



UNIVERSITY OF
THESSALY

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CHEMISTRY & CELL STRUCTURE

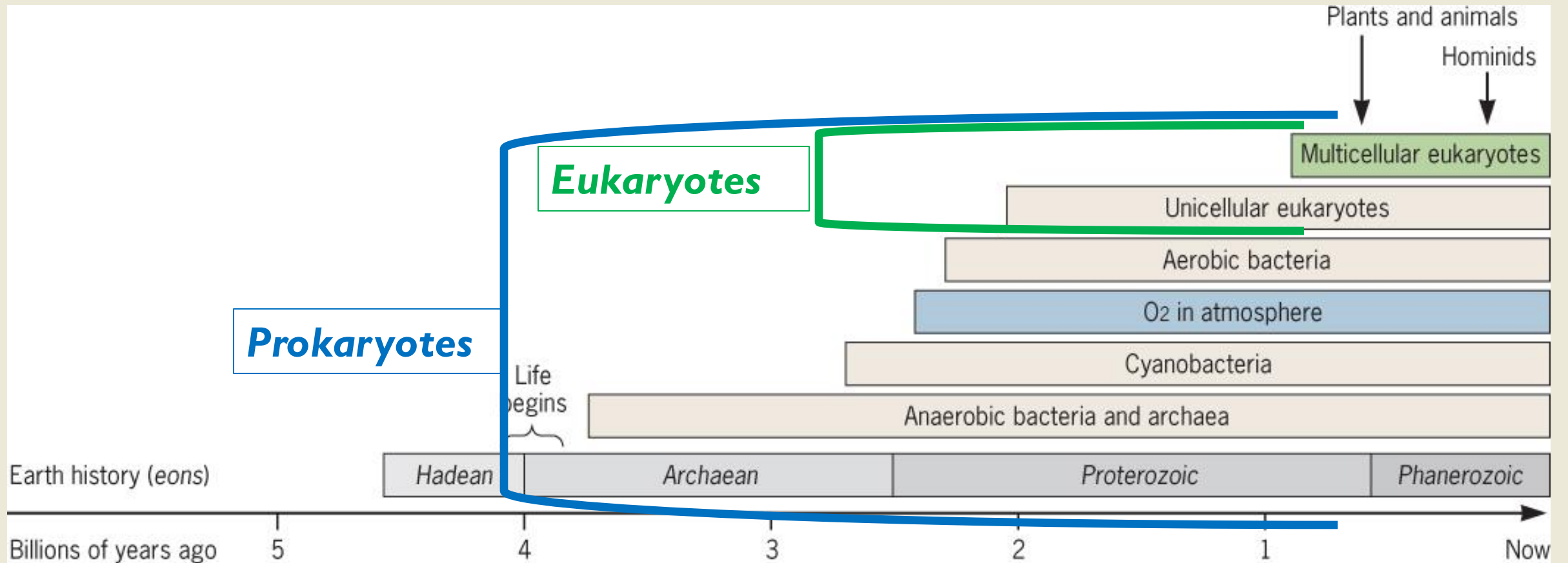
ASSESSMENT

Answers to questions about the microbiology.

Answers to questions about learning during the activity.

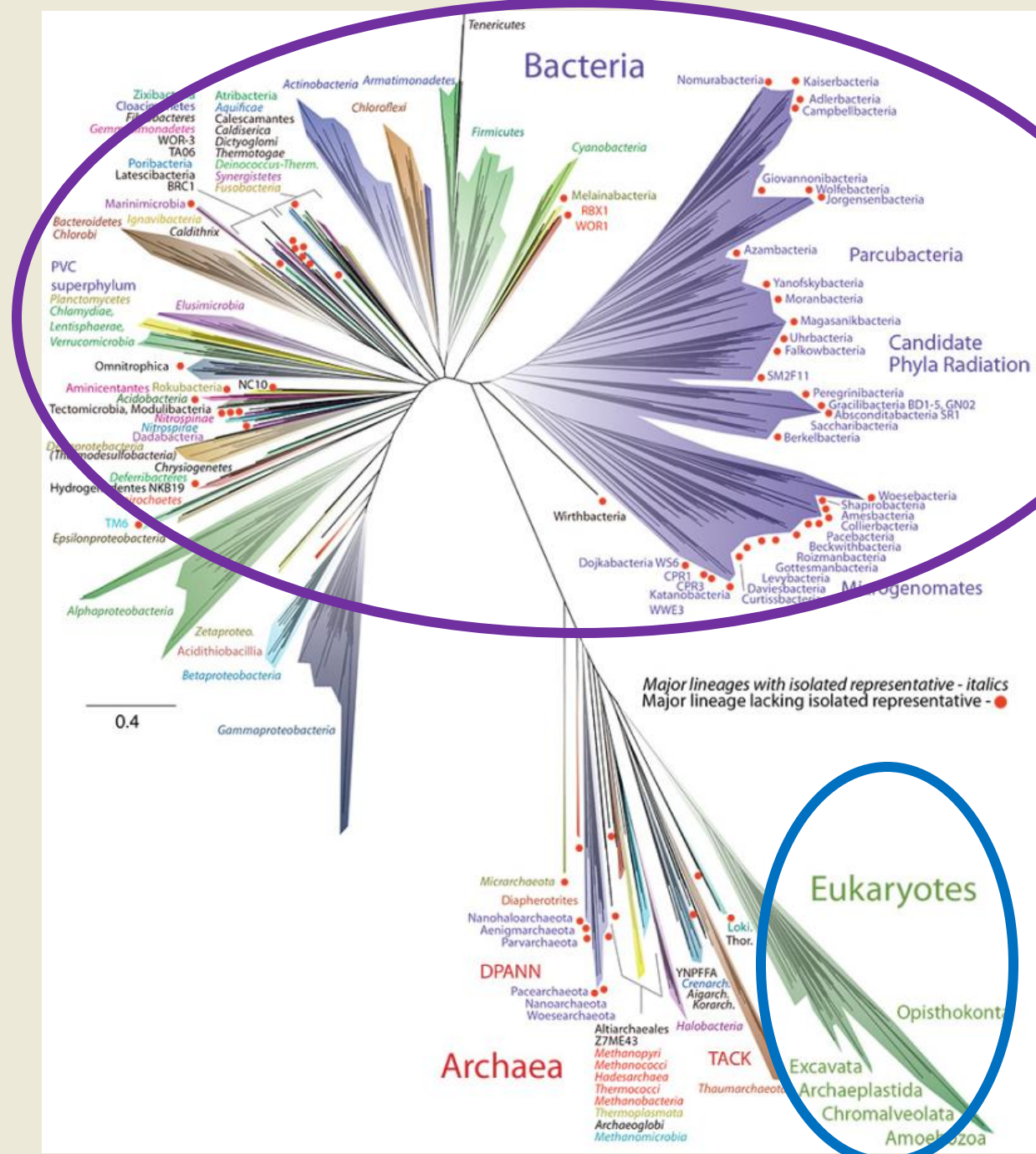
Active participation and contribution during the activity.

Microbes have occupied Earth much longer than most eukaryotes

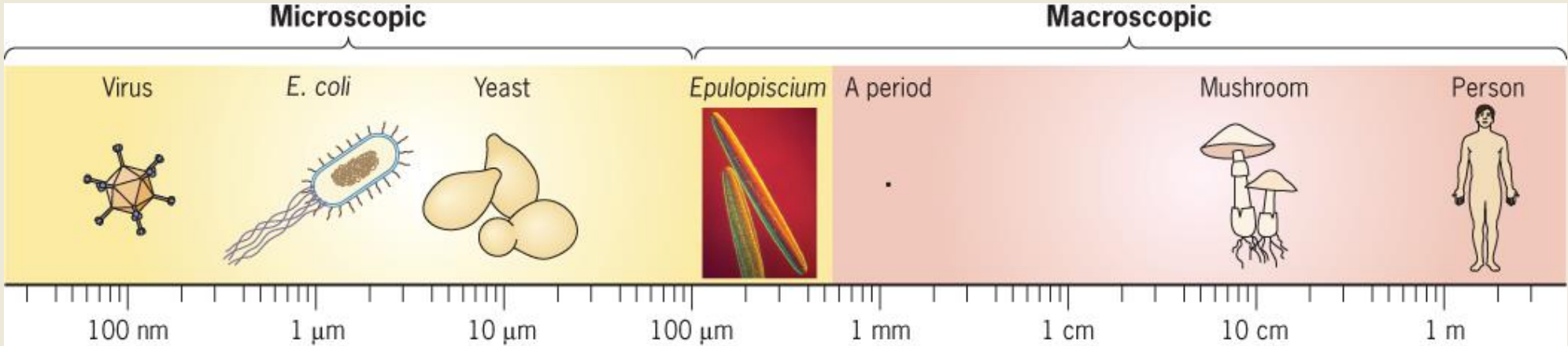


But humans only 'discovered' microbes about 350 years ago

During their long time on Earth Bacteria have become very diverse.

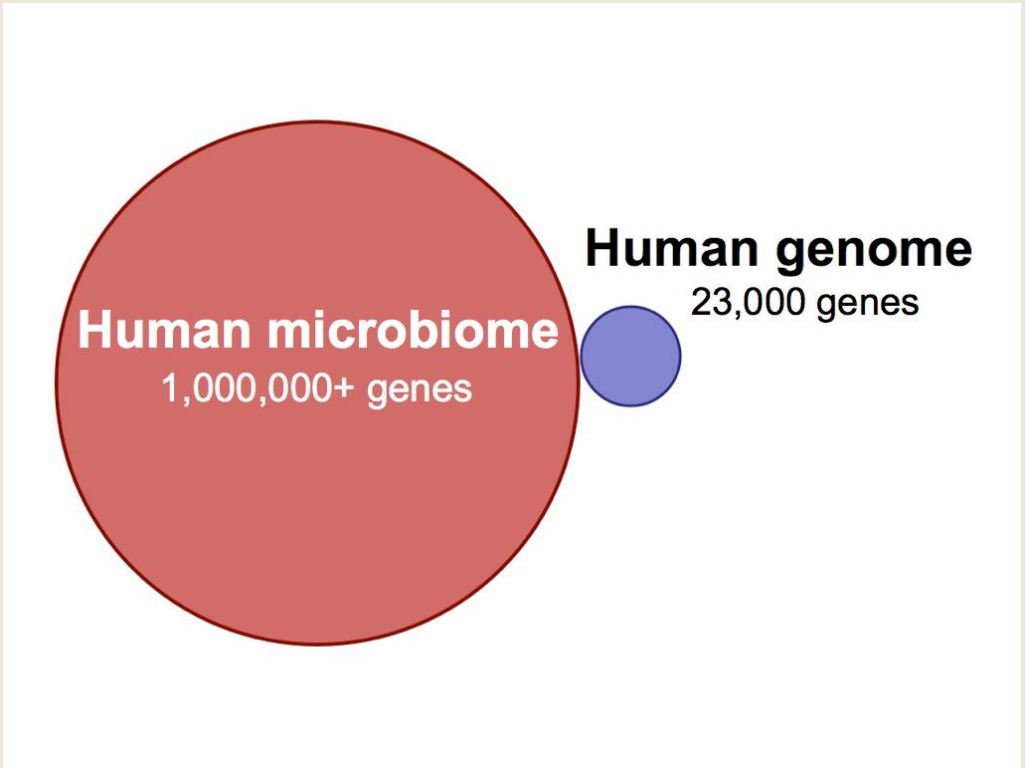
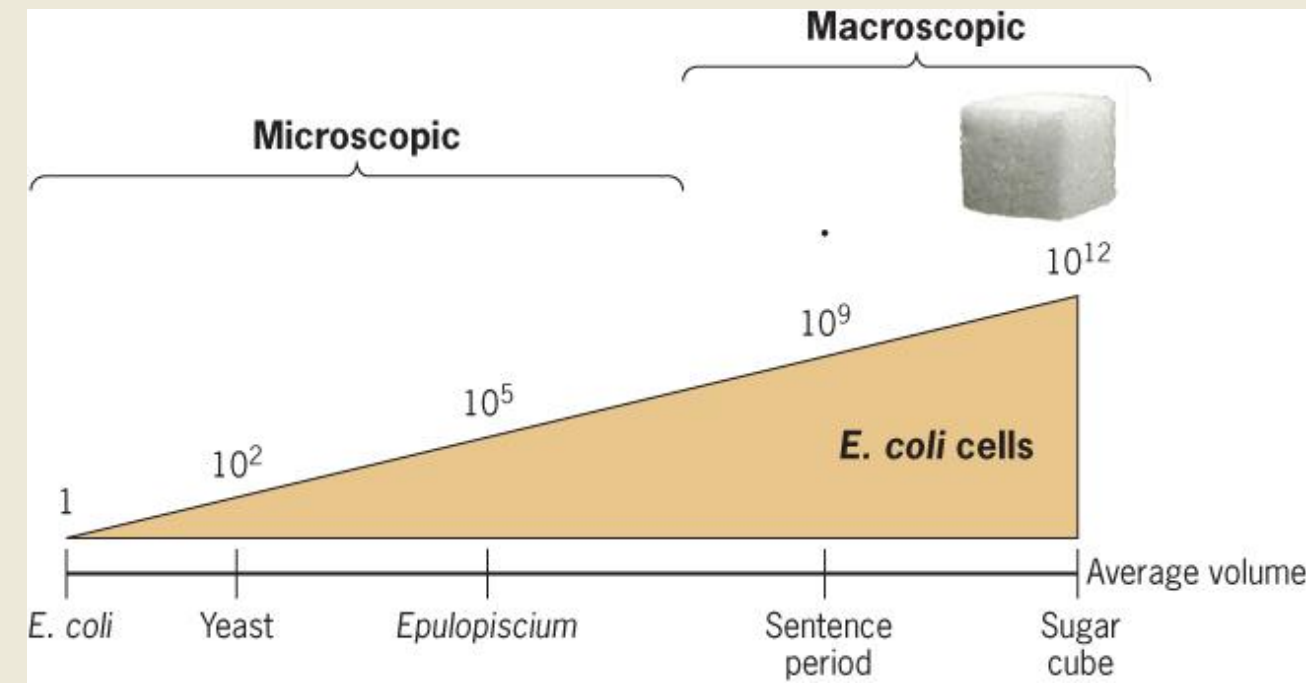


