

BACTERIA

DR. MANOJ KUMAR SHARMA

JANTA VEDIC COLLEGE, BARAUT

Bacteria are Prokaryotes –

No nucleus or organelles bound in membranes

DNA is a single circular chromosome

No Histones associated with DNA

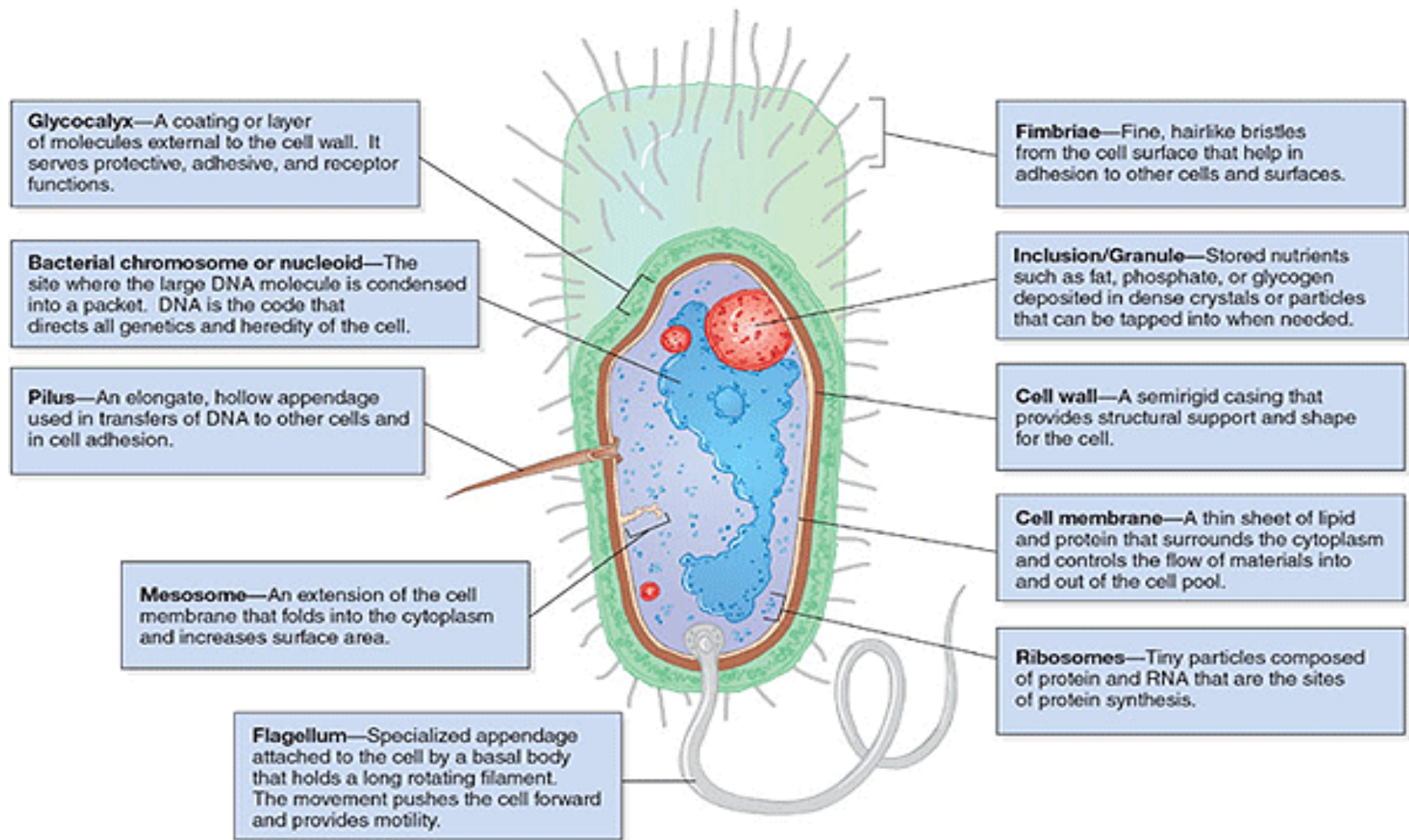
Cell Walls of peptidoglycan (polymer of NAG and NAM cross-linked with polypeptide chain)

Smaller ribosome unit 70S

Divide by binary fission (not mitosis)

