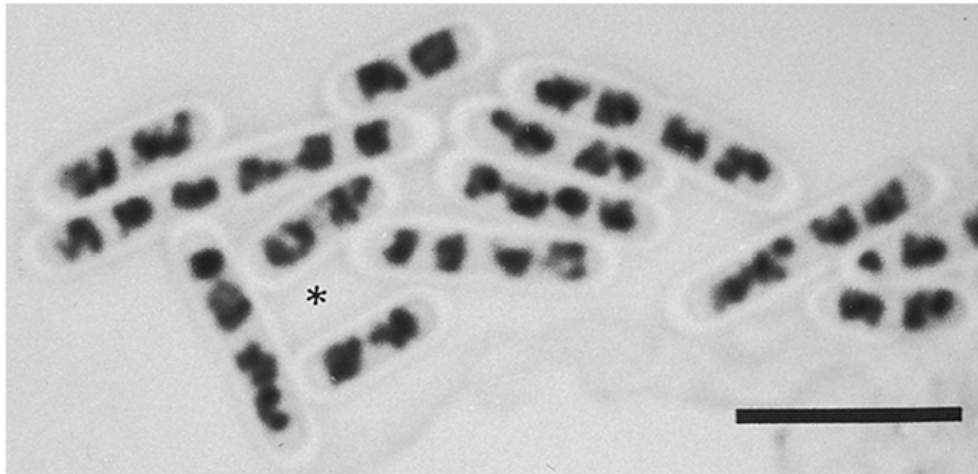
Prokaryotes



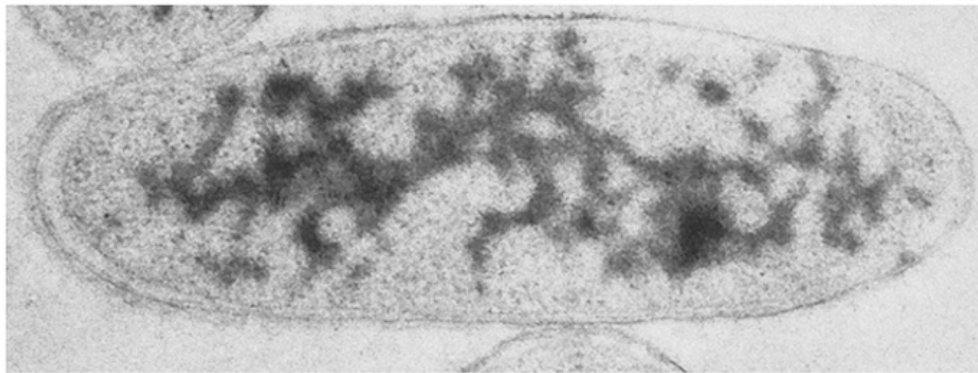
Eukaryotes



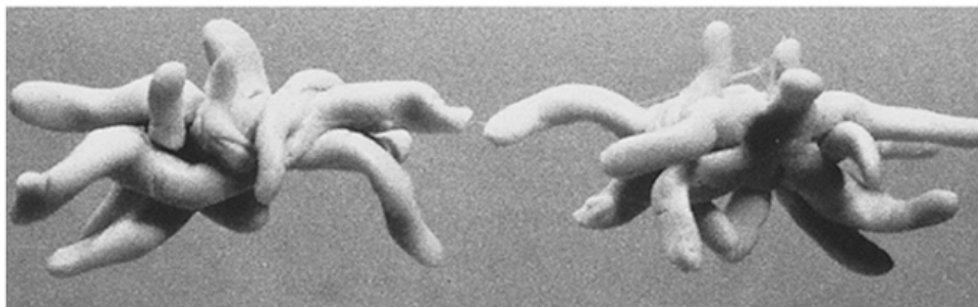
Bacterial Nucleoid



(a)



(b)



(c) Fig. 3.14

Genome organization

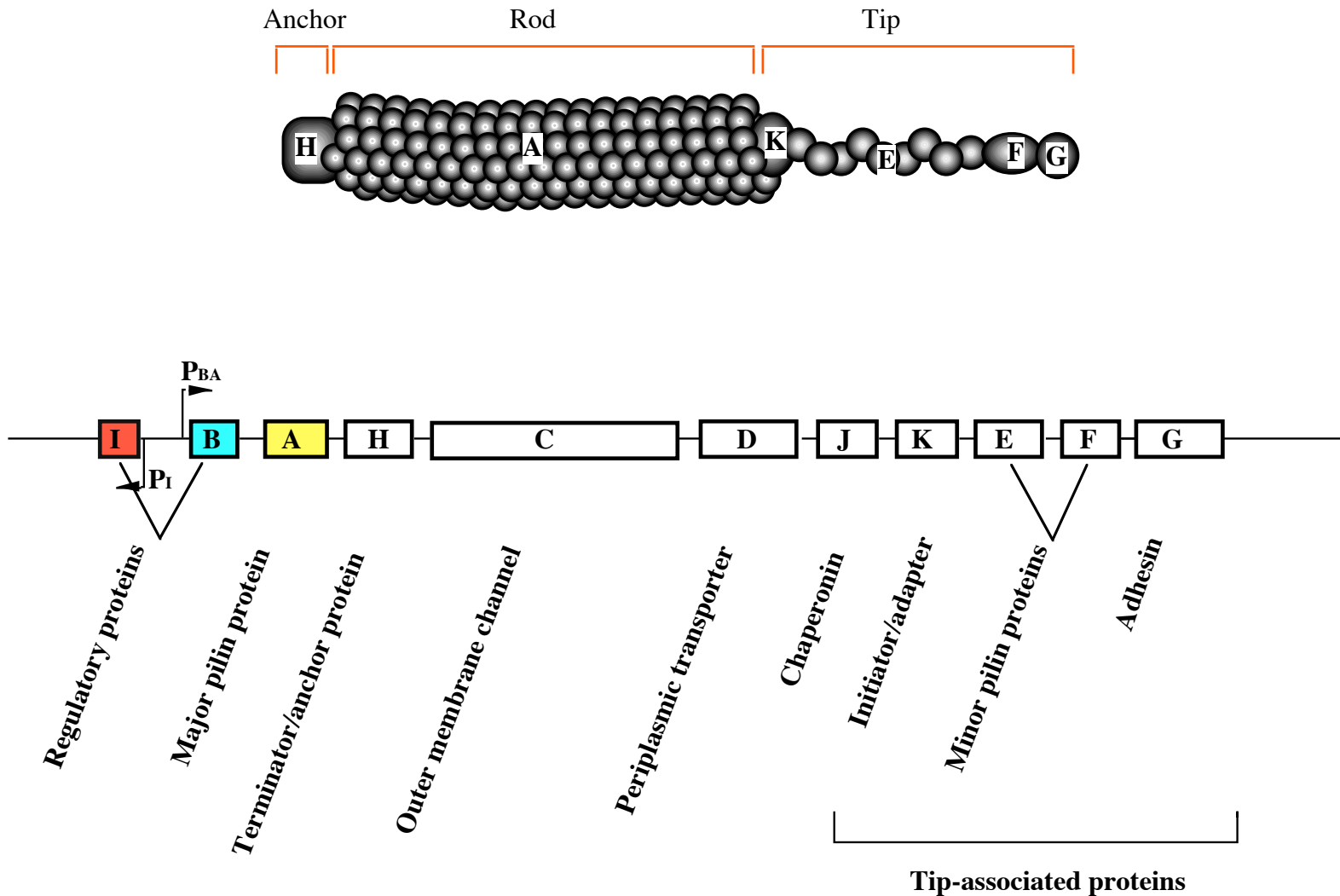
Prokaryotic

- Single, circular chromosome
- Extrachromosomal DNA=
Plasmids
- Haploid= 1 copy of each gene
- No introns
- Genes arranged in operons

Eukaryotic

- Multiple, linear chromosomes
- Plasmids limited
- Diploid
- Contain introns
- One promoter for each gene

