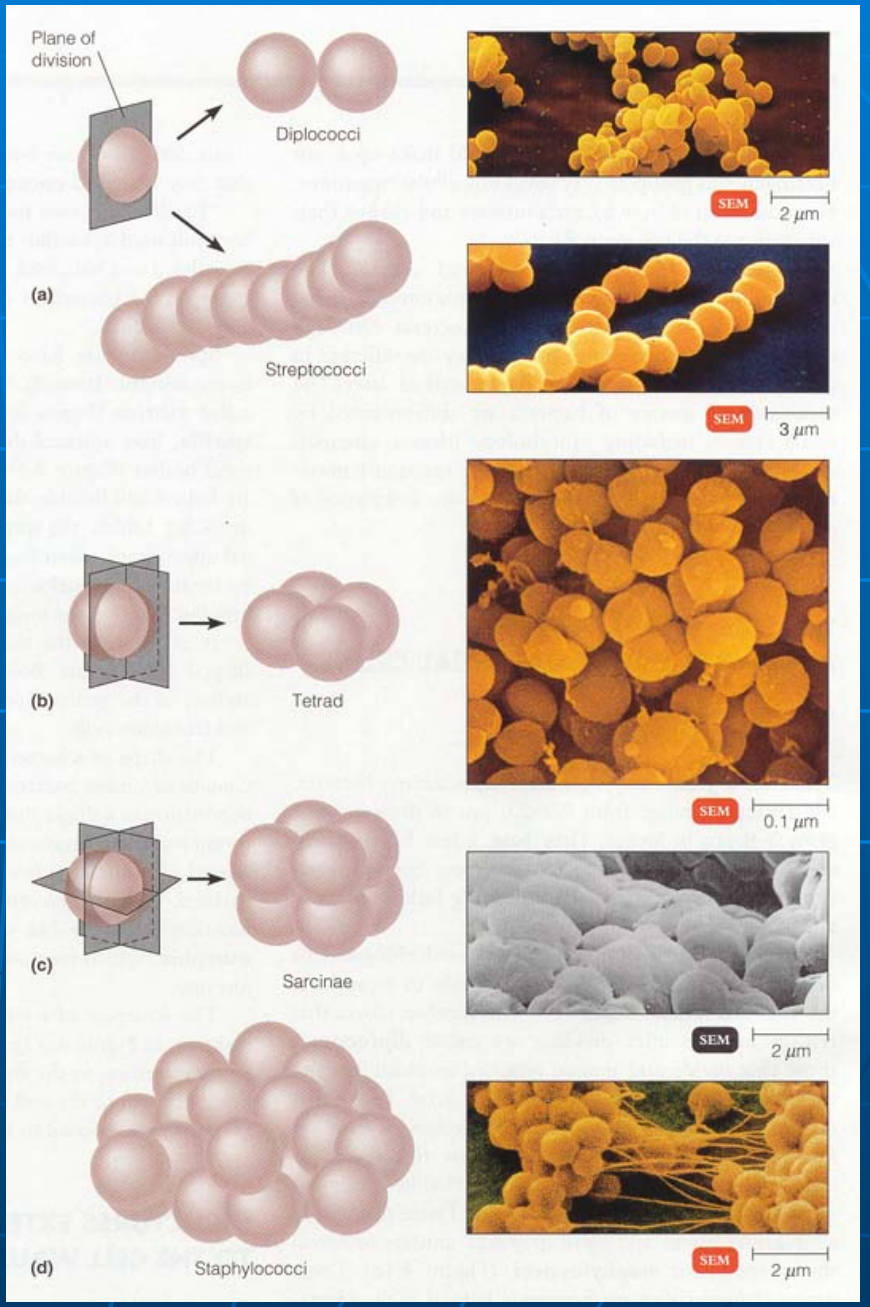
"Principles of Infectious Disease"

Dr. Ezra Levy
CSUHS MSPA Program

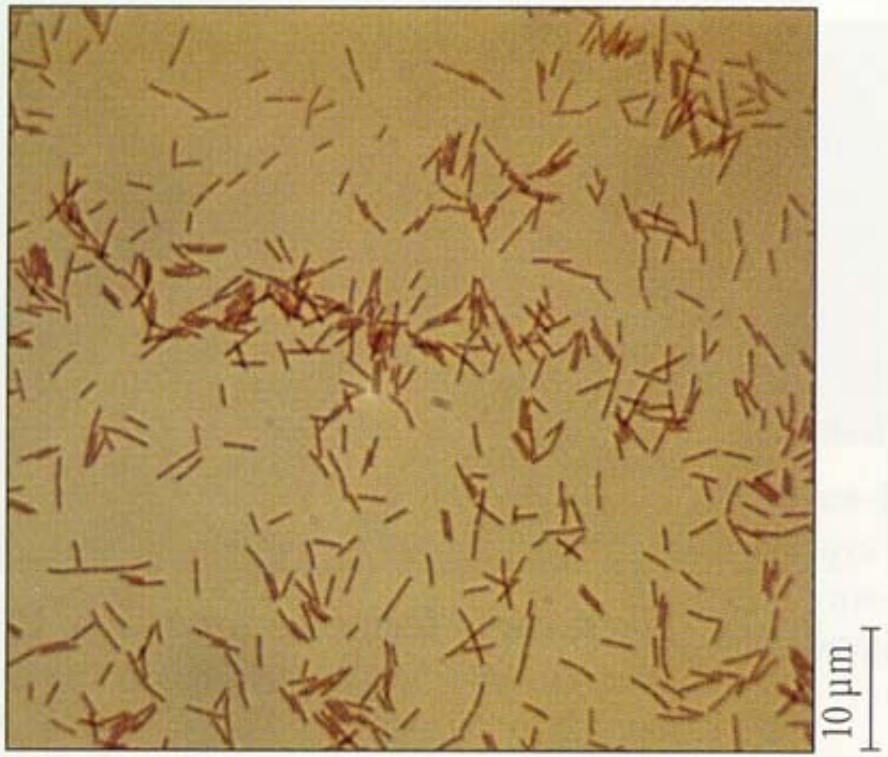
I. Microbiology

(1) morphology (e.g., cocci, bacilli)