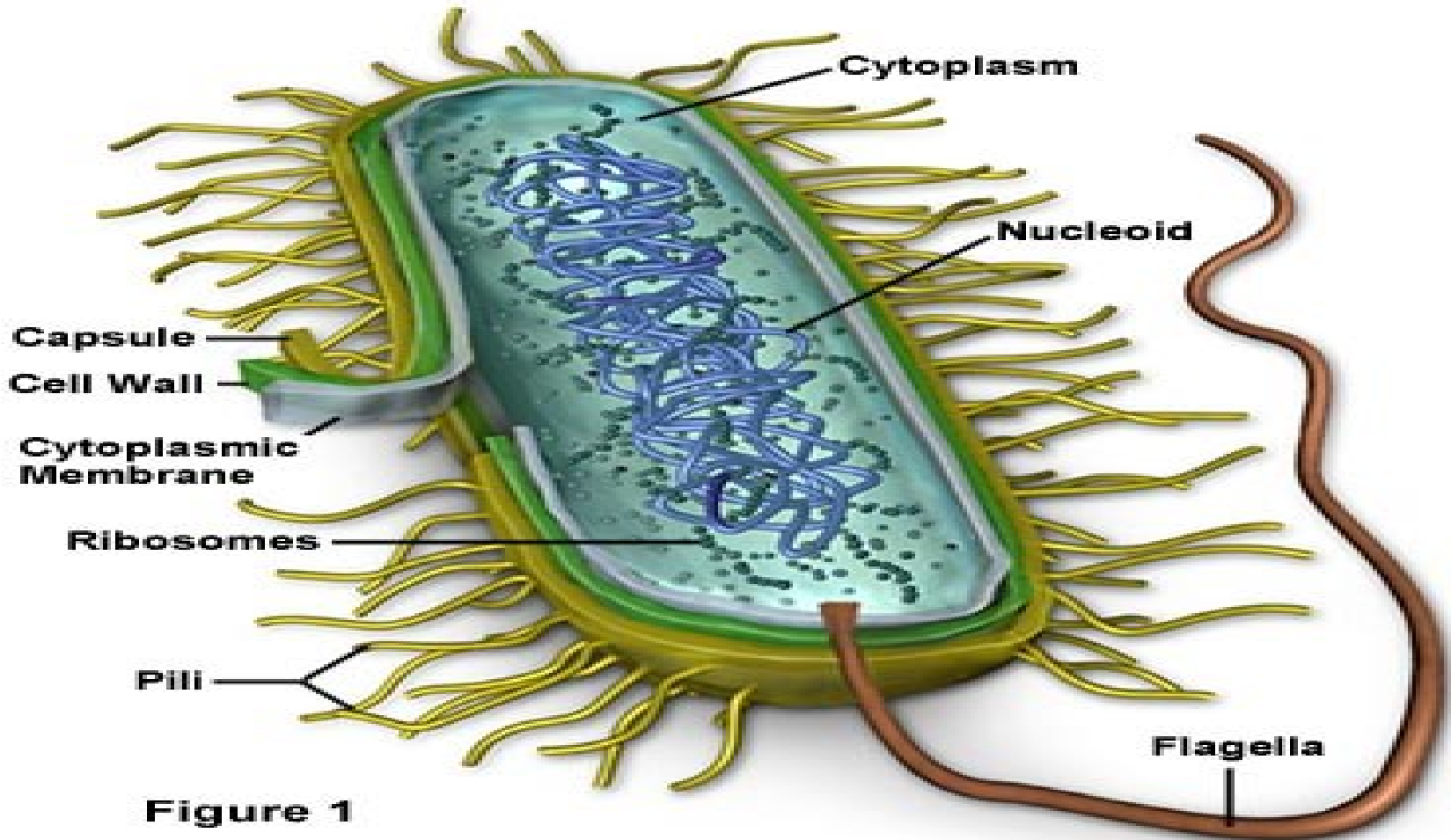
Typical bacteria diagram

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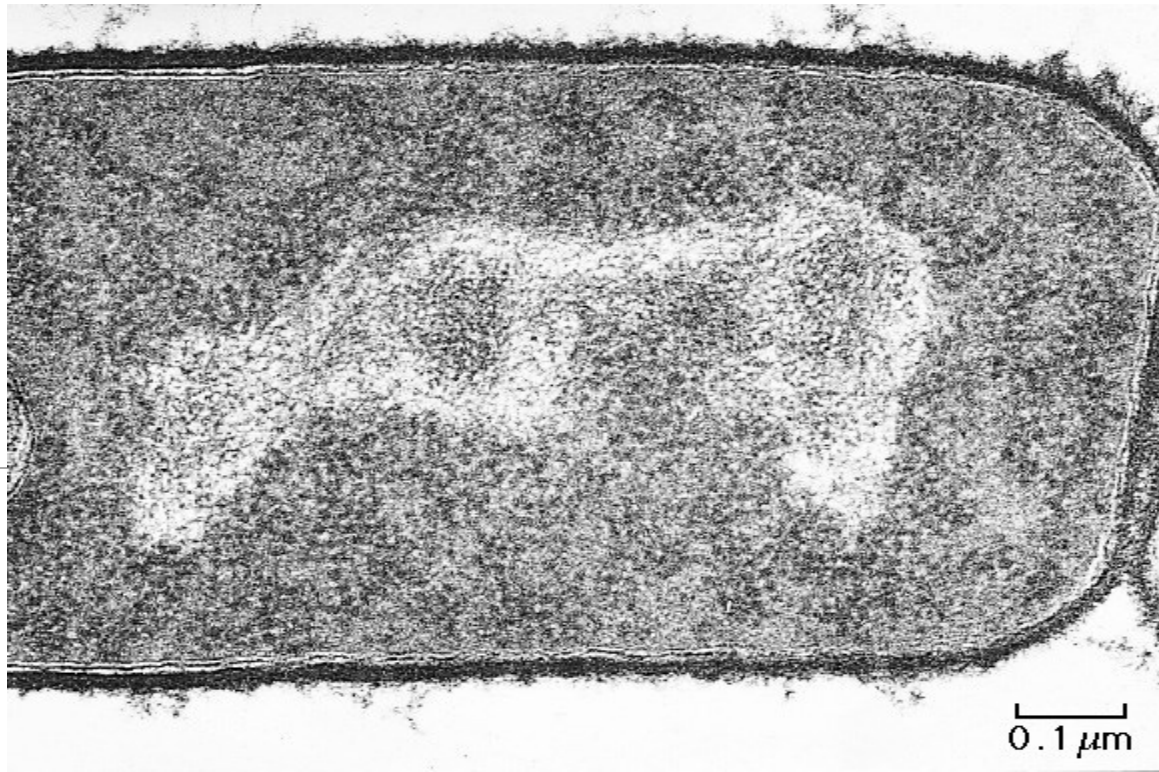
ANOTHER BACTERIA DIAGRAM

Prokaryotic Cell Structure



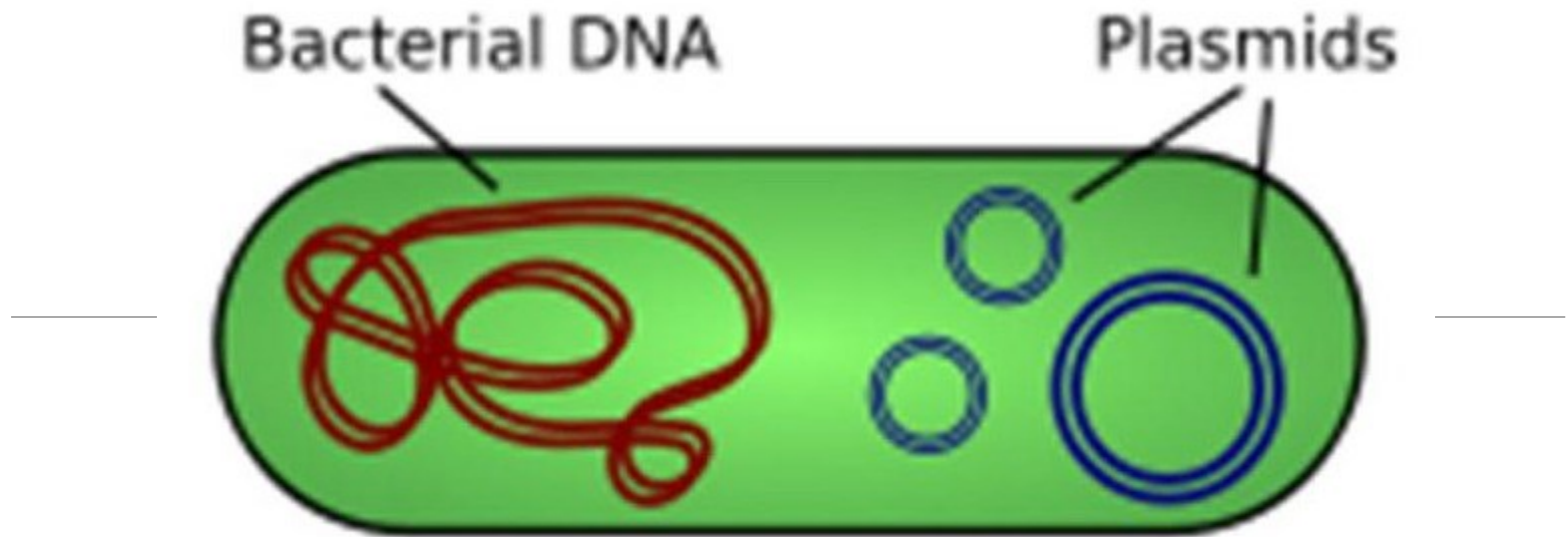
Bacteria

BACTERIAL CHROMOSOME IN “NUCLEOID AREA”



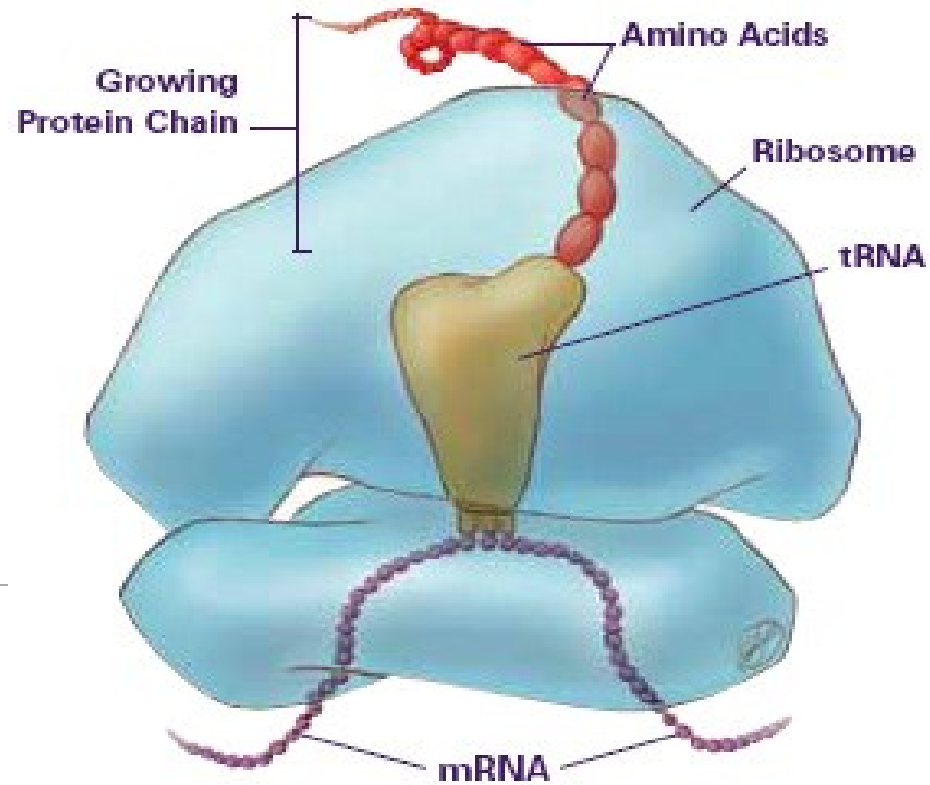
Bacteria

BACTERIAL CHROMOSOME AND AN EXTRA-CHROMOSOMAL
“PLASMID”



