

Discovery of penicillin

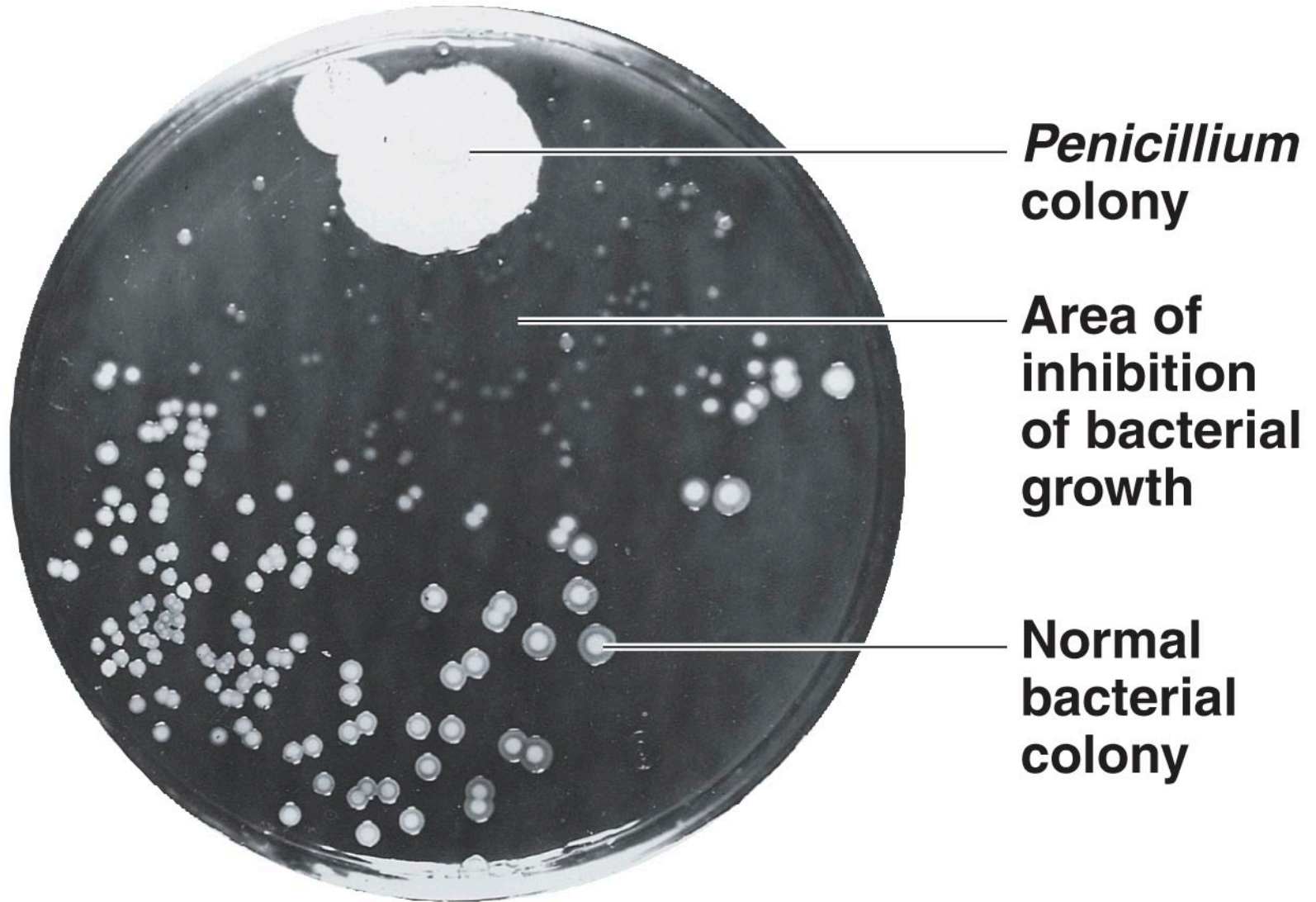


Table 20.1	Representative Sources of Antibiotics	
	Microorganism	Antibiotic
	Gram-Positive Rods	
	<i>Bacillus subtilis</i>	Bacitracin
	<i>Paenibacillus polymyxa</i>	Polymyxin
	Actinomycetes	
	<i>Streptomyces nodosus</i>	Amphotericin B
	<i>Streptomyces venezuelae</i>	Chloramphenicol
	<i>Streptomyces aureofaciens</i>	Chlortetracycline and tetracycline
	<i>Saccharopolyspora erythraea</i>	Erythromycin
	<i>Streptomyces fradiae</i>	Neomycin
	<i>Streptomyces griseus</i>	Streptomycin
	<i>Micromonospora purpurea</i>	Gentamicin
	Fungi	
	<i>Cephalosporium</i> spp.	Cephalothin
	<i>Penicillium griseofulvum</i>	Griseofulvin
	<i>Penicillium chrysogenum</i>	Penicillin

ADRIAMYCIN, ONE OF OUR MOST POTENT CHEMOTHERAPY DRUGS, COMES FROM THE DIRT FROM AN ITALIAN CASTLE.



MY HOBBY:

