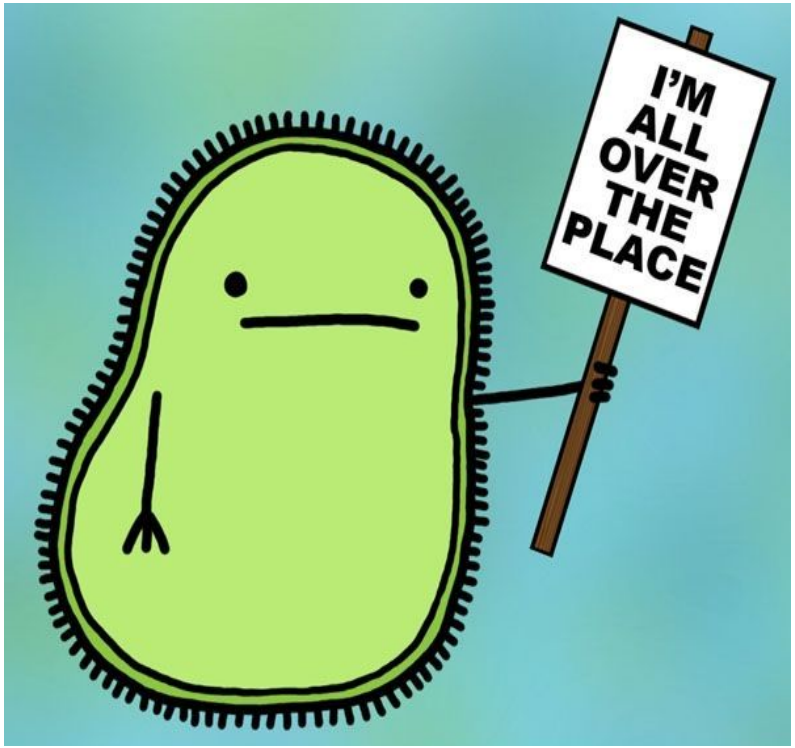
SBI3C
Bacteria
& Human life

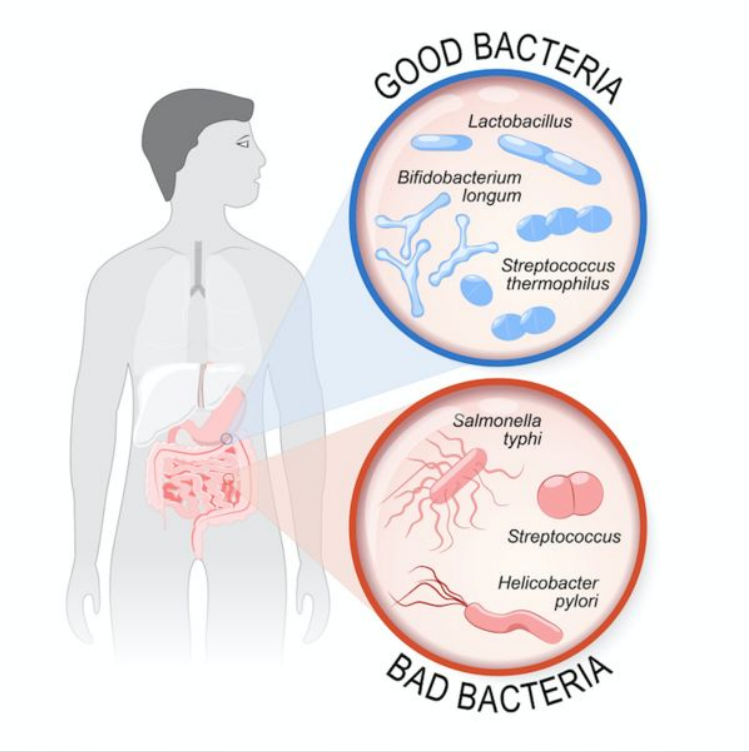
Literally.