Operon organization



Endospores

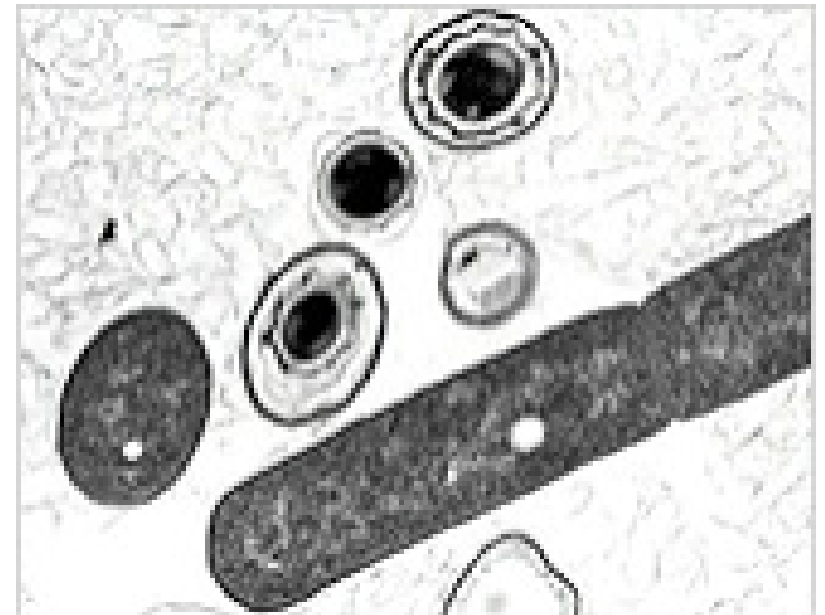
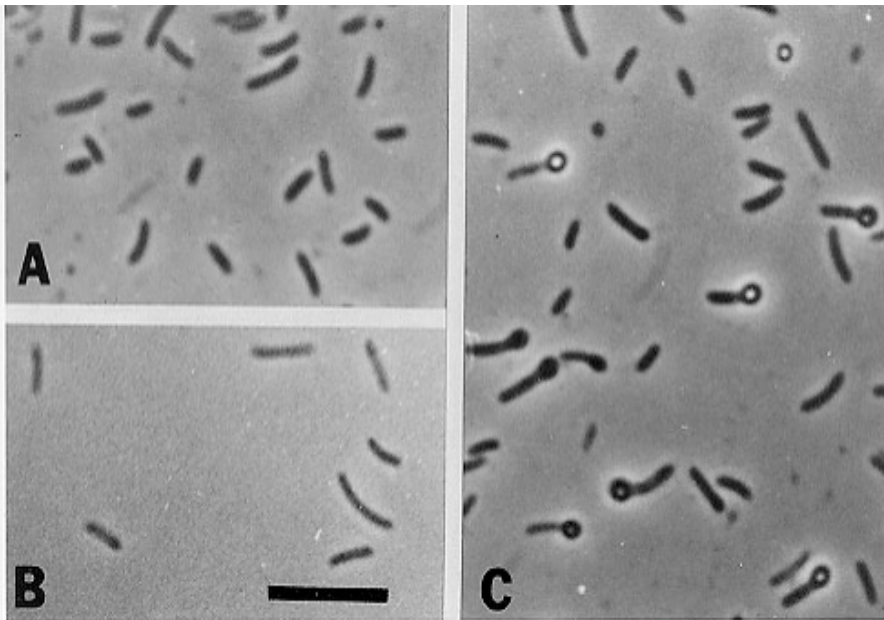


Image from the Boston Globe

Well known spore formers:

Bacillus anthracis

Clostridium botulinum, *Clostridium tetani*

Endospores

- Highly resistant to environmental conditions
- Have no measurable metabolism
- Germinate under favorable conditions

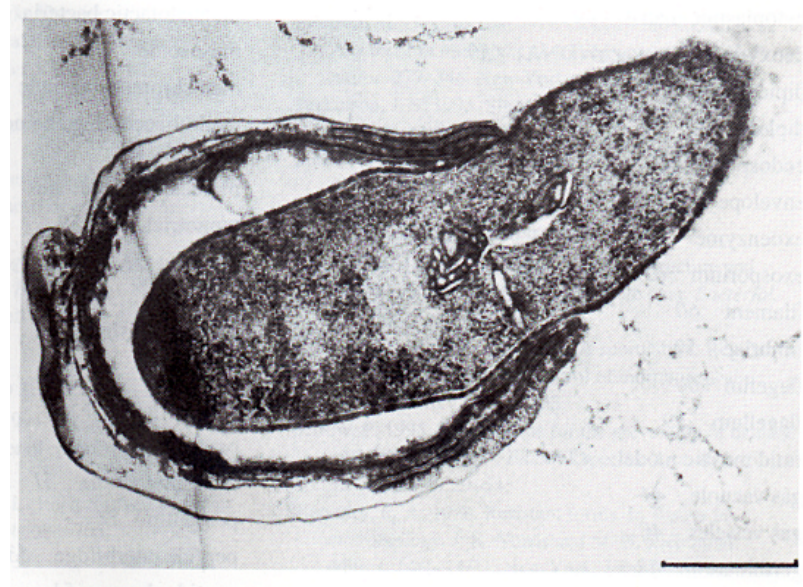
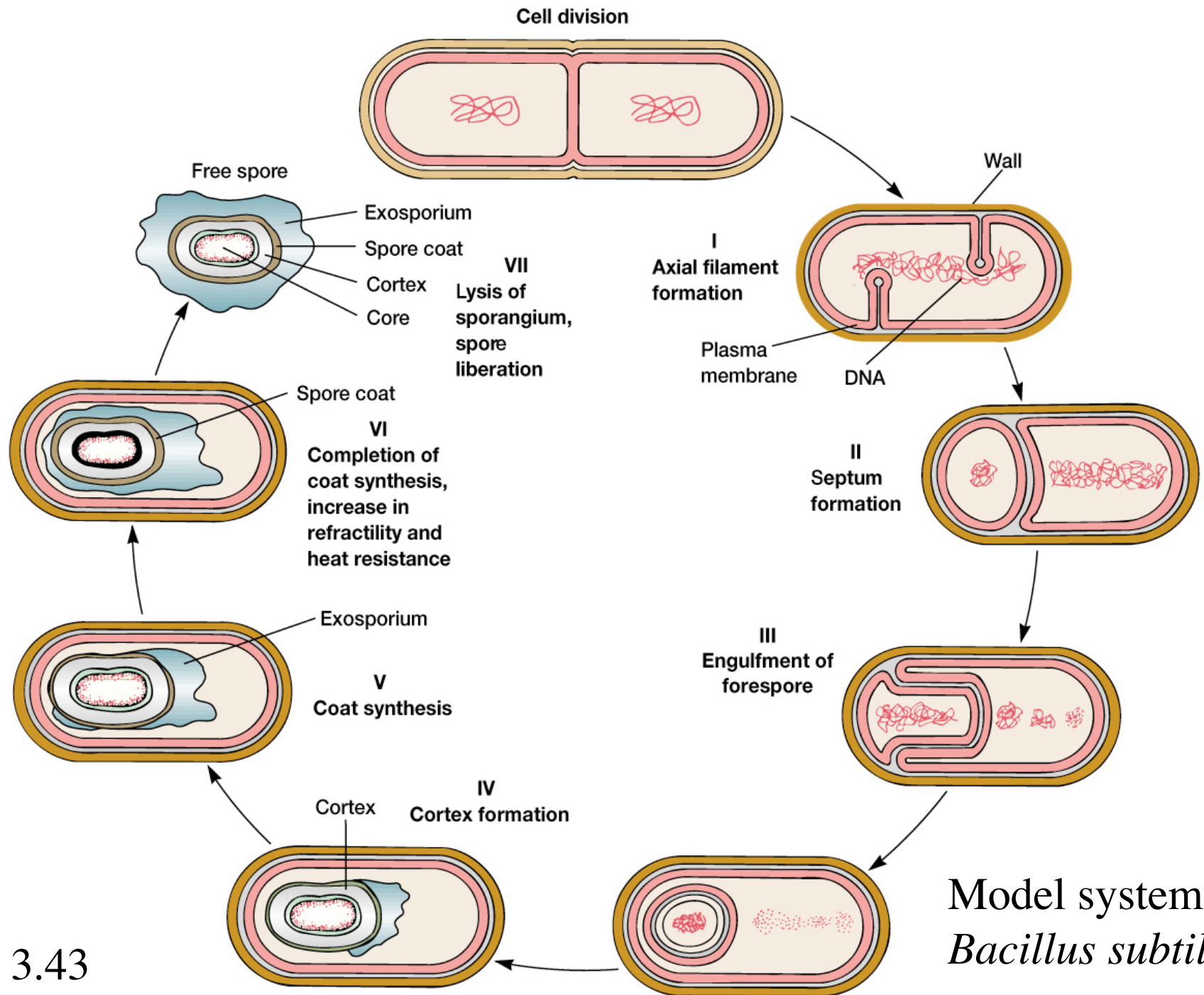


Image from Microbiology by Harely, Prescott, and Klein. 4th ed.