There is more difference among bacteria, than among eukaryotes

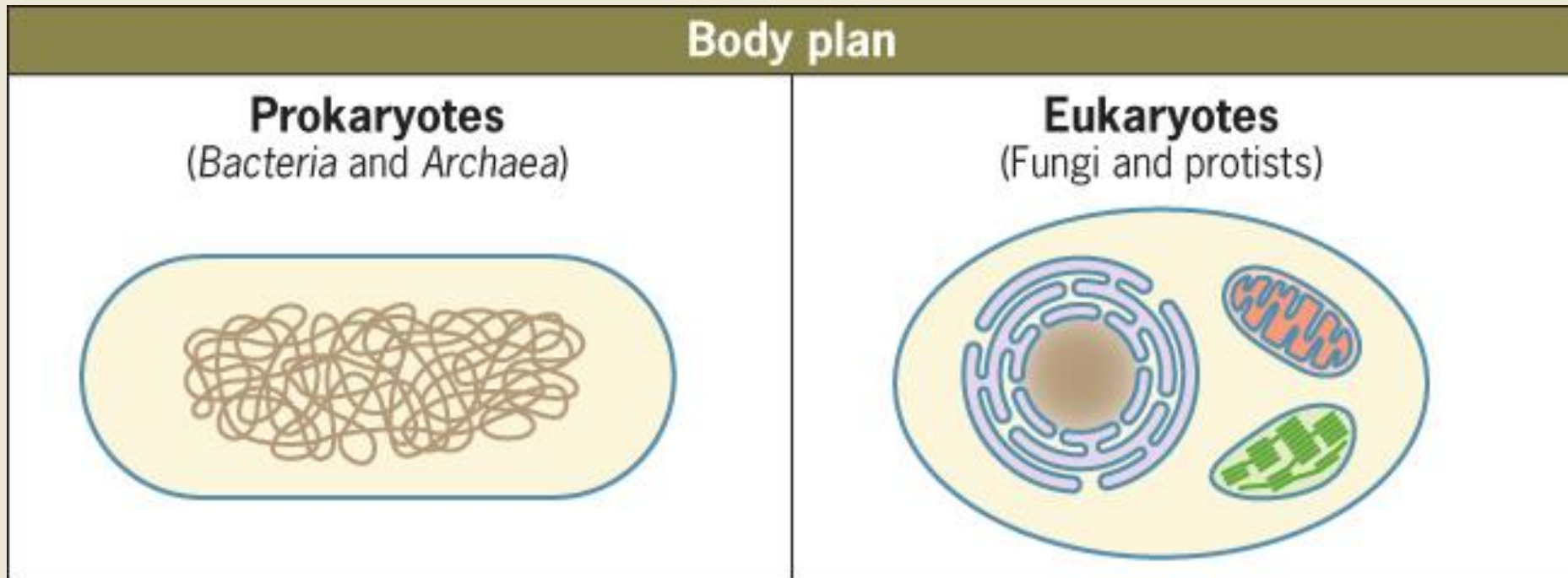


Microbes are also small so A LOT of them can fill relatively small spaces

And all those microbes can have big effects on their environment



Living cells can be separated into two large groups: prokaryotic and eukaryotic. We mostly define prokaryotic cells by what they do not have - but I will ask you to do the opposite 😊

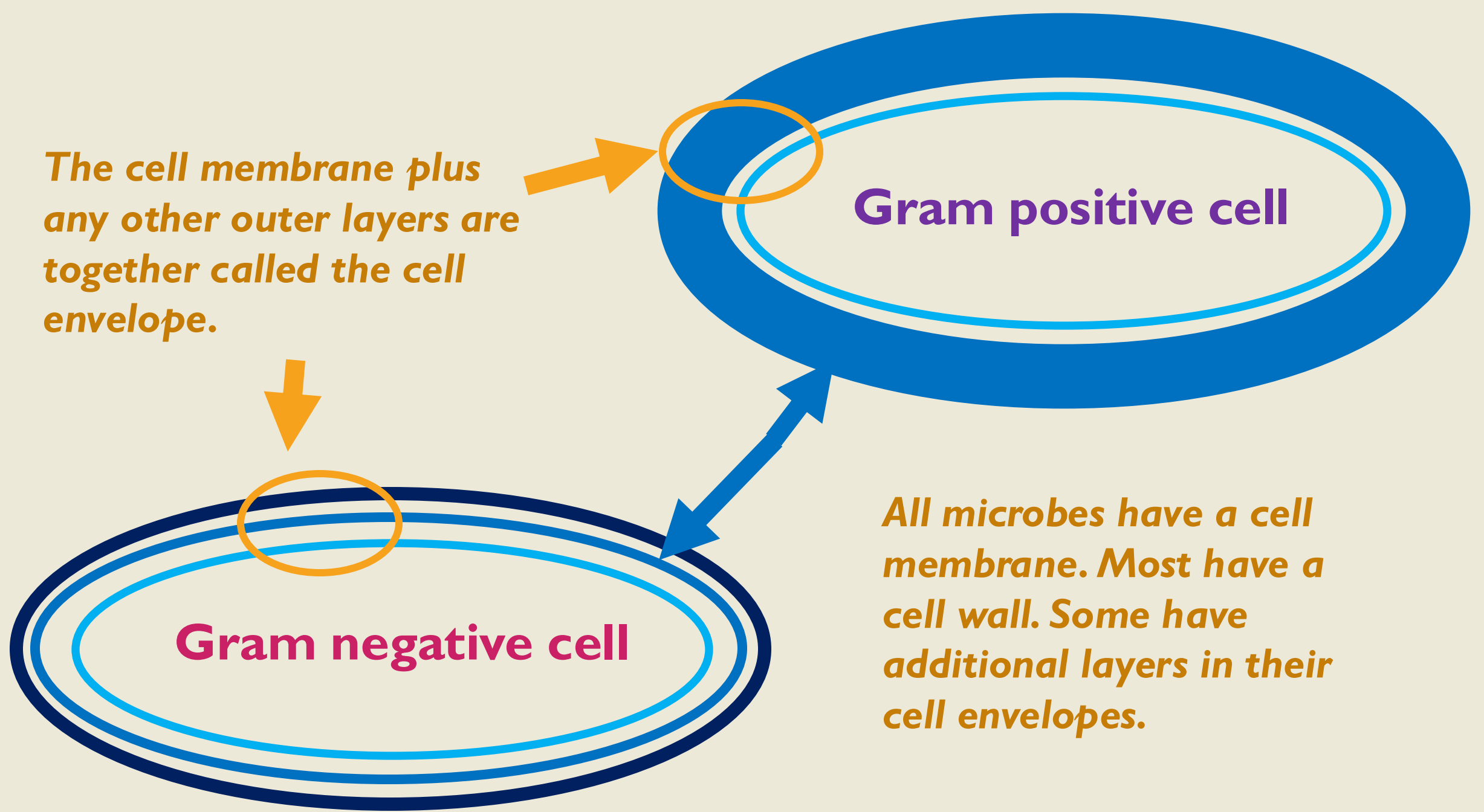


The cell membrane plus any other outer layers are together called the cell envelope.