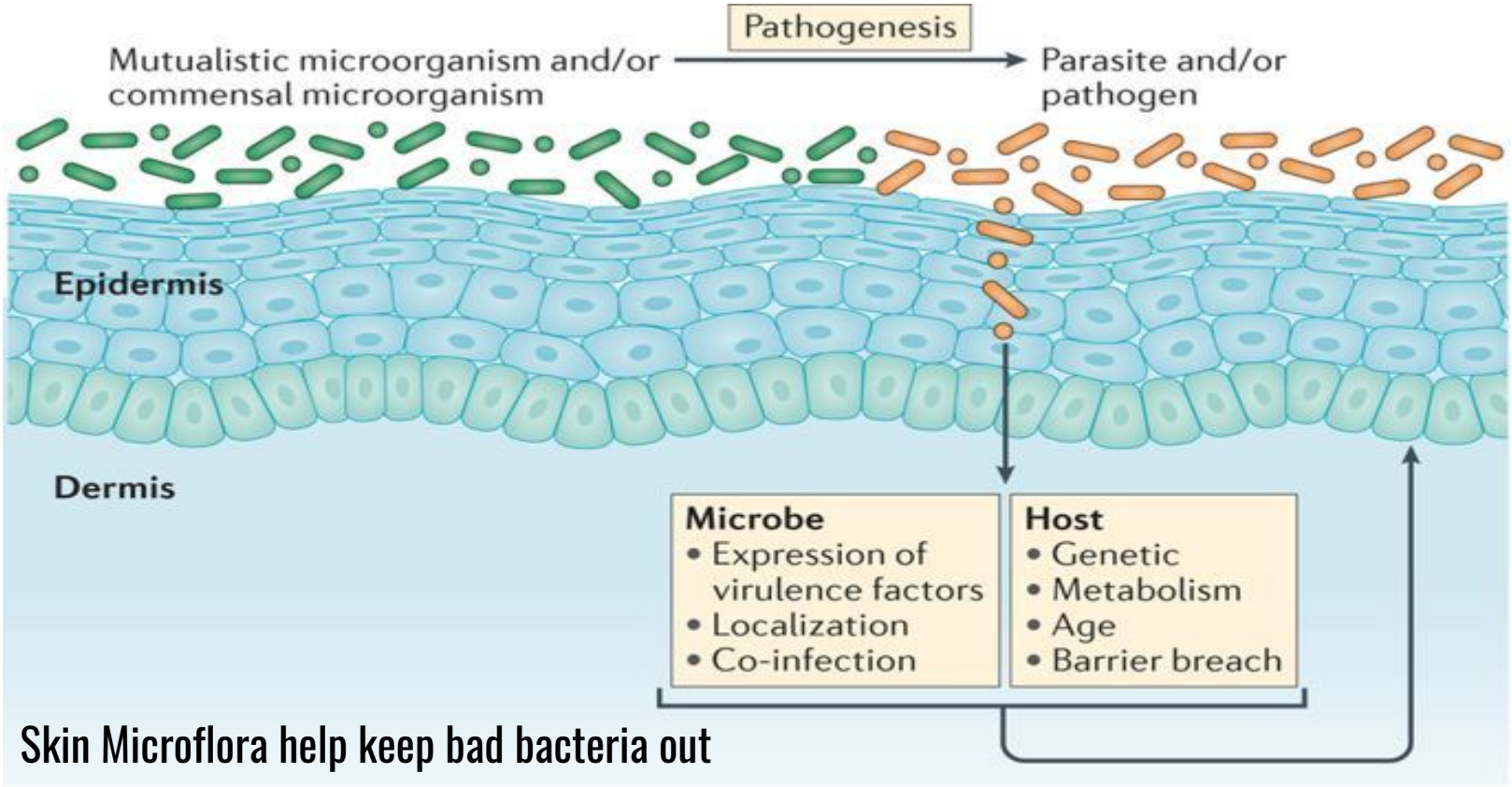
They're everywhere...
But that's okay!



