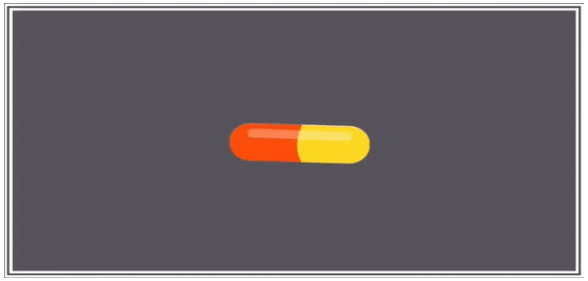
Mechanism of Drug Resistance in Pathogens



By
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ANTIMICROBIALS

ANTIBIOTICS/ ANTIBACTERIALS

against bacteria, e.g. drugs for bacterial pneumonia

ANTIVIRALS

against viruses, e.g. drugs for herpes and HIV

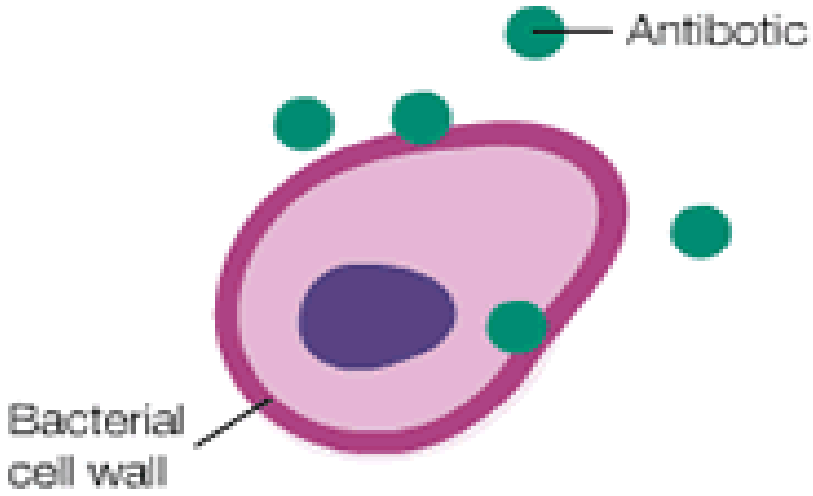
ANTIPARASITIC AGENTS

against parasites, e.g. drugs for malaria