BREAKING INTO AIRPLANE HANGARS AND REPLACING
THE ADS ON THEIR GIANT BANNERS WITH COOL FACTS

xkcd.com/1355

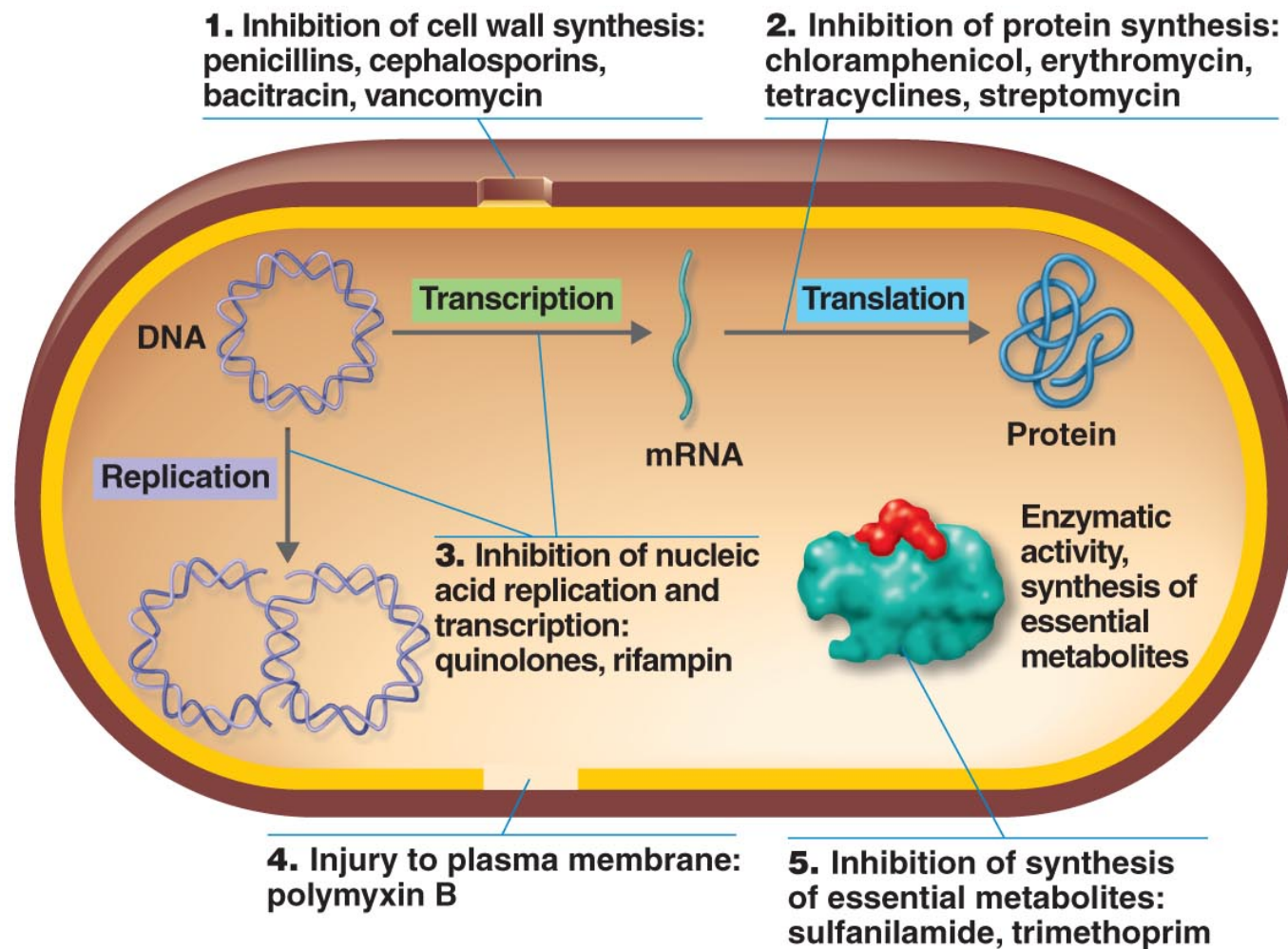


**Hans Rosling: “200 Countries...”
or “The River of Myths”**

Table 20.2 The Spectrum of Activity of Antibiotics and Other Antimicrobial Drugs

<i>Prokaryotes</i>				<i>Eukaryotes</i>			
<i>Mycobacteria*</i>	Gram-Negative Bacteria	Gram-Positive Bacteria	Chlamydias, Rickettsias[†]	Fungi	Protozoa	Helminths	Viruses
		Penicillin G ↔		Ketoconazole ↔		Niclosamide (tapeworms) ↔	
	Streptomycin ↔				Mefloquine (malaria) ↔		
							Acyclovir ↔
						Praziquantel (flukes) ↔	
			Tetracycline ↔				
Isoniazid ↔							

*Growth of these bacteria frequently occurs within macrophages or tissue structures.
[†]Obligately intracellular bacteria.



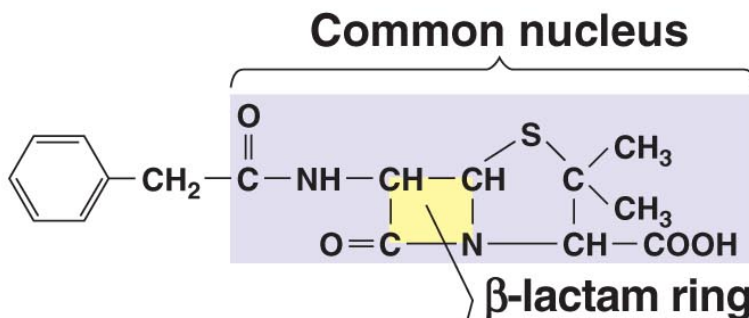
Key Concept

Antimicrobial drugs function in one of the following five ways: inhibiting cell wall synthesis, inhibiting protein synthesis, inhibiting nucleic acid synthesis, injuring the plasma membrane, or inhibiting synthesis of essential metabolites.

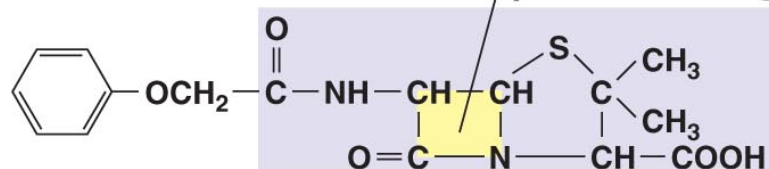
Penicillins

(a) Natural penicillins

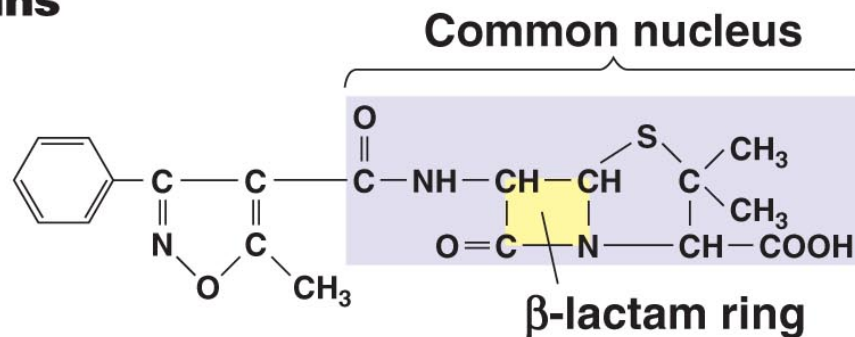
Penicillin G (requires injection)