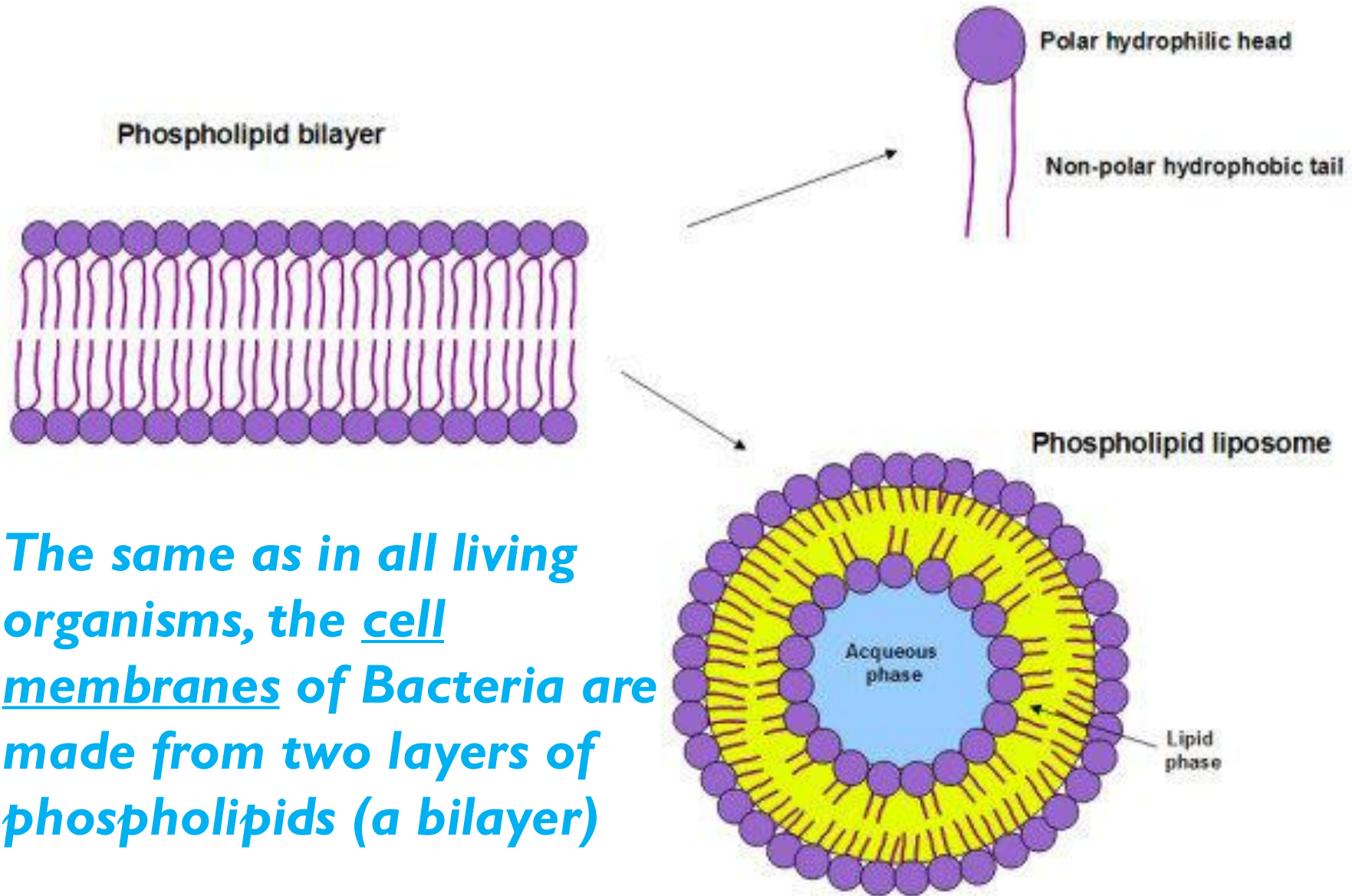
Gram positive cell

Gram negative cell

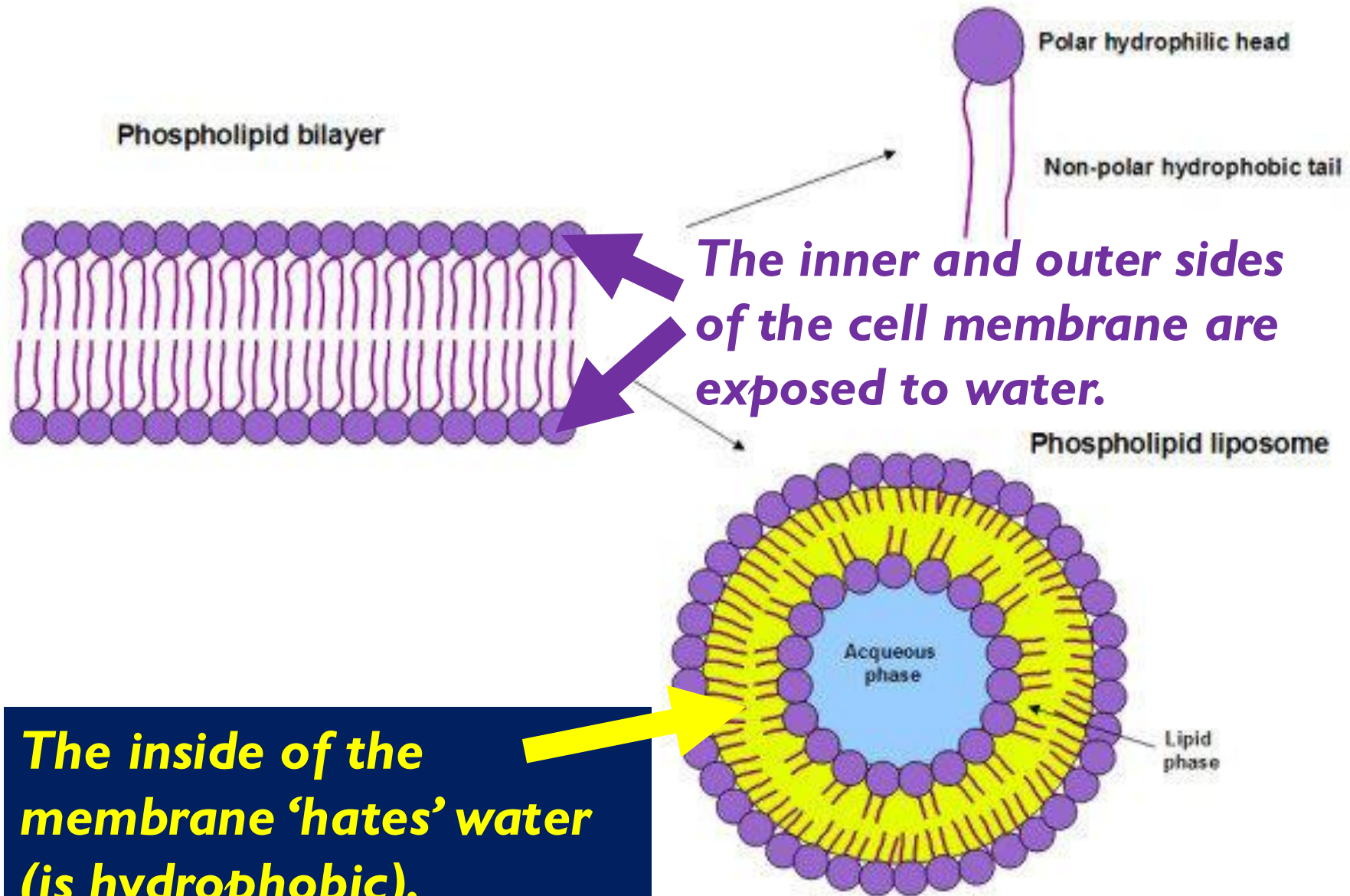
All microbes have a cell membrane. Most have a cell wall. Some have additional layers in their cell envelopes.

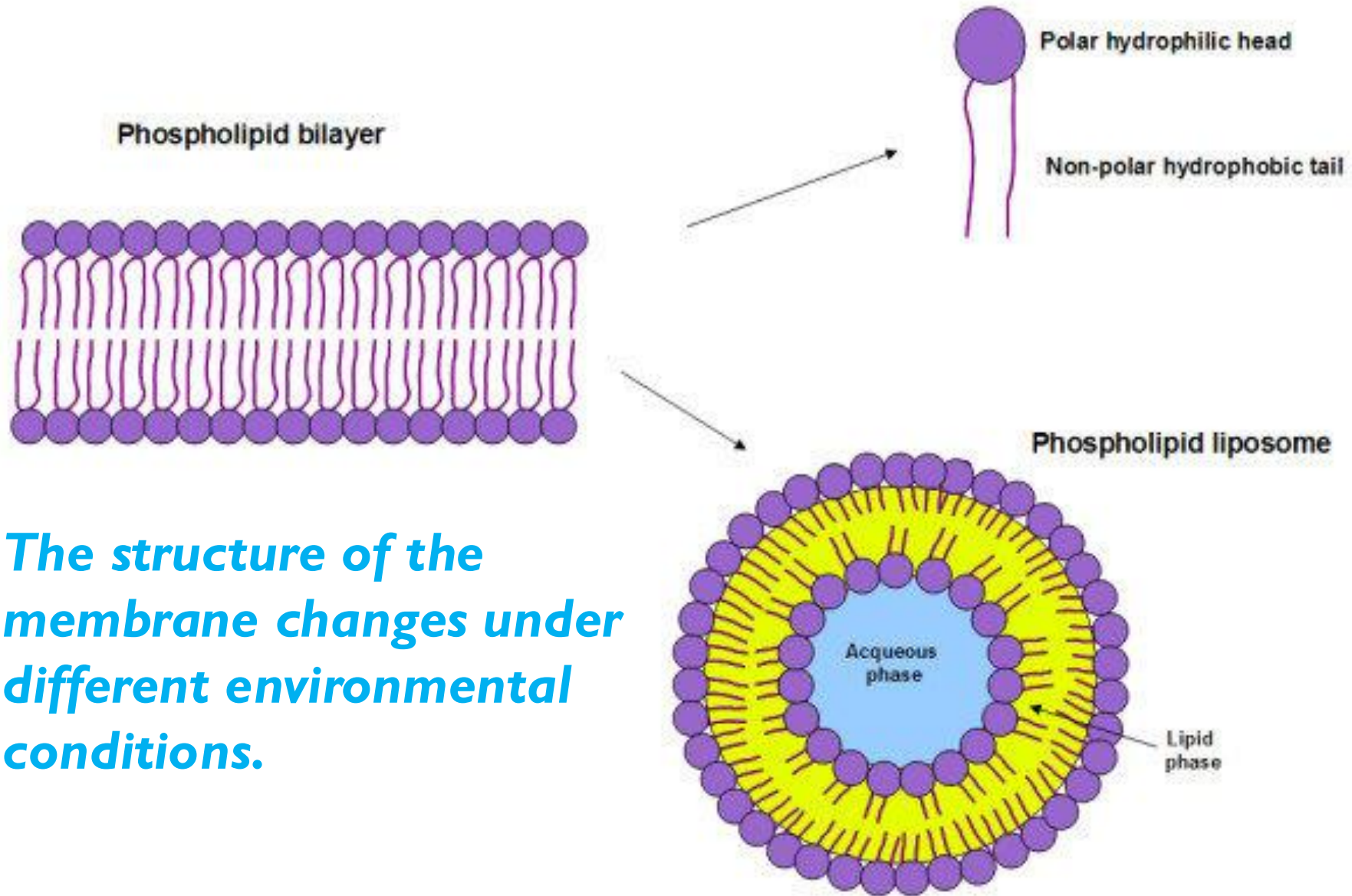


CELL MEMBRANE



*The same as in all living organisms, the cell membranes of **Bacteria** are made from two layers of phospholipids (a bilayer)*



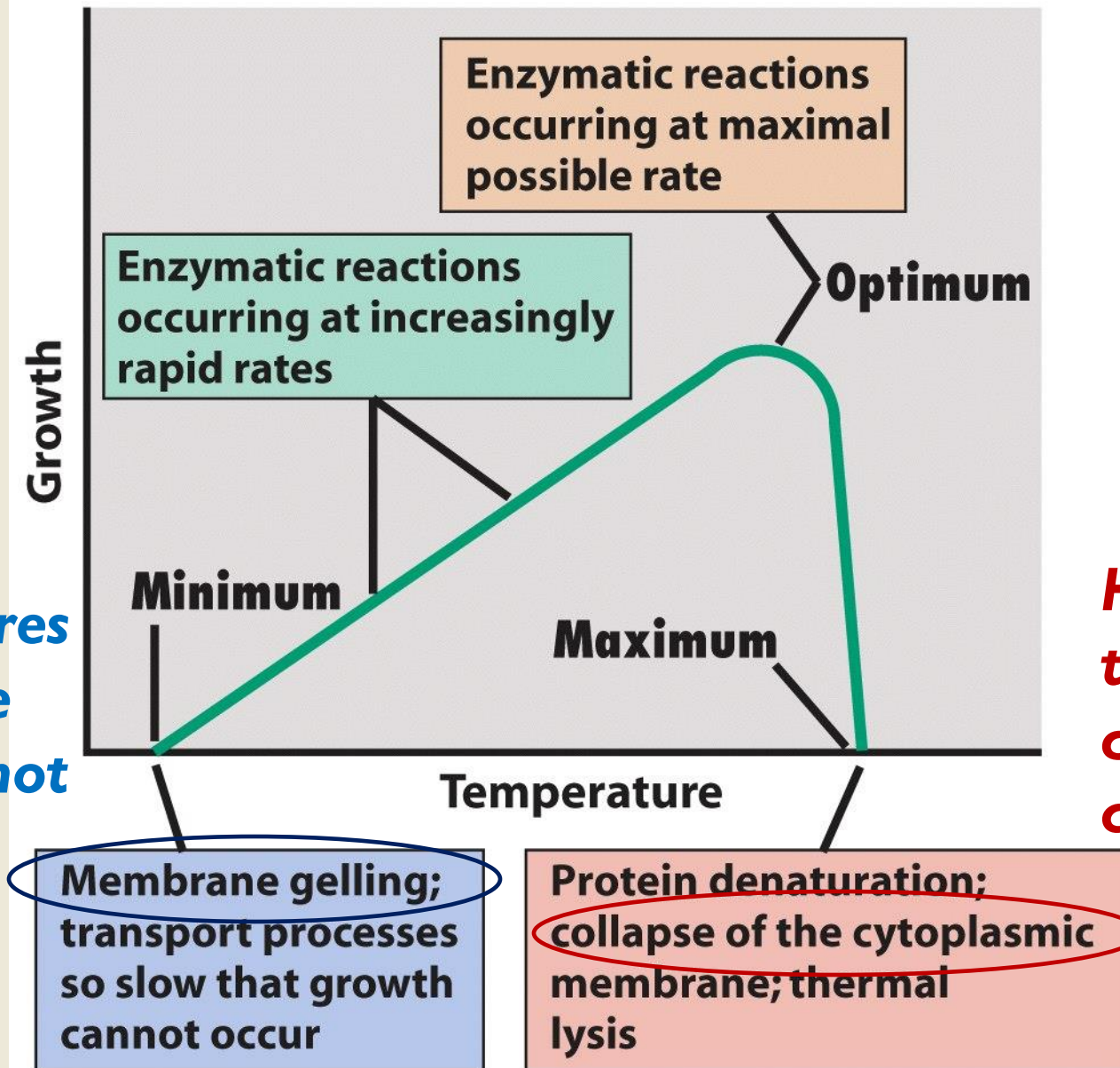


The structure of the membrane changes under different environmental conditions.

FOR EXAMPLE: TEMPERATURE

The minimum, optimal and maximum are based upon the effects temperature has on cells membranes and enzymes.