Microflora

- The bacteria that live on us & inside of us
- Produce Vitamin K
- Help boost immunity
- Fight bad Bacteria

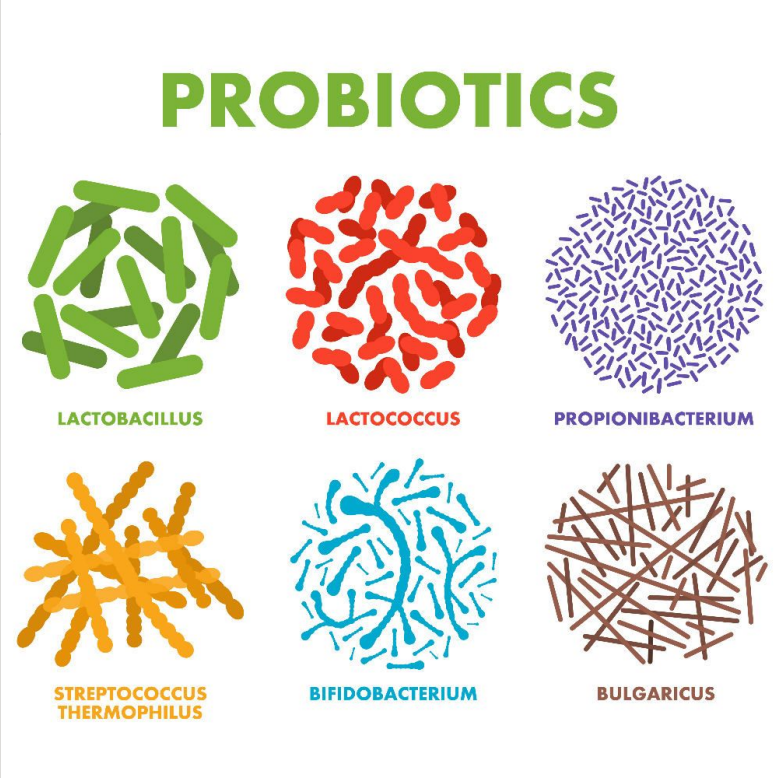




Skin Microflora help keep bad bacteria out

Probiotics

- Bacteria and yeast
- In our intestines
- May help us fight digestive disorders like IBS, diarrhea



INTESTINAL MICROFLORA

10^{14} micro-organisms, >500 differentes species

Lactobacilli	Stomach	10^2 to 10^3
	Duodenum	$<10^{4-5}$
Streptococci Lactobacilli	Jejunum	
Enterobacteria Enterococcus Faecalis Bacteroides Bifidobacteria Peptococcus Peptostreptococc Ruminococcus Clostridia Lactobacilli	Ileum	10^3 to 10^7
and....	Colon with appendix	10^9 to 10^{12}

- Certain medications, like antibiotics, damage our microflora
- Eating probiotic-rich foods helps restore it
- Yogurt, kimchi, pickles

APPLE CIDER VINEGAR

contain healthy acids that encourage a pH in your body that supports the growth of probiotics.

FERMENTED DAIRY

is probiotic-rich and helps improve gut health.

SAUERKRAUT

is rich in Lactobacillus. It's high in vitamin C and in digestive enzymes.

KIMCHI

the Korean cousin to sauerkraut, made with Chinese cabbage and some other foods and spices.

NATTO

is a Japanese dish of fermented soybeans high in *Bacillus subtilis*.

KVASS

is a common beverage in Eastern Europe made from fermented barley or rye.

MISO

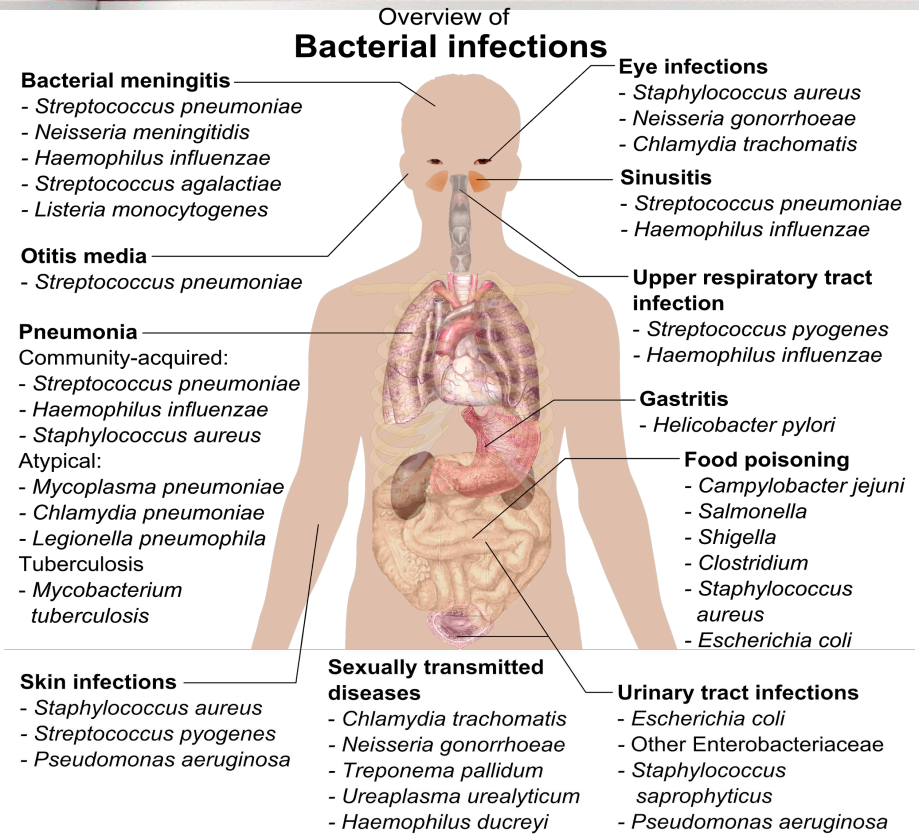
is a major component of Japanese medicine.

