Sporogenesis

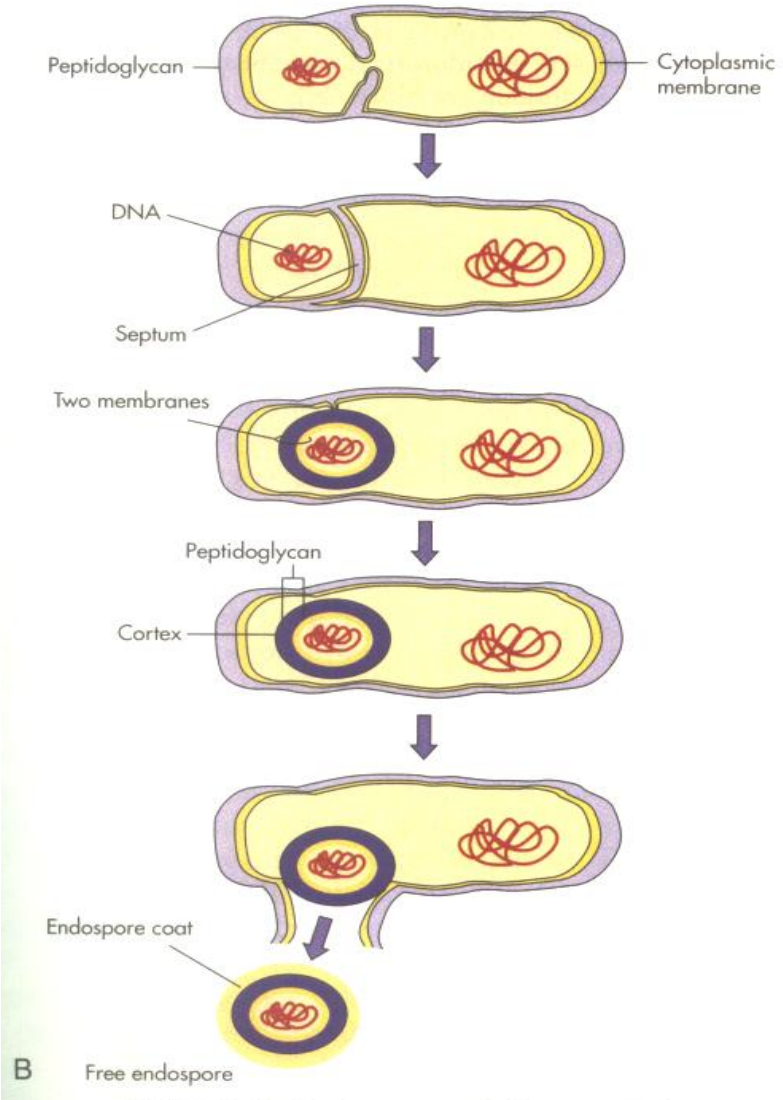
Sporogenesis : (6-8 hours)

1- Depletion of nutrients (alanine) from growth medium triggers a cascade of genetic events leading to production of spore