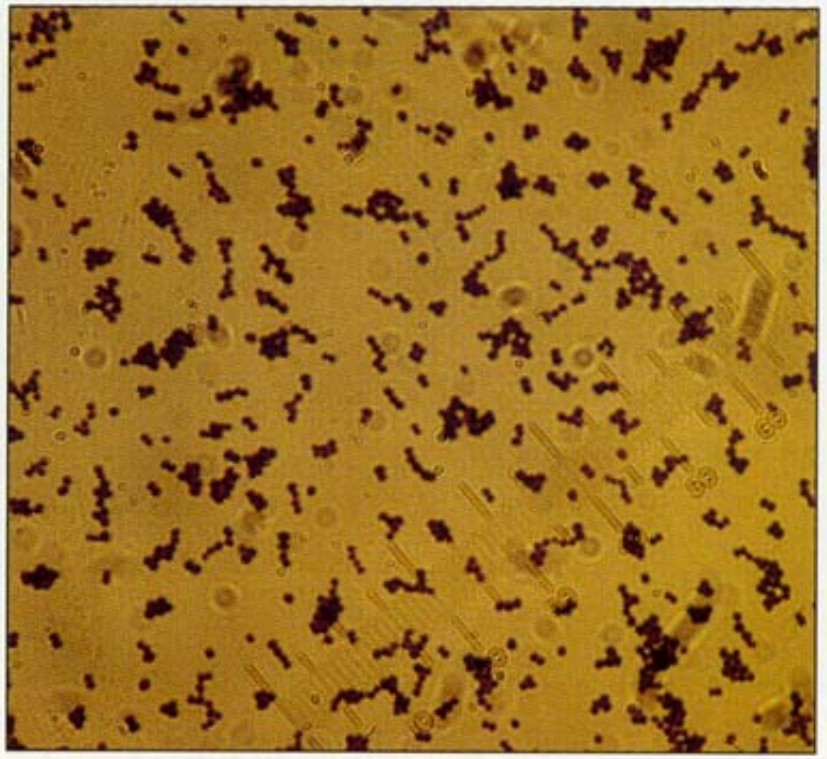
(2) growth characteristics (e.g., aerobic vs anaerobic)



(3) other qualities (e.g., Gram's stain positive or Gram's stain negative)

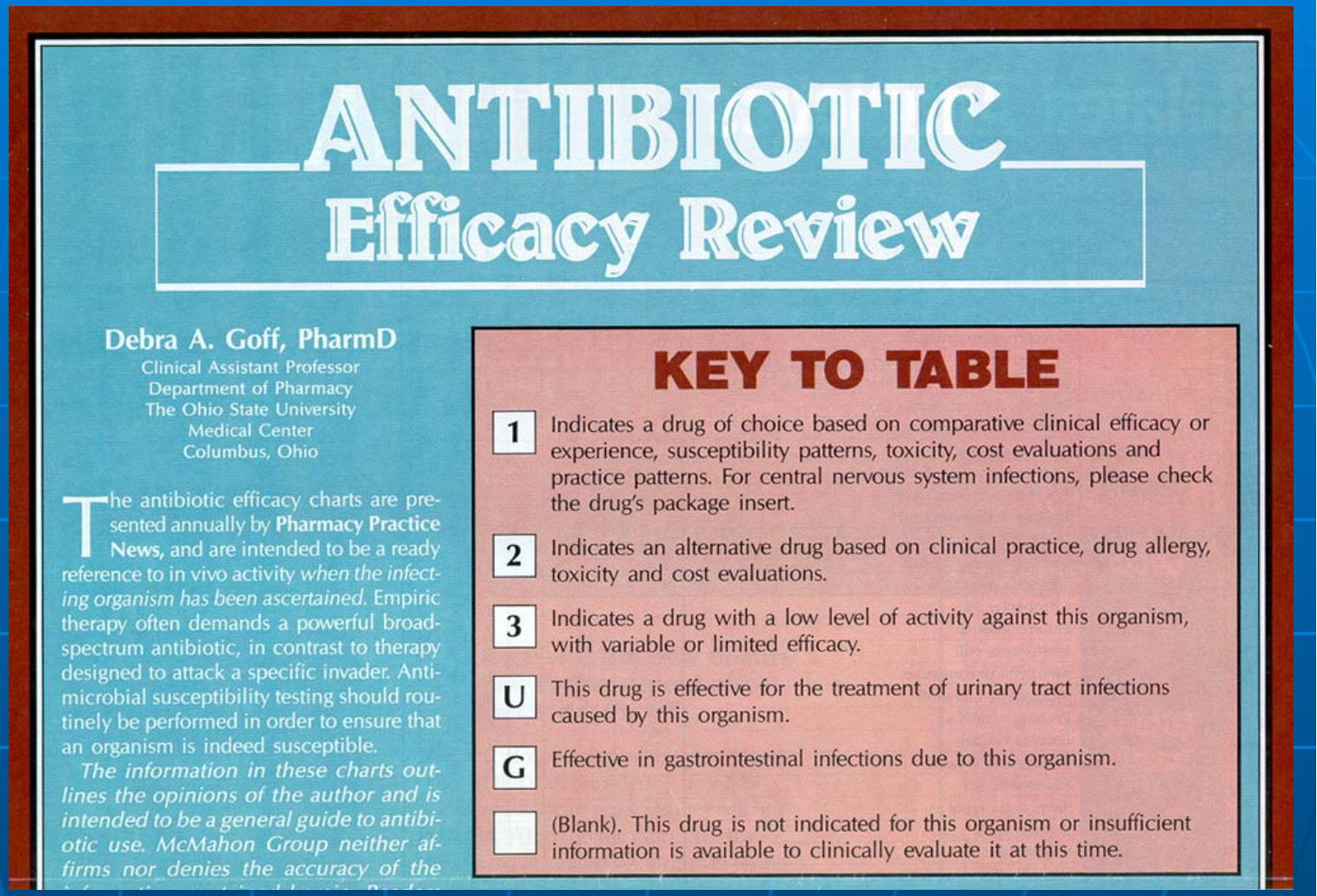


I.1 Gram-negative rods.
Escherichia coli



I.2 Gram-positive cocci. *Staphylococcus aureus*

Choice of Antimicrobial Therapy



ANTIBIOTIC Efficacy Review

Debra A. Goff, PharmD
Clinical Assistant Professor
Department of Pharmacy
The Ohio State University
Medical Center
Columbus, Ohio

The antibiotic efficacy charts are presented annually by **Pharmacy Practice News,** and are intended to be a ready reference to in vivo activity *when the infecting organism has been ascertained.* Empiric therapy often demands a powerful broad-spectrum antibiotic, in contrast to therapy designed to attack a specific invader. Antimicrobial susceptibility testing should routinely be performed in order to ensure that an organism is indeed susceptible.