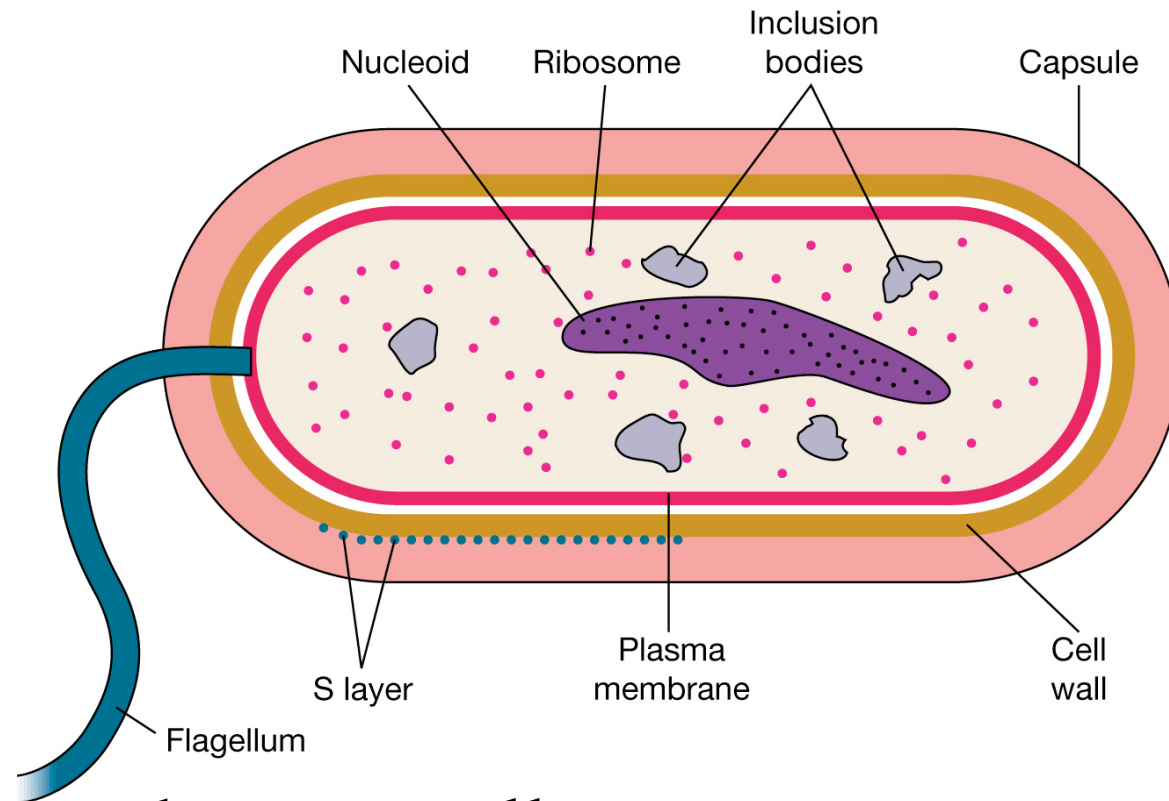
Fig. 3.44



Model system:
Bacillus subtilis

Fig. 3.43

Cell Wall



- Gives shape to cell
- Prevent osmotic pressure from rupturing cells
- Anchorage point for external structures