2- Transcription of spore mRNA and Turn off to another mRNA

3- Production of dipicolinic acid

4- Excretion of enzymes and antibodies



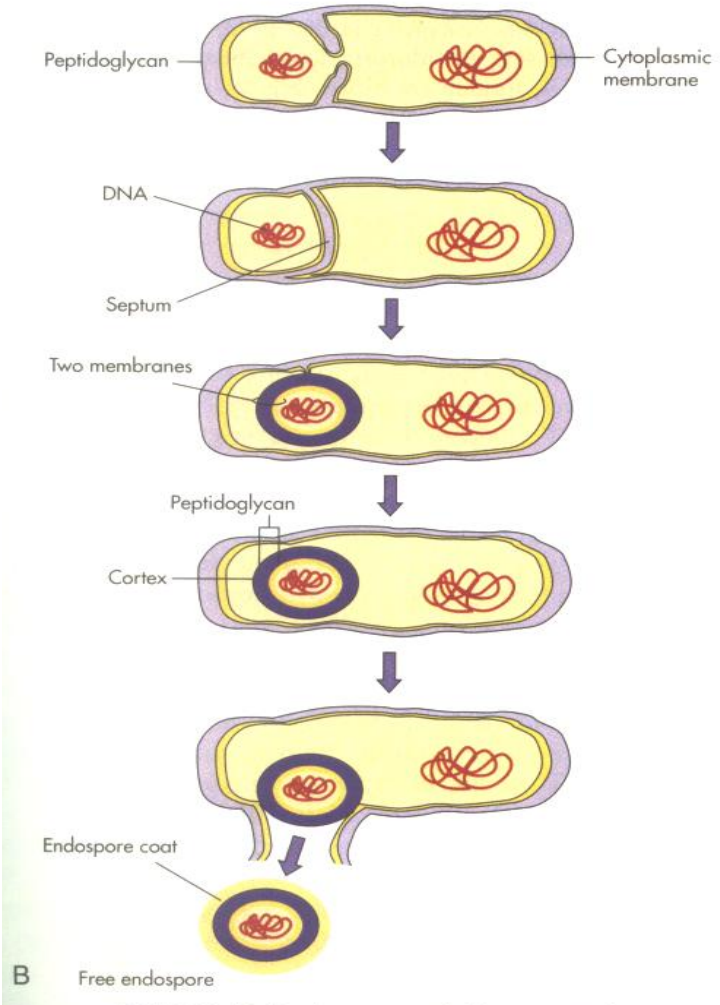
Sporogenesis (cont`d)

5- Duplication of chromosome

6- Surrounding of DNA and core by cytoplasmic membrane, peptidoglycan and membrane of septum

7- Surrounding of two layers by cortex(a different peptidoglycan)

8- Surrounding of cortex by keratin-like protein coat



Germination of spores

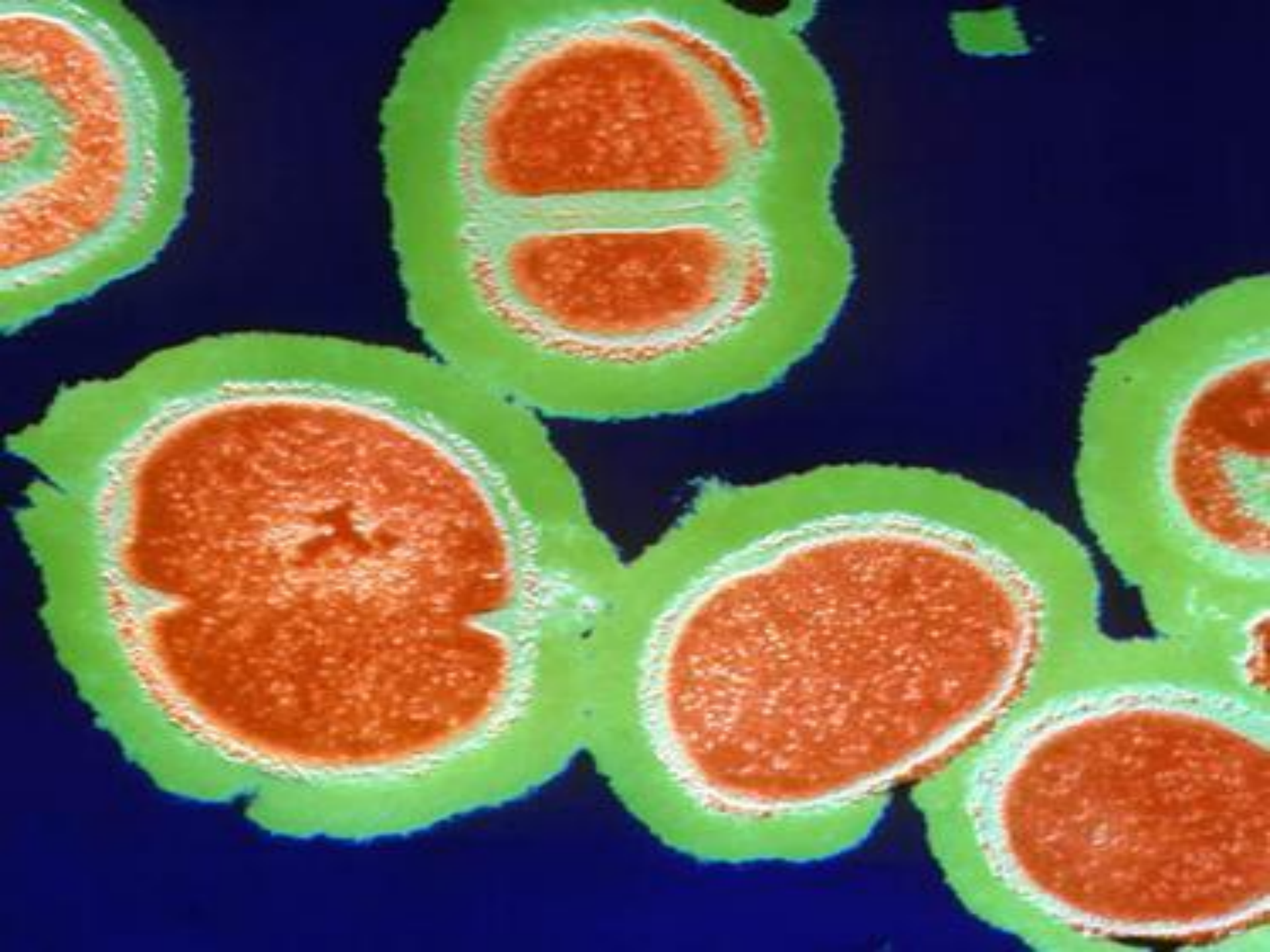
- Germination of spores into the vegetative state: is stimulate by disruption of the outer coat by mechanical stress, pH, heat ,….. And requires water and nutrients. (takes 90 minutes.)
- Spore take up water, swell, shed its coat
- Spore is weaked, vulnerable inactivated like another bacteria