KOMBUCHA

is black tea fermented using a symbiotic colony of bacteria and yeast.

Pathogens

- Cause diseases
- Take advantage of us as a nutrient source
- **Secondary infections**: take advantage of us when we're already sick



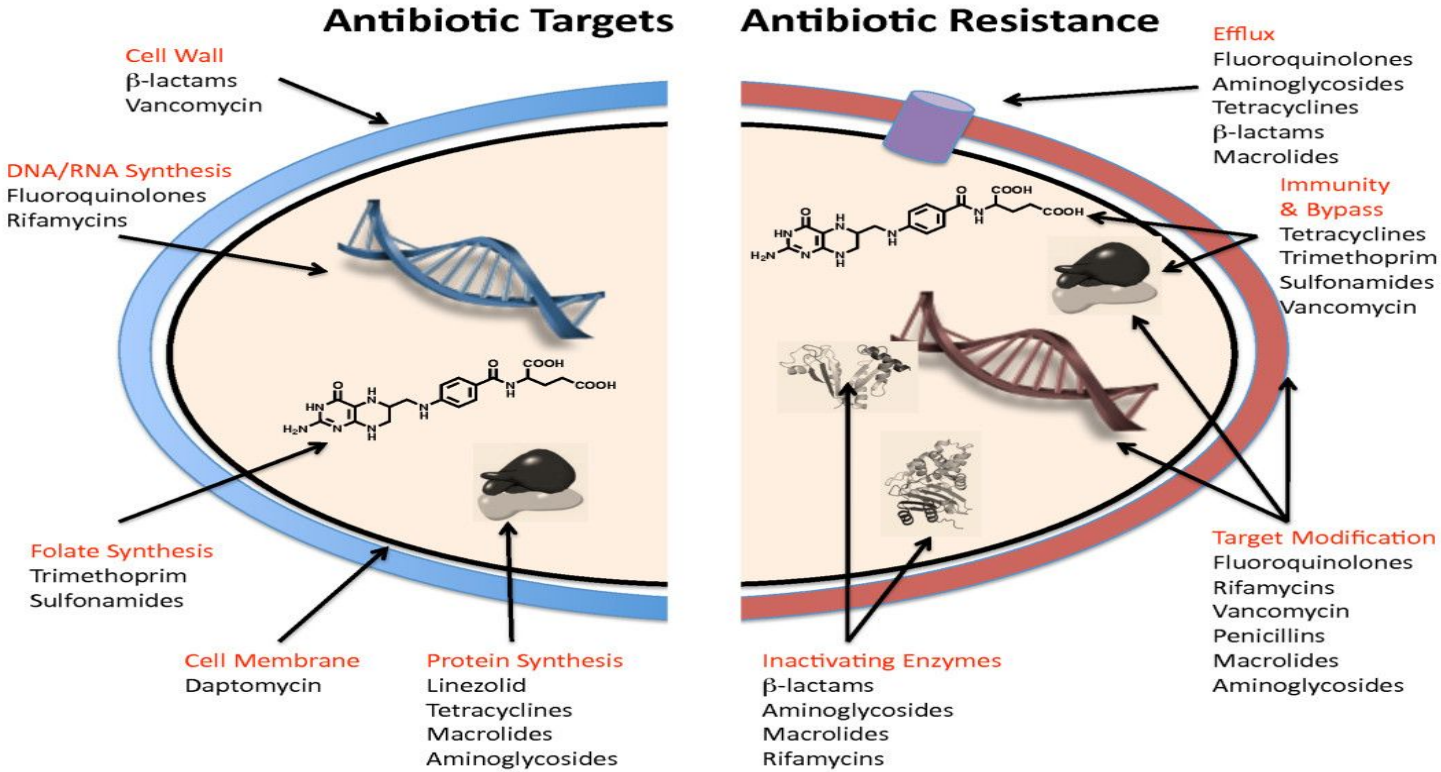
- Common: Acne, Strep throat, ulcers, cavities, food poisoning
- Rare: Cholera, Meningitis