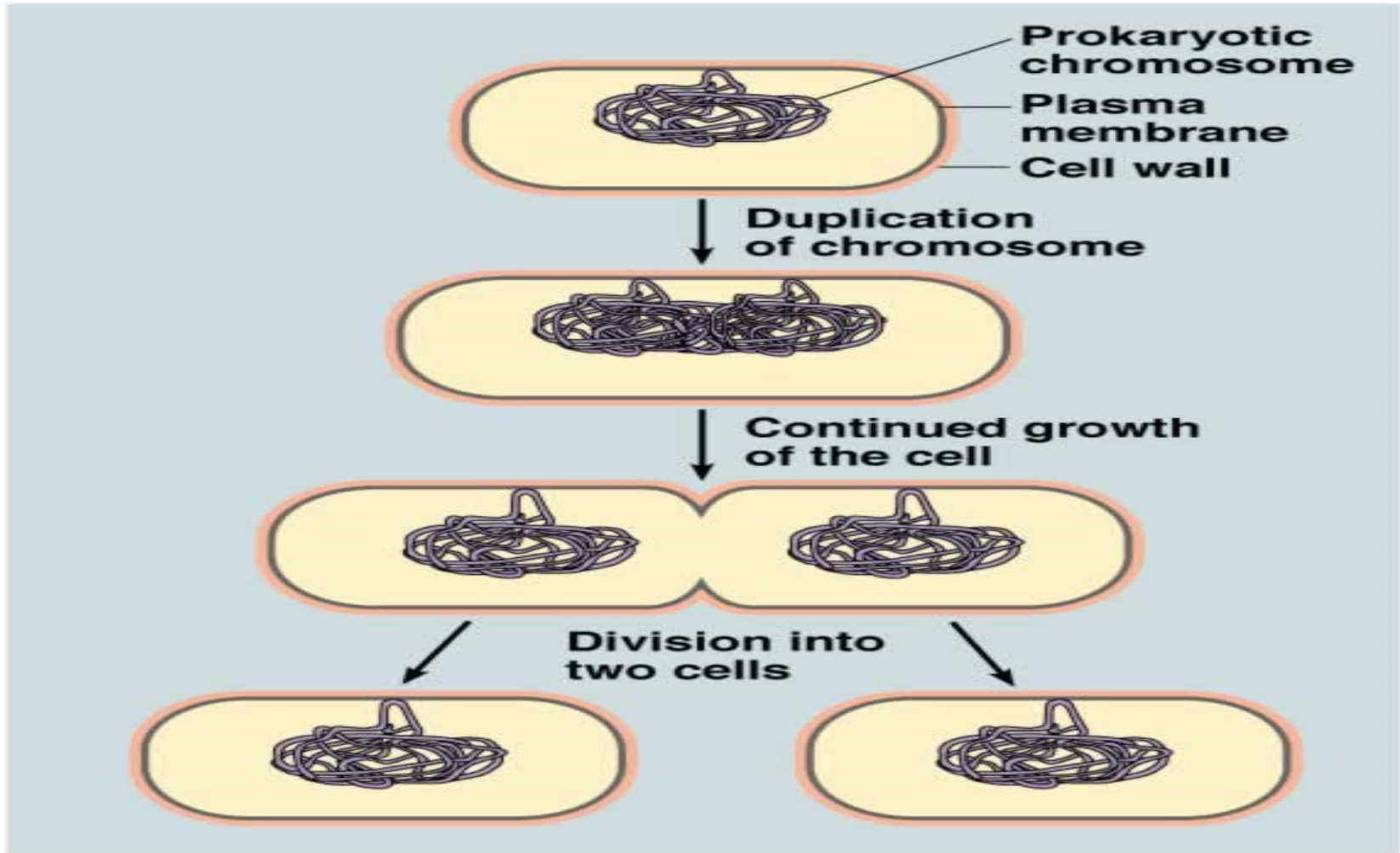
Bacteria

SMALLER RIBOSOME THAN EUKARYOTES, SAME
FUNCTION: PROTEIN SYNTHESIS



Bacteria

BACTERIA DIVIDE BY “BINARY FISSION”



Bacteria

EUKARYOTES – “TRUE NUCLEUS”, AND MEMBRANE BOUND ORGANELLES

DNA IS MEMBRANE BOUND, INSIDE NUCLEUS, NUCLEAR MEMBRANE IS A DOUBLE MEMBRANE

CHROMOSOMES ARE USUALLY MULTIPLE (PAIRED), AND HAVE SPECIAL HISTONE PROTEIN ASSOCIATED WITH THE DNA MOLECULES

MEMBRANE BOUND “ORGANELLES”: PACKAGES WHERE SPECIALIZED FUNCTIONS TAKE PLACE: MITOCHONDRIA, LYSOSOME, ER, GOLGI, ETC.

CELL WALL, IF PRESENT IS CHEMICALLY SIMPLE (CELLULOSE, OR CHITIN)

SLIGHTLY LARGER RIBOSOME

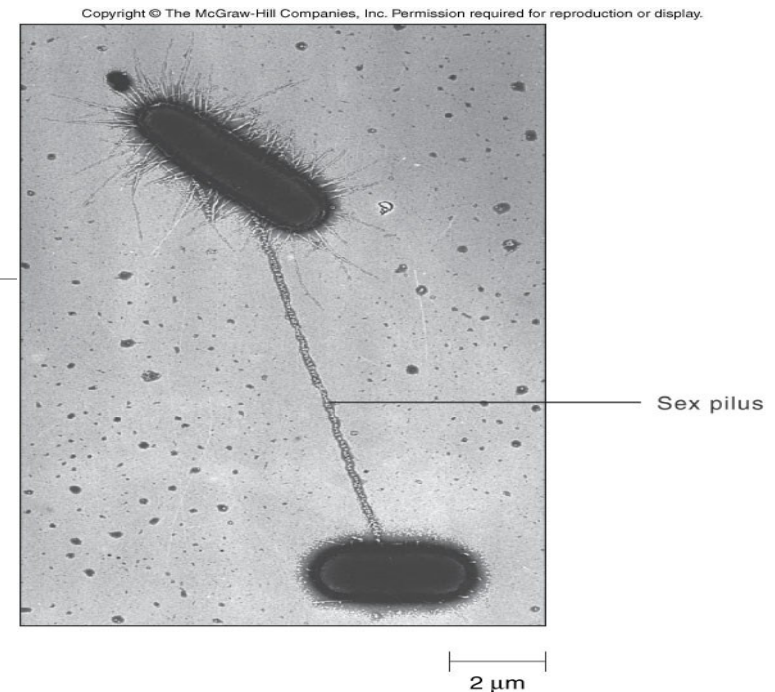
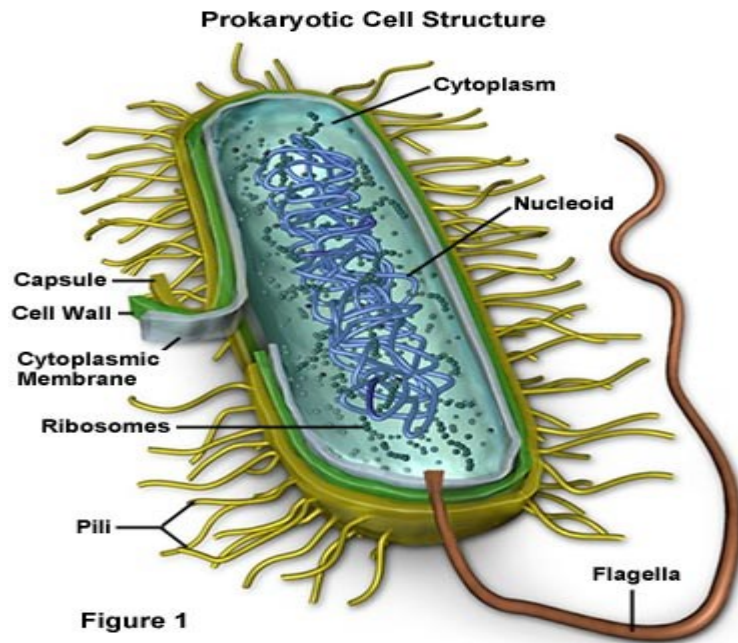
CELLS DIVIDE BY A PROCESS LIKE MITOSIS (AND CAN HAVE MEIOSIS TOO)

Bacteria

BACTERIAL APPENDAGES: PILLI (FIMBRIAE) AND FLAGELLA

PILLI ARE SHORT, HAIR-LIKE, PROTEIN: FUNCTION “ADHERENCE” – STICK TO EACH OTHER, STICK TO SURFACES, HARDER TO WASH AWAY

SPECIALIZED “SEX” PILUS - CONJUGATION



Bacteria

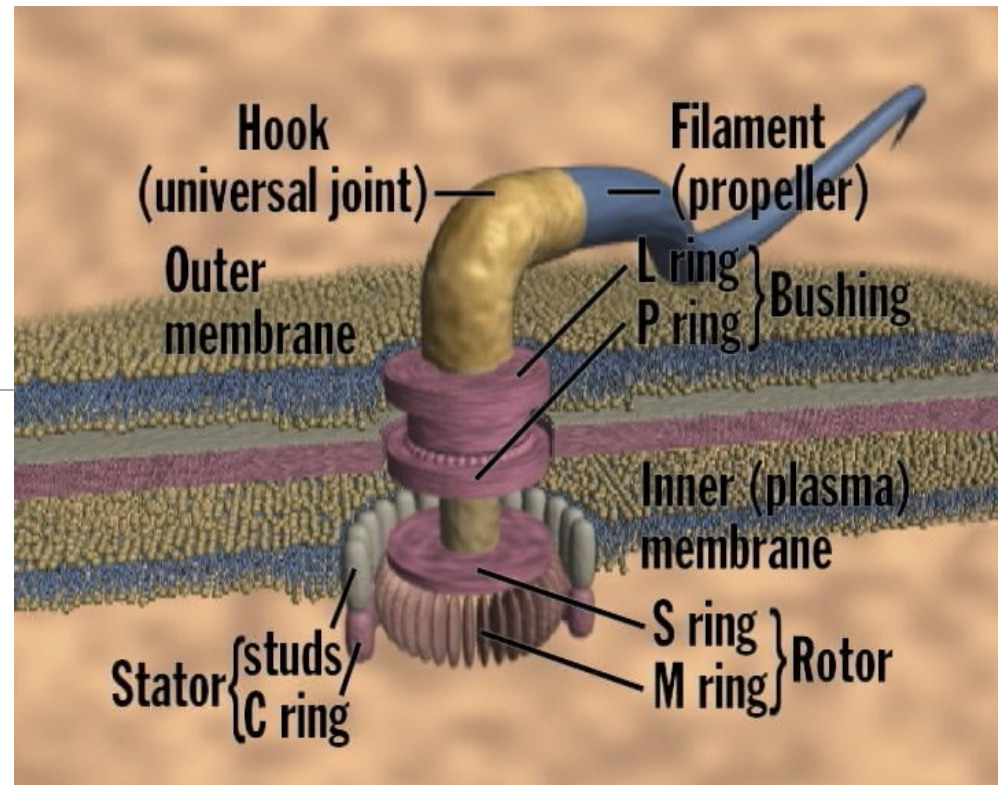
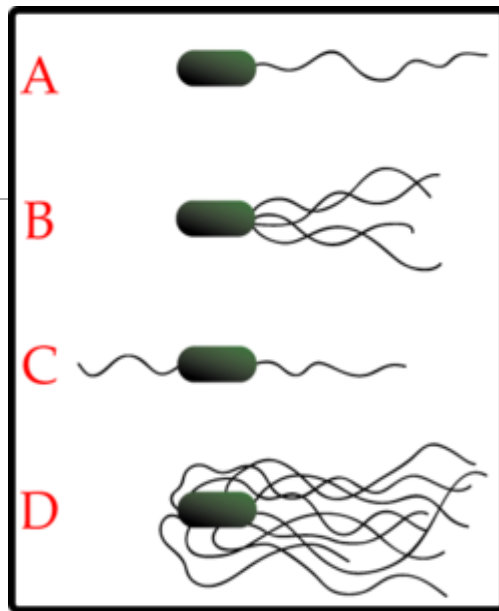
FLAGELLA: COMPLEX ORGAN OF MOTILITY, A “MOTOR”
VERY COOL