Membrane of G(+) &G(-) bacteria

characteristic	Gram-positive	Gram-negative
Outer membrane	-	+
Cell wall	Thicker	Thinner
LPS	-	+
Endotoxin	-	+
Teichoic acid	Often present	-
Sporulation	Some strains	-
capsule	Sometimes presents	Sometimes presents
lysozyme	Sensitive	Resistant
Antibacterial activity of penicillin	More susceptible	More resistant
Exotoxin production of some strains	Some strains	Some strains

TABLE 3–3. Functions of the Bacterial Envelope

Function	Component
Structural rigidity	All
Packaging of internal contents	All
Permeability barrier	Outer membrane or plasma membrane
Metabolic uptake	Membranes and periplasmic transport proteins, porins, permeases
Energy production	Plasma membrane
Adhesion to host cells	Pili, proteins, teichoic acid
Immune recognition by host	All outer structures
Escape from host immune recognition	Capsule, M protein
Antibiotic sensitivity	Peptidoglycan synthetic enzymes
Antibiotic resistance	Outer membrane
Motility	Flagella
Mating	Pili
Adhesion	Pili



Cell division

- The replication of bacterial chromosome is initiated at membrane
- Bacterial membrane, peptidoglycan synthesis and cell division are liked together.
- Growth and extension of the cell wall components
- Production of a septum that consists of two membranes separated by two layers of peptidoglycan (cross wall)
- ✓ Septum formation is initiated at a site defined by protein complexes affixed to a protein filament ring that lines the inside of the CM. grows from opposite sides to center of cell , and requires PBPs and another enzymes
- Division the daughter bacteria into two cells.