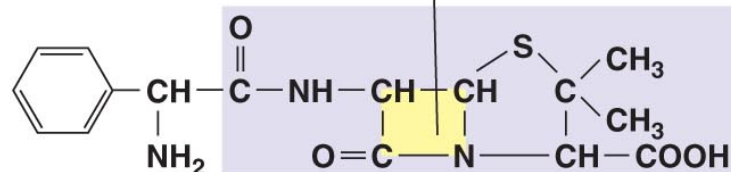
Penicillin V (can be taken orally)

**(b) Semisynthetic penicillins**

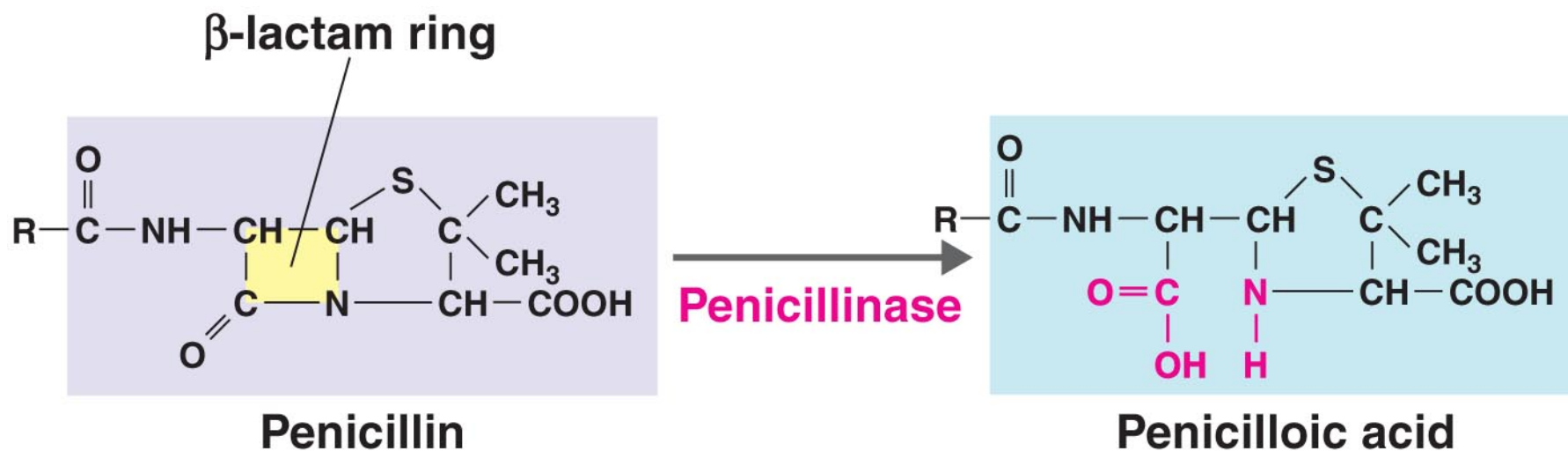
Oxacillin:
Narrow spectrum, only
gram-positives, but resistant
to penicillinase



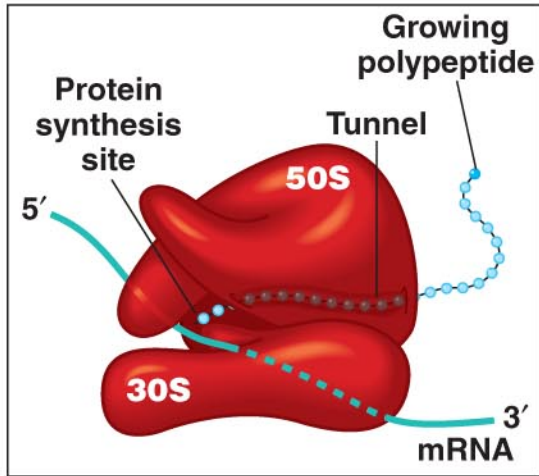
Ampicillin:
Extended spectrum,
many gram-negatives



