RAMA UNIVERSITY

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FACULTY OF ENGINEERING &TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Endospores structure and process of sporulation

❖Endospores are special resistant dormant structures formed by gram positive bacteria inside their plasma membrane under nutrient deficient conditions.

❖Endospores develop within vegetative bacterial cells of several genera: *Bacillus* and *Clostridium* (rods), *Sporosarcina* (cocci), and others.

❖These structures are extraordinarily resistant to environmental stresses such as heat, ultraviolet radiation, gamma radiation, chemical disinfectants, and desiccation.

❖This extraordinary resistant is attributed to its dehydrated structure and presence of large amount of an organic acid called *dipicolinic acid* which is accompanied by a large number of calcium ions.

❖Evidence indicates that DPA protects the endospore DNA against damage.

❖The highly dehydrated endospore core contains only DNA, small amounts of RNA, ribosomes, enzymes, and a few important small molecules.

❖These cellular components are essential for resuming metabolism later.

Location of spores inside bacterial plasma membrane

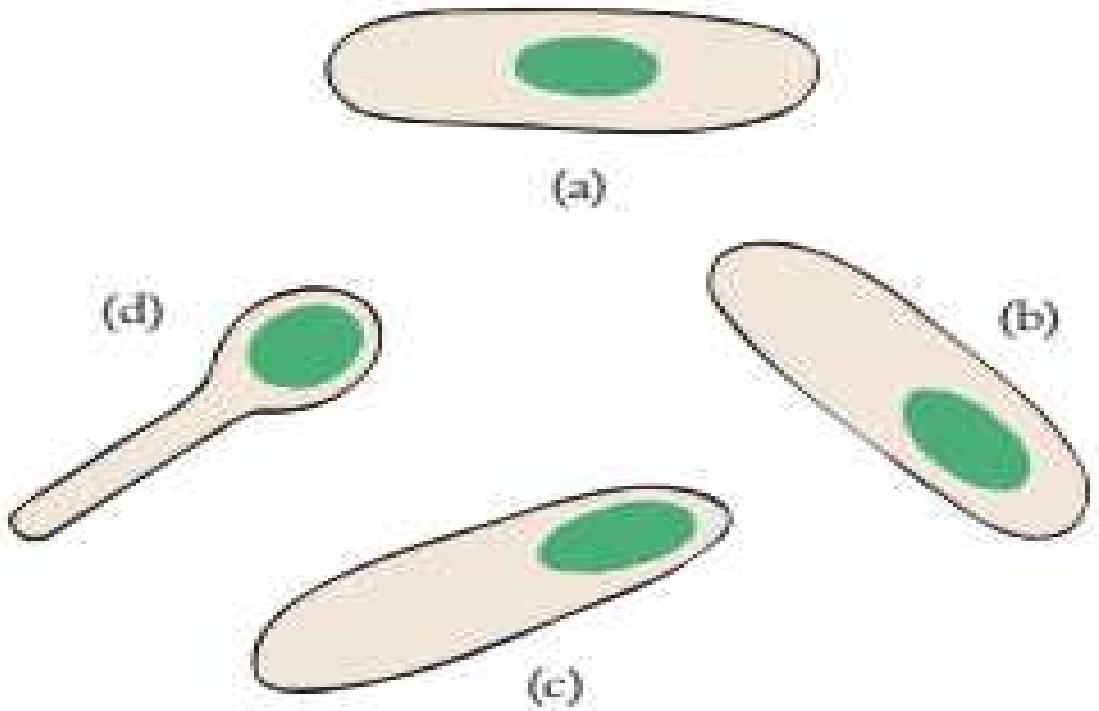

Figure: Example of endospore location and size. (a) Central spore (b) Subterminal spore (c) Terminal spore (d) Terminal spore with swollen sporangium

Depending on the species, the endospore might be located *terminally* (at one end), *subterminally* (near one end), or *centrally* (Figure) inside the vegetative cell. When the endospore matures, the vegetative cell wall ruptures (lyses), killing the cell and the endospore is freed.