Fig. 3.4

Peptidoglycan

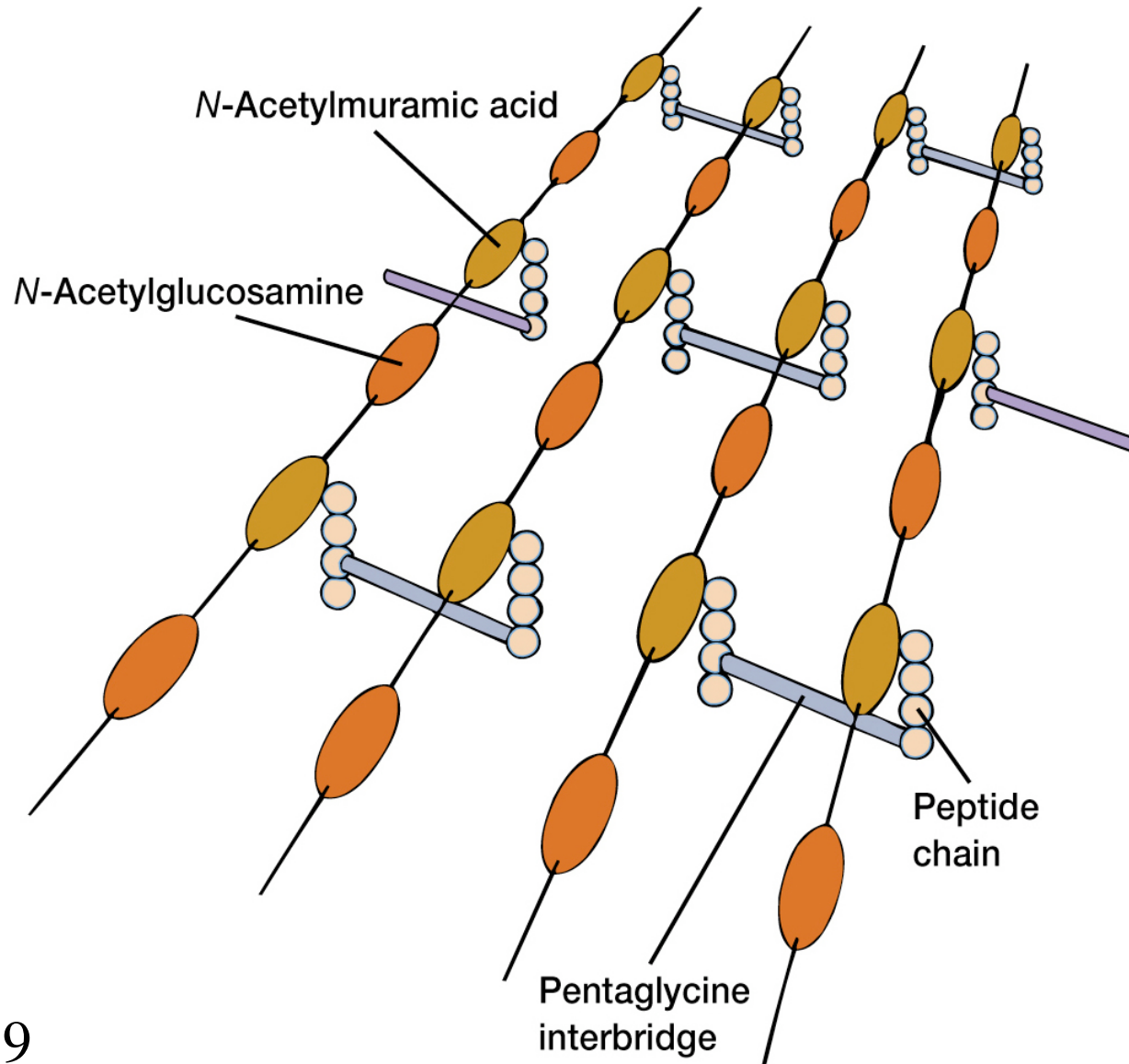


Fig. 3.19

Peptide interbridges

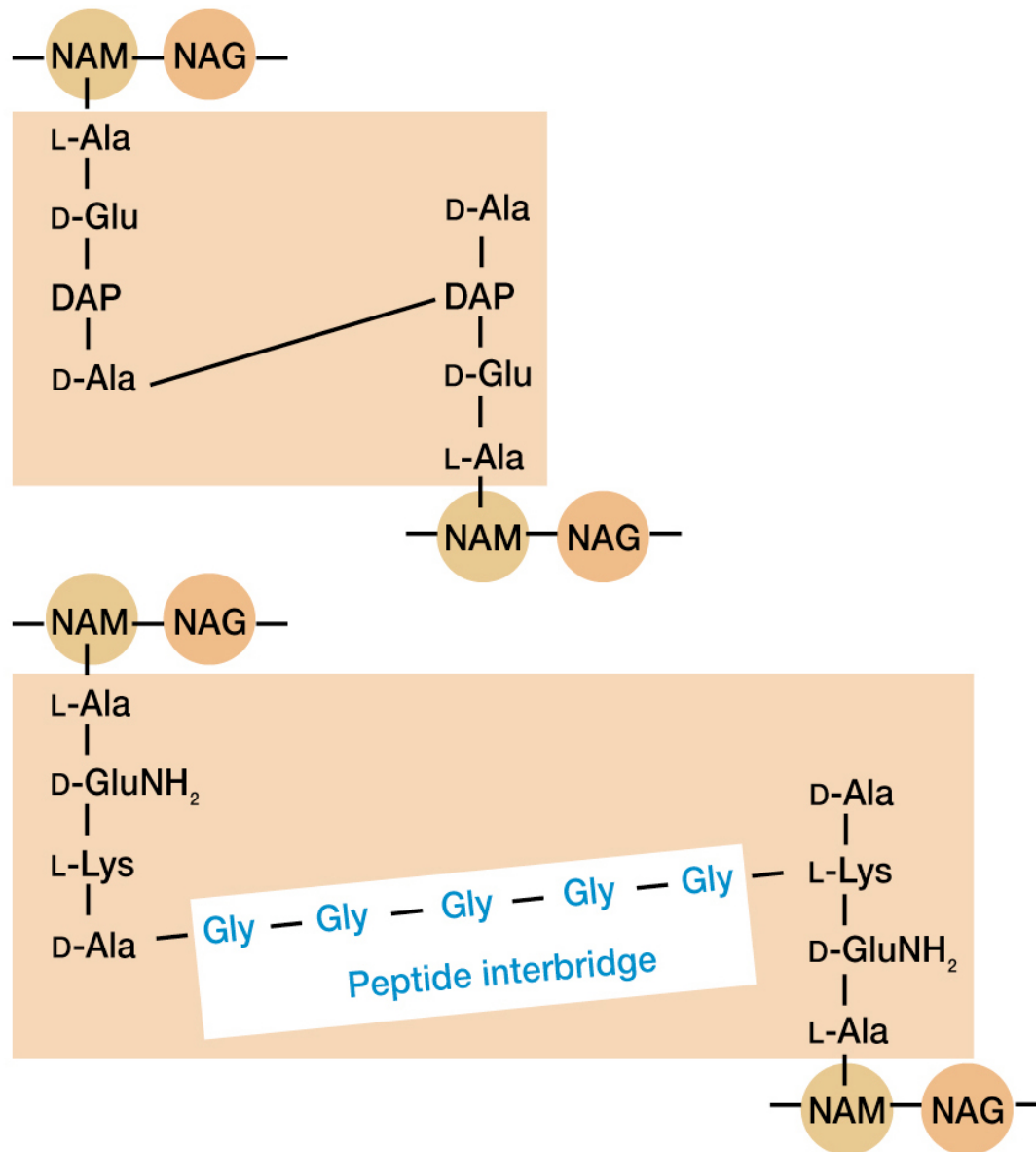


Fig. 3.18

Gram+ vs. Gram-

The gram-positive cell wall

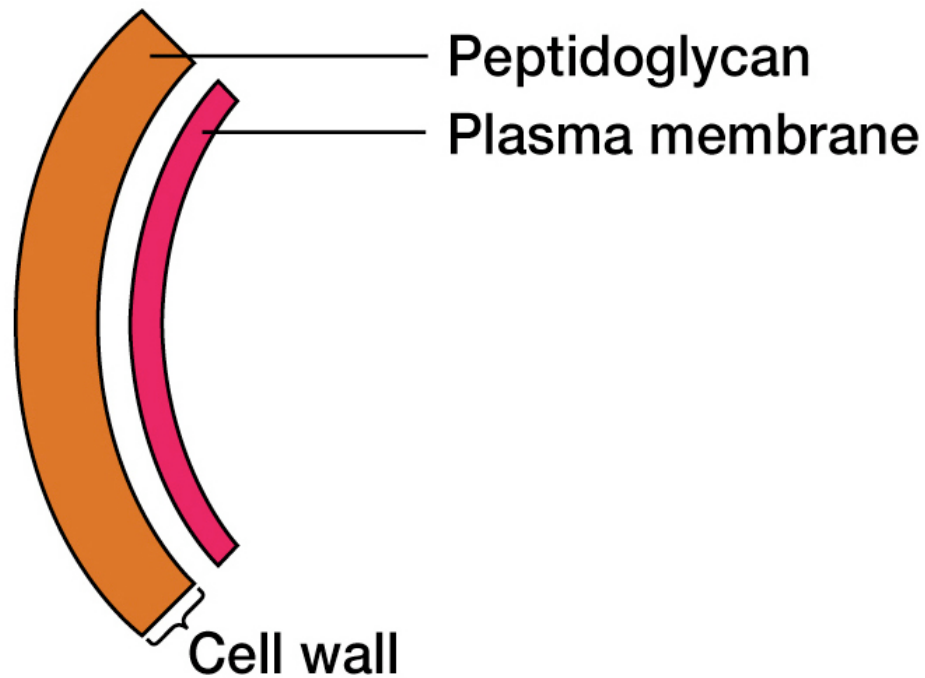
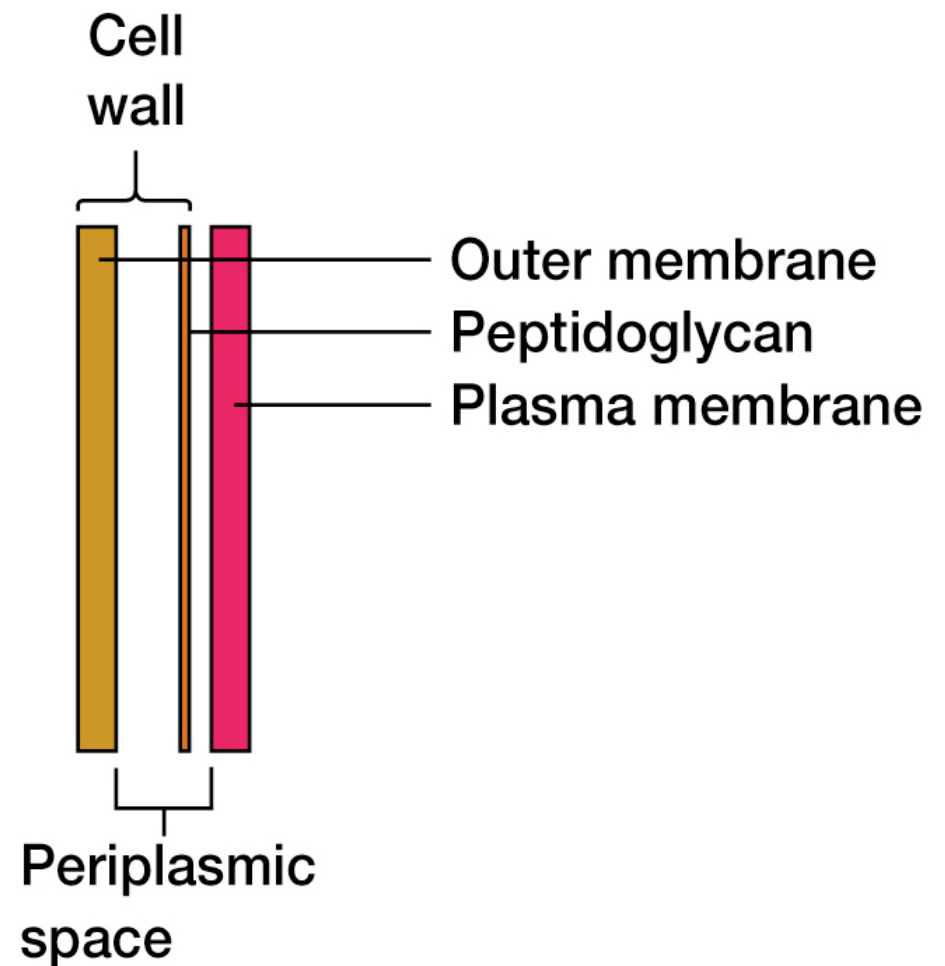