The information in these charts outlines the opinions of the author and is intended to be a general guide to antibiotic use. McMahon Group neither affirms nor denies the accuracy of the

KEY TO TABLE

1	Indicates a drug of choice based on comparative clinical efficacy or experience, susceptibility patterns, toxicity, cost evaluations and practice patterns. For central nervous system infections, please check the drug's package insert.
2	Indicates an alternative drug based on clinical practice, drug allergy, toxicity and cost evaluations.
3	Indicates a drug with a low level of activity against this organism, with variable or limited efficacy.
U	This drug is effective for the treatment of urinary tract infections caused by this organism.
G	Effective in gastrointestinal infections due to this organism.
	(Blank). This drug is not indicated for this organism or insufficient information is available to clinically evaluate it at this time.

- based on the morphology and growth patterns of microorganisms

Penicillins & Related Antibiotics

				β-LACTAMASE-SUSCEPTIBLE								β-LACTAMASE-RESISTANT									
				Nonantipseudomonal				Antipseudomonal				Antistaphylococcal					Others				
				AMOXICILLIN	AMPICILLIN	PENICILLIN G	PENICILLIN V	AZLOCILLIN	MEZLOCILLIN[e]	PIPERACILLIN[e]	TICARCILLIN[e]	CLOXACILLIN	DICLOXACILLIN	METHICILLIN	NAFCILLIN	OXACILLIN	AMOXICILLIN/CLAVULANATE	AMPICILLIN/SULBACTAM	PIPERACILLIN/TAZOBACTAM	TICARCILLIN/CLAVULANATE	AZTREONAM	IMIPENEM/CILASTATIN (CARBAPENEM)
GRAM-POSITIVE AEROBES	Cocci	Staphylococcus aureus:	non-penicillinase-producing	2	2	1	1		3	3	3	2	2	2	2	2	2	2	2	2	2
			penicillinase-producing									1	1	1	1	1	2	2	2	2	2
			methicillin-resistant[a]																		
		Staphylococcus epidermidis:	non-penicillinase-producing	2	2	1	1		3	3	3	2	2	2	2	2	2	2	2	3	2
			penicillinase-producing									1	1	1	1	1	2	2	2	2	2
			methicillin-resistant[a]																		
		Streptococcus group A (S. pyogenes)		2	2	1	1		2	2	2	3	3	3	3	3	2	2	2	2	2
		Streptococcus group B		1	1	1	1		1	1	2						2	2	2	2	
		Streptococcus group D:	enterococcal (eg, E. faecalis[b])		1	1	2		2	2							3	2	2		2
			nonenterococcal (eg, S. bovis)	2	2	1	1		3	3	3						2	2	3	3	
		Streptococcus pneumoniae		2	2	1	1		2	2	3						2	2	2	3	2
		Streptococcus viridans		2	2	1	1		3	3	3	3	3	3	3	3	2	2	3	3	
	Bacilli	Bacillus anthracis				1	1														
		Corynebacterium diphtheriae[c]				2	2														
		Corynebacterium jeikeium																			
		Listeria monocytogenes[d]			1	1											2	2			

Cephalosporins

				1st GENERATION						2nd GENERATION								3rd GENERATION									4th GEN
				CEFADROXIL	CEFAZOLIN	CEPHALEXIN	CEPHALOTHIN	CEPHAPIRIN	CEPHRADINE	CEFACLOR	CEFAMANDOLE	CEFMETAZOLE	CEFONICID	CEFOTETAN	CEFOXITIN	CEFUROXIME	CEFUROXIME AXETIL	CEFIXIME	CEFOPERAZONE	CEFOTAXIME	CEFPODOXIME PROXETIL	CEFPROZIL	CEFTAZIDIME	CEFTIZOXIME	CEFTRIAXONE	LORACARBEF	CEFEPIME
GRAM-POSITIVE AEROBES	Cocci	Staphylococcus aureus:	non-penicillinase-producing	1	1	1	1	1	1	2	2	2	3	3	2	2	2		2	2	2	2	3	2	2	2	2
			penicillinase-producing	1	1	1	1	1	1	2	2	2	3	3	2	2	2		2	2	2	2	3	2	2	3	2
			methicillin-resistant[a]																								
		Staphylococcus epidermidis:	non-penicillinase-producing	1	1	1	1	1	1	2	2	3	3	3	3	2	2		3	2	2	2	3	2	2	2	2
			penicillinase-producing	1	1	1	1	1	1	2	2	3	3	3	3	2	2		3	2	2		3	2	2	3	2
			methicillin-resistant[a]																								
		Streptococcus group A (S. pyogenes)		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2
		Streptococcus group B		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2
		Streptococcus group D:	enterococcal (eg, E. faecalis[b])																								
			nonenterococcal (eg, S. bovis)	2	2	2	2	2	2	2	2	2	2	2	2	2			2	2	2	3	3	2	2	2	2
		Streptococcus pneumoniae		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2
		Streptococcus viridans		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	
	Bacilli	Bacillus anthracis																									
		Corynebacterium diphtheriae[c]																									
		Corynebacterium jeikeium																									
		Listeria monocytogenes[d]																									