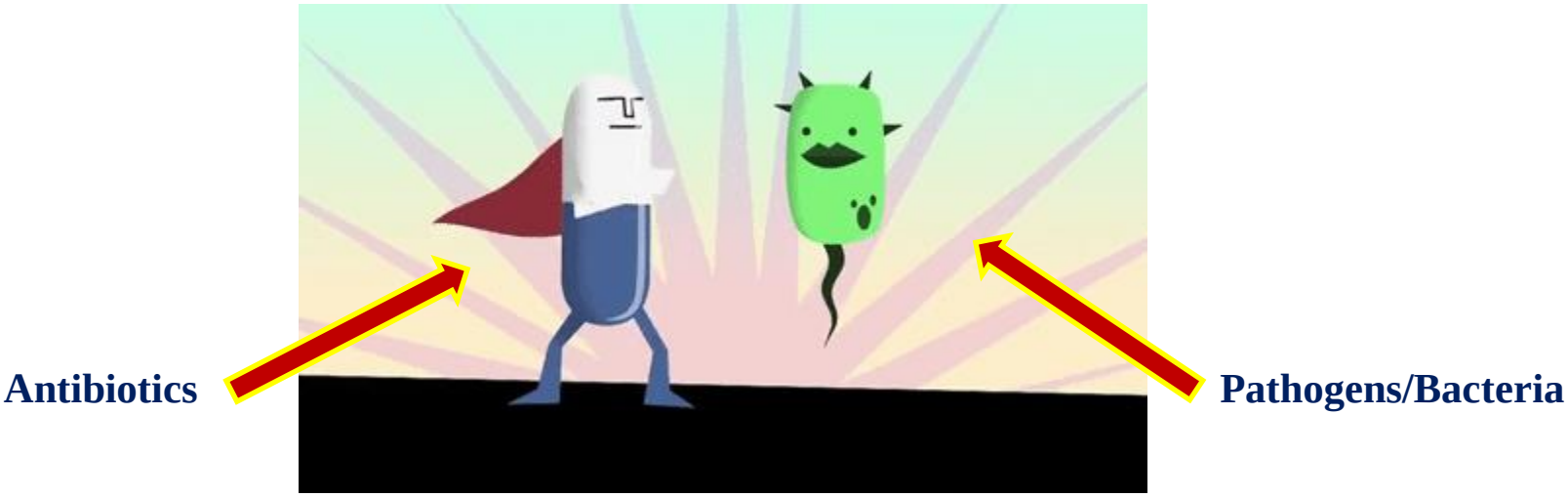
ANTIFUNGALS

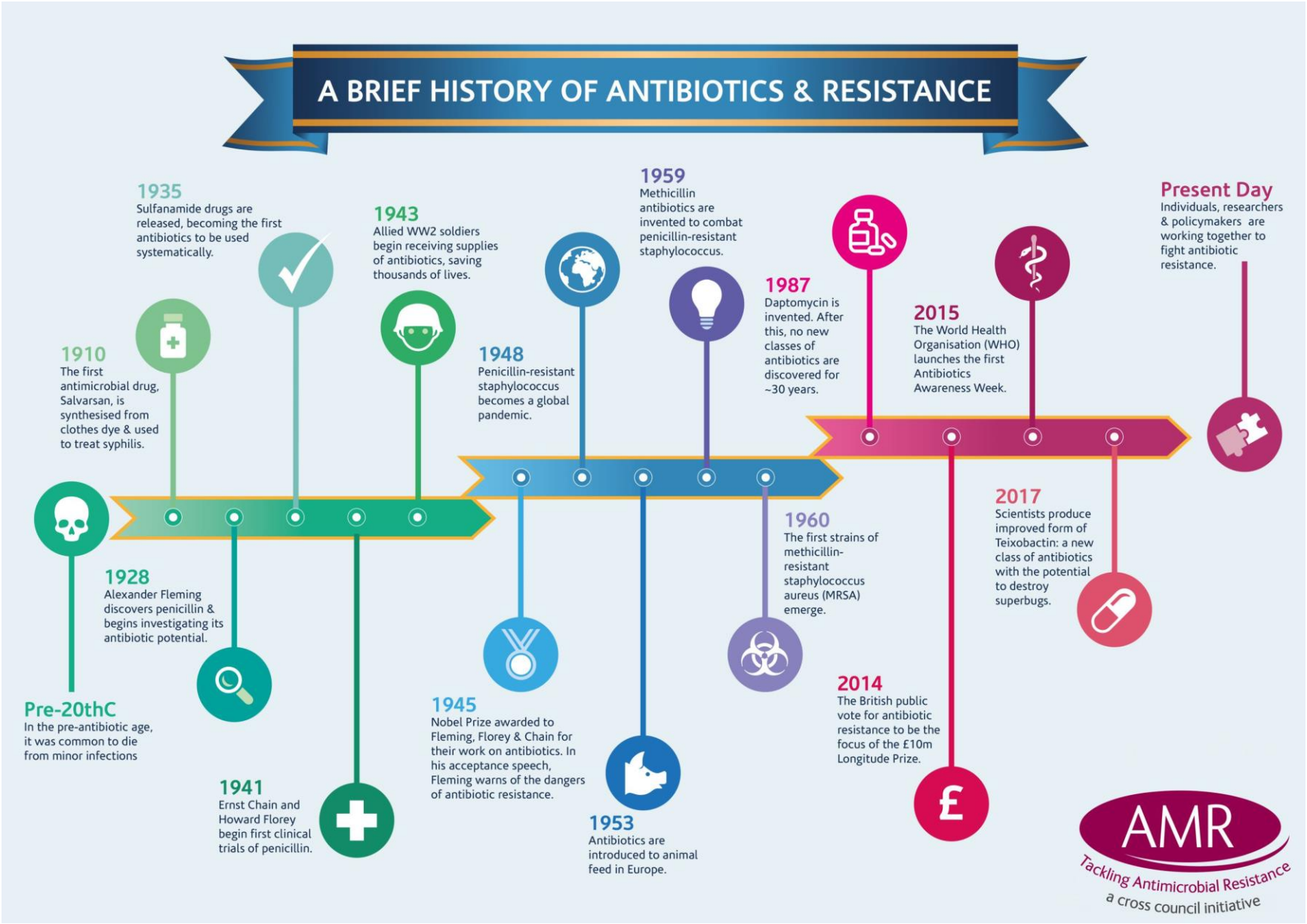
against fungi, e.g. drugs for yeast infections

- Antibiotics are medicines which disrupt essential structures or processes in bacteria. This in turn either kills the bacteria or stops them from multiply



- Bacteria have in turn evolved many antibiotic resistance mechanisms to withstand the actions of antibiotics.