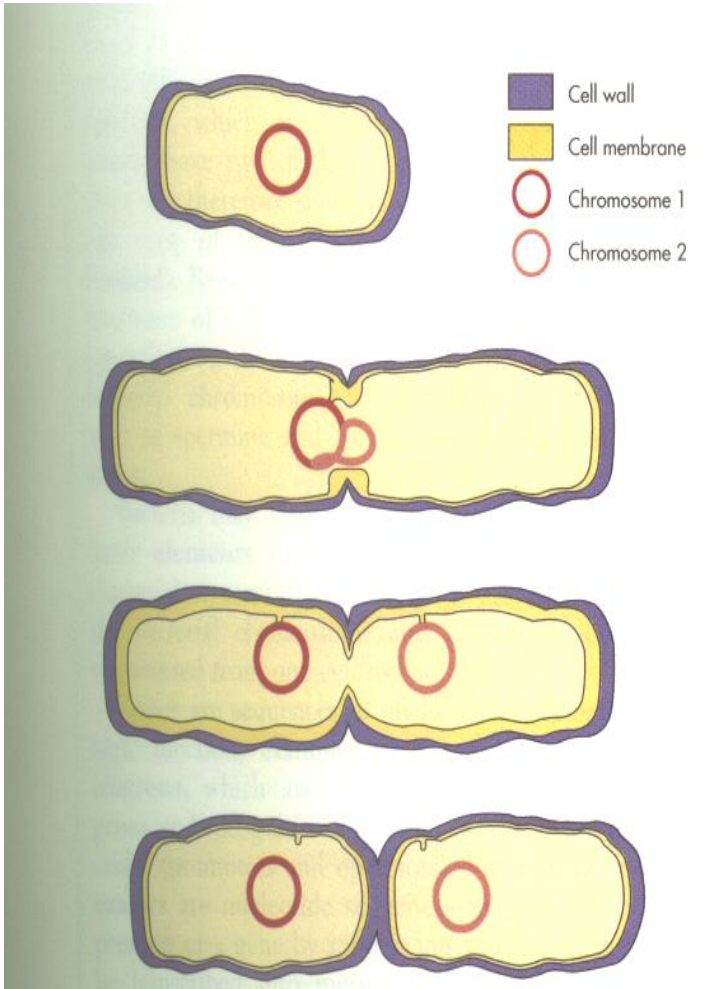


FIGURE 4–10. Bacterial cell division. Replication requires extension of the cell wall as well as replication of the chromosome and septum formation. Membrane attachment of the DNA pulls each daughter strand into a new cell.