Aminoglycosides, Macrolides, Quinolones & Other Antibiotics

			AMINOGLYCOSIDES					MACROLIDES			QUINOLONES					OTHER ANTIBIOTICS								UTI AGENTS	
			AMIKACIN	GENTAMICIN	NETILMICIN	STREPTOMYCIN	TOBRAMYCIN	AZITHROMYCIN	CLARITHROMYCIN	ERYTHROMYCIN	CIPROFLOXACIN[o,p]	ENOXACIN[o,p,q]	LOMEFLOXACIN[o,p]	NORFLOXACIN[o,p,q]	OFLOXACIN[o,p]	CHLORAMPHENICOL	CLINDAMYCIN	METRONIDAZOLE	RIFAMPIN[r]	SULFONAMIDES	TETRACYCLINES[o,s]	TRIMETHOPRIM–SULFAMETHOXAZOLE	VANCOMYCIN	NITROFURANTOIN	NITROFURANTOIN
GRAM-POSITIVE AEROBES	Cocci	Staphylococcus aureus: non-penicillinase-producing		3			3	2	2	2	2		2	U	2		2		2		3	2	2	U	U
		Staphylococcus aureus: penicillinase-producing		3			3	2	2	2	2		2	U	2		2		2		3	2	2		
		Staphylococcus aureus: methicillin-resistant[a]		2							3		3	U	3				2			2	1		
		Staphylococcus epidermidis: non-penicillinase-producing		3			3				2	U	2	U	2		2		2			2	2		
		Staphylococcus epidermidis: penicillinase-producing		2							2	U	2	U	2		2		2			2	2		
		Staphylococcus epidermidis: methicillin-resistant[a]		2							3		3	U	3				2			2	1		
		Streptococcus group A (S. pyogenes)						2	2	2	3		3		3		2						2		
		Streptococcus group B						2	2	2	3		3	U	3		2				2		2	U	U
		Streptococcus group D: enterococcal (eg, E. faecalis[b])	3	1	2	2								U									1	U	U
		Streptococcus group D: nonenterococcal (eg, S. bovis)	3	3		3	3				3		3	U	3		3						2	U	U
		Streptococcus pneumoniae						2	2	2	3		3		3	2	2				2	2	2		
		Streptococcus viridans						2	2	2	3		3		3		3				2		2		
	Bacilli	Bacillus anthracis							2	2											2				
		Corynebacterium diphtheriae[c]								1							3		3						
		Corynebacterium jeikeium	2	2	2		2			2	3		3		3								1		
		Listeria monocytogenes[d]	2	2	2		2	2	2	2						2					2	2			

II. Empirical Therapy

- empirical therapy is often based on a working knowledge of the most likely pathogens expected to be found at the site of infection
- certain organisms are predictably associated with infection at certain tissue sites and not in others
- certain host factors such as age, immunosuppression, prior antibiotic usage, and environment help to predict the most likely organism

SANFORD GUIDE

熱病

Twenty-sixth Edition

GUIDE TO ANTIMICROBIAL THERAPY

1996

Jay P. Sanford, MD
David N. Gilbert, MD
Merle A. Sande, MD

RAPID REFERENCE

ISBN-0-933775-26-1
L0112-596 PRINTED IN U.S.A.

ANTIMICROBIAL DRUG DOSAGE (continued)

	ADULTS		CHILDREN		USUAL INTERVAL
	ORAL Daily Dosage	PARENTERAL Daily Dosage	ORAL Daily Dosage	PARENTERAL Daily Dosage	Between Doses
Cefaclor	0.75-1.5 Gm		20-40 mg/kg		q8h
Cefadroxil	1-2 Gm		30 mg/kg		q12-24h
Cefamandole		1.5-12 Gm		50-150 mg/kg	q4-8h
Cefazolin		1-6 Gm		25-100 mg/kg	q6-8h
Cefixime	400 mg		8 mg/kg		q12-24h
Cefmetazole		4-8 Gm			q6-12h
Cefonicid		0.5-2 Gm			q24h
Cefoperazone		2-12 Gm		100-150 mg/kg	q6-12h
Cefotaxime		2-12 Gm[12]		100-200 mg/kg	q4-8h
Cefotetan		2-6 Gm			q12h
Cefoxitin		3-12 Gm		80-160 mg/kg	q4-8h
Cefprozil	500-1000 mg		30 mg/kg		q12h
Ceftazidime		0.5-6 Gm		90-150 mg/kg	q8-12h
Ceftizoxime		2-12 Gm		150-200 mg/kg	q6-12h
Ceftriaxone		1-4 Gm[12]		50-100 mg/kg	q12-24h
Cefuroxime		2.25-9 Gm		50-100 mg/kg[13]	q8h
Cefuroxime axetil	250 mg-1 Gm		250-500 mg		q12h

12. For gonorrhea, can use single dose of cefotaxime (1 gram) or ceftriaxone (125 or 250 mg)

USUAL MAXIMUM DOSE/DAY	DOSAGE IN RENAL FAILURE For Creatinine Clearance (ml/min) Dose	80-50	50-10	<10	Extra Dose After Hemodialysis
4 Gm	250-500 mg	Change not required			yes
2 Gm	0.5-1 Gm	q12-24h	q24h	q36h	yes
12 Gm	0.5-2 Gm	1-2 Gm q6h[11]	1-2 Gm q8h[11]	0.5-1 Gm q8-12h[11]	yes
6 Gm	0.5-1.5 Gm	q8h	0.5-1 Gm q8-12h[11]	0.5-1 Gm q24h[11]	yes
400 mg	200-400 mg	q24h	q24h	200 mg q24h	no
8 Gm	1-2 Gm	q8h	q16h	q48h	no*
2 Gm	0.5-2 Gm	0.5-1.5 Gm q24h	0.5-1 Gm q24h	0.5-1 Gm q3-5 days	no
12 Gm	1-4 Gm	Change not required			no*
12 Gm	1-2 Gm	q4-6h	q6-12h	q12h	yes
6 Gm	1-3 Gm	q12h	q12-24h	q48h	yes
12 Gm	0.5-2 Gm	1-2 Gm q8h[11]	1-2 Gm q12h[11]	0.5-1 Gm q12-24h[11]	yes
1000 mg	250-500	No change	q24h	q24h	yes
6 Gm	0.5-2 Gm	q8-12h	1 Gm q12-24h	0.5 Gm q24-48h	yes
12 Gm	0.25-1 Gm	0.5-1.5 Gm q8h[11]	0.25-1 Gm q12h[11]	0.25-1 Gm q24-48h[11]	yes
4 Gm	0.5-2 Gm	Change not required			no
9 Gm	0.75-1.5 Gm	q8h	q8-12h	q24h	yes
1 Gm	250-500 mg	Change not required			yes

* But give usual dose after dialysis.