A = MONOTRICHOUS

B = AMPHITRICHOUS

C = LOPHOTRICHOUS

D = PERITRICHOUS

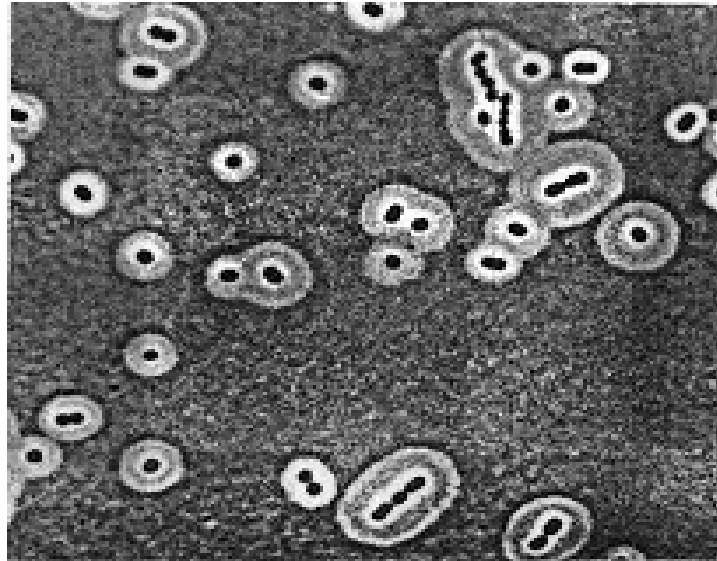


Bacteria

Bacterial “Envelope” – Structures on the outside of bacteria:

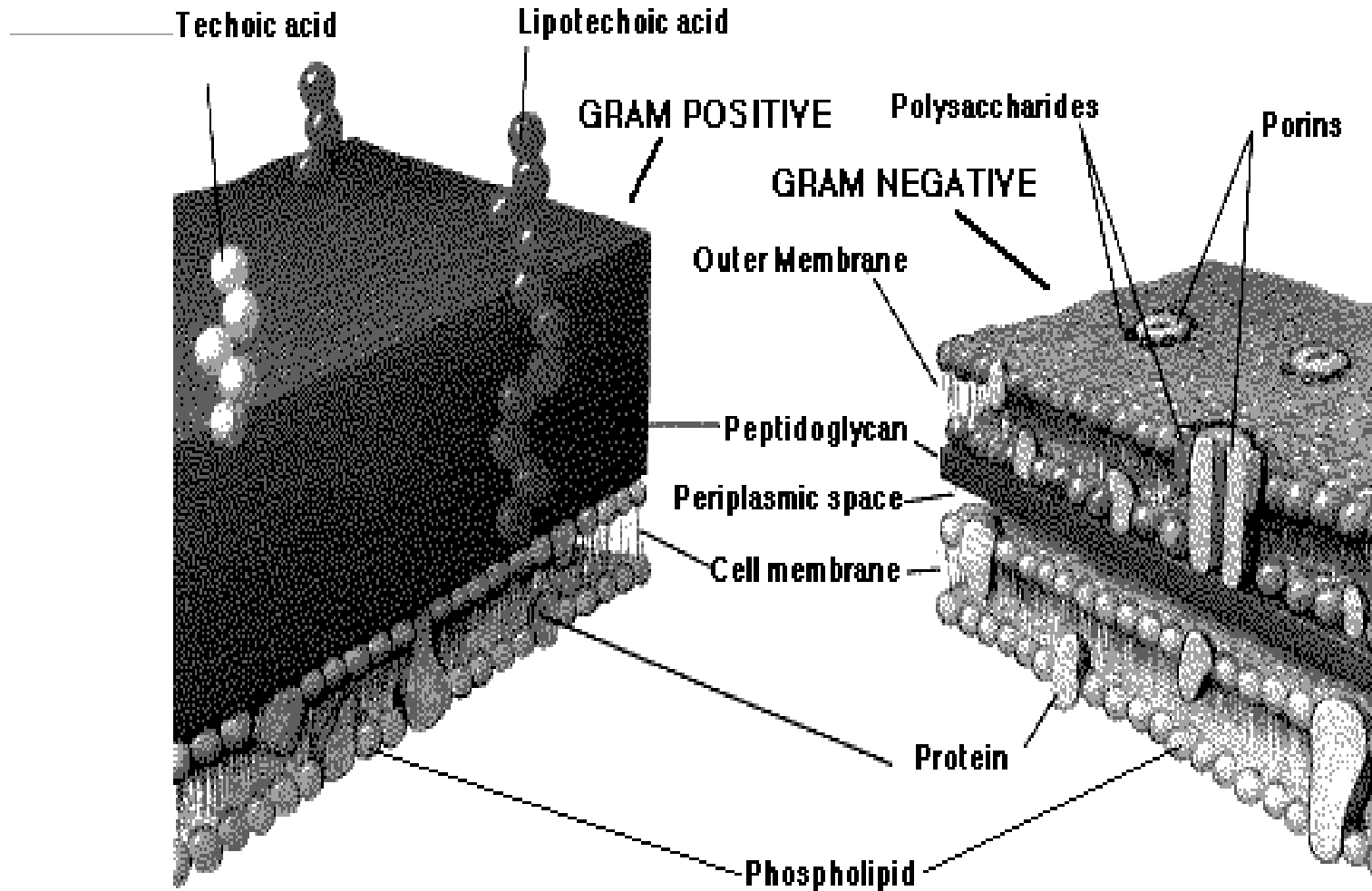
Glycocalyx – sugar coat, if tightly bound = capsule

- Protects and prevents from drying, also protects from phagocytes
- Slimy, and often a significant component of “biofilms”



Bacteria

Outer membrane (outside of cell wall) found in Gram (-) bacteria

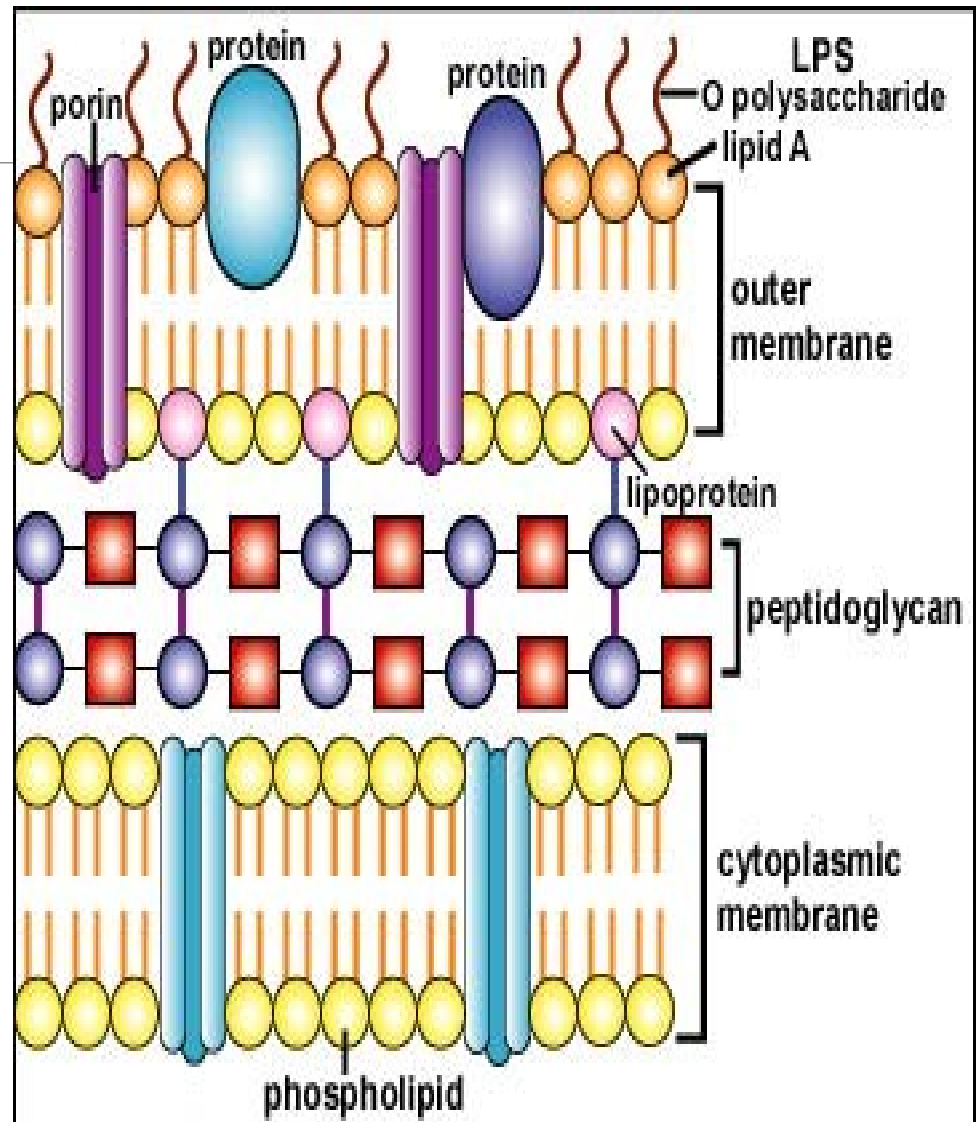


Bacteria

Outer membrane (outside of cell wall) found in Gram (-) bacteria

Gram – bacteria have LPS (lipopolysaccharide), lipoprotein, and phospholipids

These can cause some of the symptoms of Gram – bacterial infections (fever, shock, diarrhea)