Fig. 3.15

The gram-negative cell wall



Gram+

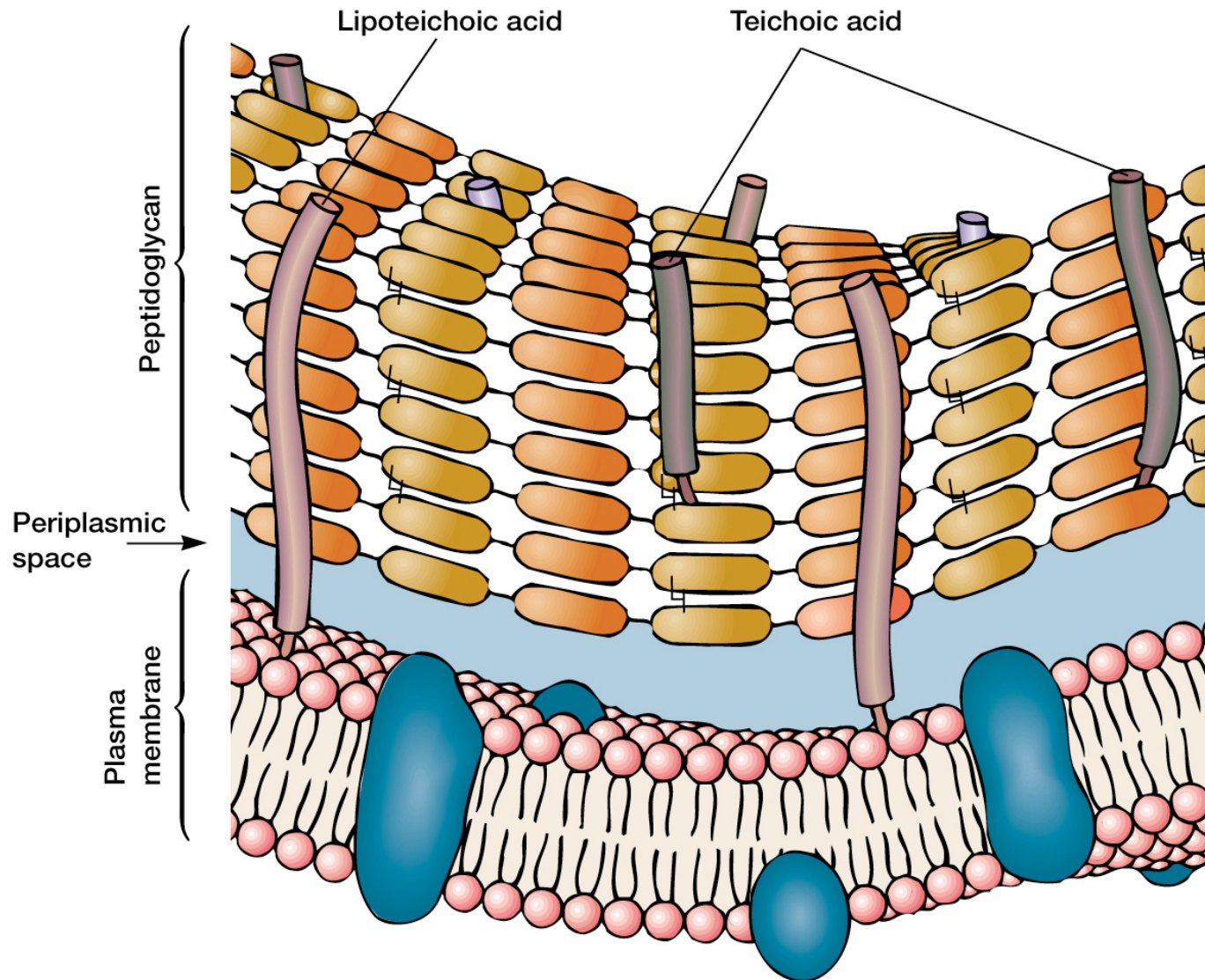
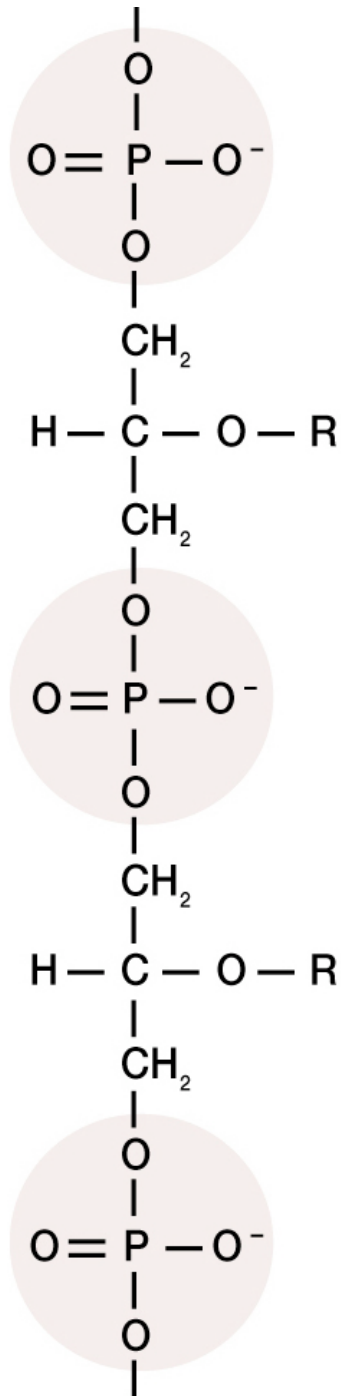


Fig. 3.21



Teichoic Acid

- Only present in Gram+ bacteria
- Give - charge to outer surface of Gram+
- Unknown function