13. Up to 200-240 mg/kg/day, divided every 6 to 8 hours, for bacterial meningitis.

SPUTUM CULTURE W/GS

ACCESSION: MB-96-03169
SOURCE: SPUTUM

COLLECTED: 04/20/96 0905
RECEIVED: 04/20/96 0923
STARTED: 04/20/96 0940

----------STAIN AND PREPARATION----------

GRAM STAIN 04/21/96 0806
MANY NEUTROPHILS
FEW EPITHELIAL CELLS
RARE GRAM NEGATIVE BACILLI

----------FINAL REPORT----------

04/22/96 1131

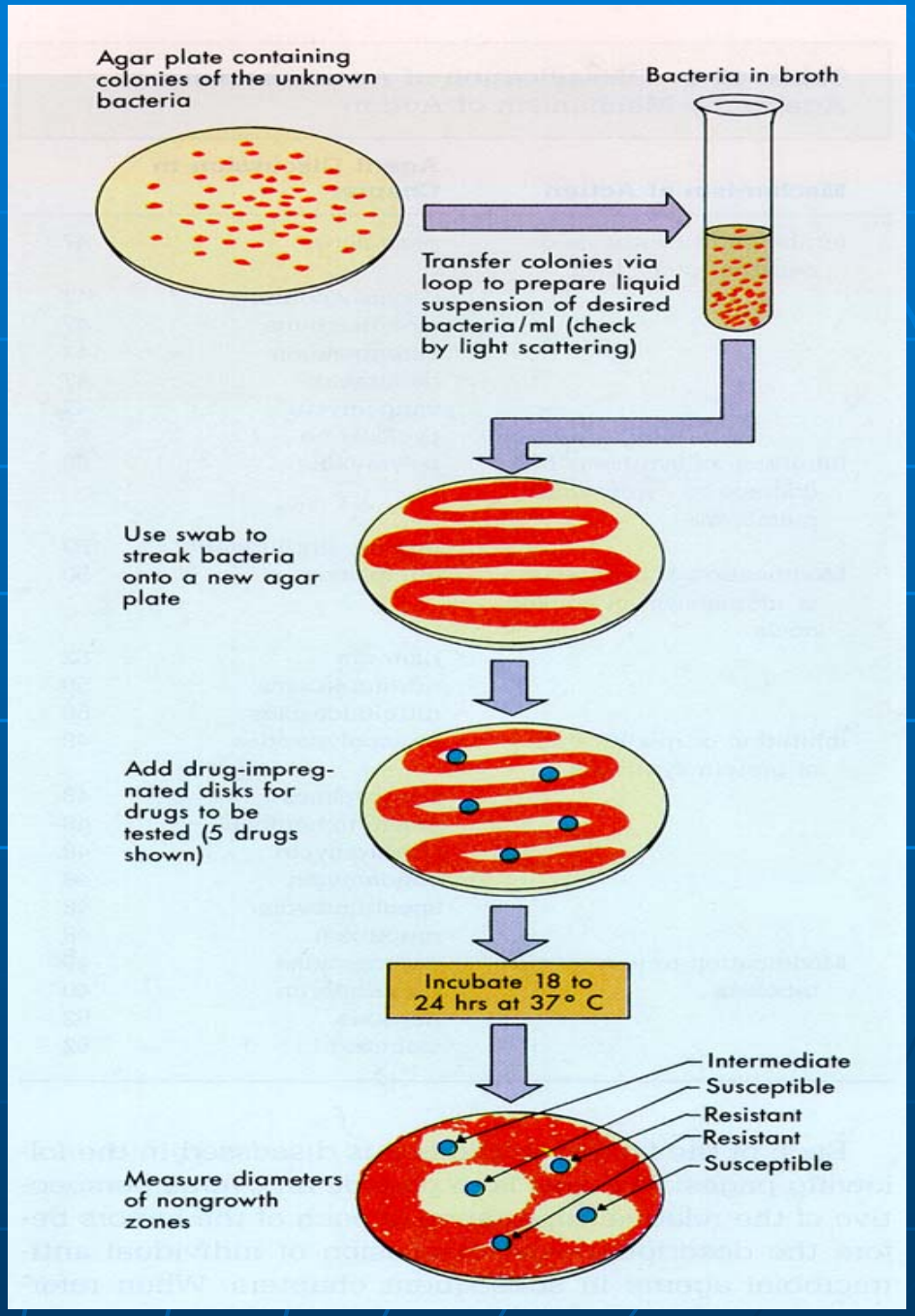
LIGHT GROWTH PSEUDOMONAS AERUGINOSA

----------SUSCEPTIBILITY REPORT----------

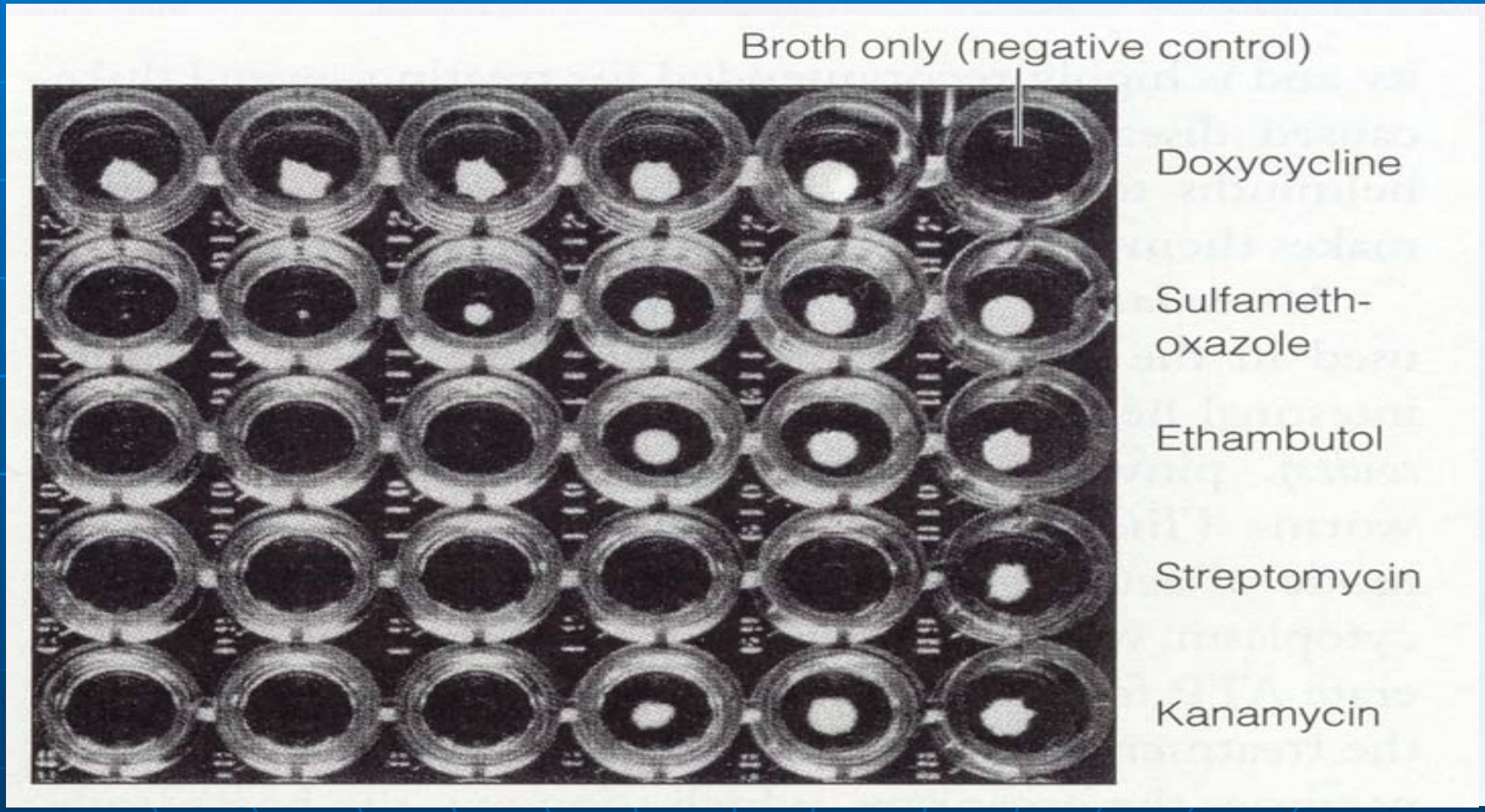
P AERUG	MIC	SYS.	*****COST CODE*****
AMIKACIN	8	S	$$$$
CEFTAZIDIME	<=2	S	$$$
CEFTRIAXONE	16	I	$$$
CEFUROXIME	>16	R	$$
CIPROFLOXACIN	<=1	S	$$$$
GENTAMICIN	2	S	$
PIPERICILLIN	<=8	S	$$$
TICAR/CLAV	<=16	S	$$$
TOBRAMYCIN	<=4	S	$$