Bacteria

Bacterial Cell Wall – macromolecule, polysaccharide, repeating sugars, NAG and NAM, cross-linked with short chains of Amino Acids

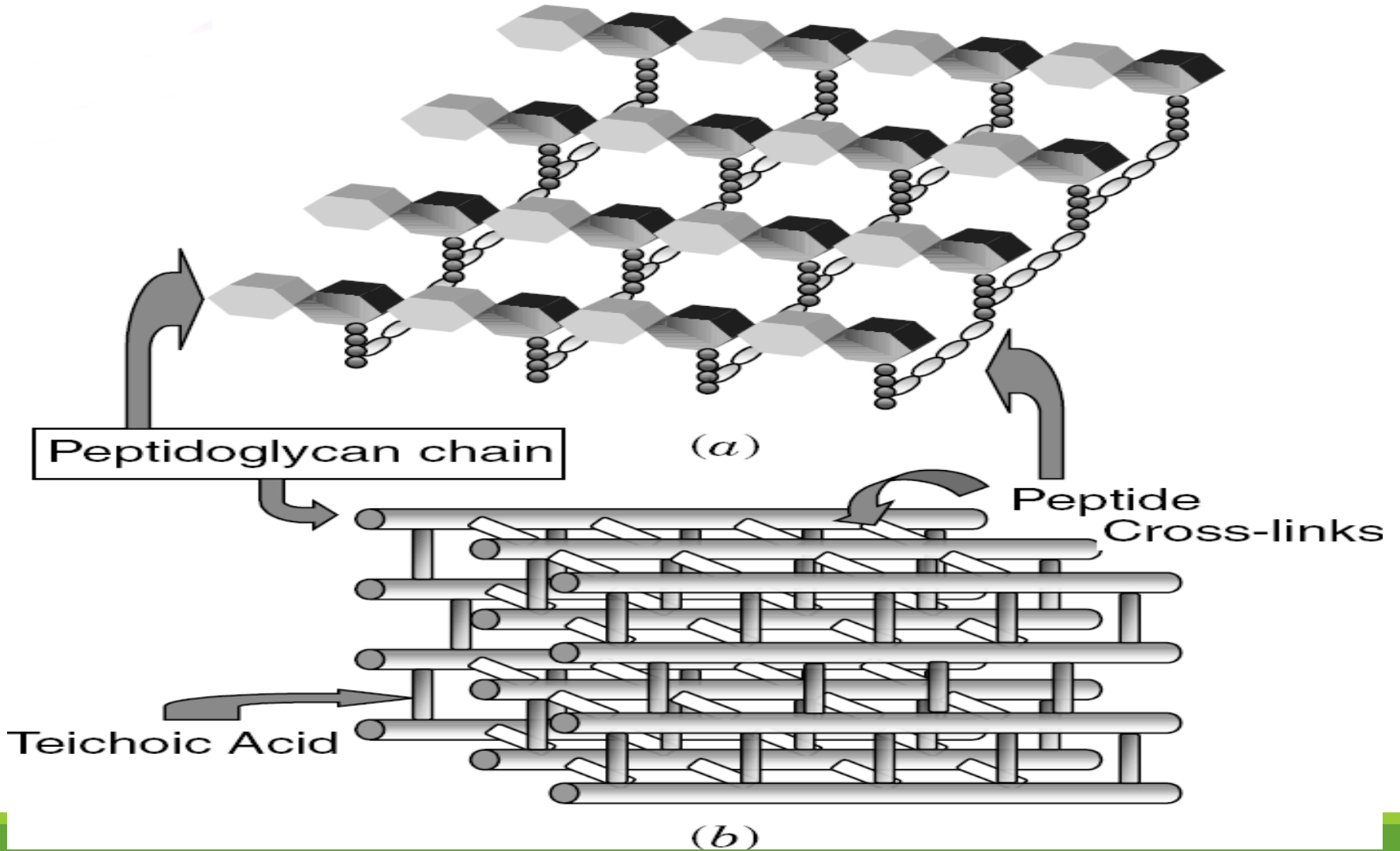
“Peptidoglycan, aka: murein”

Tough outer coat, prevents rupture, protects cell, gives it its distinct shape

Certain antibiotics work by inhibiting cell wall synthesis (penicillins)

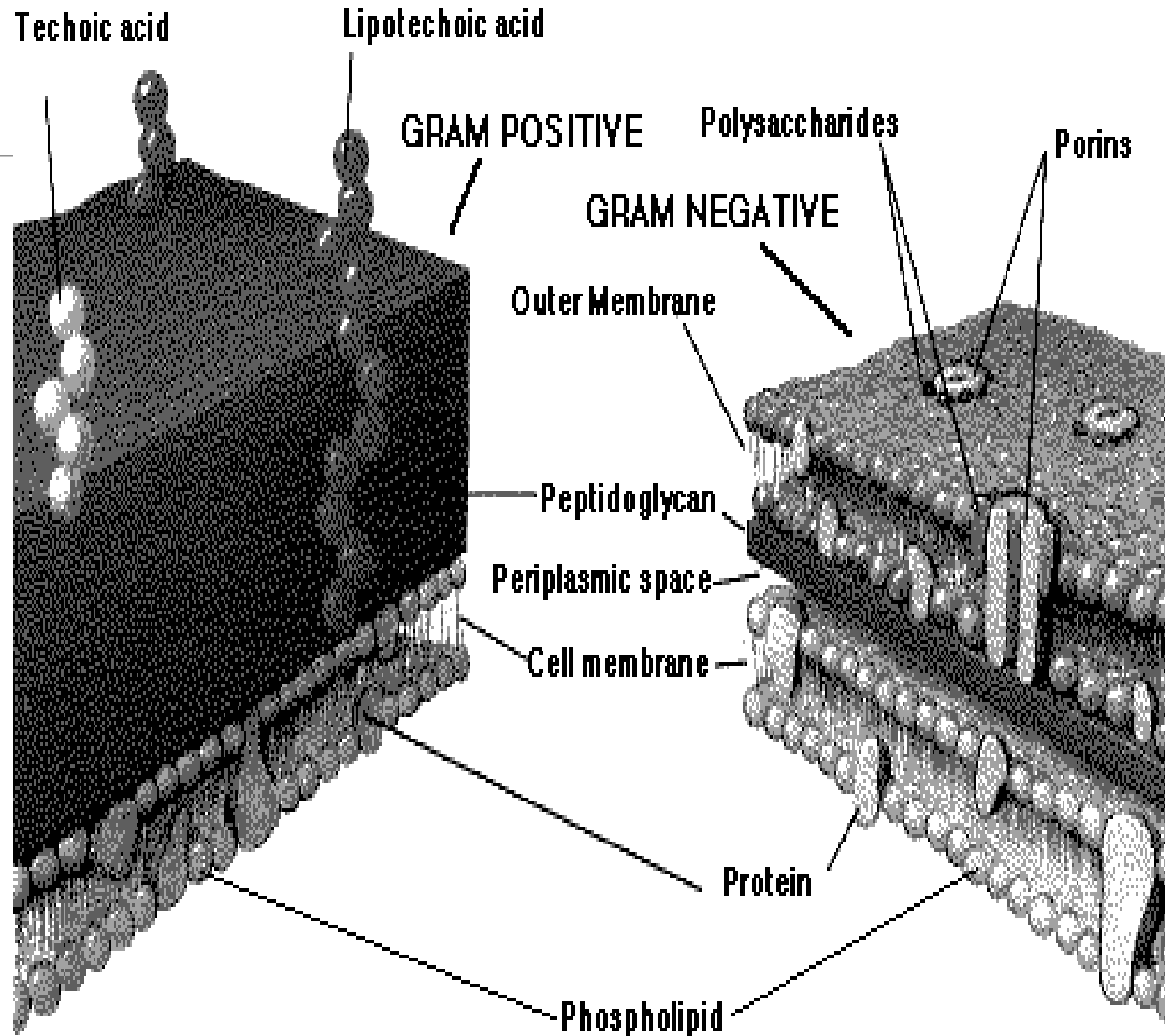
Bacteria

Bacterial Cell Wall



Bacteria

Gram + and
Gram –
bacteria have
differences in
Cell Wall and
outer envelope
(the theory of
why the grams
stain works is
based on this
difference)