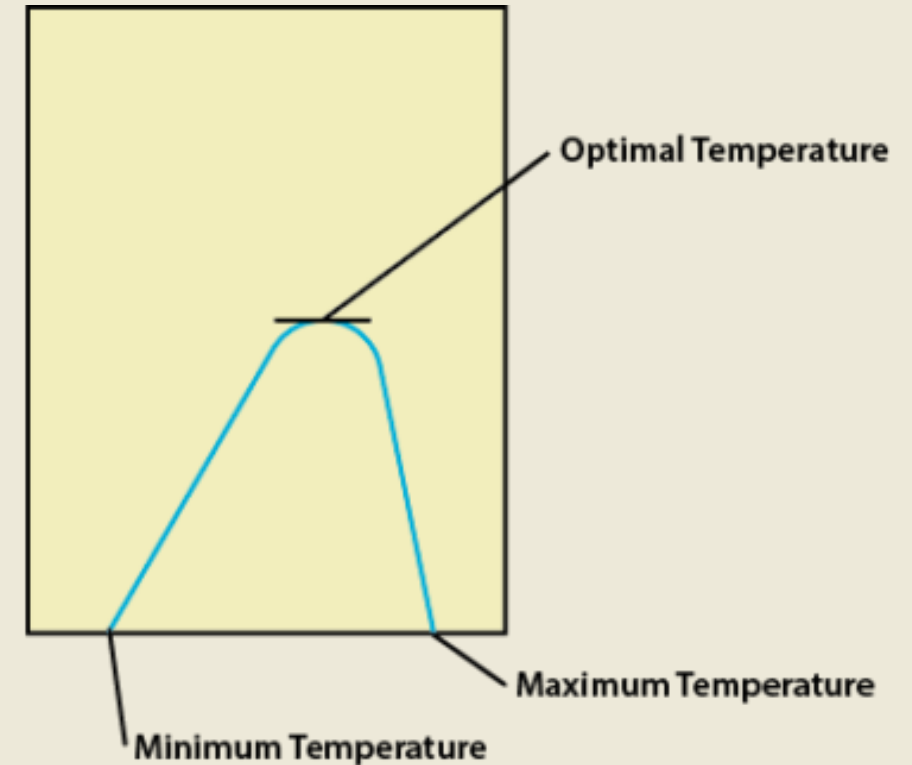
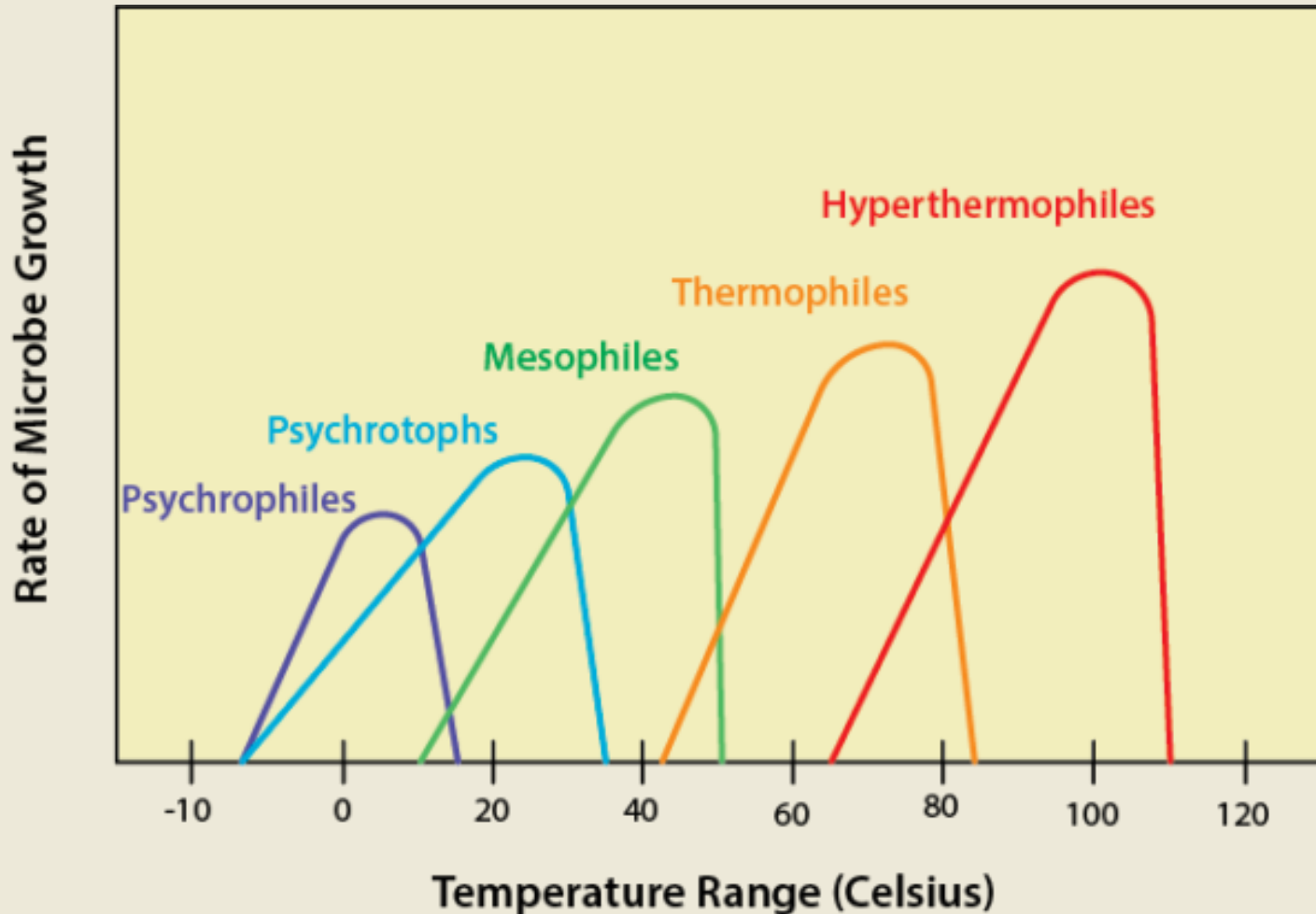
Low temperatures slow or stop the growth but do not kill cells.



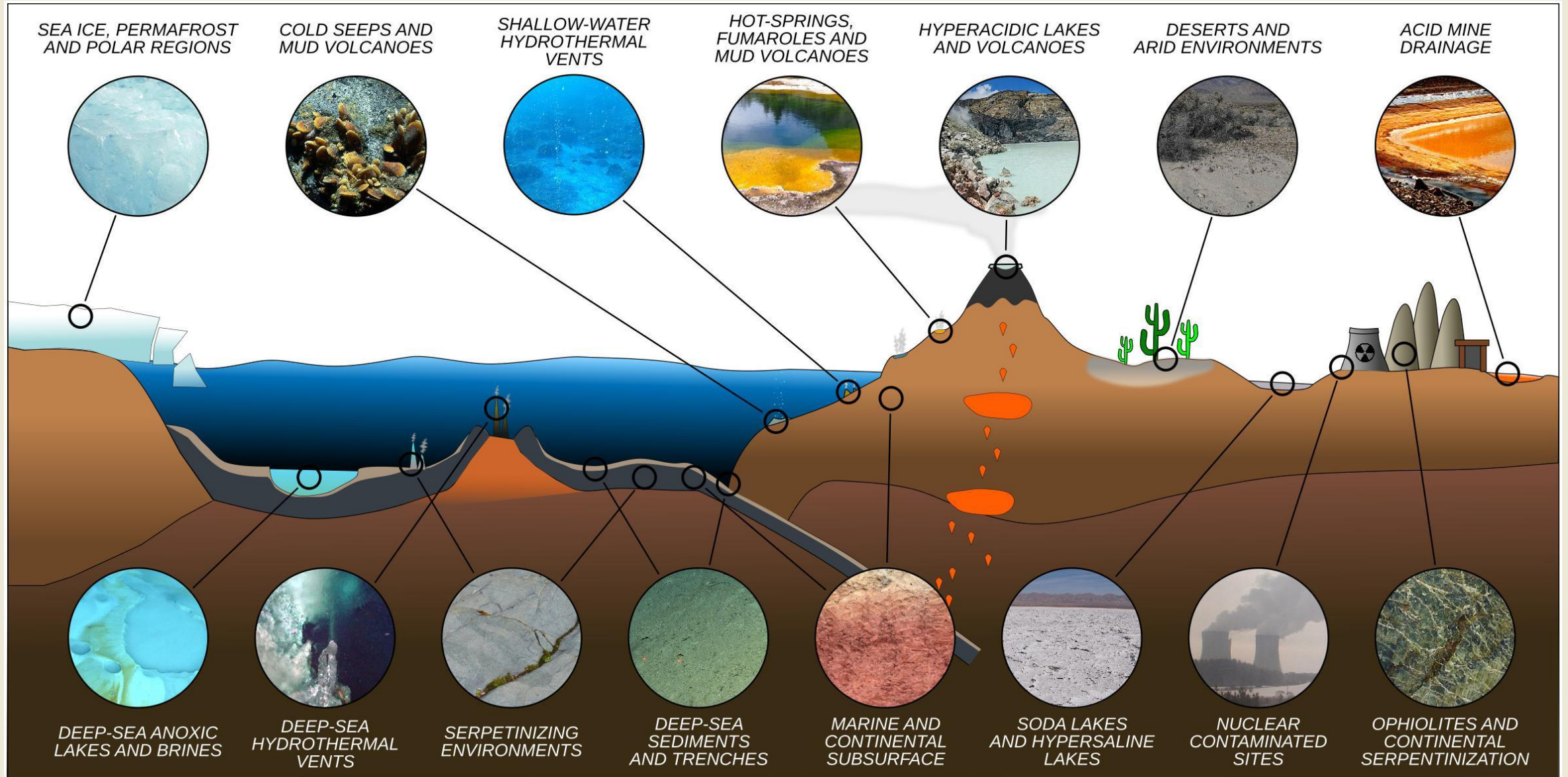
High temperatures destroy/kill cells.

Figure 6-16 Brock Biology of Microorganisms 11/e
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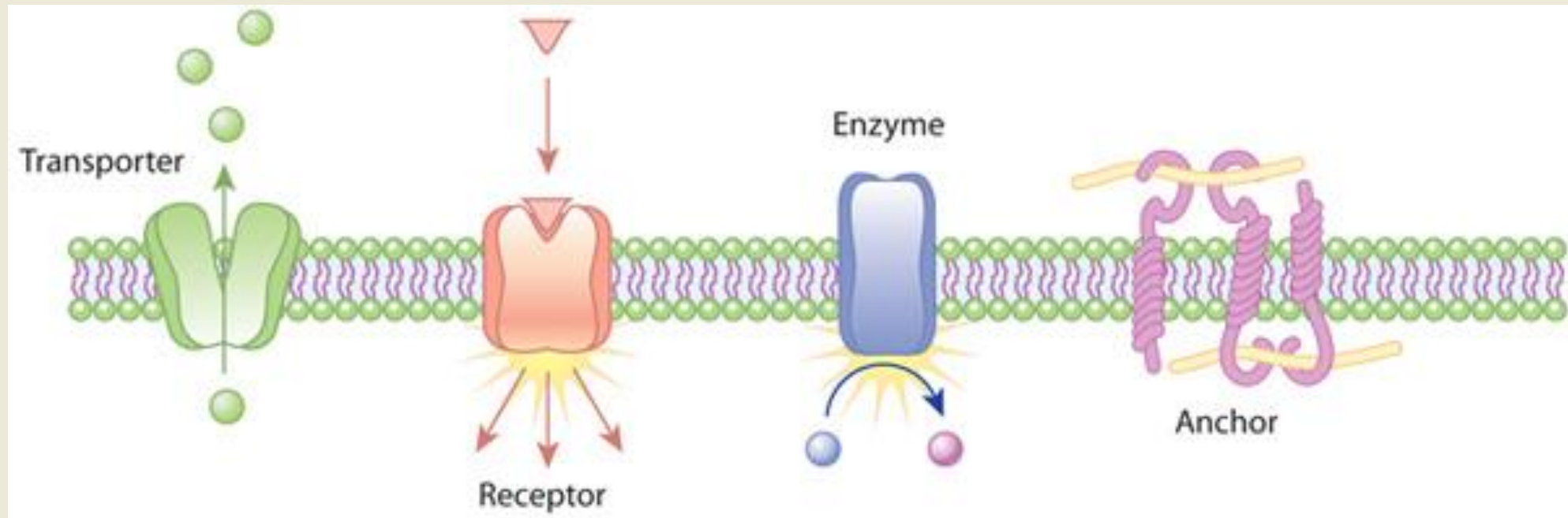
Microbes have evolved membrane structures that function best at the temperatures where they live.



So microbes can live in many different environments.



Attached to, or inside of, all cell membranes are many proteins, which are important because most molecules cannot pass through the water 'hating' (hydrophobic) inside of the membrane. More than 70% of the weight of the membrane is protein.