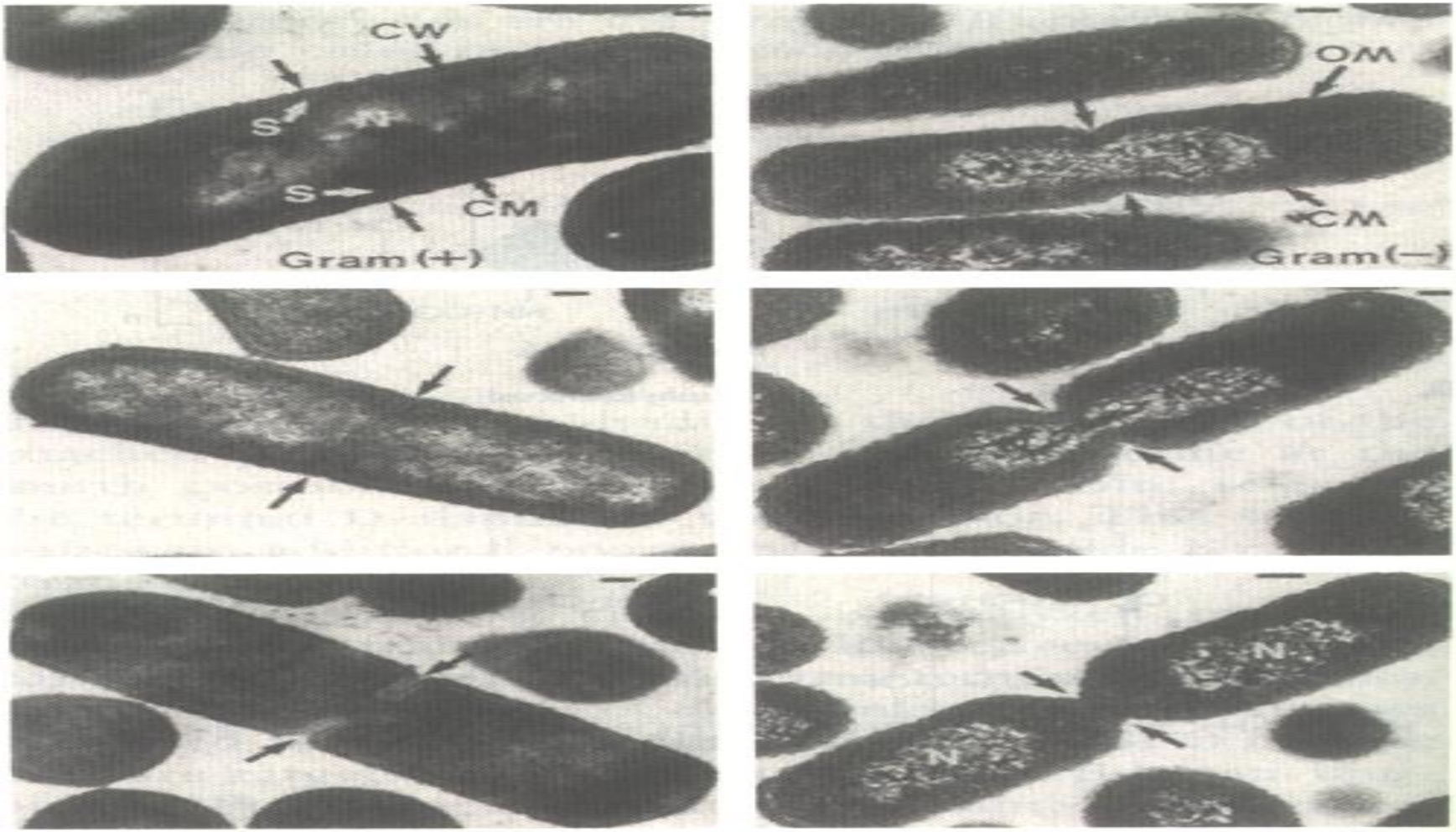


FIGURE 3–12. Electron photomicrographs of gram-positive cell division (*Bacillus subtilis*) (*left*) and gram-negative cell division (*Escherichia coli*) (*right*). *A* to *C* represent a progression in cell division. CW = Cell wall; CM = cytoplasmic membrane; S = septum; N = nucleoid; OM = outer membrane. Bar = 0.2 μm. (From Slots J, Taubman MA, editors: *Contemporary oral biology and immunology,* St Louis, 1992, Mosby.)