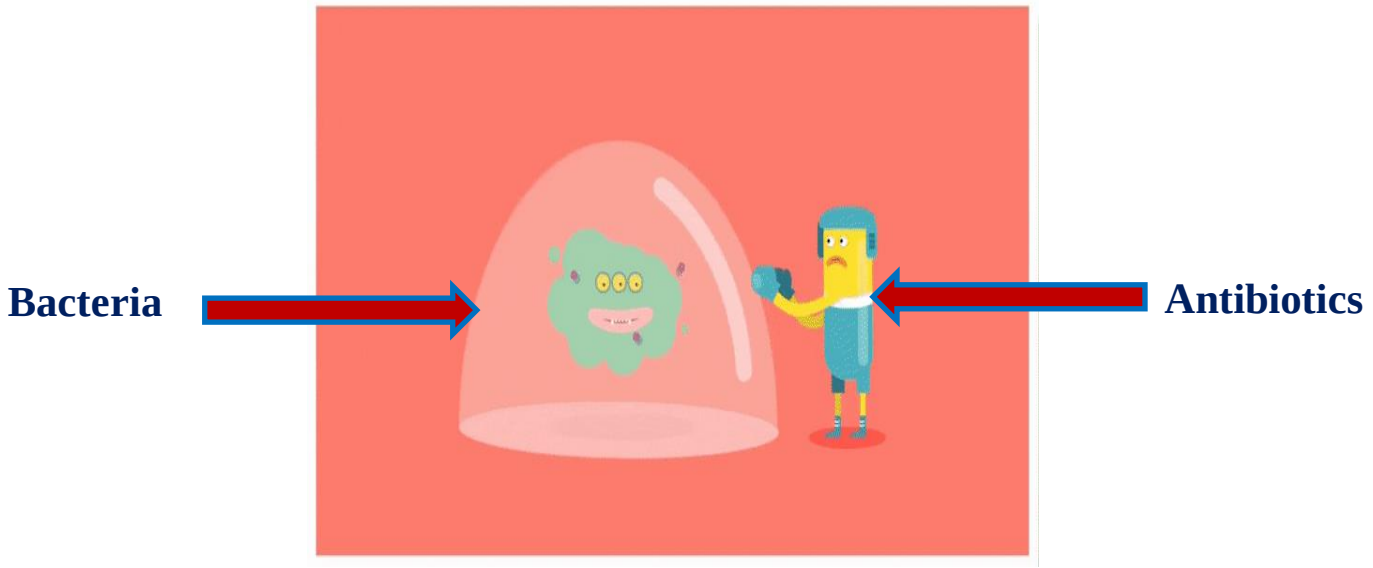


Source: UK Research & Innovation

How bacteria resist antibiotics

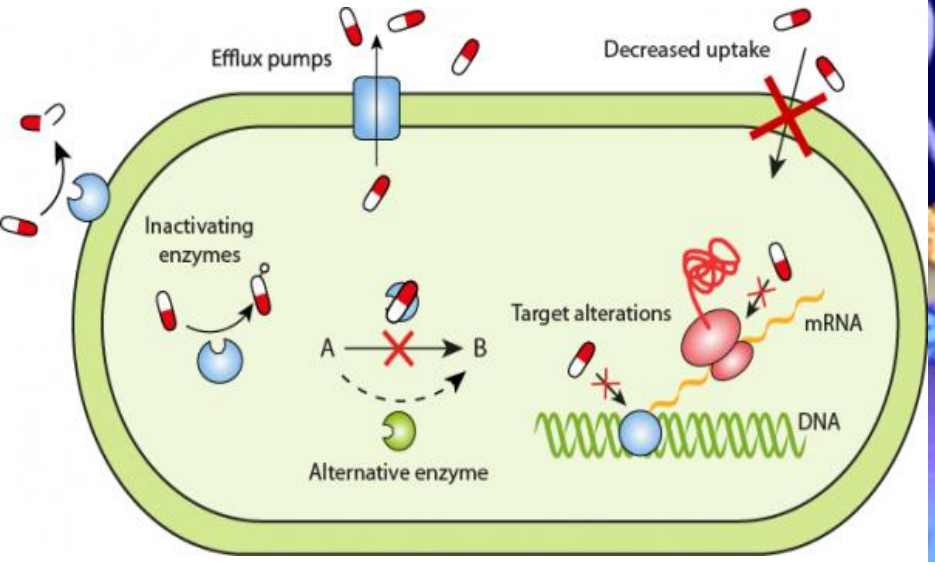
There are two main ways for bacteria to withstand the effects of an antibiotic:

