

Table 4.2 Differences between endospores and vegetative cells

Characteristic	Vegetative cell	Endospore
Structure	Typical gram-positive cell; a few gram-negative cells	Thick spore cortex Spore coat Exosporium
Microscopic appearance	Nonrefractile	Refractile
Calcium content	Low	High
Dipicolinic acid	Absent	Present
Enzymatic activity	High	Low
Metabolism (O ₂ uptake)	High	Low or absent
Macromolecular synthesis	Present	Absent
mRNA	Present	Low or absent
Heat resistance	Low	High
Radiation resistance	Low	High
Resistance to chemicals (for example, H ₂ O ₂) and acids	Low	High
Stainability by dyes	Stainable	Stainable only with special methods
Action of lysozyme	Sensitive	Resistant
Water content	High, 80–90%	Low, 10–25% in core
Small acid-soluble proteins (product of <i>ssp</i> genes)	Absent	Present
Cytoplasmic pH	About pH 7	About pH 5.5–6.0 (in core)

Activation is most easily accomplished by heating freshly formed endospores for several minutes at a sub-lethal but elevated temperature. Activated spores are then conditioned to germinate when placed in the presence of specific nutrients. *Germination*, usually a rapid

process (on the order of several minutes), involves loss of microscopic refractility of the spore, increased ability to be stained by dyes, and loss of resistance to heat and chemicals. Loss from the spores of calcium dipicolinate and cortex components occurs during this stage, and the