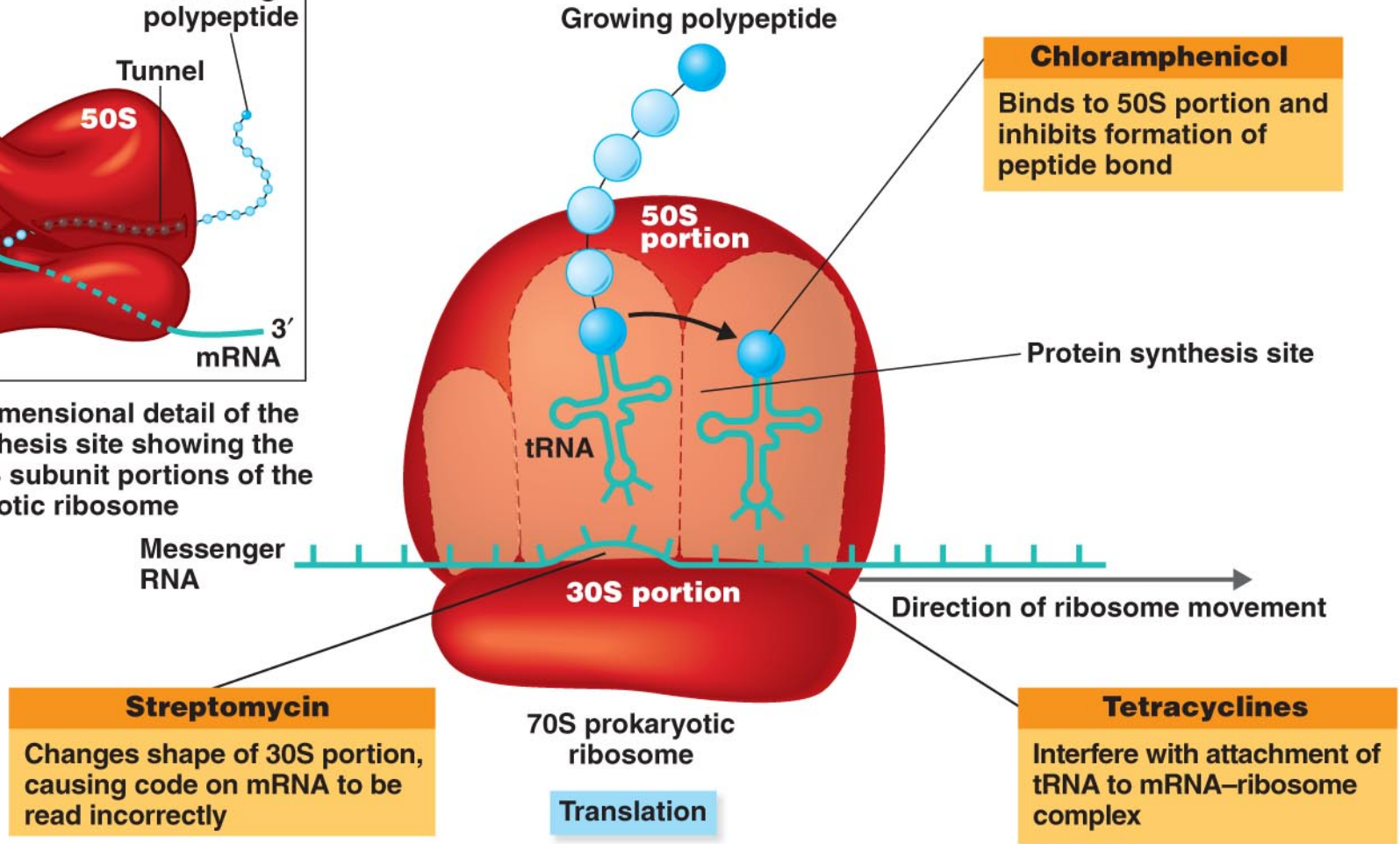
Activity of penicillinase



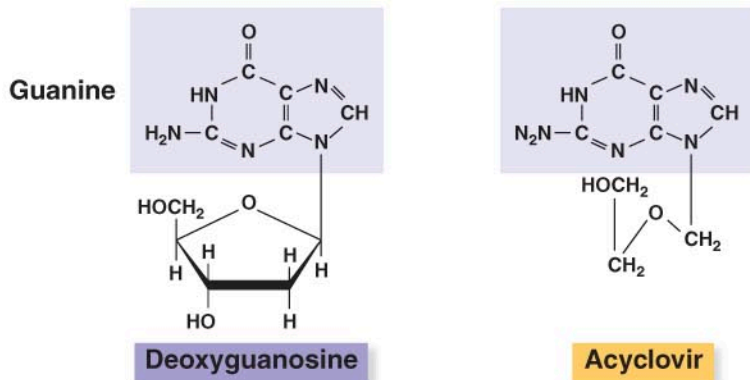
Inhibitors of protein synthesis



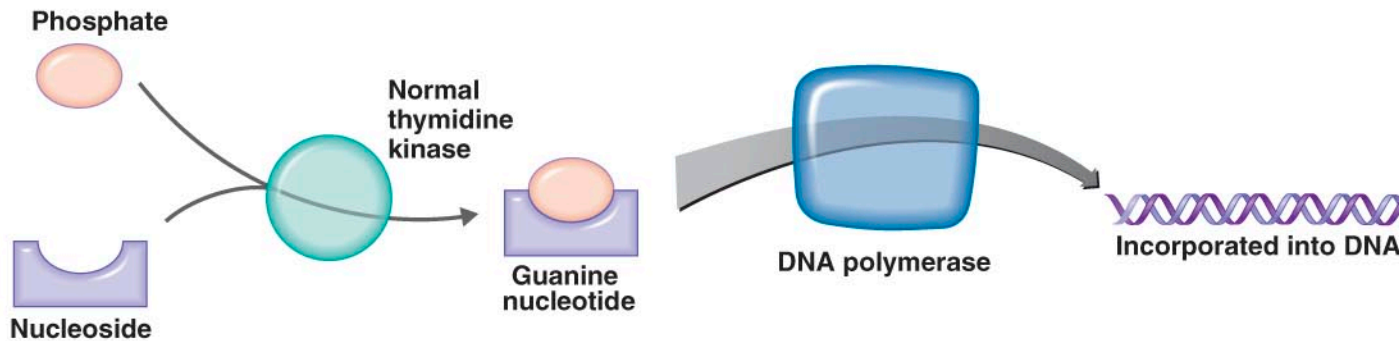
(a) Three-dimensional detail of the protein synthesis site showing the 30S and 50S subunit portions of the 70S prokaryotic ribosome



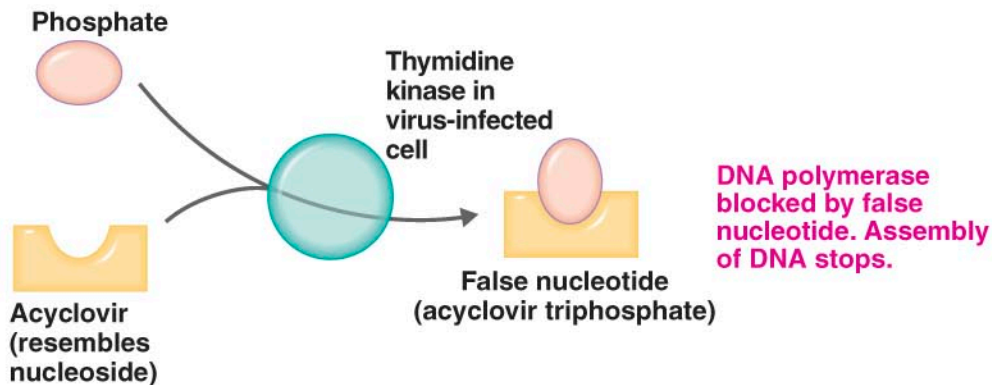
(b) Diagram indicating the different points at which chloramphenicol, the tetracyclines, and streptomycin exert their activities



(a) Acyclovir structurally resembles the nucleoside deoxyguanosine.