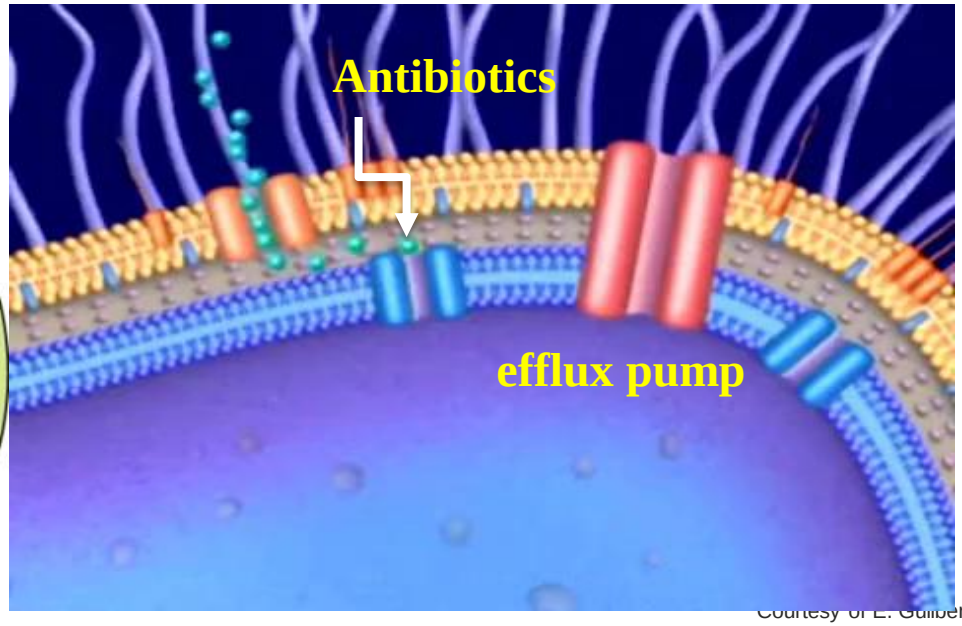
- To stop the antibiotic from reaching its target at a high enough concentration.



- Allow the microorganisms to regulate their internal environment by removing toxic substances called **efflux pumps.** In bacteria it can transport a variety of compounds such as signal molecules and nutrients.
- Some of these **pumps can also transport antibiotics out from the bacterium**, in this way lowering the antibiotic concentration inside the bacterial cell

- **Decrease permeability**
- bacterial membrane make it more difficult to pass through
- less of the antibiotic gets into the bacteria
- bacterial enzymes that can inactivate or destroy antibiotics.
- β-lactamase that destroys the active component (the β-lactam ring) of penicillins
- prohibits binding between the antibiotic and its target in the bacterial cell