Structure of endspores

The spore often is surrounded by a thin, delicate covering called the **exosporium.** A **spore coat** lies beneath the exosporium, is composed of several protein layers, and may be fairly thick. It is impermeable and responsible for the spore's resistance to chemicals. The **cortex,** which may occupy as much as half the spore volume, rests beneath the spore coat. It is made of a peptidoglycan that is less cross-linked than that in vegetative cells. The **spore cell wall** (or core wall) is inside the cortex and surrounds the protoplast or **core.** The core has the normal cell structures such as ribosomes and a nucleoid, but is metabolically inactive.

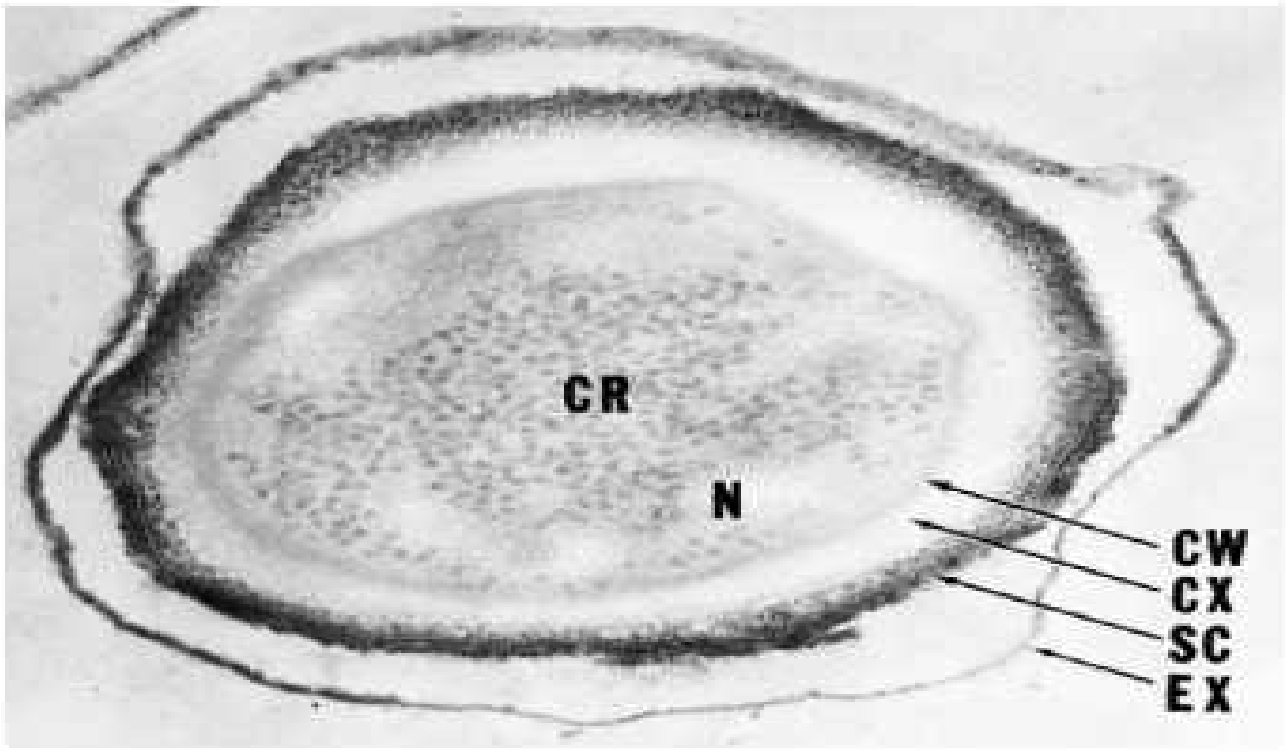

Figure : Endospore Structure**.** *Bacillus anthracis* endospore. Note the following structures: exosporium, EX; spore coat, SC; cortex, CX; core wall, CW; and the protoplast or core with its nucleoid, N, and ribosomes, CR

Process of spore Formation

Spore formation, **sporogenesis** or **sporulation,** normally commences when growth ceases due to lack of nutrients. It is a complex process and may be divided into six stages:

Stage I: Spore septum begins to isolate newly replicated DNA and a small portion of cytoplasm.