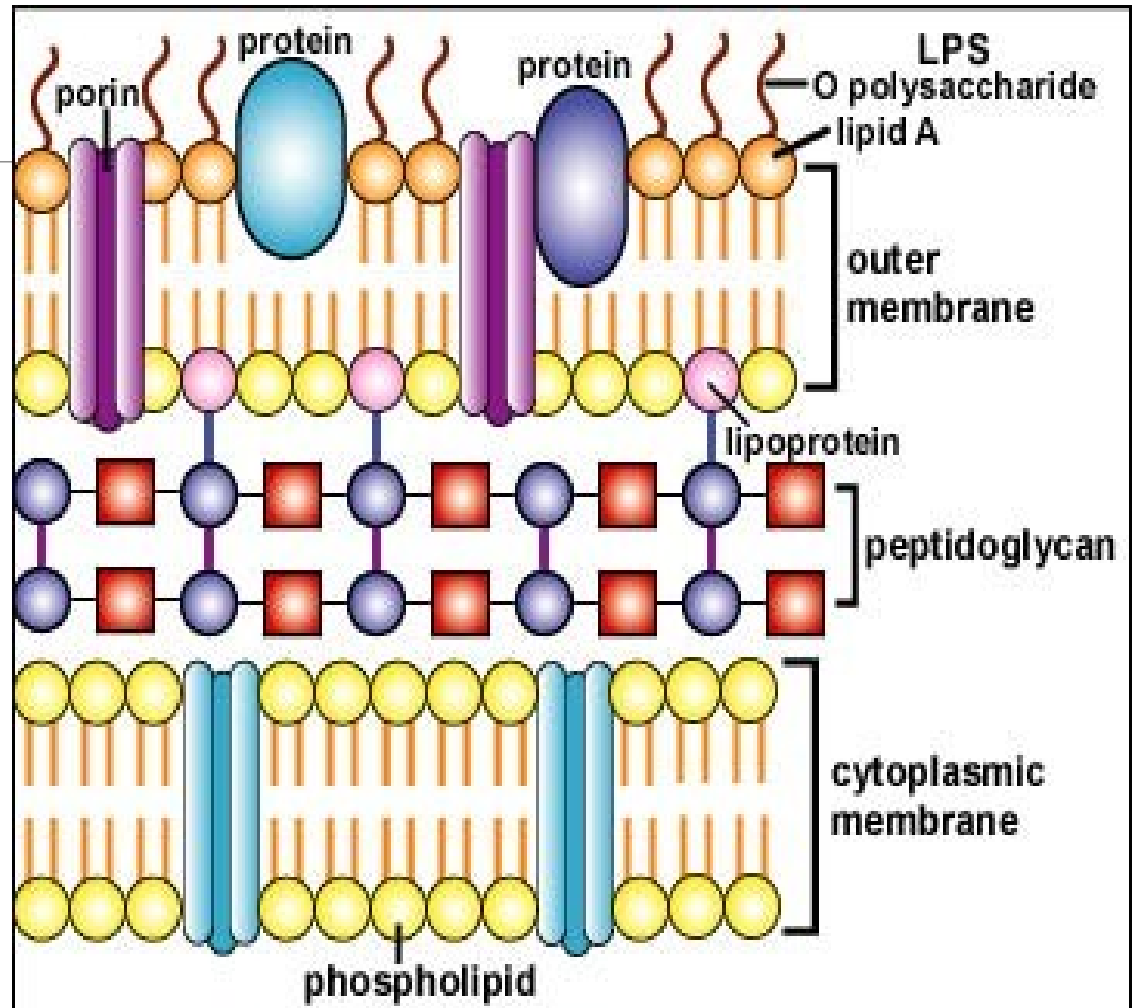


Bacteria

▶ Gram + and

▶ Gram –

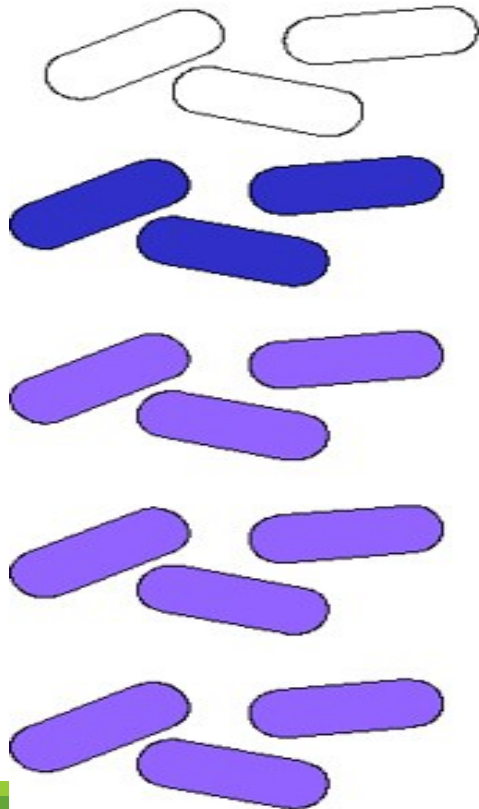
bacteria have differences in Cell Wall and outer envelope (the theory of why the grams stain works is based on this difference) Gram – are less sensitive to penicillin as a result of thinner CW and outer membrane



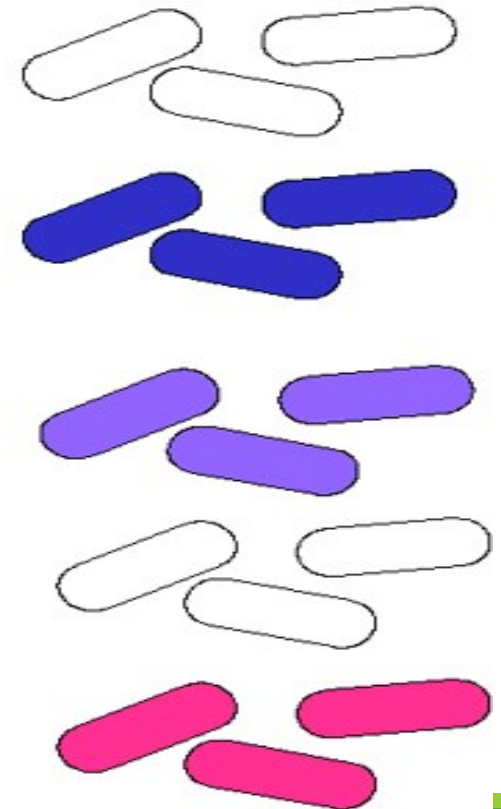
Bacteria

Grams stain = a differential stain procedure, different results, + and (-)

Gram Positive



Gram Negative



Fixation



Crystal violet



Iodine treatment



Decolorization

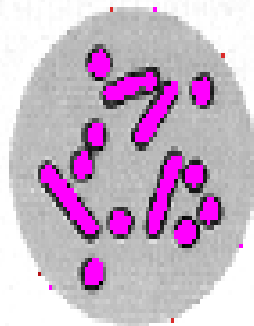
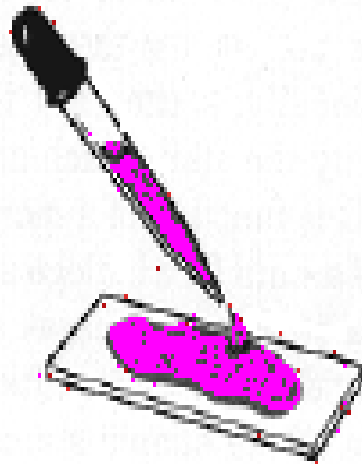


Counter stain
safranin

Bacteria

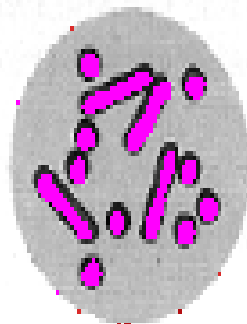
Gram stain – a differential stain procedure, different results (and / or)