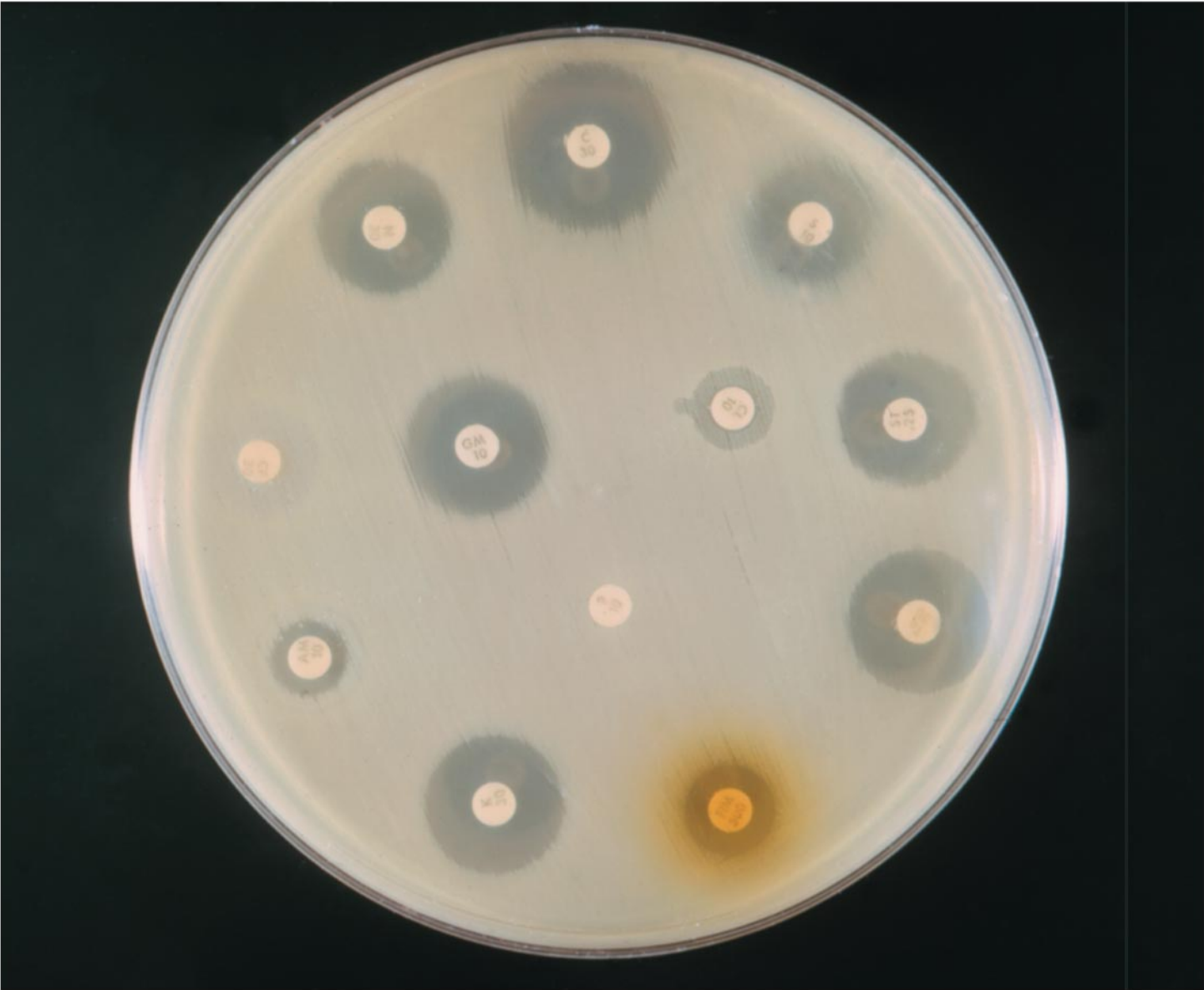


(b) The enzyme thymidine kinase combines phosphates with nucleosides to form nucleotides, which are then incorporated into DNA.