CELL WALL

Most Bacteria and Archaea have cell walls that wrap around the outside of the cell membrane

Cell envelope structure separates many microbes into two large groups

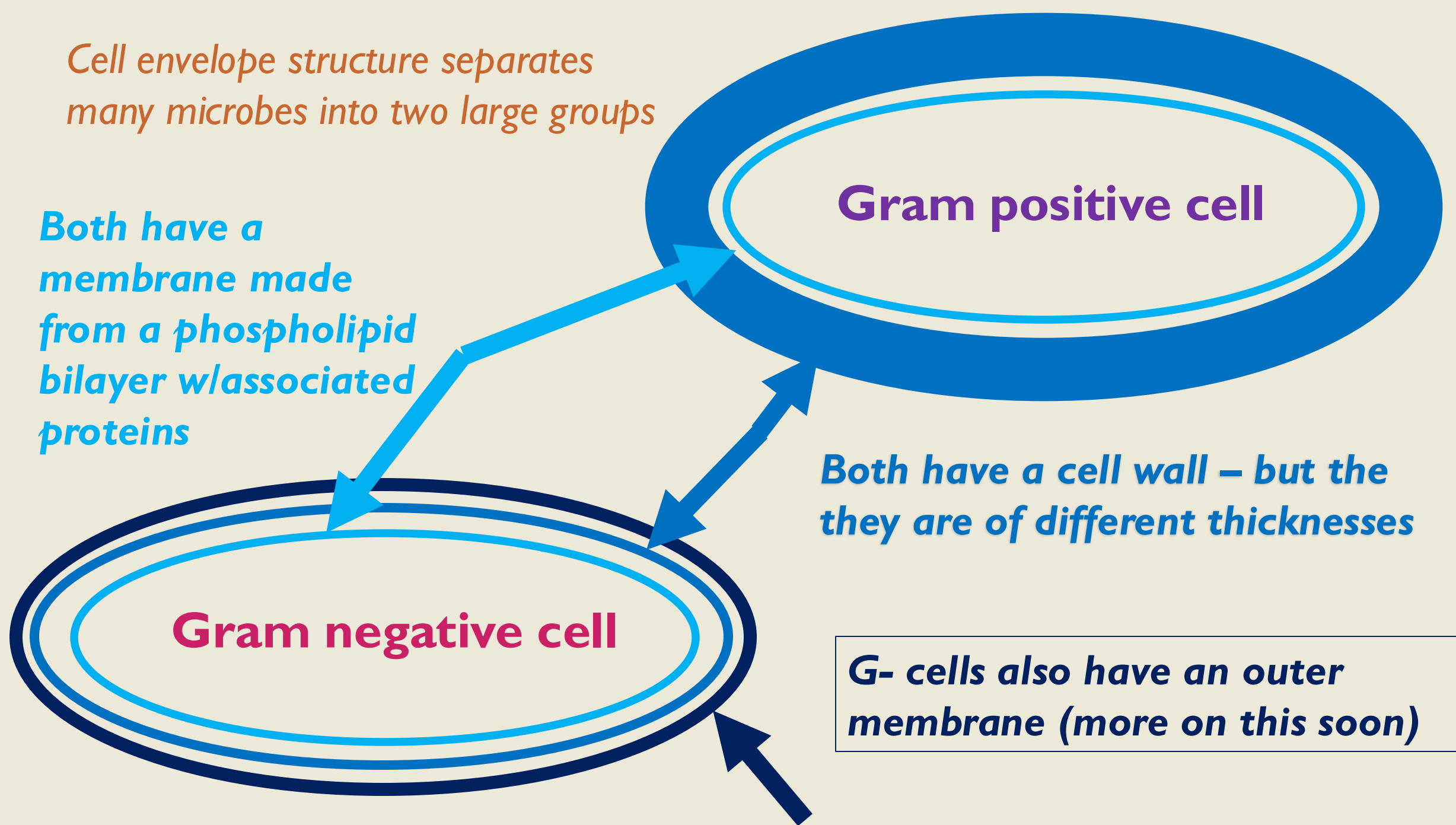
Both have a membrane made from a phospholipid bilayer w/ associated proteins

Gram positive cell

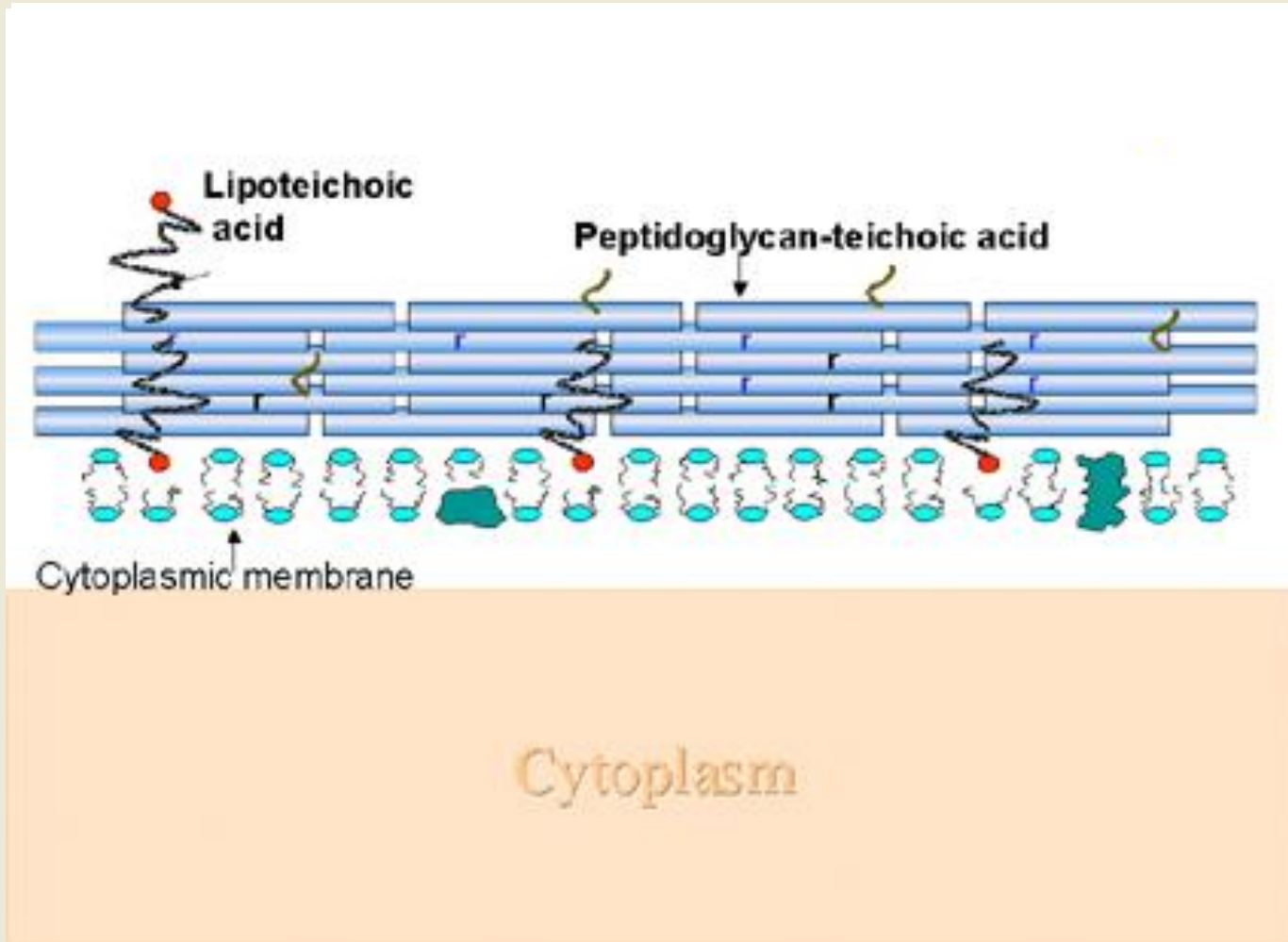
Both have a cell wall – but the they are of different thicknesses

Gram negative cell

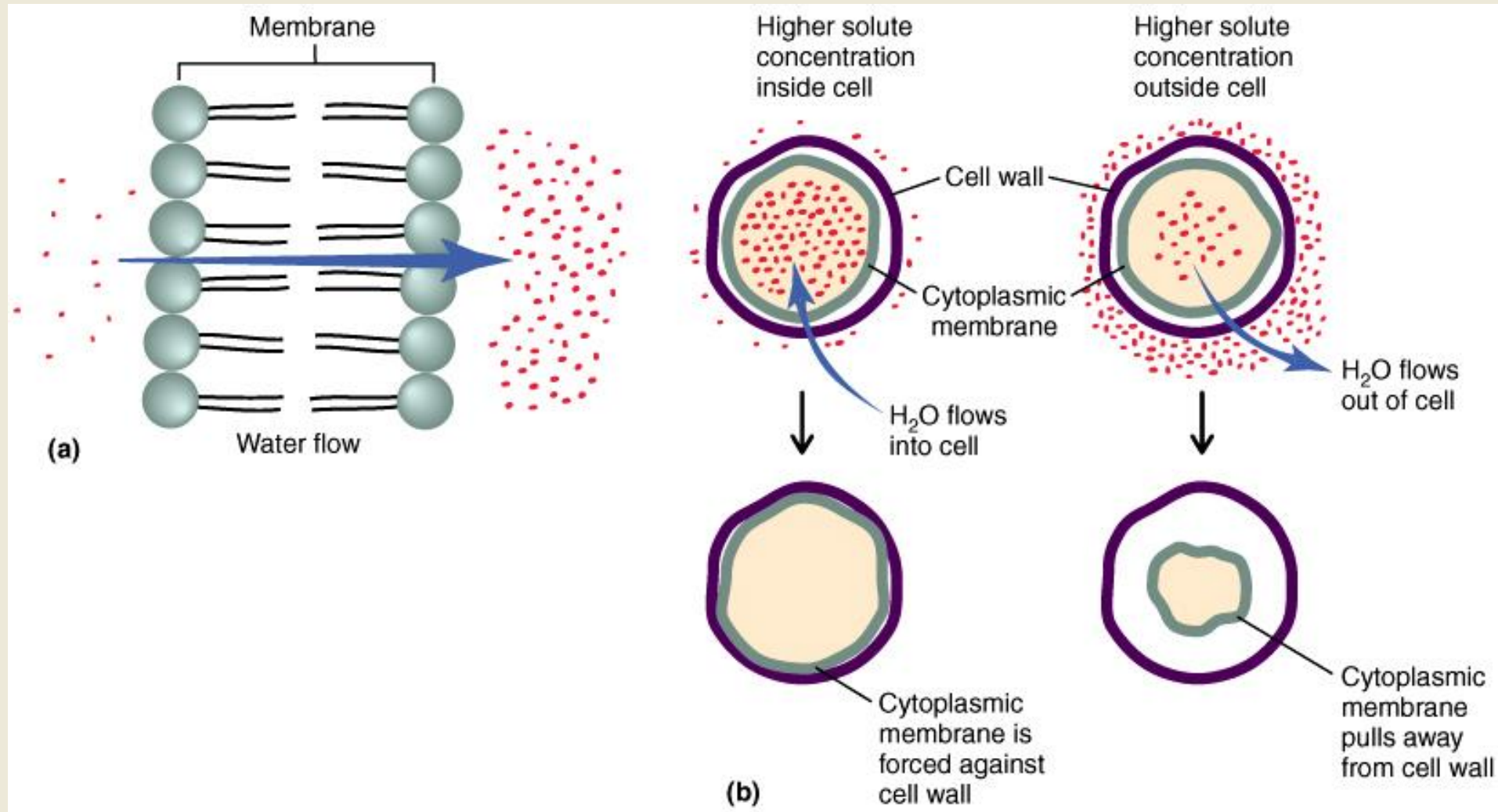
G- cells also have an outer membrane (more on this soon)



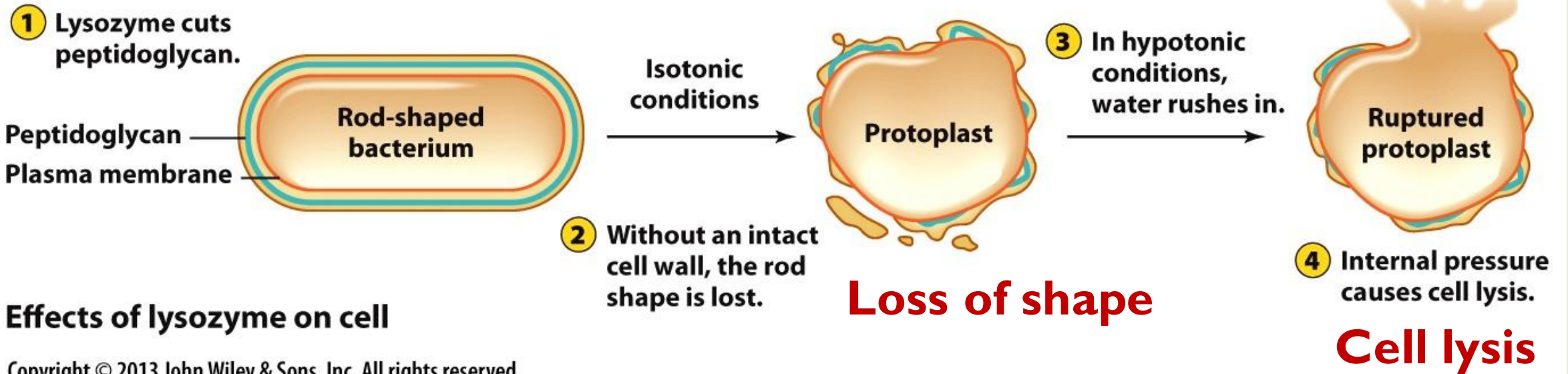
Sheets of stiff cell wall material are stacked on top of each other (like boards) to form the cell wall.