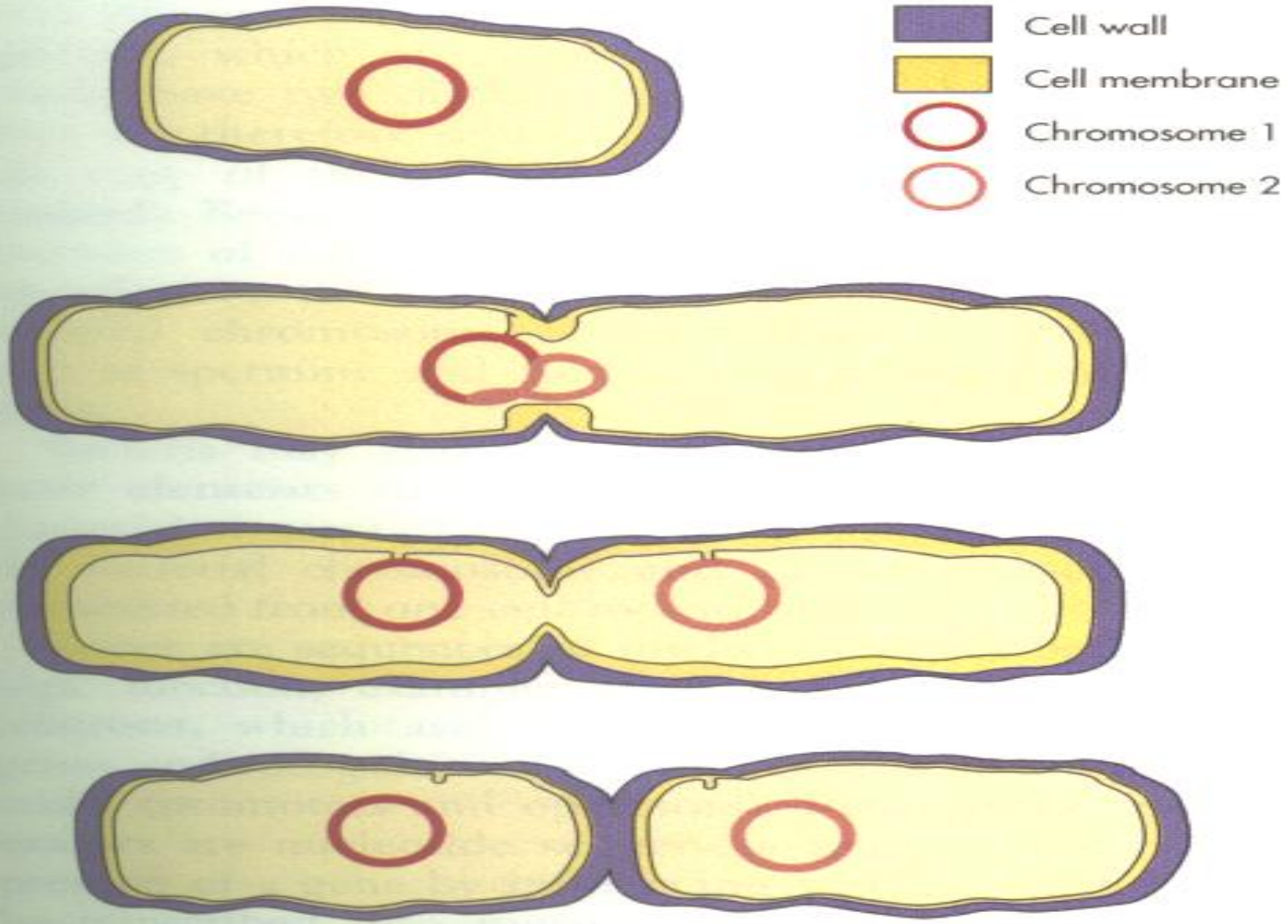


FIGURE 4–10. Bacterial cell division. Replication requires extension of the cell wall as well as replication of the chromosome and septum formation. Membrane attachment of the DNA pulls each daughter strand into a new cell.

Bacterial growth

- Log phase: time for adaptation to new environment
- Log or exponential phase: Growth and division of bacteria with a doubling time (the number of bacteria will increase to 2^n)
- Stationary phase : stop growing because of running out of metabolites or building up toxic substance
- Decline : death of bacteria is more than growing of bacteria

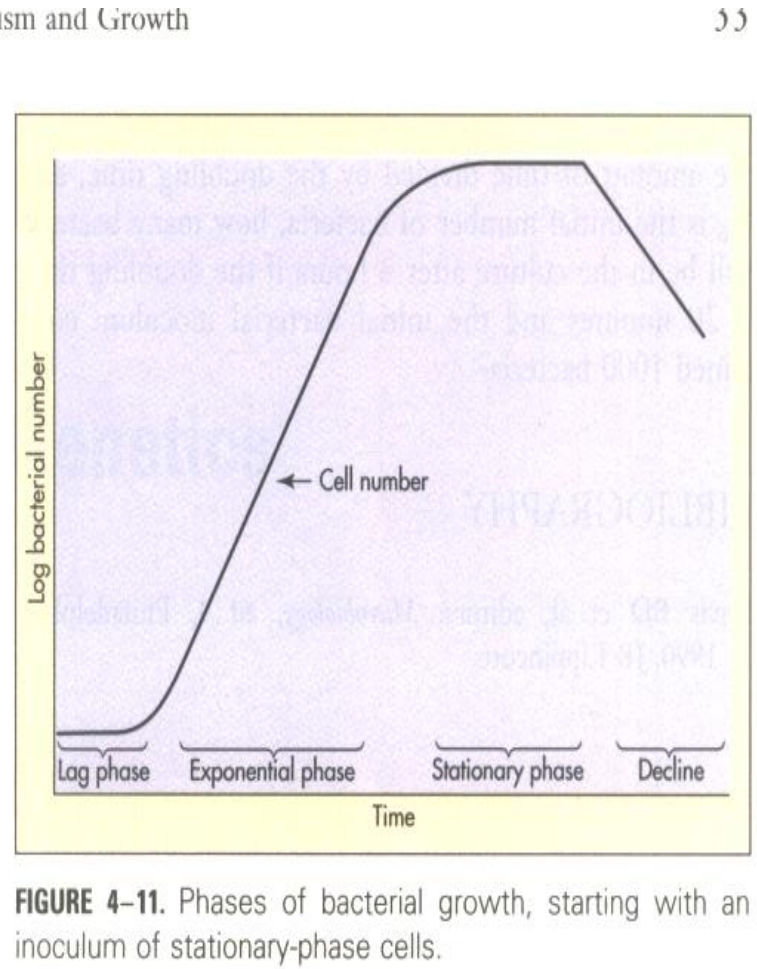


FIGURE 4–11. Phases of bacterial growth, starting with an inoculum of stationary-phase cells.