Crystal Violet



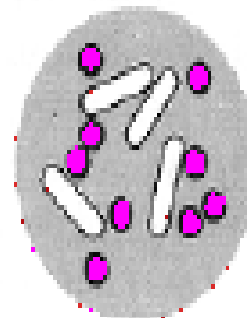
All purple

Iodine



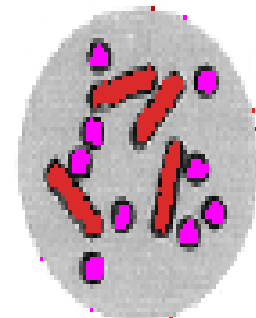
All purple

Alcohol



G+ = purple
G- = colorless

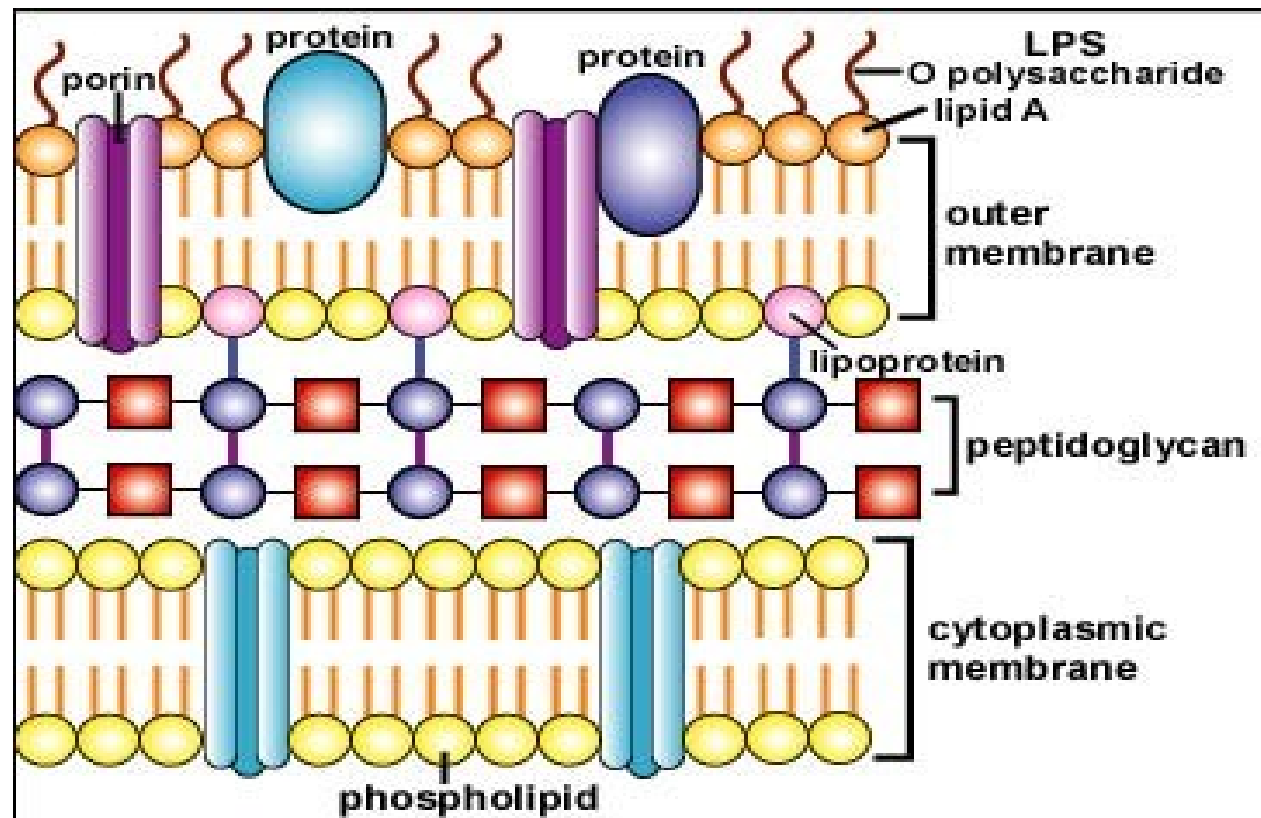
Safranin



G+ = purple
G- = red

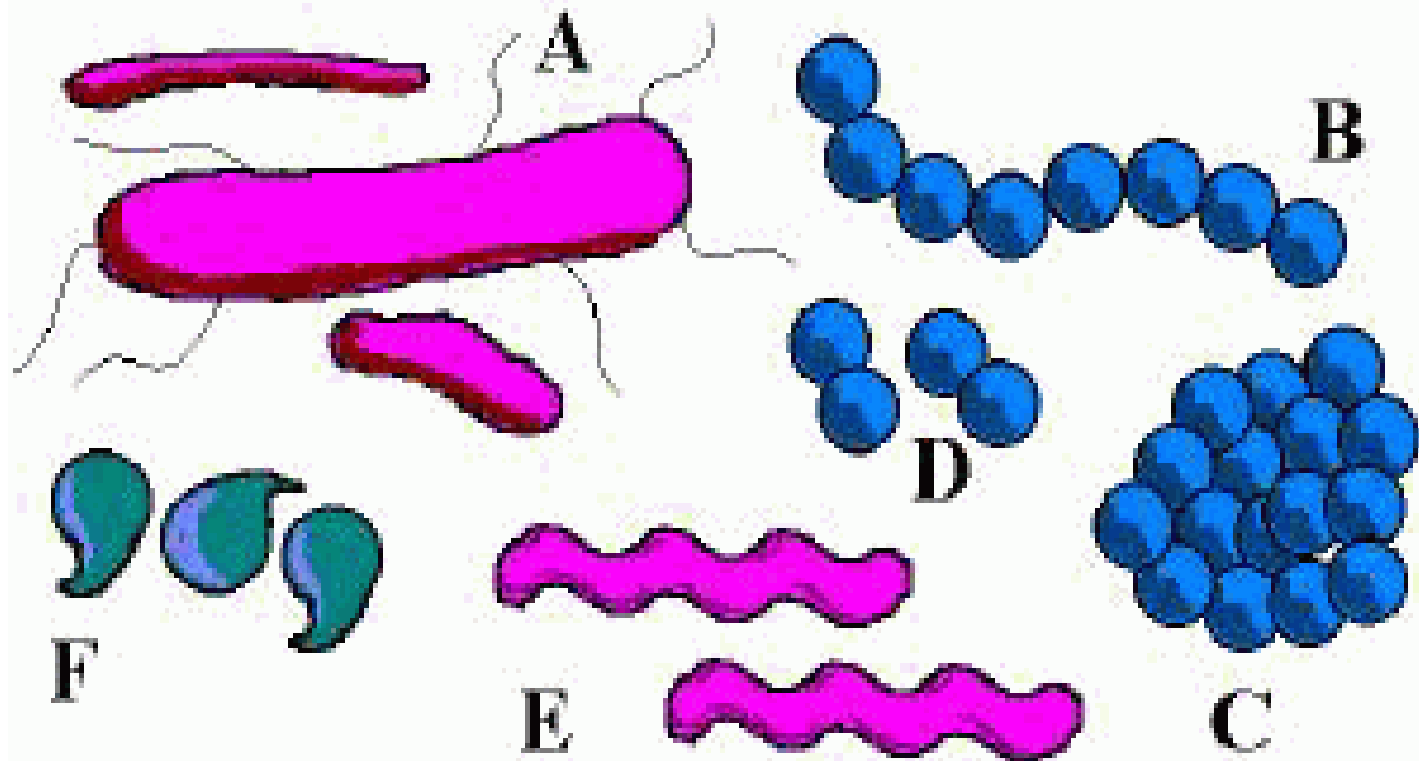
Microbiology – Chapter 4, Bacteria

Gram negative cell envelope much more complicated than Gram +: lipid, phospholipid, lipid A, peiplasmic space (fluid filled area between cell wall and outer membrane), various protein porons



Microbiology – Chapter 4, Bacteria

Bacterial cell “shapes” A=bacillus or pl. bacilli B= round, coccus, cocci pl., in chains “Streptococcus) C. Staphylococcus – clusters D= diplococcus
E=Spirillum, spirilla pl. (spirochete is a corkscrew shape – not shown) F= vibrio, more comma shaped



Bacteria

Cell shape is determined by the genetic character of the organism. Its genes code for the synthesis of the CW material and the cell division mechanism that results in a “round” or “rod” or “spiral” shape

One of the criteria used in ID of bacteria

Coupled with gram reaction = helpful

- Ex. Gram + cocci in clusters is “Staphylococcus”
Gram (-) bacilli, motile, green sheen on EMB is E.coli

Bacteria

- ▶ Bacterial cell membrane: regulates what moves in and out of the cytoplasm

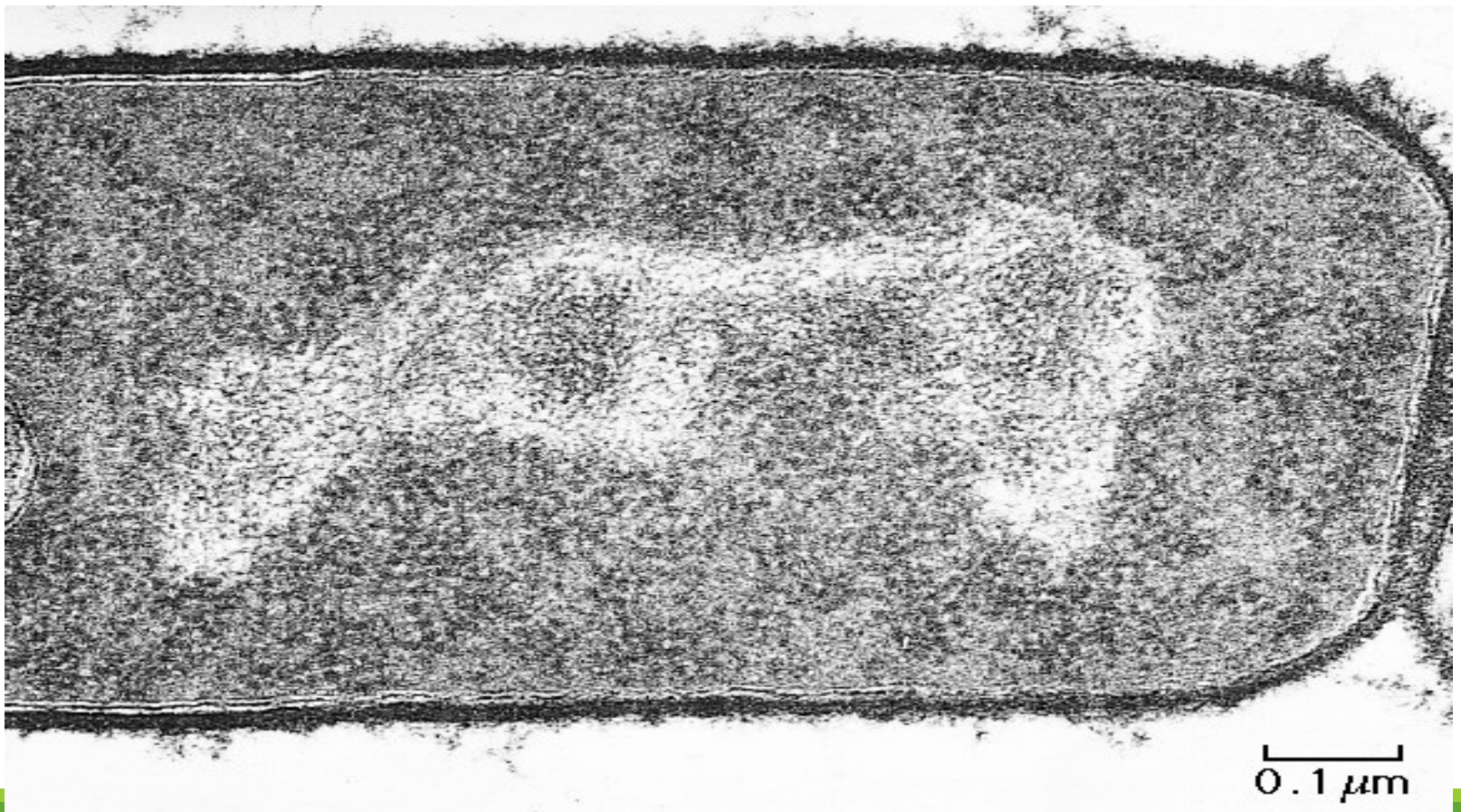
- ▶ Diffusion – concentration gradients > high to low
- ▶ Osmosis – diffusion of water across a semipermeable membrane
 - ▶ Isotonic
 - ▶ Hypertonic
 - ▶ Hypotonic