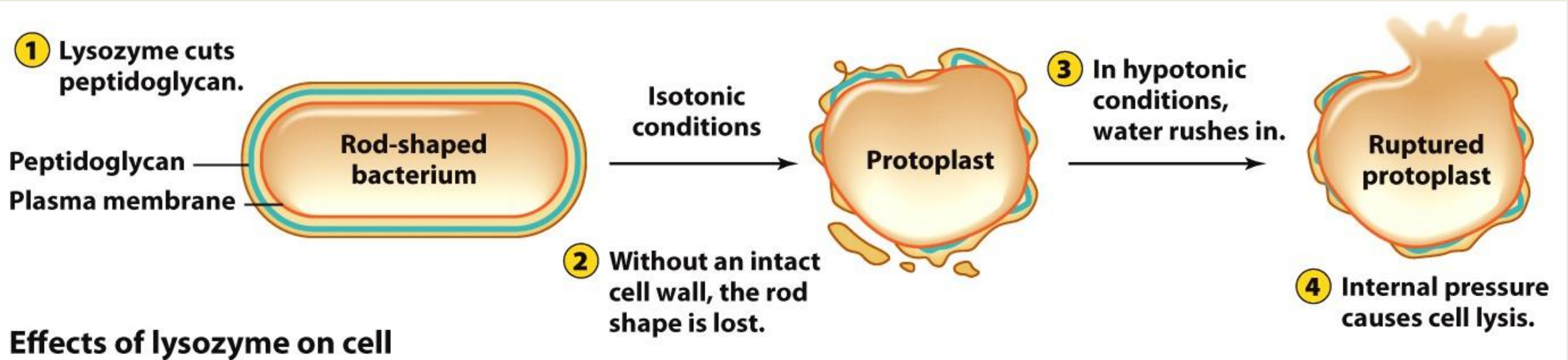
The cell wall protects a cell from osmotic changes in the surrounding environment and determines shape of a cell.



Damaging the cell wall of bacterial cells causes



Any chemical that breaks the apart the cell wall layers causes the cell wall to fall apart and kills the cell. One of these is lysozyme, found in human saliva & tears.



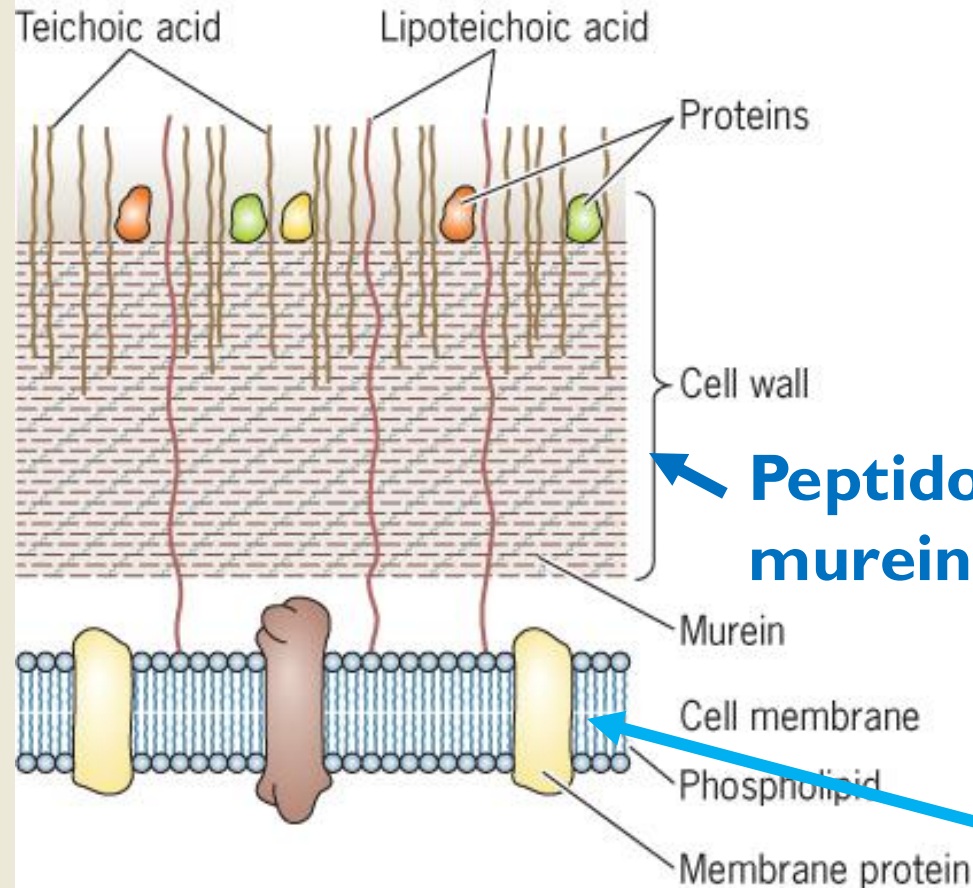
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The antibiotic penicillin also damages the cell wall – that is how it fights against an infection.

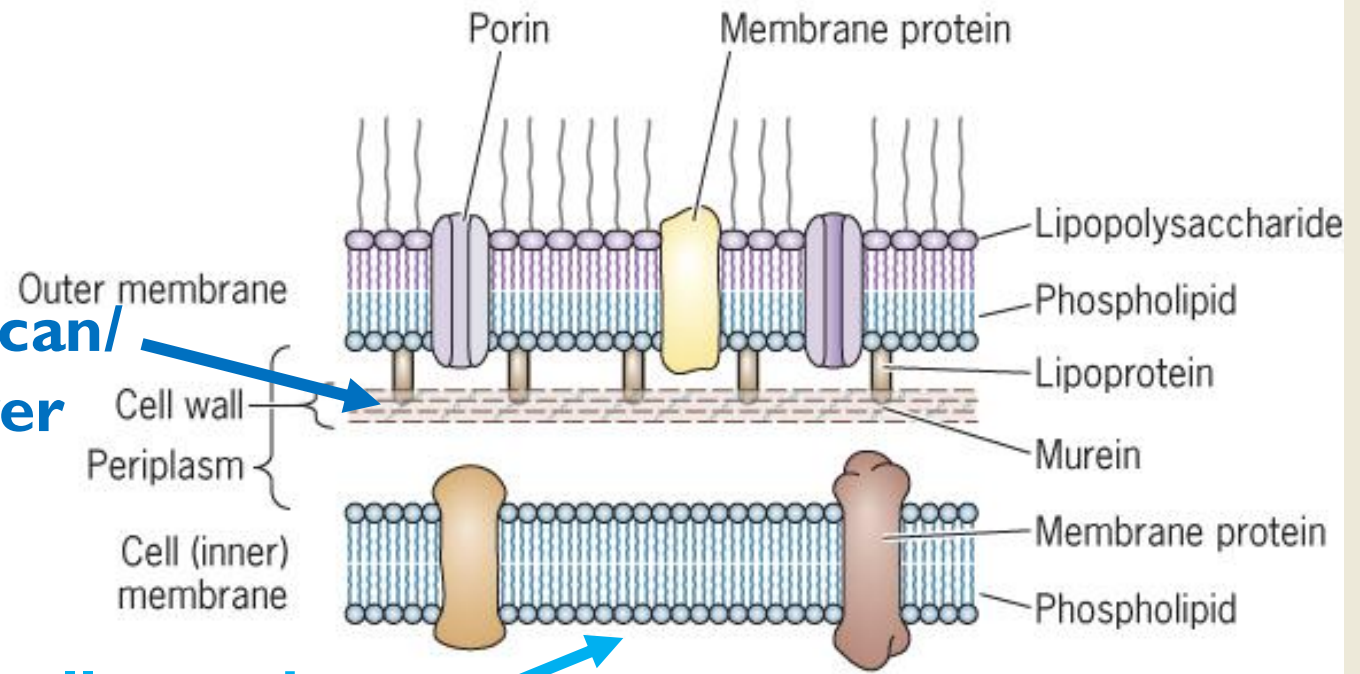
Summary

- 2 cell types: **Gram +** and **Gram -**
- Both have a cell membrane
- Both have a cell wall but thicknesses are different

Gram positive



Gram negative



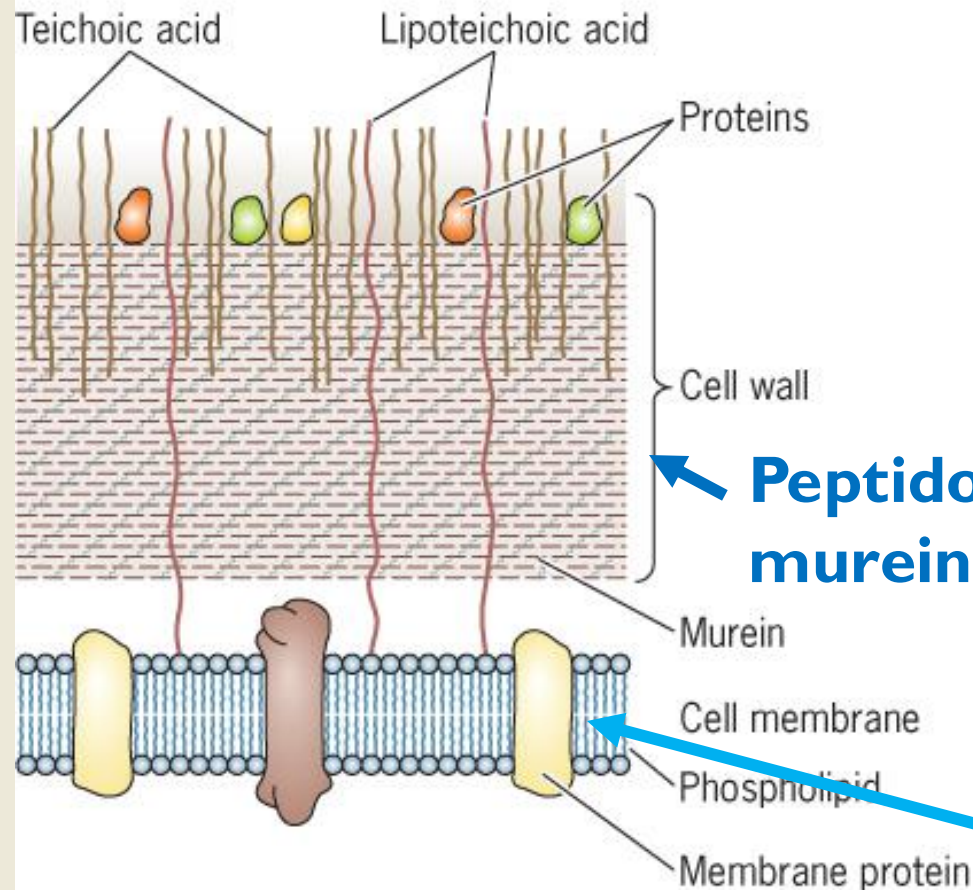
Peptidoglycan/
murein layer

cell membrane

Summary

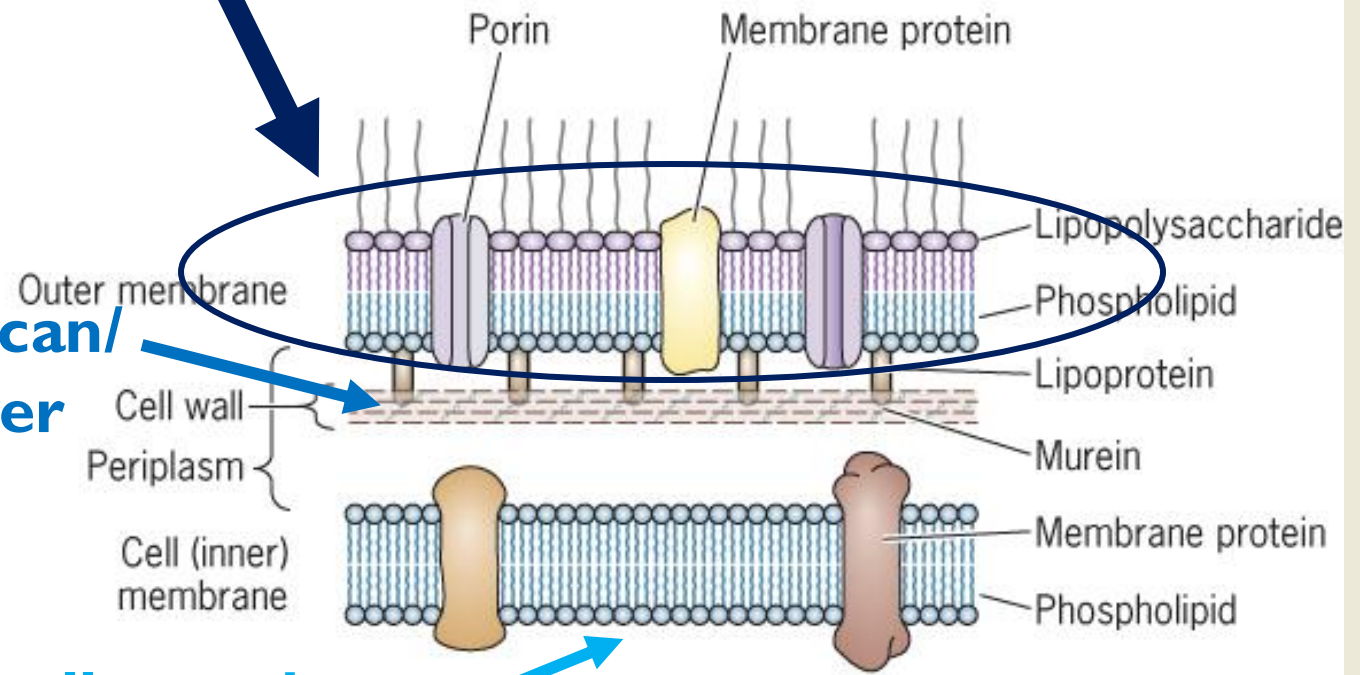
- 2 cell types: **Gram +** and **Gram -**
- Both have a cell membrane
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Gram positive