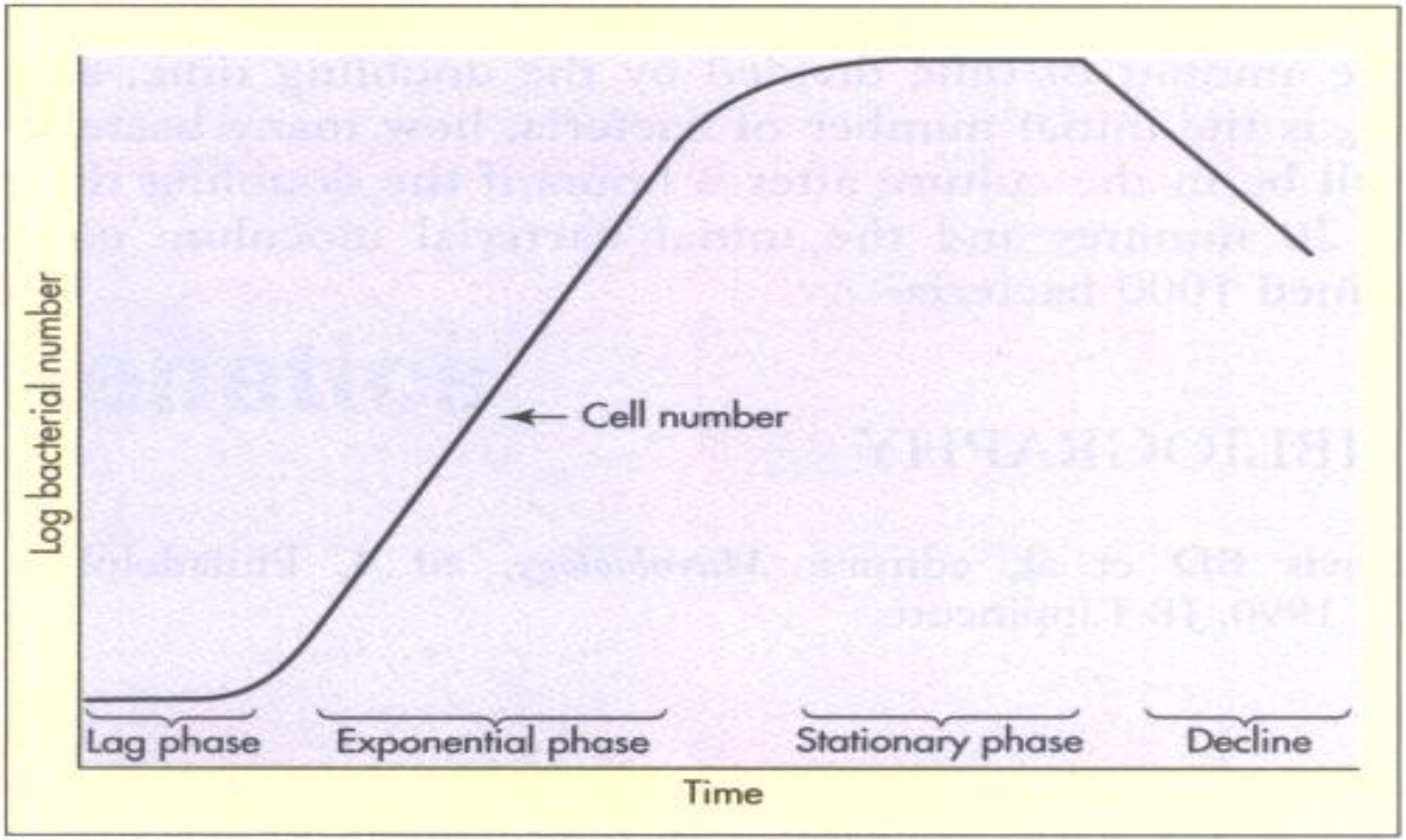


FIGURE 4–11. Phases of bacterial growth, starting with an inoculum of stationary-phase cells.