- ▶ Passive transport
- ▶ Active transport
- ▶ Engulfment (phagocytosis, pinocytosis)
- ▶ Specialized group translocation

Bacteria

► Inside the bacterial cytoplasm

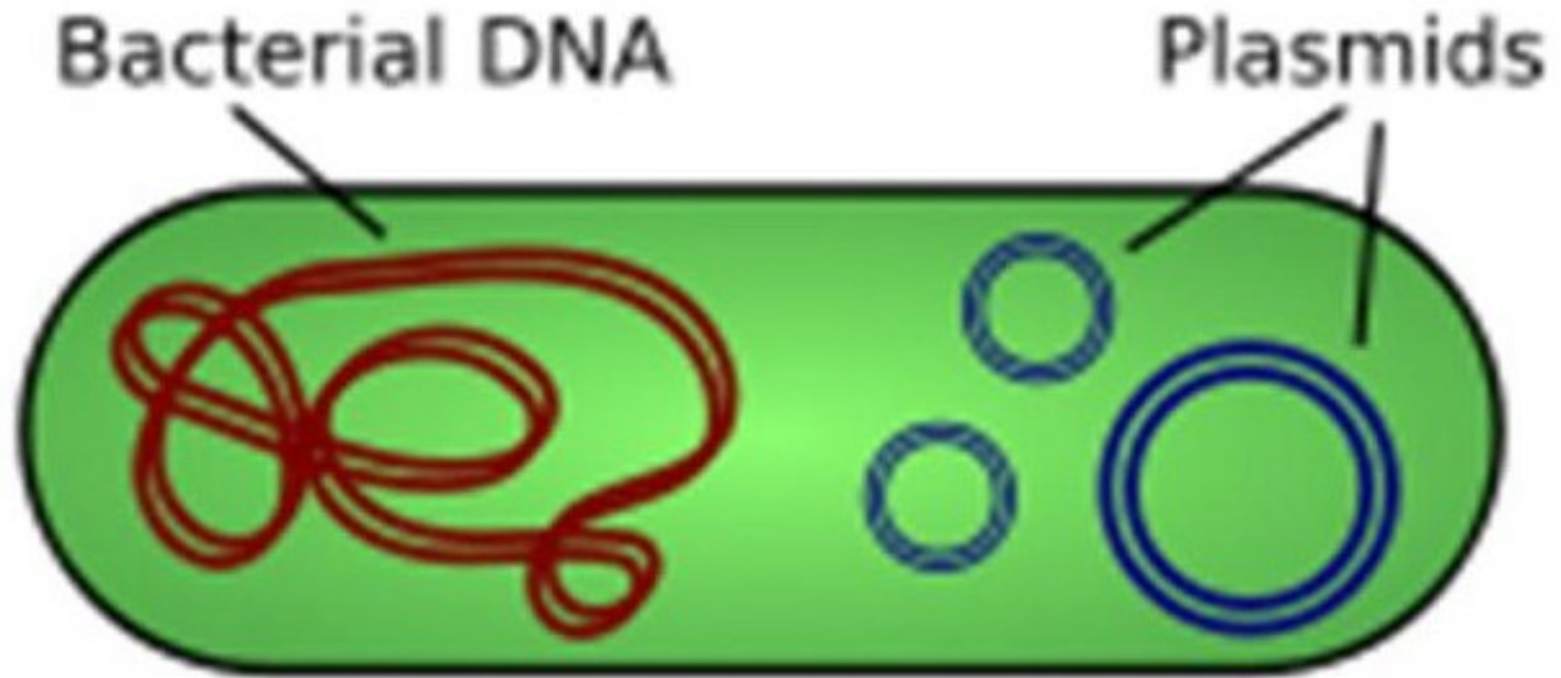
► Nucleoid – area containing the bacterial chromosome (DNA)



Bacteria

- ▶ Inside the bacterial cytoplasm
- ▶ Plasmid – Extrachromosomal DNA, not part of “genome”, different genes

- ▶ Can transfer in a process – conjugation across sex pilus, change the genetic character of the recipient
- ▶ Tool of “genetic”engineer

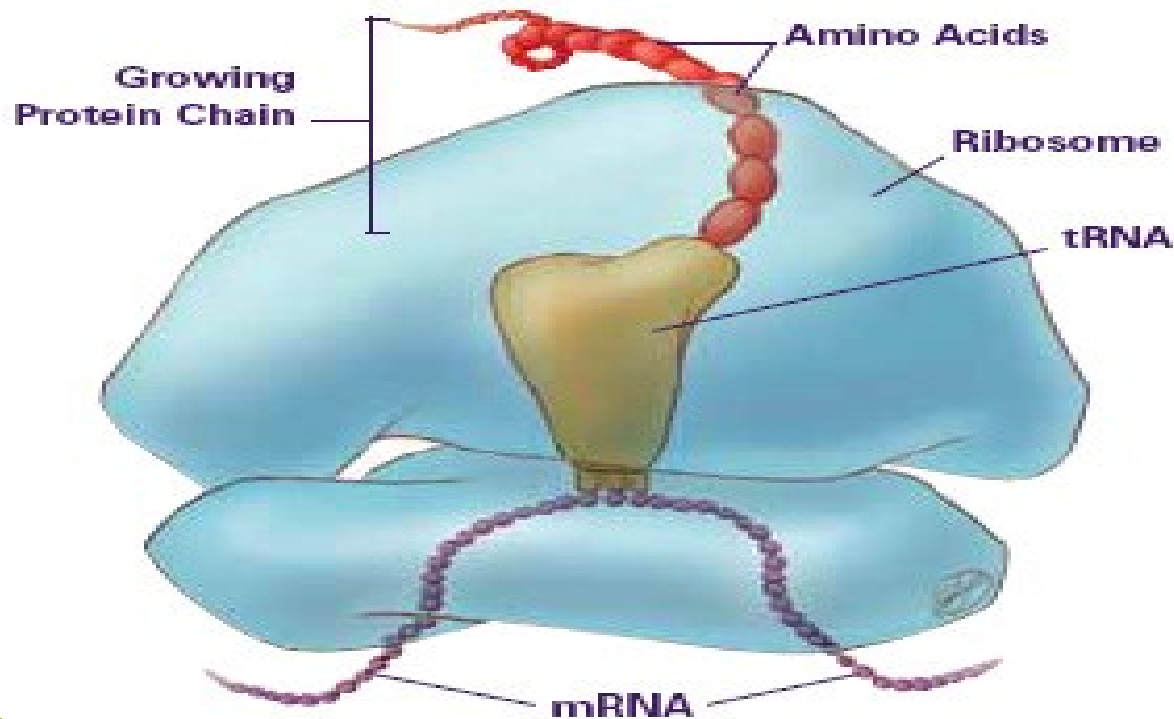


Inside the bacterial cytoplasm Bacteria

Ribosomes: structure made of RNA, site of protein synthesis

Some antibiotics work by messing with the “ribosome”

Slightly smaller than our eukaryote ribosome, so antibiotic can work on bacteria but not affect us (selective toxicity)

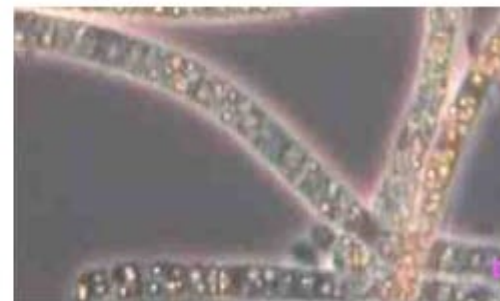
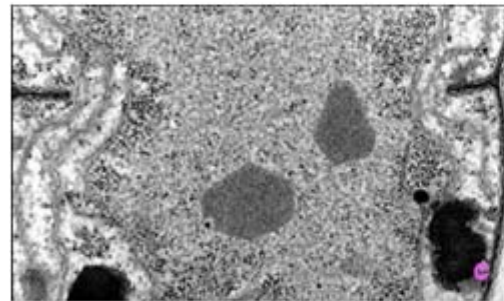
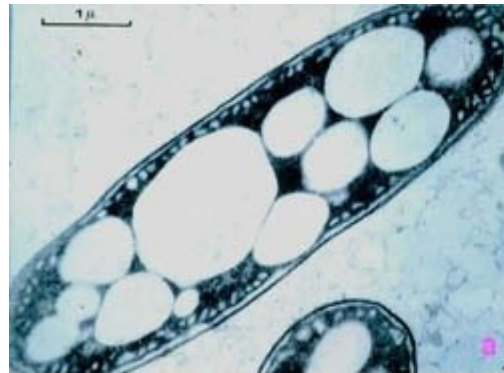


Inside the bacterial cytoplasm Bacteria

Inclusions: granules of sugar, lipid storage, etc. (storage)

Endospores (Genus: Bacillus and Clostridium) Hardest of bacterial structures. Difficult to kill with heat or chemical. Autoclave: 121 degree C, 15 lbs/sq. in. pressure – to penetrate thick coat and destroy genome of bacteria. Purpose: survival not reproduction

Inclusions:



Bacteria

- Inside the bacterial cytoplasm More spores:
-