Gram negative

What about this layer in G- cells?



cell membrane

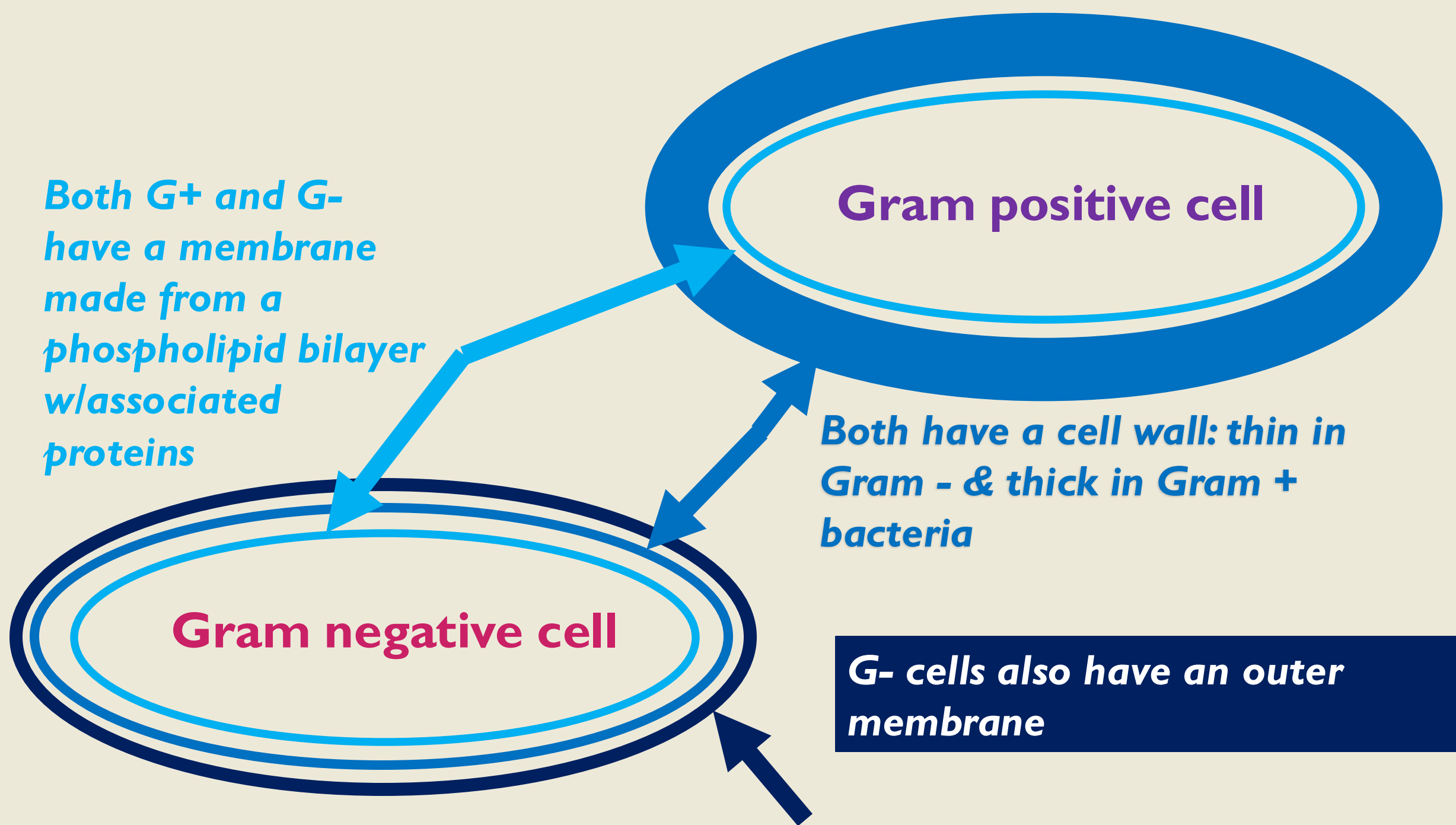
*Both G+ and G-
have a membrane
made from a
phospholipid bilayer
w/ associated
proteins*

Gram positive cell

*Both have a cell wall: thin in
Gram - & thick in Gram +
bacteria*

Gram negative cell

*G- cells also have an outer
membrane*



The outer membrane is made from a lipid bilayer, like to the cell membrane but with different chemistry.



Gram positive cell



Gram negative cell

Outer membrane contains LPS, a chemical compound that causes inflammation, fever, diarrhea, vomiting, and in large doses hemorrhagic shock & tissue necrosis.

Individual bacterial cells may also form a capsule (also called a slime layer) that surrounds the cell wall or outer membrane

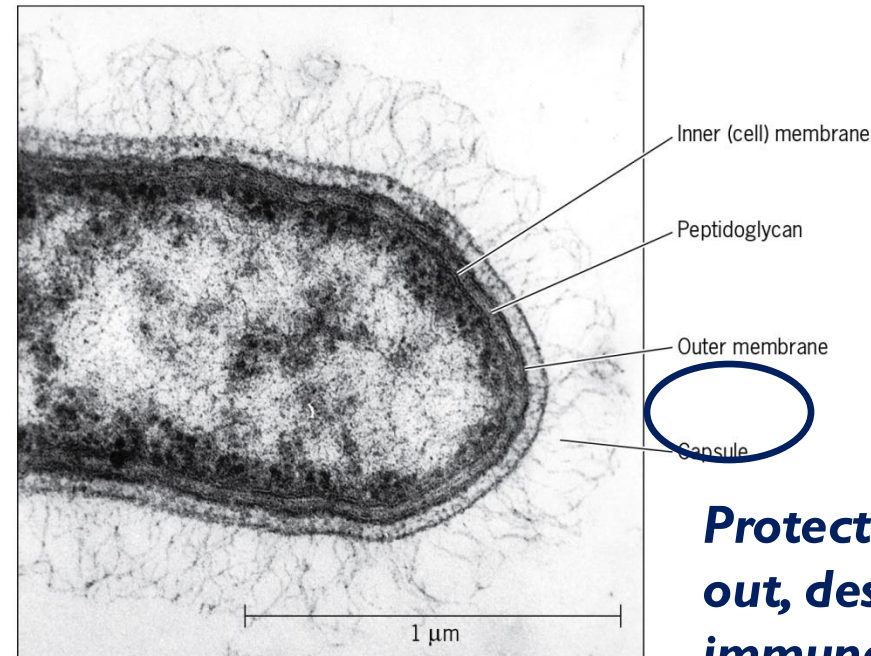
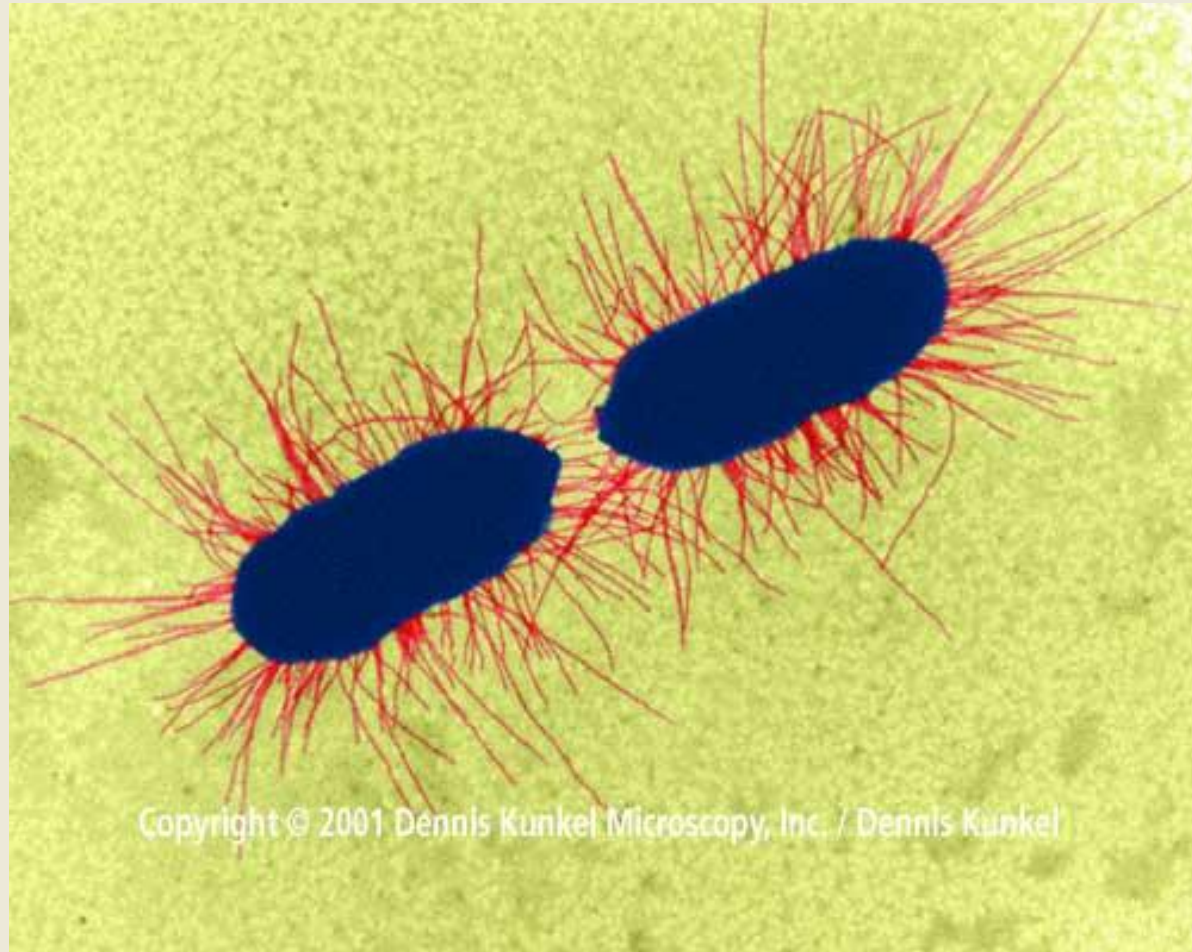


FIGURE 2.14 Bacterial capsule. The capsule is the fuzzy material surrounding the cell envelope in this electron micrograph thin section. Note that its thickness is about one-fourth of the cell's diameter. Some bacteria have considerably thicker capsules. Courtesy of T.J. Beveridge.

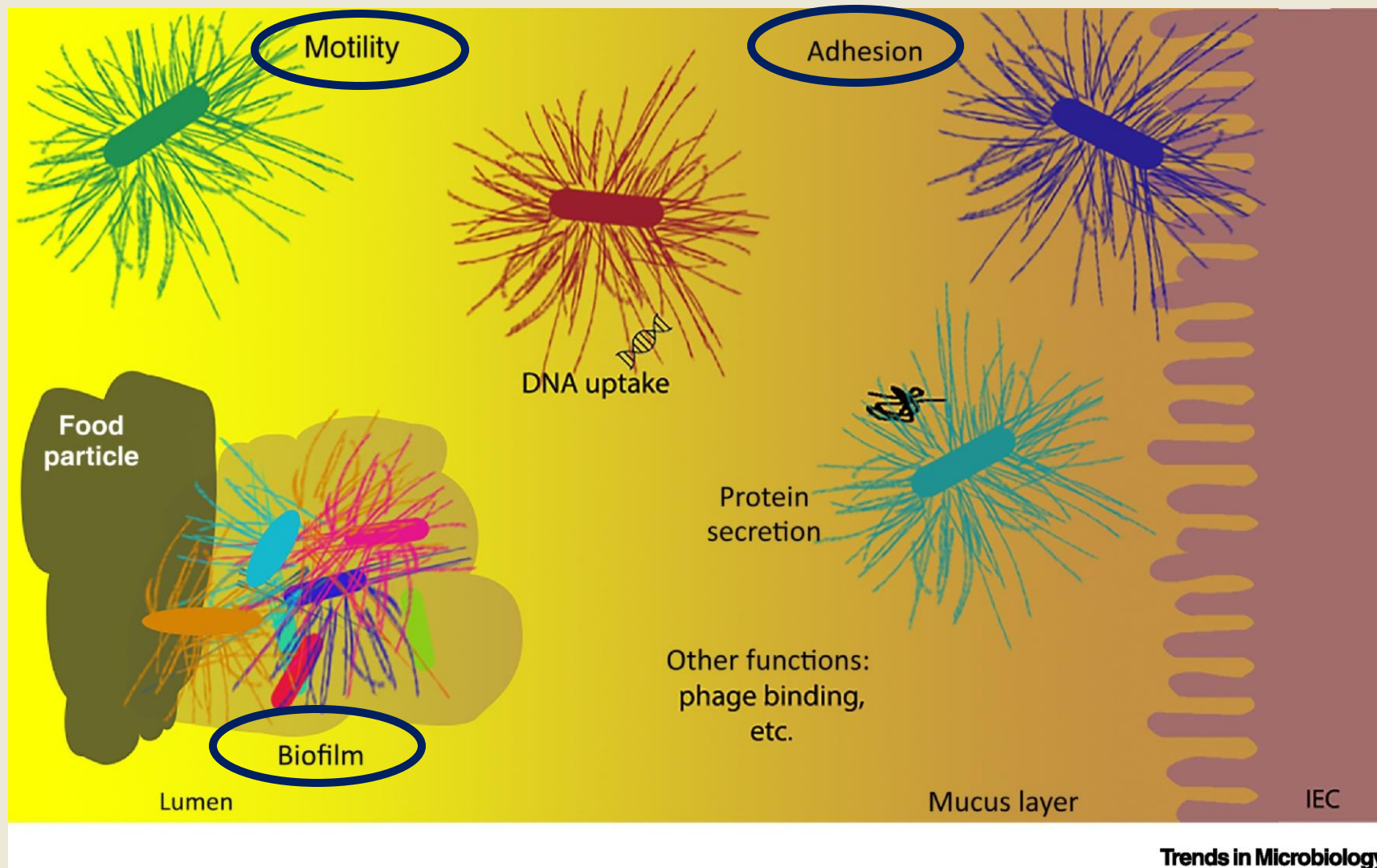
Protects against drying out, destruction from immune system cells, dangerous chemicals, and losing nutrients to the environment