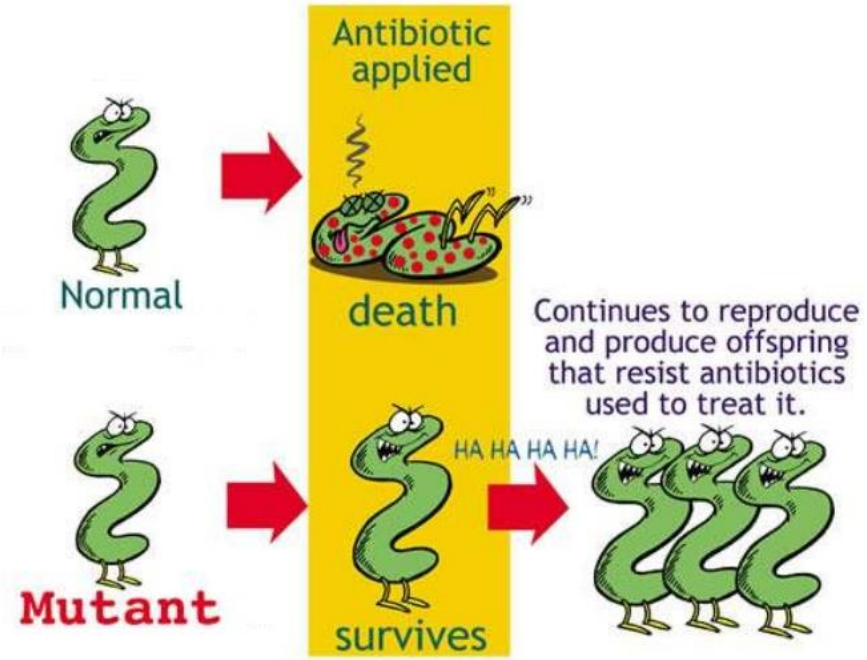




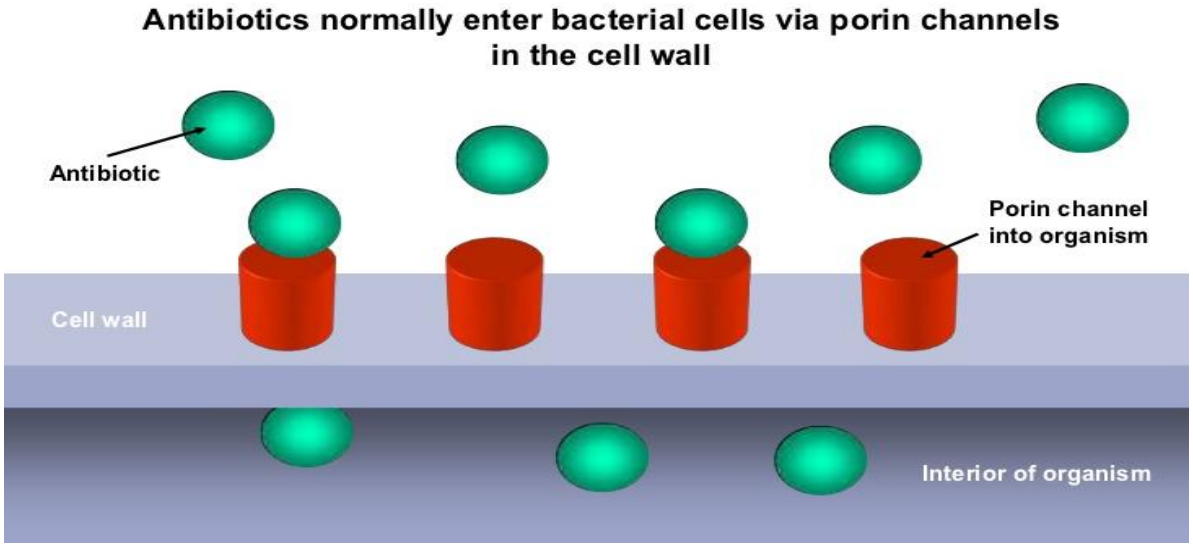
Courtesy of E. Gullberg

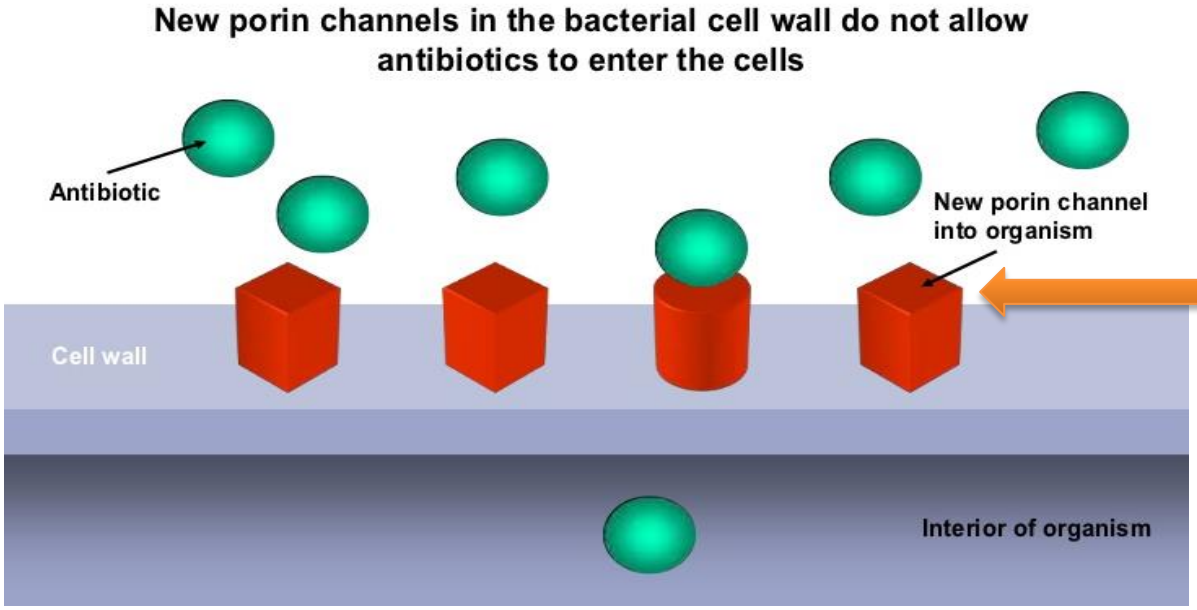
- To modify or bypass the target that the antibiotic acts on.

- Changes in the composition or structure of the target in the bacterium (resulting from mutations in the bacterial DNA) can stop the antibiotic from interacting with the target.