Fig. 3.22

Gram-

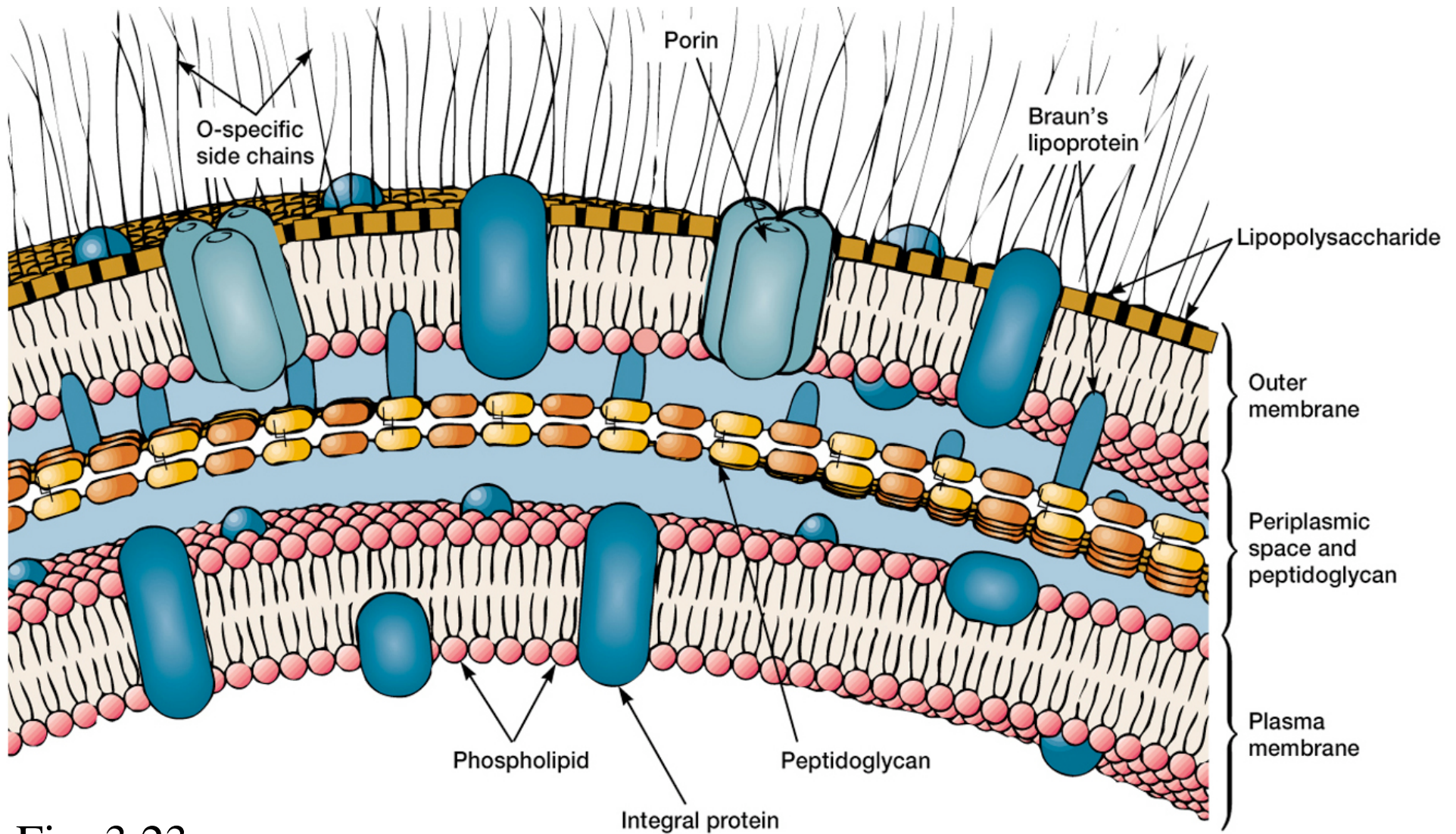
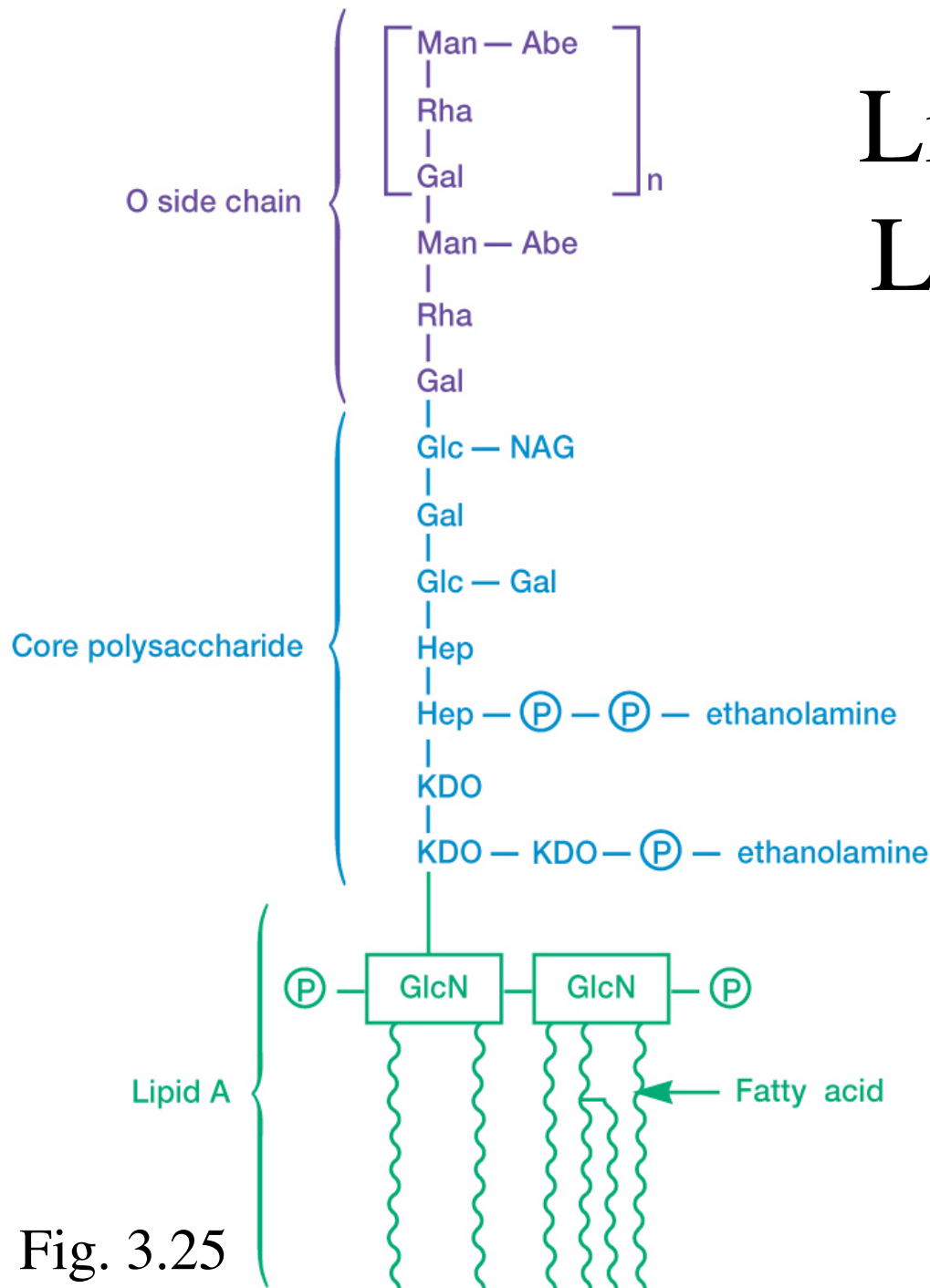


Fig. 3.23

Lipopolysaccharide= LPS or Endotoxin

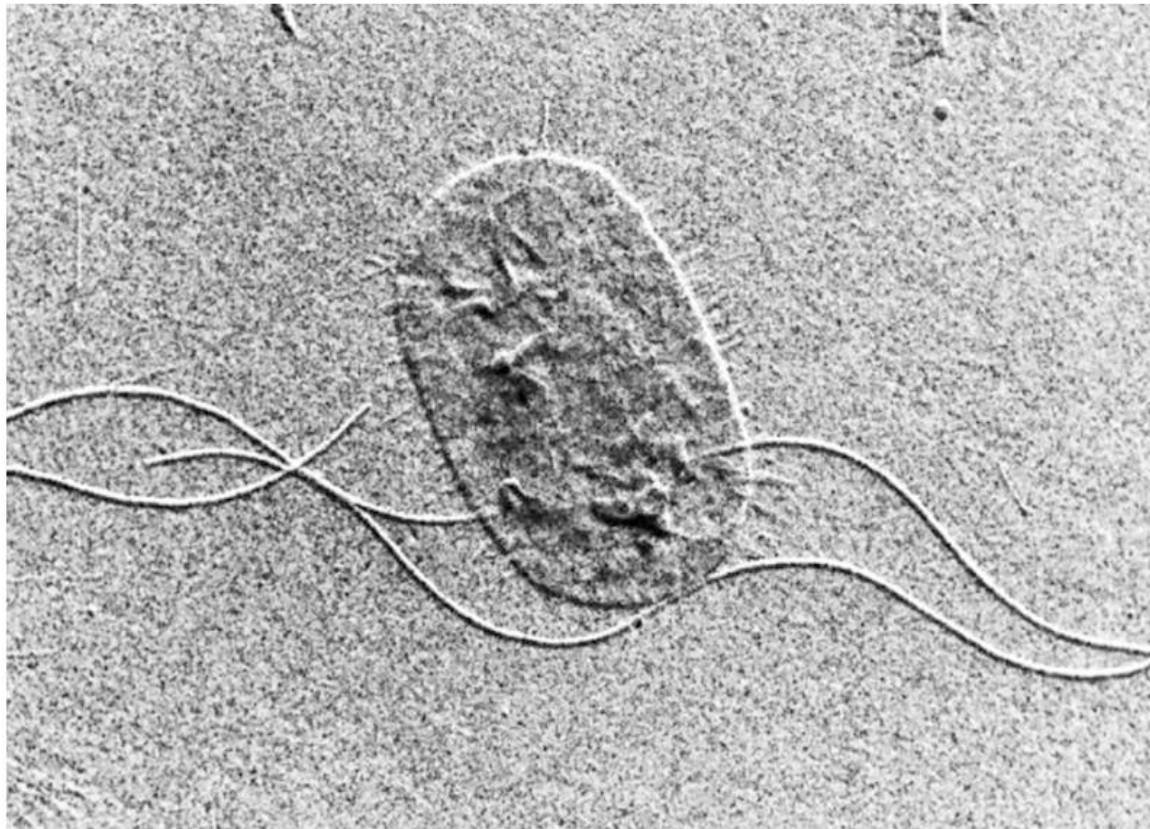


- Found only in Gram-bacteria
- Give- charge to outer surface of bacteria
- May stabilize membrane
- Bacterium can vary structure to evade immune system
- Can cause shock