Fighting Back

- Asepsis: using **antiseptics** (on living tissue) and **disinfectants** (on non-living surfaces)
- **Sterilizing** equipment
- Hand washing

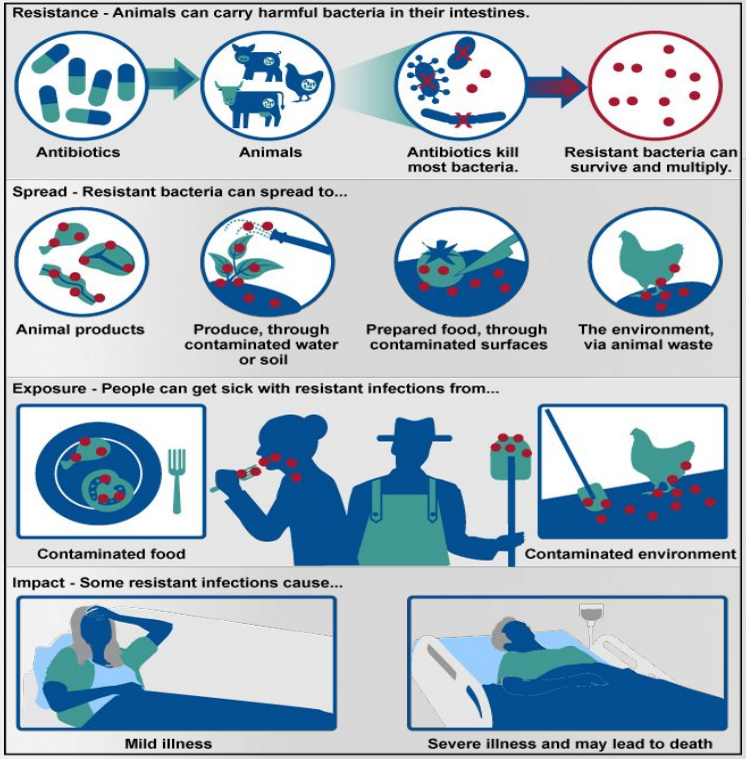
Fighting Back

- **Antibiotics**
- **Bacteriocidal** = kill bacteria directly
- Destroy cell wall or cell membrane
- **Bacteriostatic** = stop reproduction
- Stop DNA copying, protein production