Stage II: Plasma membrane starts to surround DNA, cytoplasm, and membrane isolated in step I

Stage III: Spore septum surrounds isolated portion, forming forespore

Stage IV: Peptidoglycan layers forms between membranes

Stage V: spore coat forms

Stage VI: Endospore is freed from cells

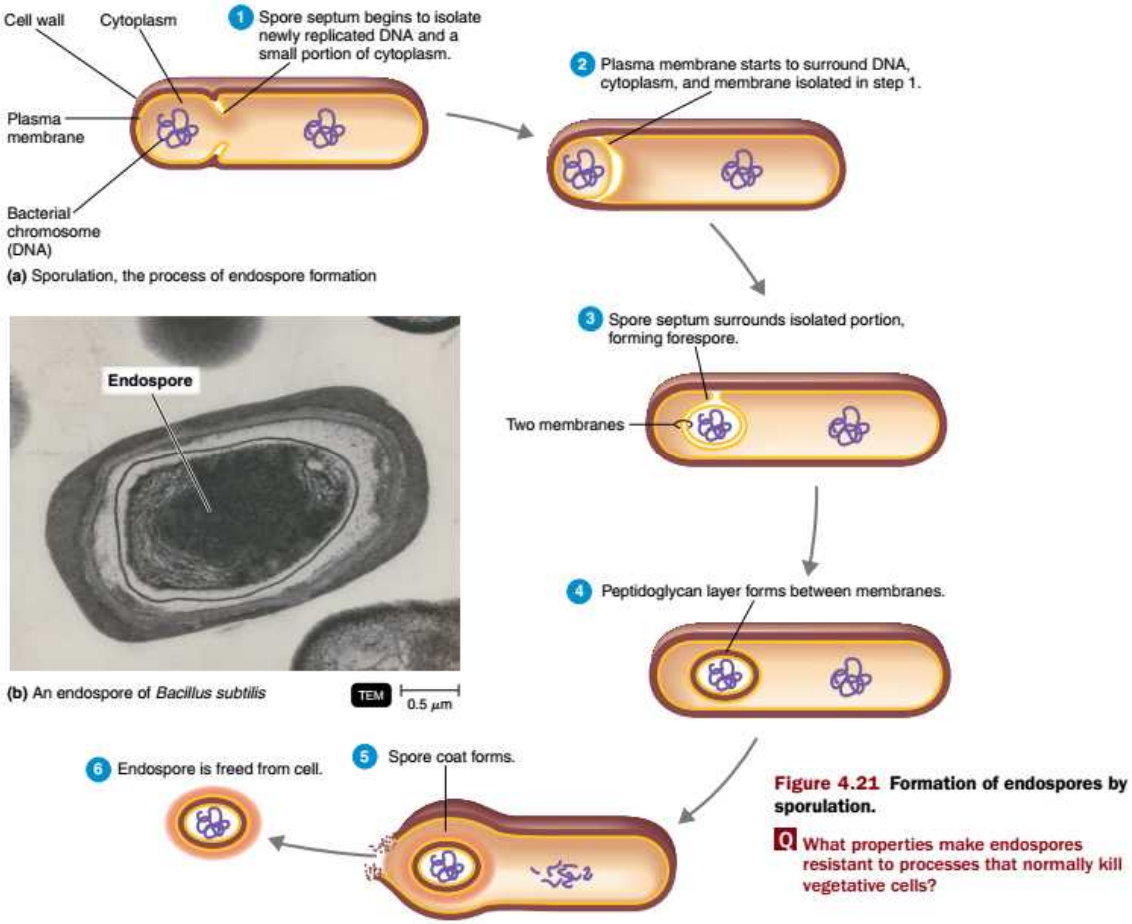

Figure: Diagrammetic representation of various stages involved in endospore formation