Fig. 3.25

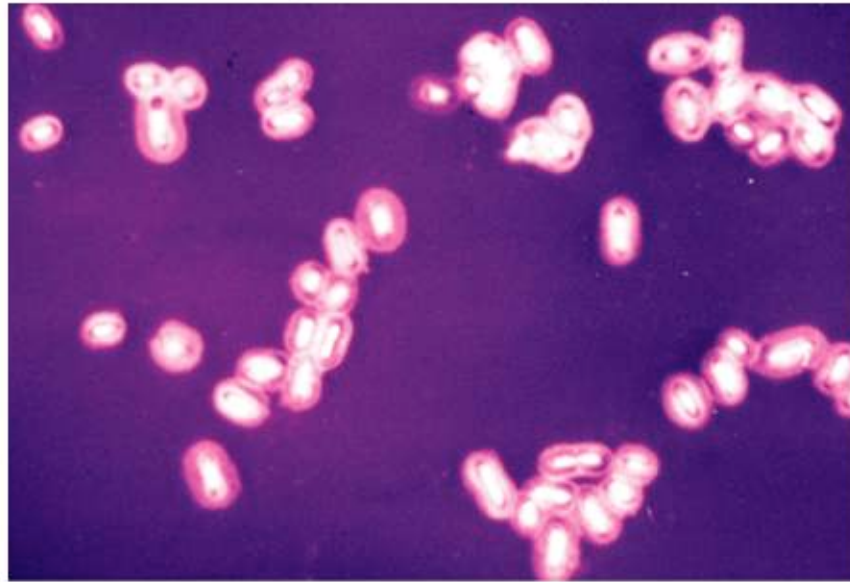
Fimbriae

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Capsule

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(a) *K. pneumoniae*



(b) *Bacteroides*

Fig. 3.27

Bacterial Flagella

- Monotrichous
 - Single, polar flagellum
- Amphitrichous
 - Flagellum at each end
- Lophotrichous
 - 2 or more at either end
- Peritrichous
 - Distributed over cell