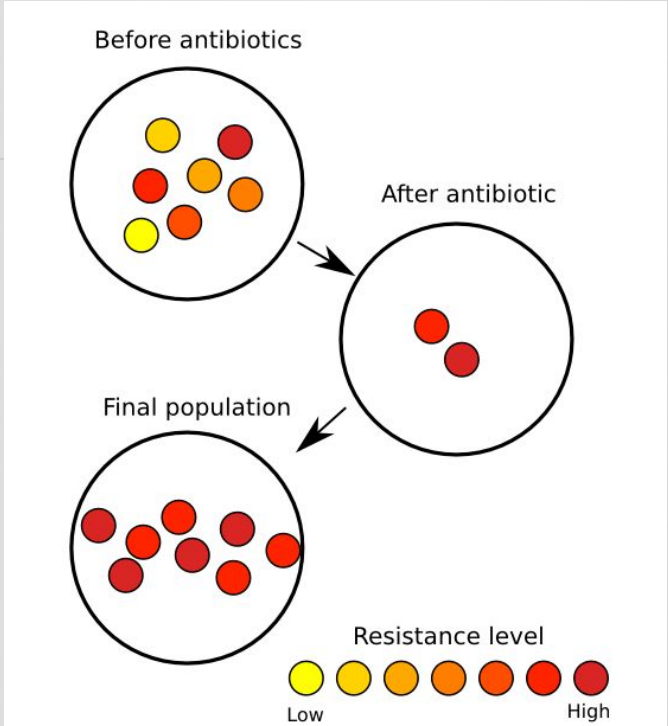

Antibiotic Targets
Cell Wall
β-lactams
Vancomycin
DNA/RNA Synthesis
Fluoroquinolones
Rifamycins
Folate Synthesis
Trimethoprim
Sulfonamides
Cell Membrane
Daptomycin
Protein Synthesis
Linezolid
Tetracyclines
Macrolides
Aminoglycosides
Antibiotic Resistance
Efflux
Fluoroquinolones
Aminoglycosides
Tetracyclines
β-lactams
Macrolides
Immunity
& Bypass
Tetracyclines
Trimethoprim
Sulfonamides
Vancomycin
Target Modification
Fluoroquinolones
Rifamycins
Vancomycin
Penicillins
Macrolides
Aminoglycosides
Inactivating Enzymes
β-lactams
Aminoglycosides
Macrolides
Rifamycins

Resistance

- Antibiotics have been around since WWII
- Bacteria are “used to them”
- Resistant bacteria pass their genes to others by **conjugation**
- Entire species today won’t respond to antibiotic treatment



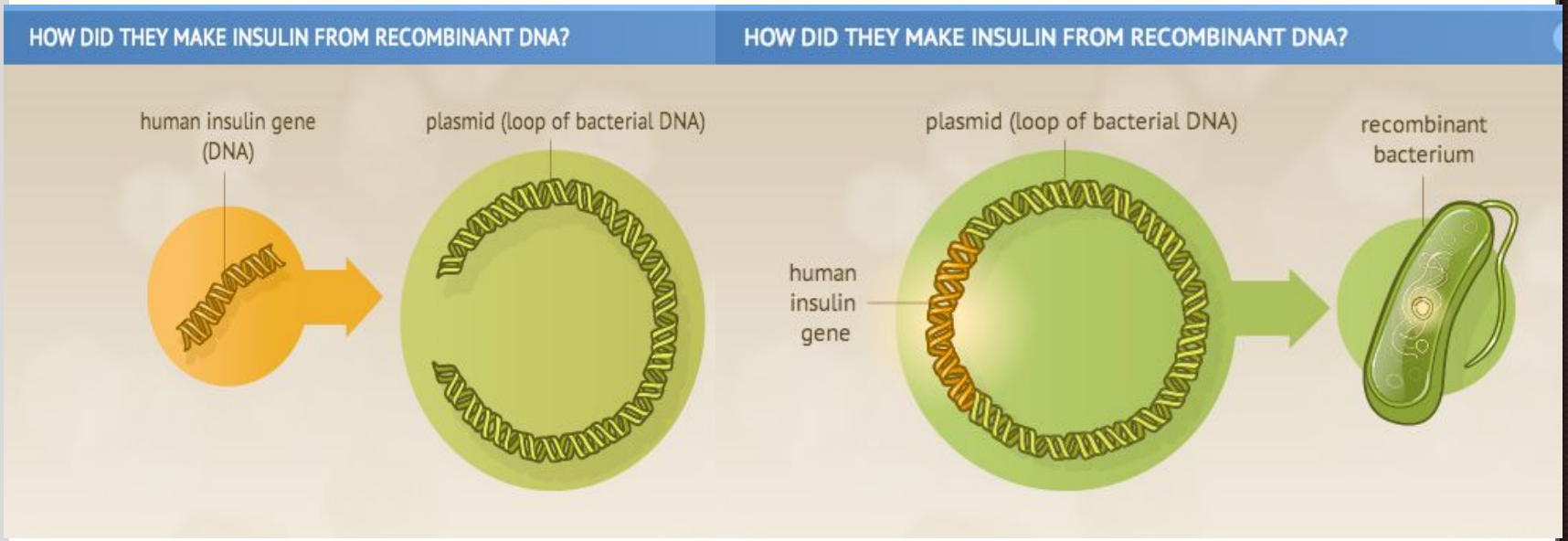
Source: Centers for Disease Control and Prevention. | GAO-17-192