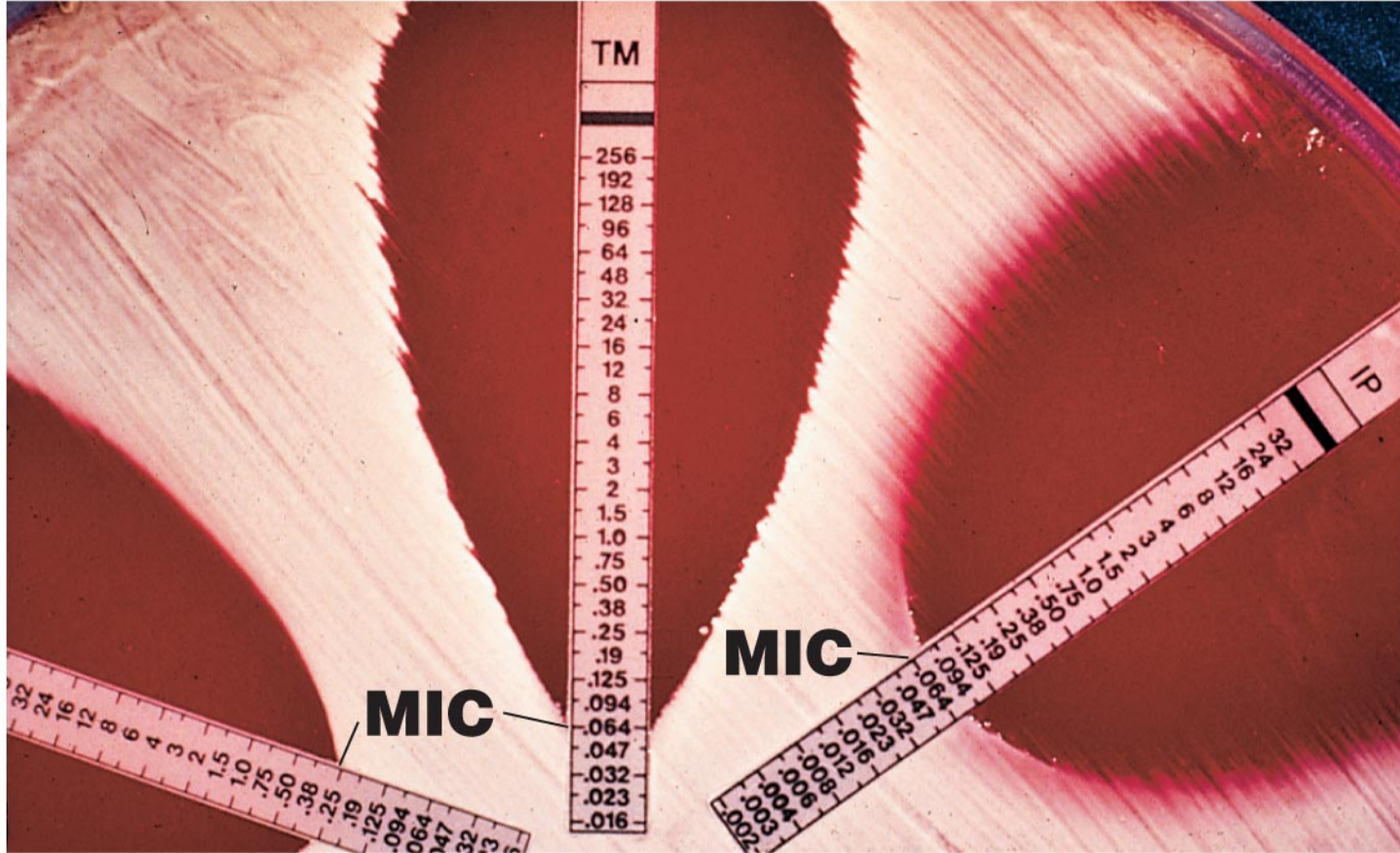


(c) Acyclovir has no effect on a cell not infected by a virus, that is, with normal thymidine kinase. In a virally infected cell, the thymidine kinase is altered and converts the acyclovir (which resembles the nucleoside deoxyguanosine) to a false nucleotide, which blocks DNA synthesis by DNA polymerase.

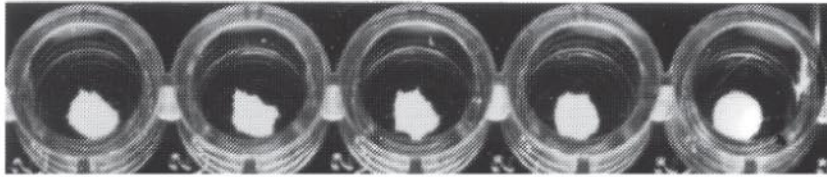
Kirby-Bauer / Disk-diffusion



E-test



Broth dilution tests



Doxycycline
(Growth in all wells, resistant)



Sulfamethoxazole
(Trailing end point; usually read where there is an estimated 80% reduction in growth)



Streptomycin
(No growth in any well; sensitive at all concentrations)



Ethambutol

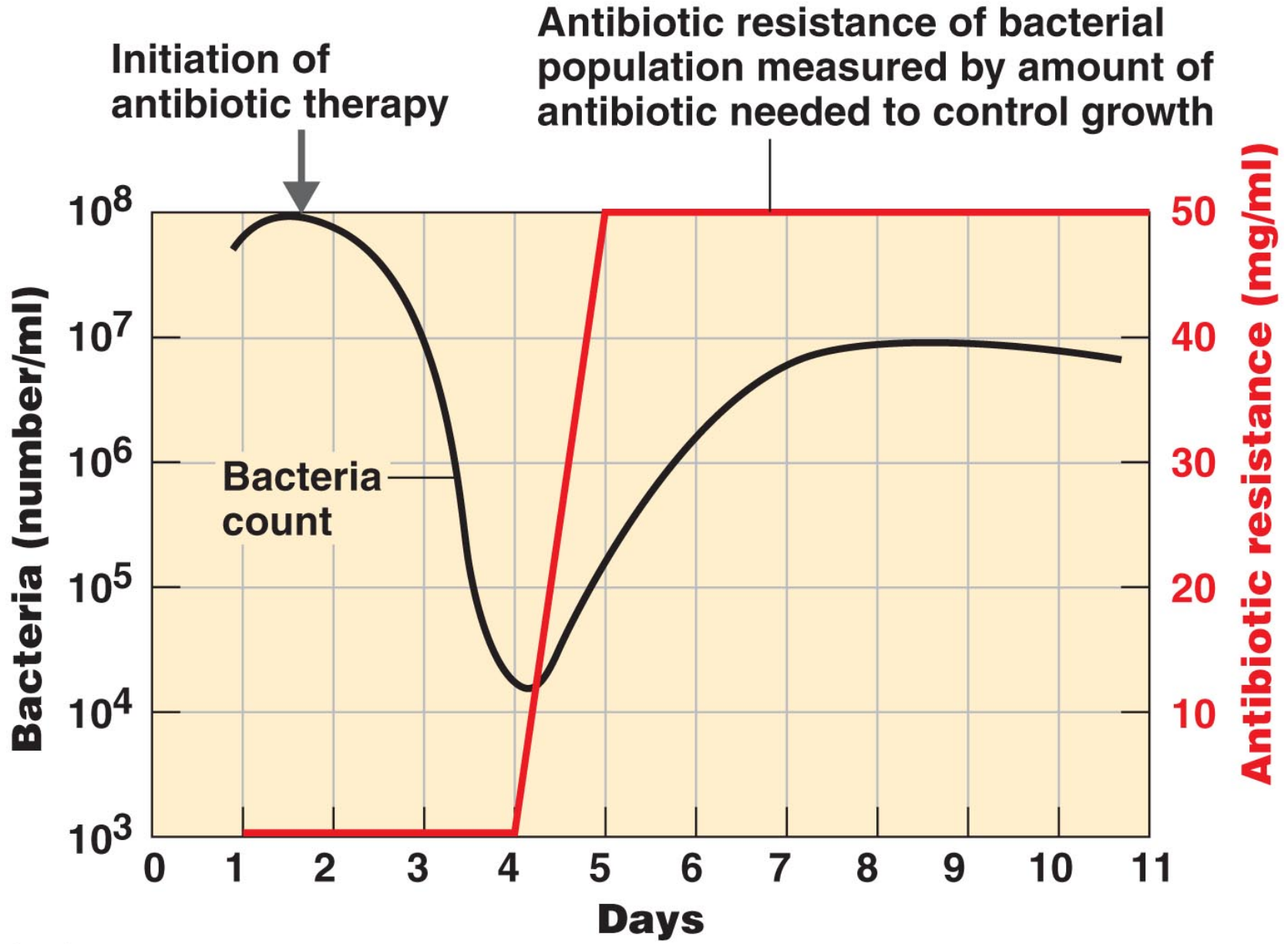
(Growth in fourth wells;
equally sensitive to
ethambutol and kanamycin)