III. Selection of an Antimicrobial Agent (cont.)

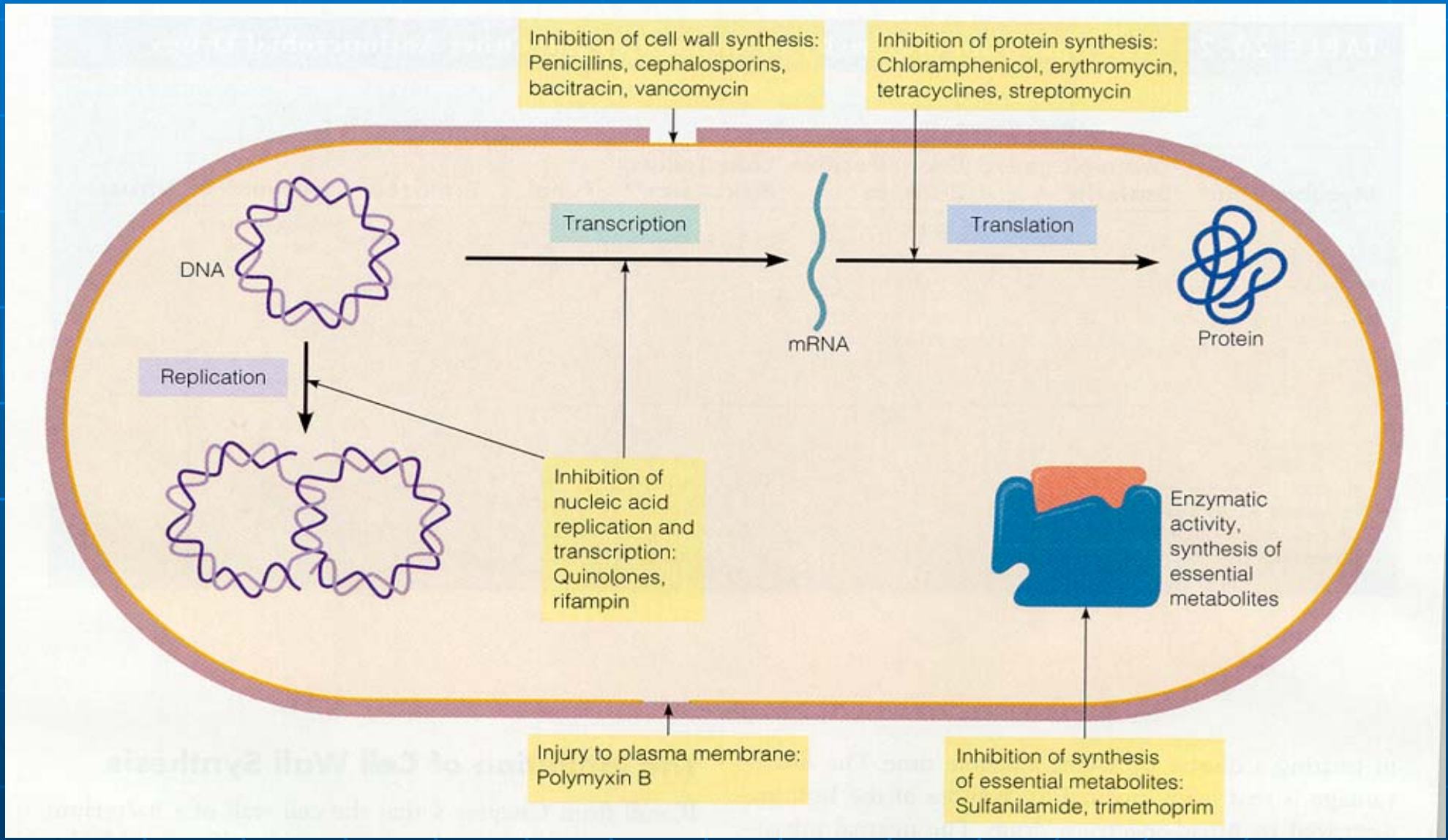
C & S Testing

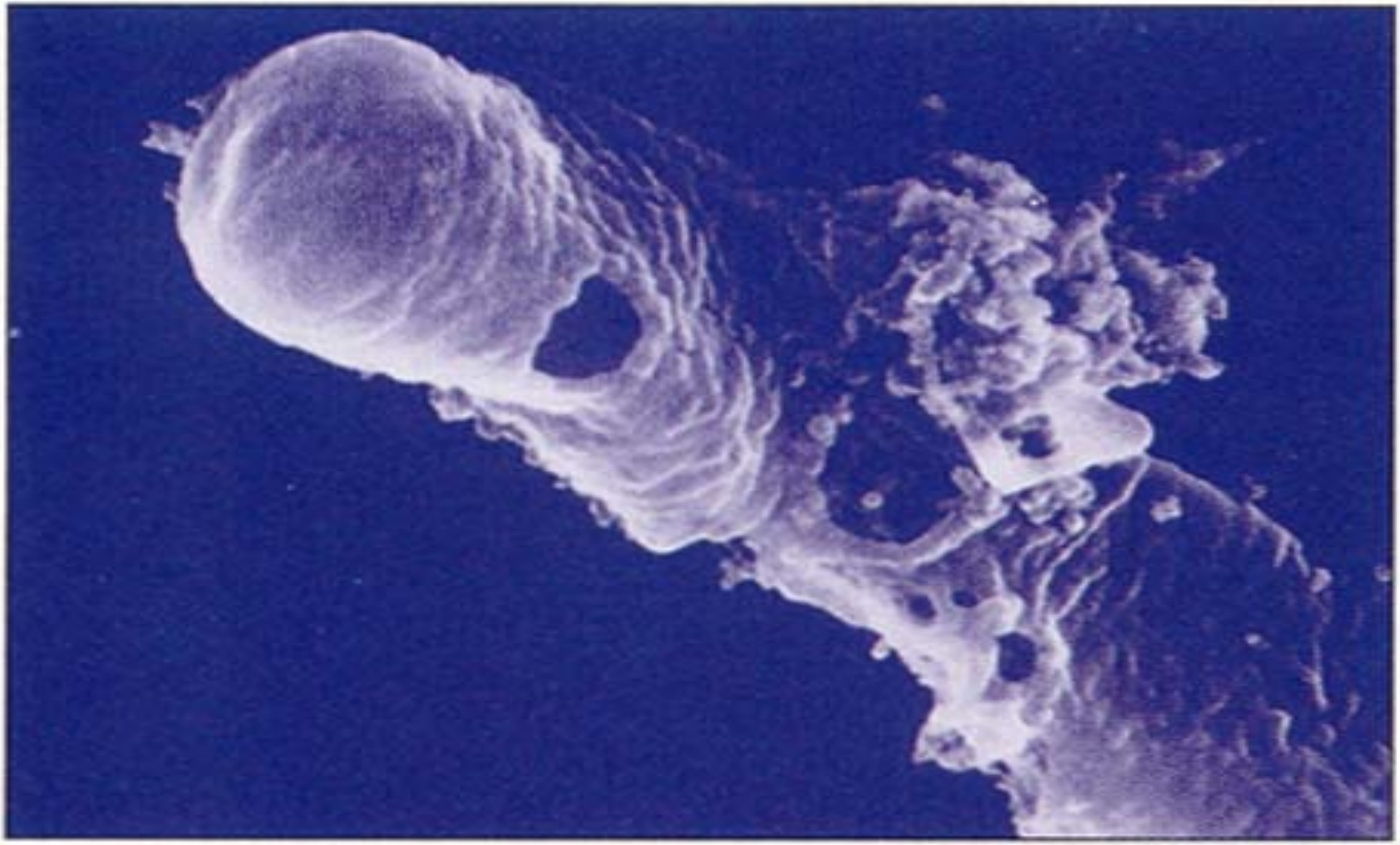


III. Selection of an Antimicrobial Agent (cont.)



ANTIMICROBIAL MECHANISMS OF ACTION




SEM
0.5 μm

Treatment of Uncomplicated UTI (Outpatient)

Pathogens

E. coli

Proteus mirabilis

Klebsiella pneumoniae

Enterococcus faecalis

Staph saprophyticus

First Line Agents

(1) Trimethoprim-sulfamethoxazole (SMX/TMP) 160/800 mg (Bactrim DS, Septra DS): 1 tablet PO BID x 3 days.
(2) Nitrofurantoin (MacroBid): 100 mg PO Q12H x 5 days
(3) Fosfomycin (Monurol) Packet: 3 gm packet PO once x 1 day

Alternate Agents

(1) Cephalexin (Keflex) 500 mg PO Q6-12H x 7 days
(2) Ciprofloxacin (Cipro) 250 mg PO Q12H x 3 days
(3) Levofloxacin (Levaquin) 250-500 mg PO daily x 3 days
(4) Augmentin/Clavulanate (Augmentin) 500/125 mg PO Q12H x 3 d
(5) Cefpodoxime (Vantin) 100 mg PO Q12H x 3 days

Complicated UTI (ESBL) Pathogens

Meropenem (Merrem) 500 mg IV Q6H
Ertepenem (Invanz) 1 gm IV/IM Q24H

Floroquinolones Adverse Effects : Tendonitis, myalgia, QT-interval prolongation

Treatment of Pyelonephritis (Inpatient and Outpatient)

Pathogens

E. coli

Klebsiella pneumoniae

Enterobacter sp.