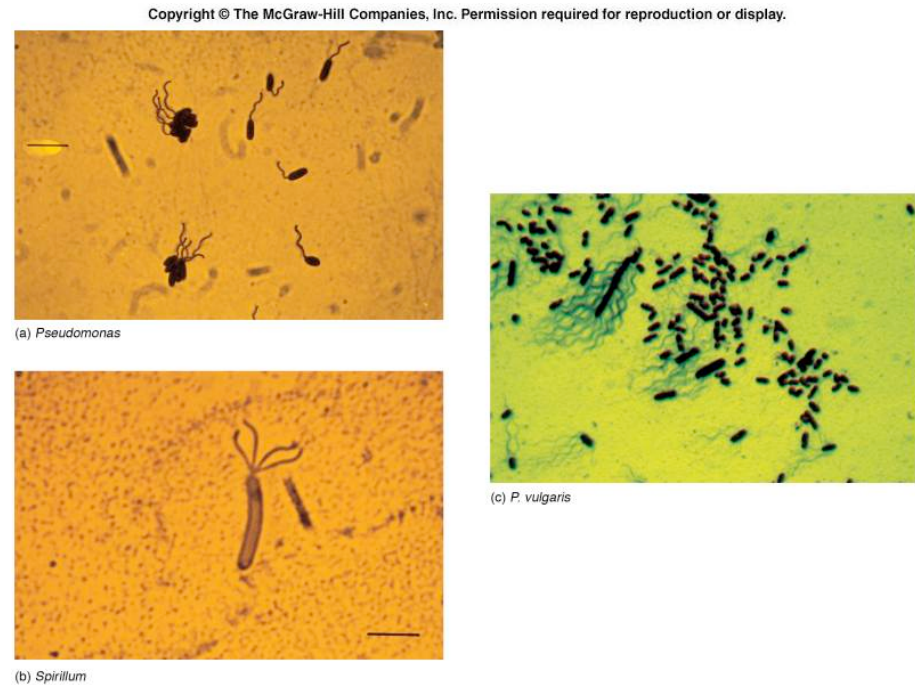


Fig. 3.31

Bacterial Flagella Structure

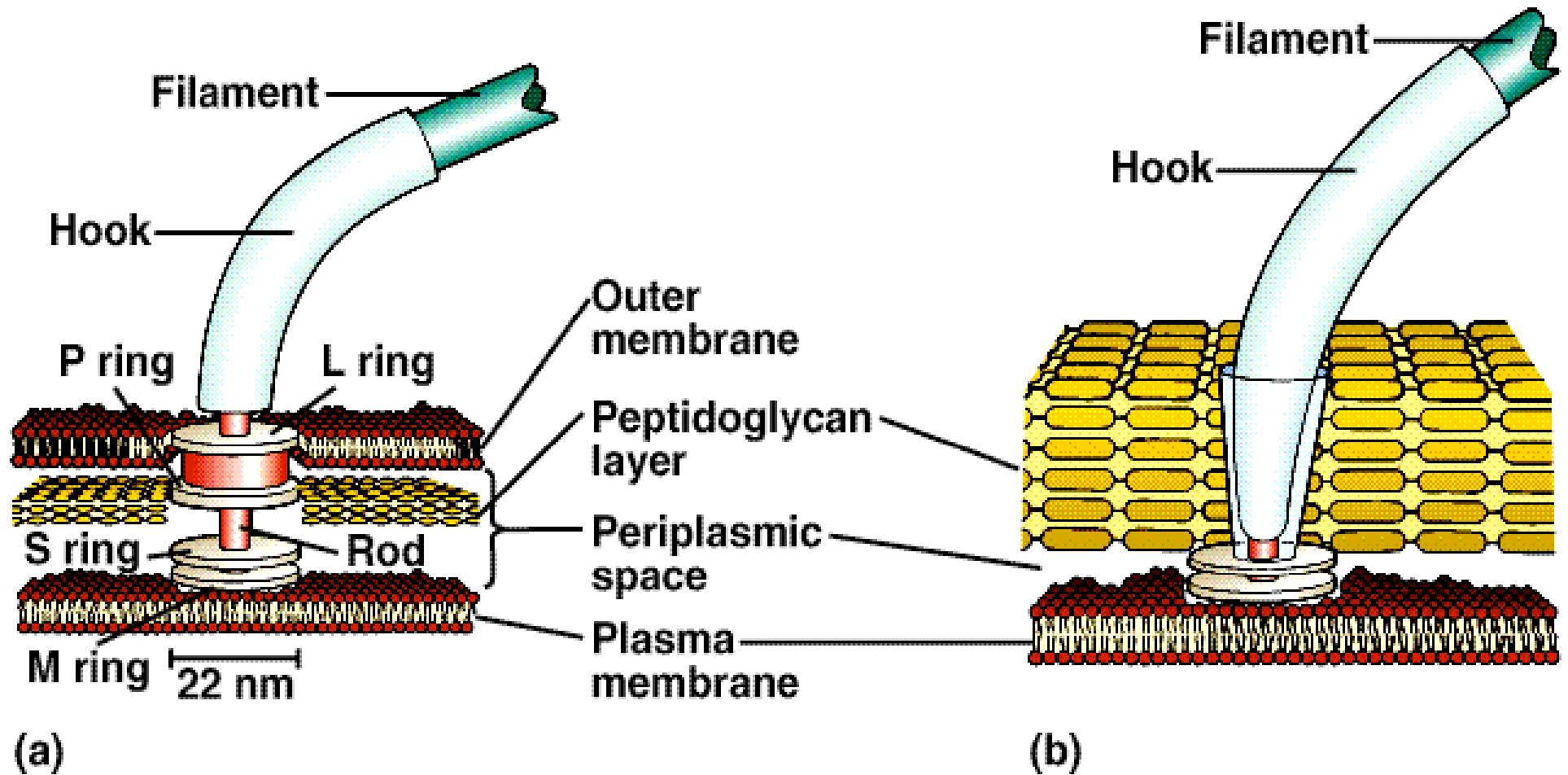


Fig. 3.33

Flagellar Motility

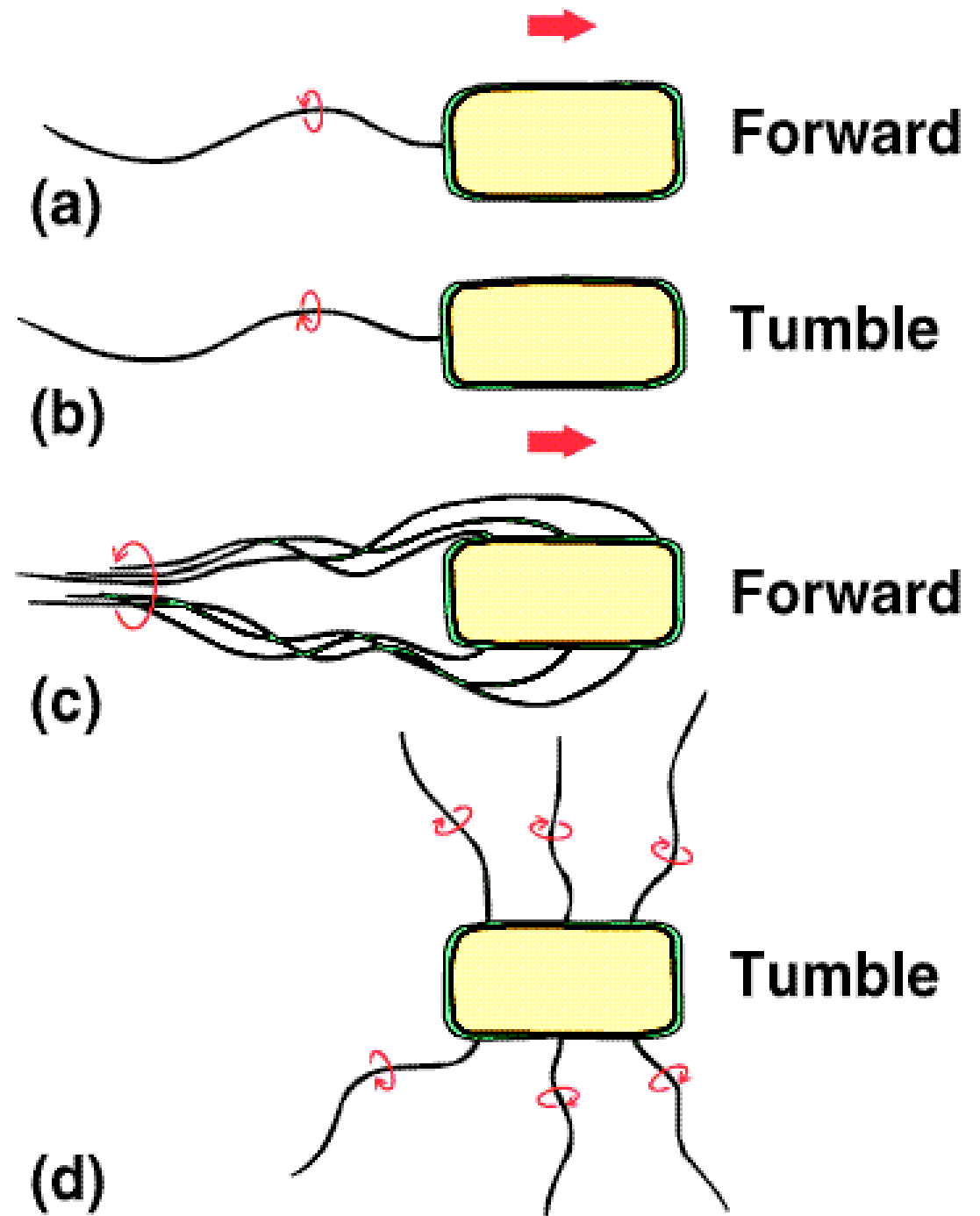
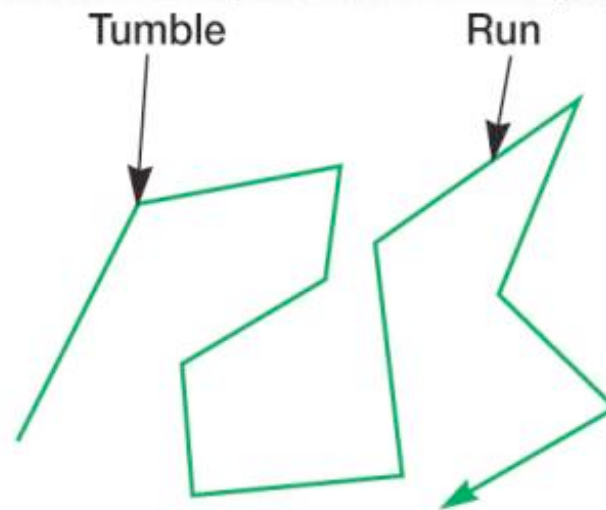


Fig. 3.35

Bacterial Taxis

- Movement towards/away from environmental stimulus
 - Chemotaxis
 - Phototaxis
 - Magnetotaxis

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(a)



(b)

Chemotaxis in *E. coli*

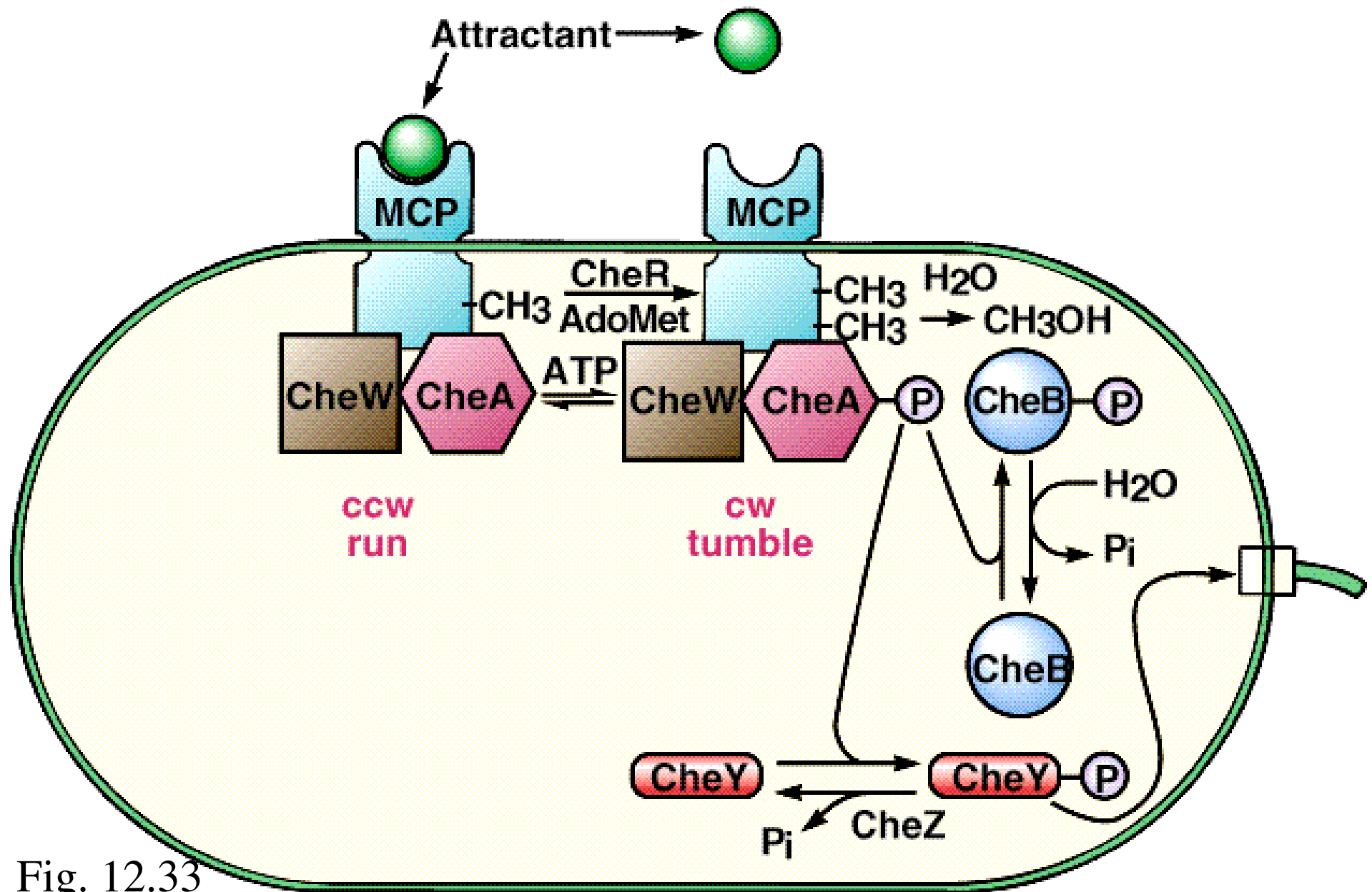


Fig. 12.33

Other types of motility

- Axial filaments
- Gliding motility

How do prokaryotes differ from
eukaryotes?

Antibiotics and Selective Toxicity

Target

Plasma membrane

DNA replication

Transcription

Translation

Cell wall

Example Antibiotics

Polymixin

Ciprofloxacin

Rifampin

Tetracycline, Erythromycin

Penicillin, Vancomycin,
Bacitracin