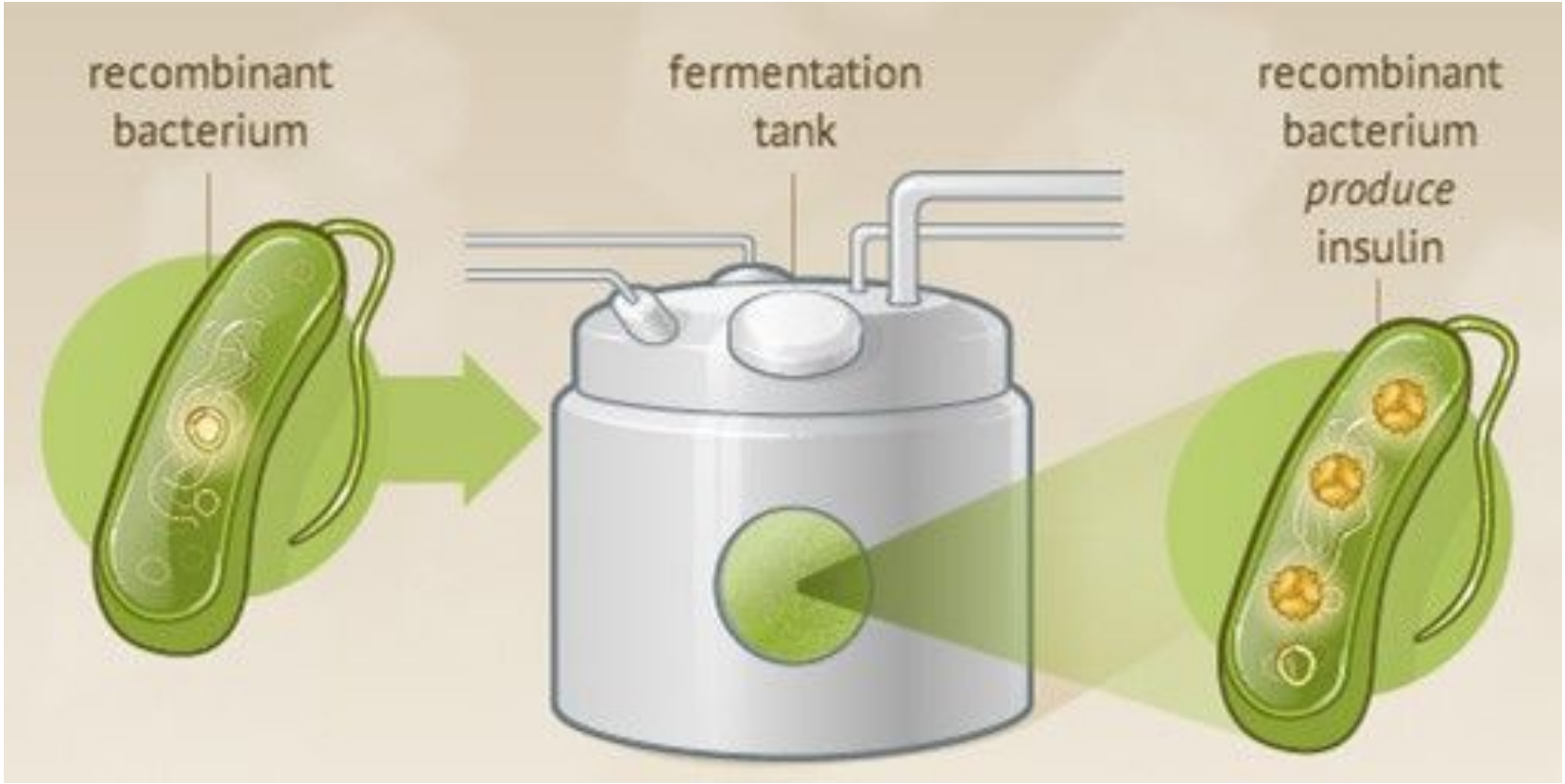
Adapted from Wikipedia (http://en.wikipedia.org/wiki/User:Wykis)