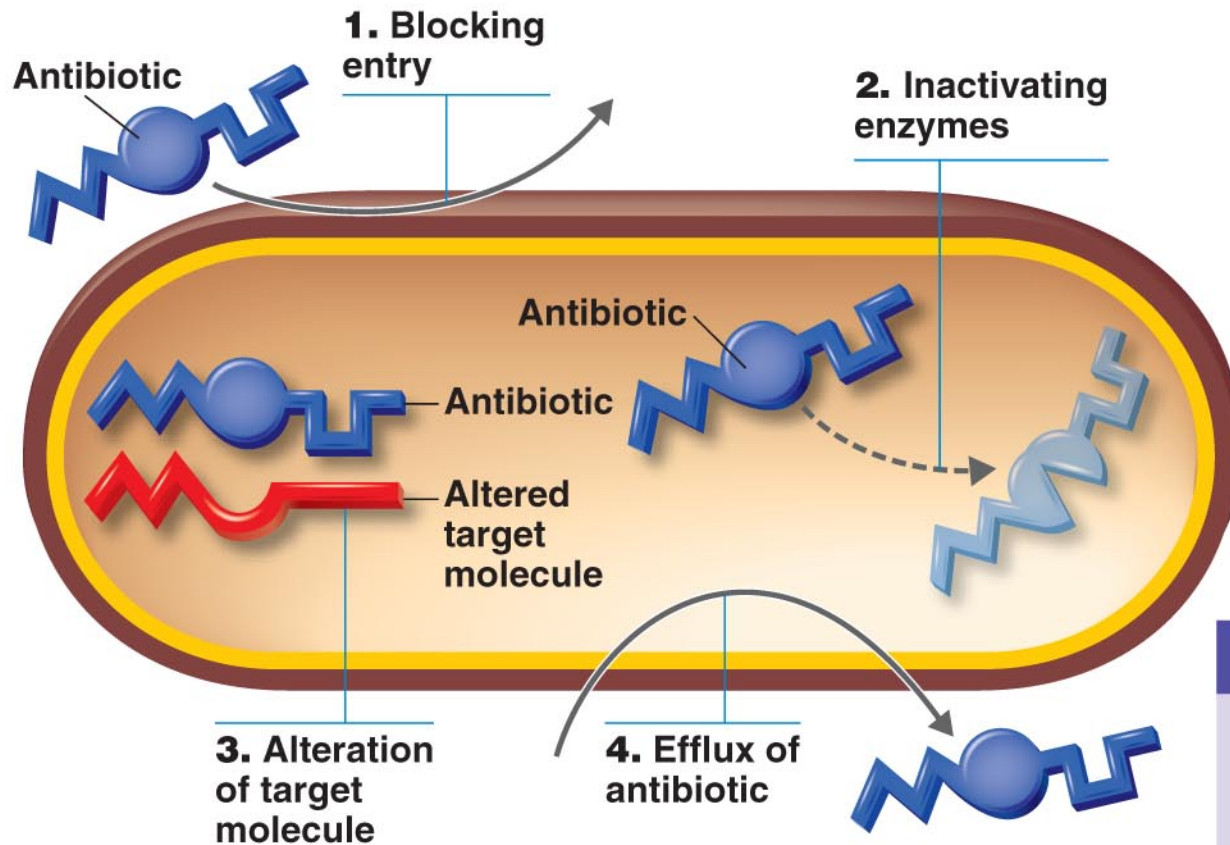
Kanamycin

Decreasing concentration of drug →

Development of resistance in population



Mechanisms of resistance

**Key Concept**

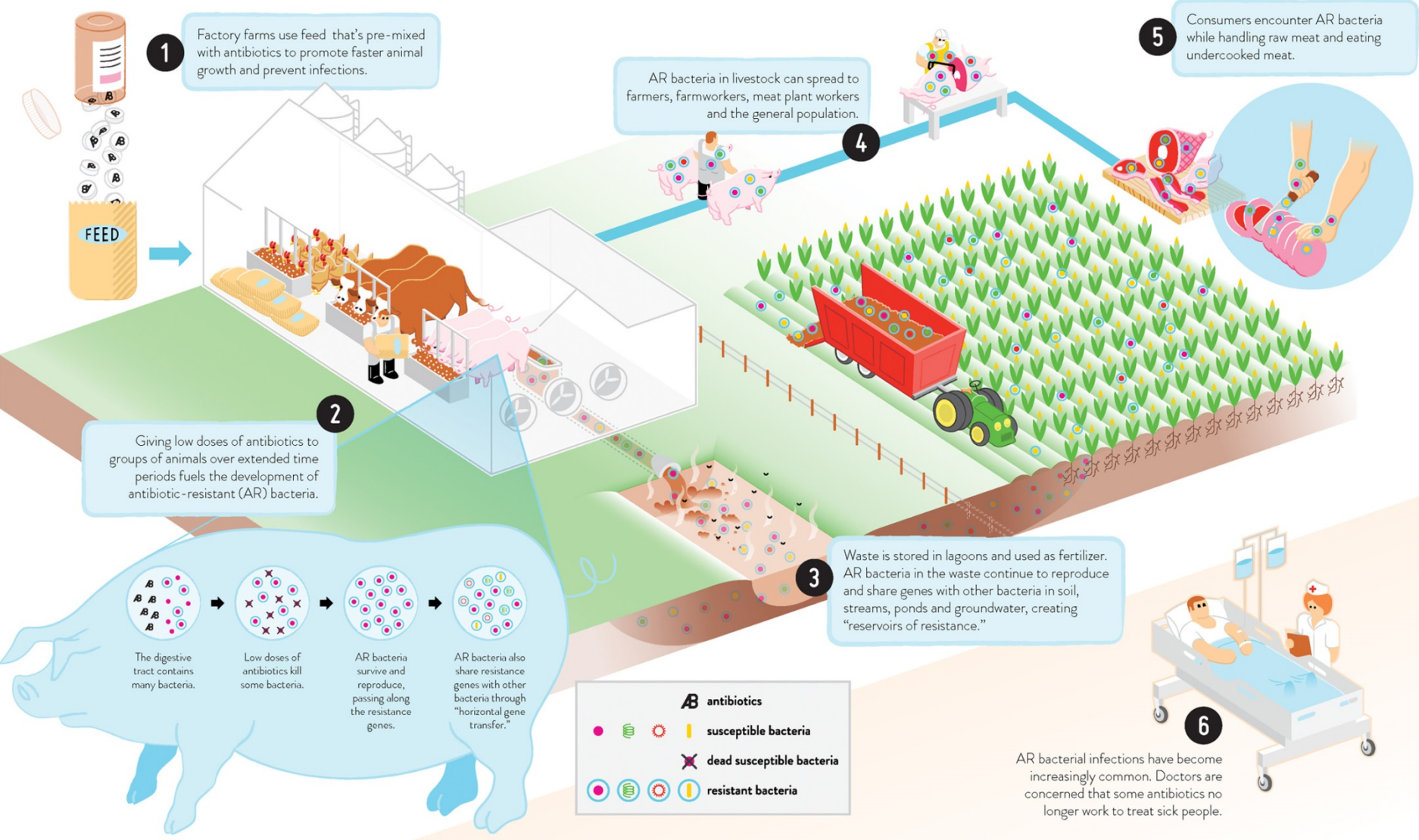
The four main mechanisms of microbial resistance to antimicrobial agents are blocking entry of the drug into the cell, inactivation of the drug by enzymes, alteration of the drug's target sites, and efflux of the drug from the cell.