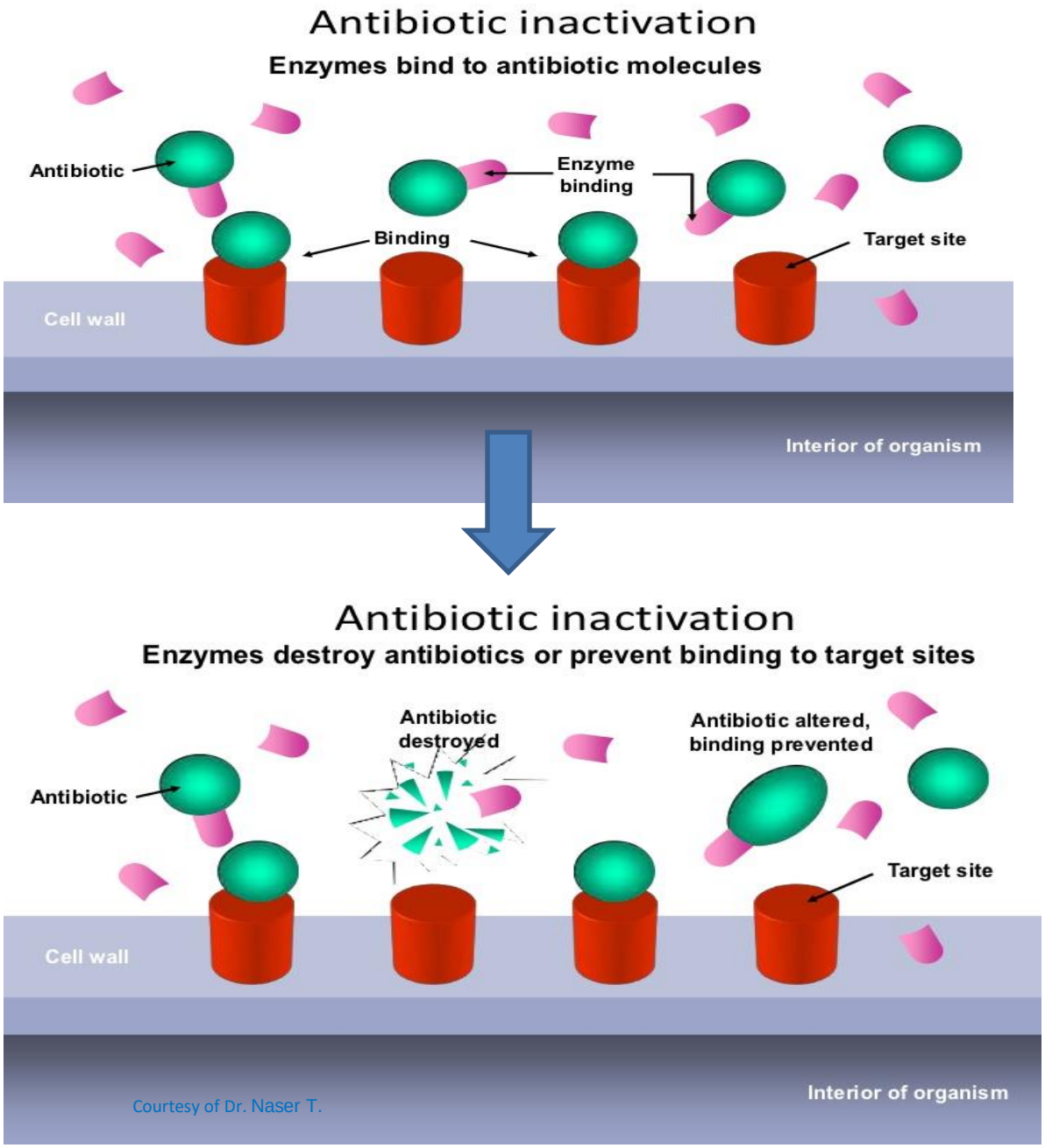


Antibiotic resistance mechanisms





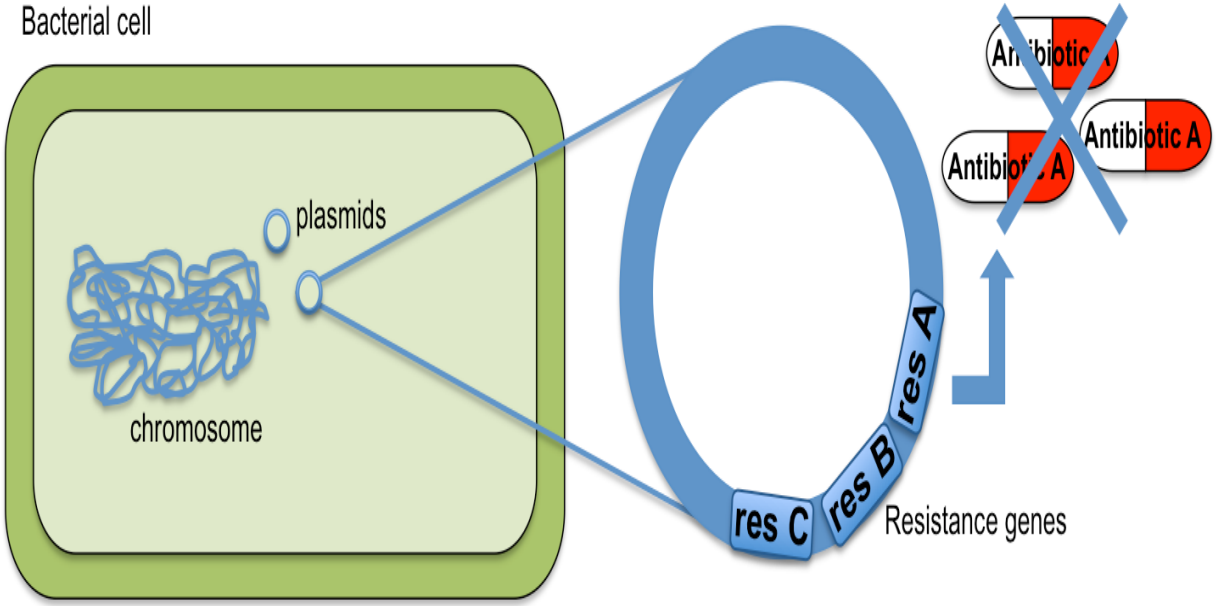
Bacteria can develop resistance through mutations in the porin gene



Courtesy of Dr. Naser T.

Multi Drug Resistance

- Plasmids are small DNA circles outside the bacterial chromosome.
- Several antibiotic resistance genes called res A, res B and res C.
- Res A gives resistance to antibiotic A, res B to antibiotic B and so on. Adding antibiotic A (or antibiotic B or C) will select for all three resistance genes since they are on the same plasmid.



Courtesy Dr. Woerther

Thank You