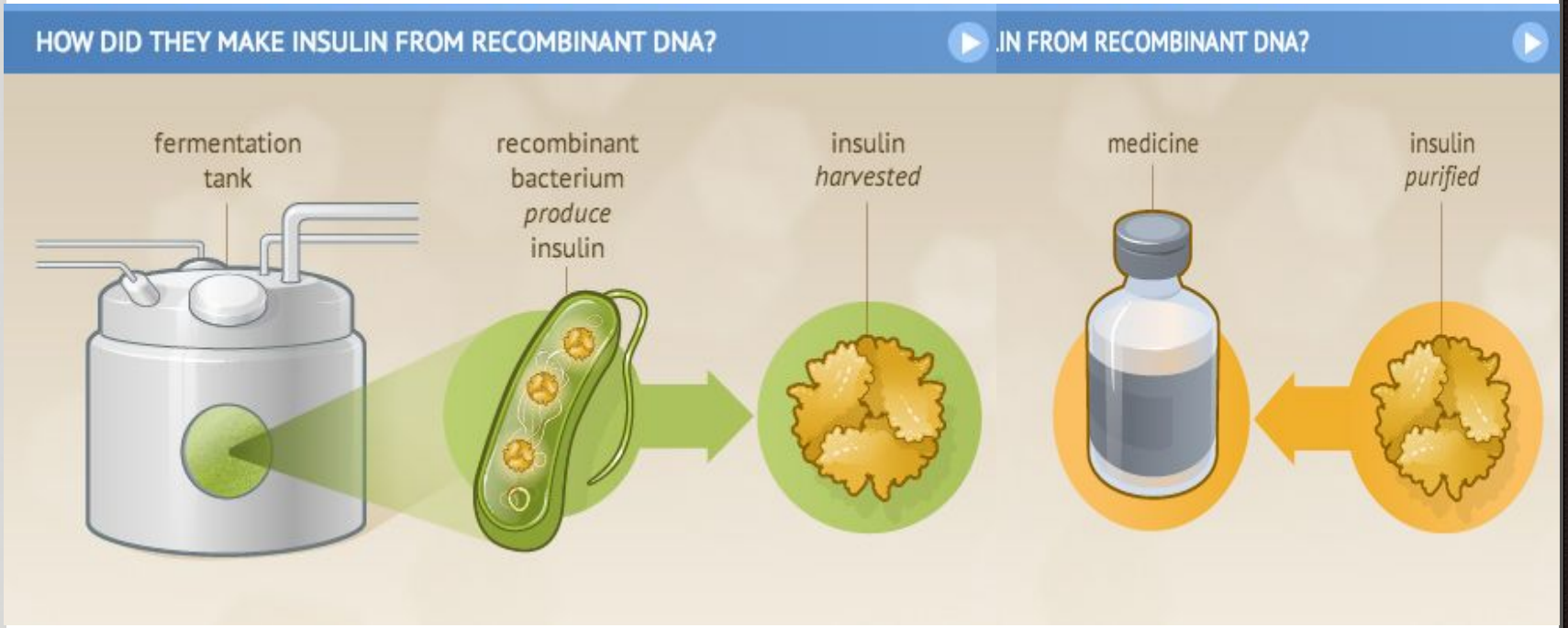
Cooperating with bacteria

- Food production, farming.
- **Mutualism** = two species rely on one another and both benefit
- They get a food source (sugars like fructose or lactose)
- The acids bacteria produce make many of our foods



Genetically Modified Bacteria can make Human Insulin


recombinant bacterium
fermentation tank
recombinant bacterium *produce* insulin


HOW DID THEY MAKE INSULIN FROM RECOMBINANT DNA?
.IN FROM RECOMBINANT DNA?
fermentation tank
recombinant bacterium *produce* insulin
insulin *harvested*
medicine
insulin *purified*


Arla
SKYR
ICELANDIC STYLE YOGURT
FAT FREE • REDUCED SUGAR • HIGH PROTEIN
MIXED WITH HONEY
Yoplait
GREEK
2X PROTEIN
OF THE LEADING YOGURT
PLAIN
0% FAT
1
Oregon Brineworks
FARM FRESH FERMENTS
ORGANIC
Sauerkraut
Net Wt. 25oz (739.338mL)