Antibiotic misuse

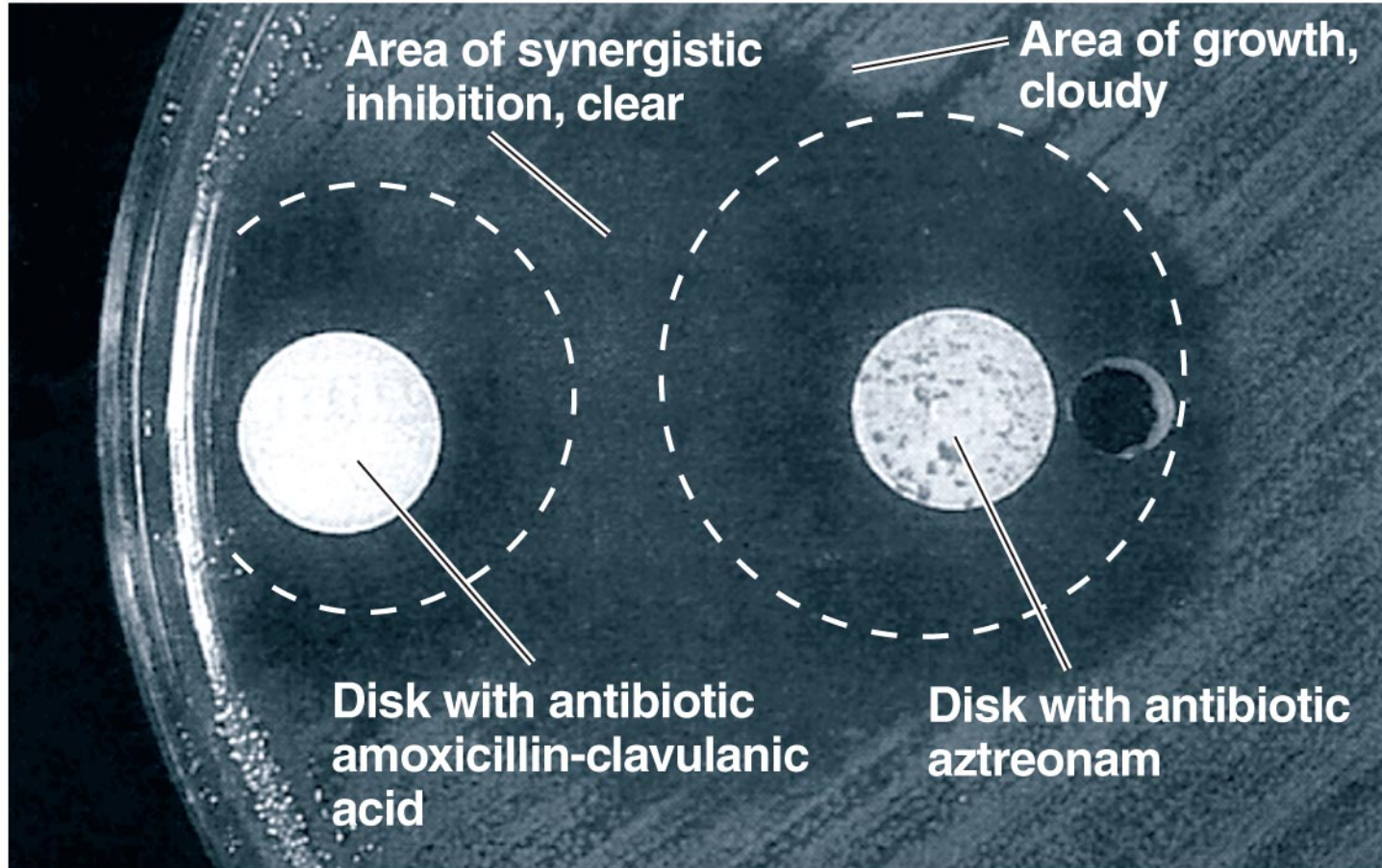


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How Antibiotic Misuse on Factory Farms Can Make You Sick



Drug combinations

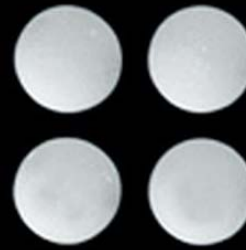




Yellow pills make the most effective antidepressants, like little doses of pharmaceutical sunshine.



Red pills can give you a more stimulating kick. Wake up, Neo.



More is better, scientists say. Placebos taken four times a day deliver greater relief than those taken twice daily.



Branding matters. Placebos stamped or packaged with widely recognized trademarks are more effective than "generic" placebos.



The color green reduces anxiety, adding more chill to the pill.



White tablets—particularly those labeled "antacid"—are superior for soothing ulcers, even when they contain nothing but lactose.



Clever names can add a placebo boost to the physiological punch in real drugs. *Viagra* implies both vitality and an unstoppable Niagara of sexy.