***Pili are stiff brush-like structures
formed by some bacteria***

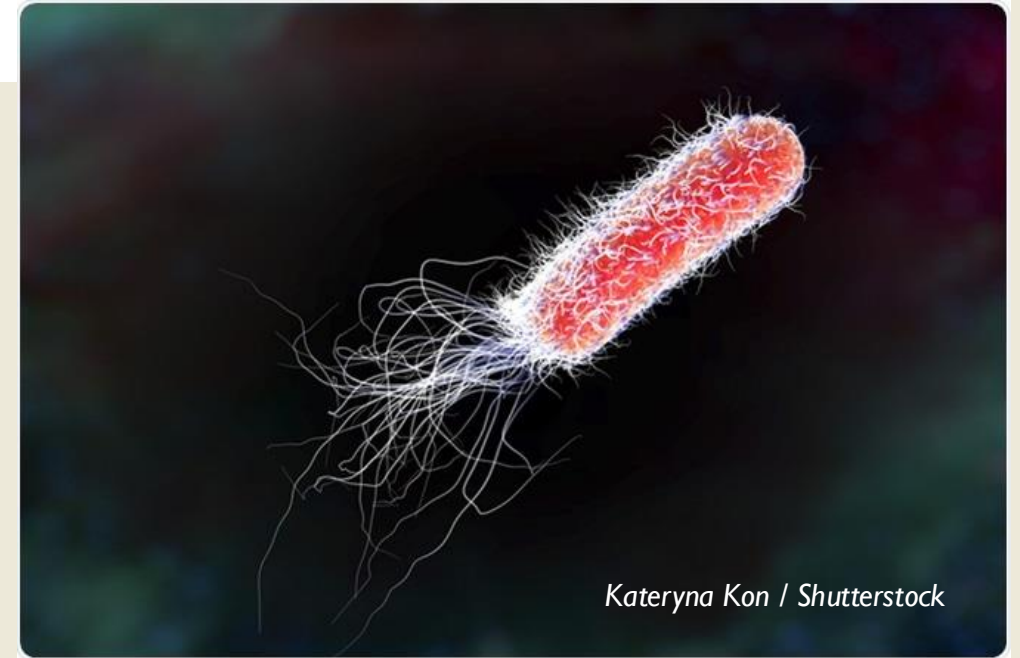
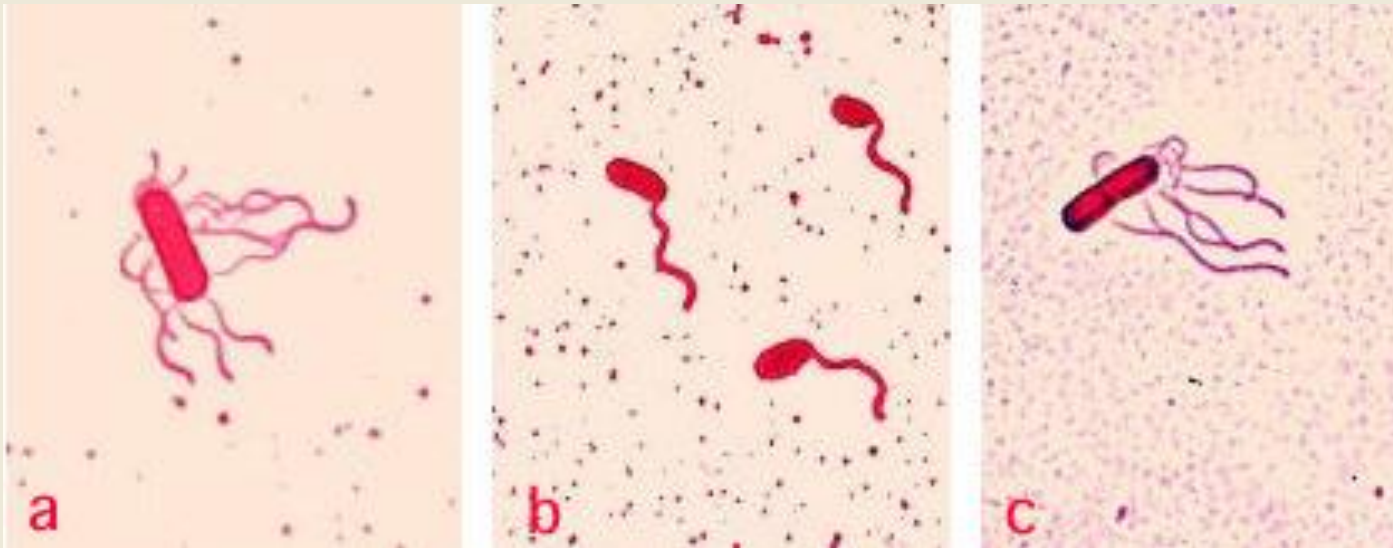
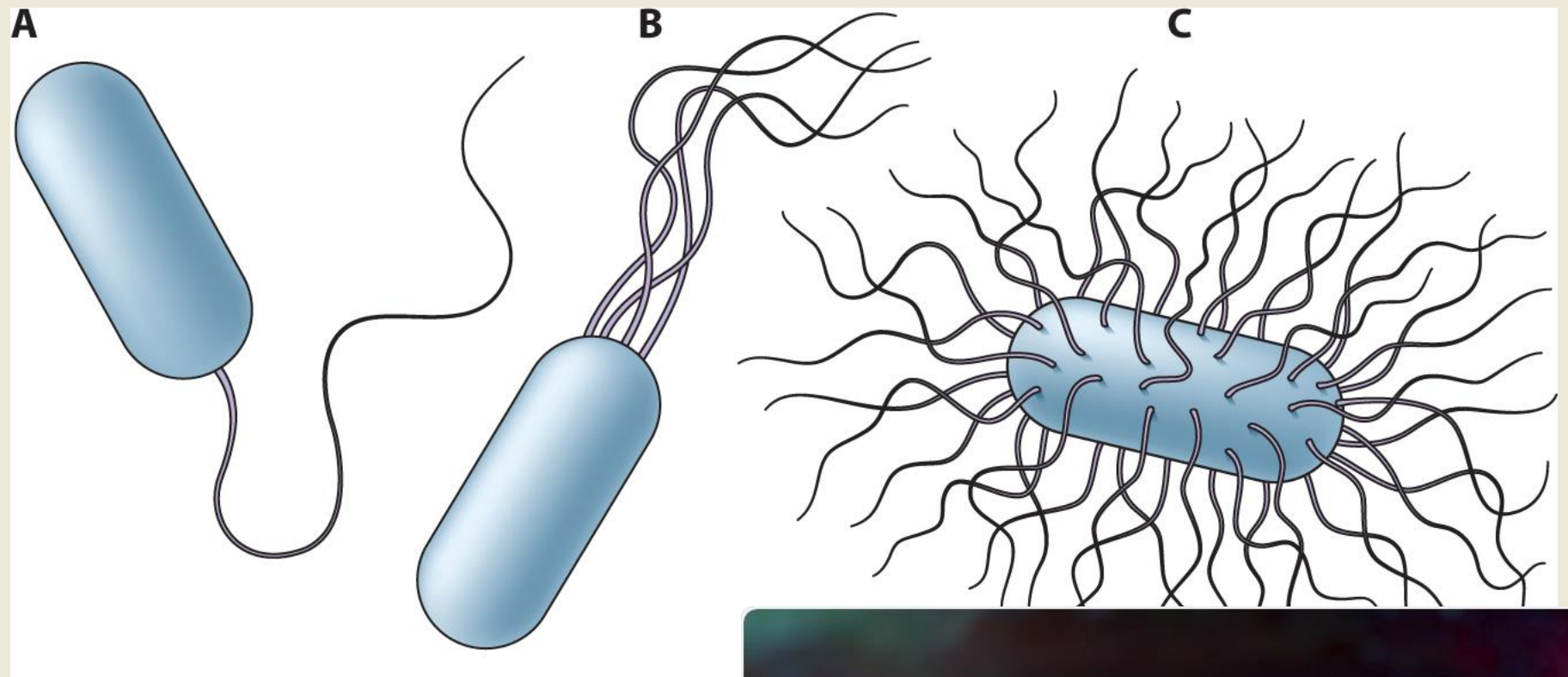


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Cells use *pili* for all sorts of functions



The other structure some bacteria use for movement are flagella

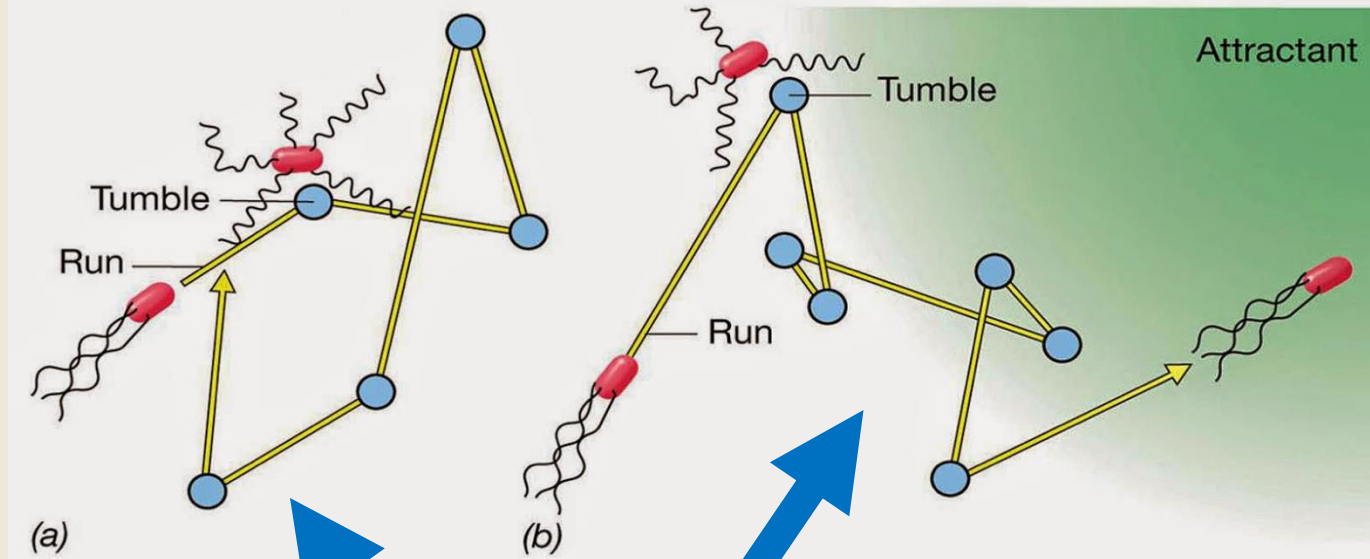


Microbe Table 12.2



Movement towards a + stimulus or away from a – stimulus is called –taxis.

Tactic response	Description
Chemotaxis	Directed movement in response to chemicals (chemoeffectors), which can be either attractants (positive chemotaxis) or repellents (negative chemotaxis); widespread property of prokaryotes
Aerotaxis	Directed movement in response to oxygen; widespread property
pH taxis	Movement either toward or away from acid or alkaline conditions; <i>E. coli</i> moves from either acid or alkali to reach a neutral pH
Magnetotaxis	Directed movement along geomagnetic lines of force; believed to function in guidance up or down rather than north or south and useful in moving toward microaerophilic environments
Thermotaxis	Directed movement toward a range of temperatures usually optimal for the bacterium's growth; widespread property
Phototaxis	Directed movement toward wavelengths of light, usually related to photopigments and their function in the metabolism of the bacterium; property associated with virtually all photosynthetic bacteria



Random Walk

Taxis