Pseudomonas aeruginosa

Inpatient Treatment

Ceftriaxone (Rocephin) 1 gm IV Q24H

OR

Ciprofloxacin* 400 mg IV Q12H
Levofloxacin 500 mg IV/PO Q24H

OR

AGLY**: Gentamicin / Tobramycin
5–7 mg/kg/day IV once daily

For High-Risk Resistant Bacteria

(ESBL, obstructive uropathy, recent quinolone exposure)
Meropenem (Merrem) 500 mg IV Q6H
Ertepenem (Invanz) 1 gm IV/IM Q24H

* Ciprofloxacin (Cipro) 500 mg PO BID
** Aminoglycoside (AGLY) Toxicities: Nephrotoxicity, Ototoxicity

Tx of Community-Acquired Pneumonia (Inpatient)

Pathogens

S. Pneumoniae (12 – 68%)

H. Influenza (2.5 - 45%)

Mycoplasma pneumoniae

Chlamydia pneumoniae

Legionella species

Antimicrobial Drugs of Choice

Ceftriaxone (Rocephin) 1 gm IVPB Q24H

PLUS

Azithromycin* 500 mg IVPB Q24H
(may be switched to PO on discharge from hospital)

OR

Levofloxacin 500-750 mg IVPB Q24H
(may be switched to PO on discharge from hospital)

* Doxycycline (Vibramycin) 100 mg IV Q12H → may be used in place of Azithromycin if patient has cardiac arrythmias (e.g., atrial fibrillation) since azithromycin may prolong QT-interval.

Tx of Hospital-Acquired (Nosocomial) Pneumonia (HAP)

Pathogens

Staphylococcus aureaus

S. pneumoniae, E. coli

Klebsiella pneumoniae

Pseudomonas aeruginosa

Antimicrobial Drugs of Choice

Vancomycin* 15 mg/kg/dose IV Q12H

PLUS

Cefepime 2 gm IV Q8H
OR…Piperacillin-Tazobactam 3.75 gm IV Q8H
OR…Levofloxacin 500-750 mg IV Q24H

Treatment of Aspiration Pneumonia

Vancomycin PLUS Piperacillin-Tazobactam (Zosyn)

Cefepime (Maxipime), Levofloxacin (Levaquin), Piperacillin-Tazobactam (Zosyn)

* Vancomycin Toxicities
Nephrotoxicity, Ototoxicity

Treatment of Meningitis (Community-Acquired)

Pathogens

Streptococcus pneumoniae (pneumococcus)

Neisseria meningitidis (meningococcus)

Antimicrobial Drugs of Choice

Vancomycin 15 mg/kg/dose IV Q12H

PLUS

Ceftriaxone (Rocephin) 2 gm IV Q12H

PLUS

Acyclovir (Zovirax) 10 mg/kg/dose IV Q8H
(to cover viral meningitis pending culture results)

Treatment of H. pylori

Clarithromycin-Based Therapy

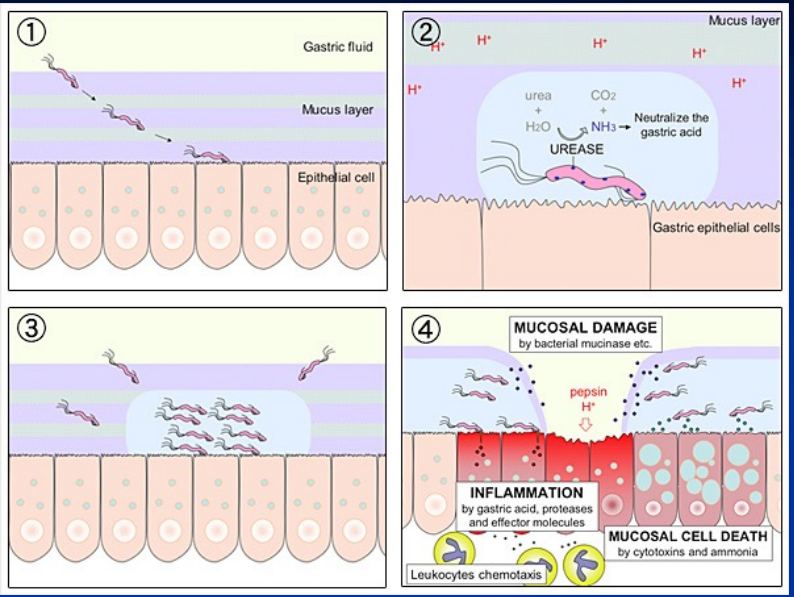
(preferred 10-day regimen)

Lansoprazole (Prevacid) 30 mg PO BID
Amoxicillin (Amoxil) 1000 mg PO BID
Clarithromycin (Biaxin) 500 mg PO BID
Metronidazole (Flagyl) 500 mg PO BID

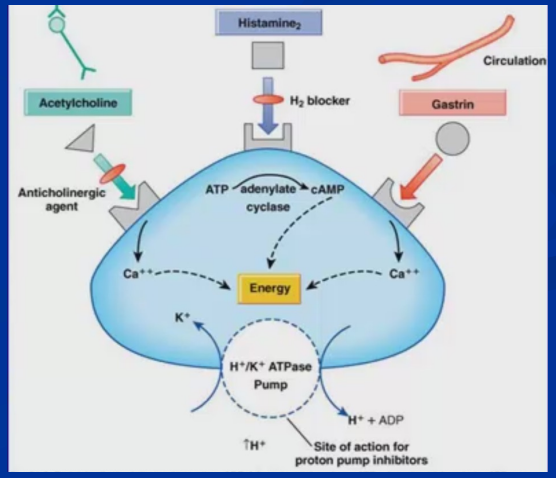
Bismuth Quadruple Therapy

(PCN-allergic patients: 14 days)

Lansoprazole (Prevacid) 30 mg PO BID
Tetracycline (TCN) 500 mg PO QID
Bismuth Subsalicylate (Pepto Bismol)
300 or 524 mg PO QID
Metronidazole (Flagyl)
250 mg PO QID or 500 mg PO TID



MOA of Proton-Pump Inhibitors



Treatment of Intra-Abdominal Sepsis

(e.g., Peritonitis, Cholecystitis)

Pathogens

Gram-Negative
(Enteric Bacteria)

Streptoccocci

Anaerobic Bacteria
(Clostridium species,
Bacterioides species)

Antimicrobial Drugs of Choice

Piperacillin-Tazobactam (Zosyn)
3.375 gm IV Q8H

OR

Ertapenem (Invanz) 1 gm IV Q24

OR

Meropenem (Merrem) 500 mg IV Q6H

Treatment of Cellulitis / Osteomyelitis

Pathogens (Cellulitis)

Staph aureus (MSSA or MRSA)

Staph epidermidis

Streptococcus pyogenes (Groups A, B, C, G)

Drugs of Choice (Cellulitis)

Cephalexin (Keflex) 500 mg PO QID

PLUS

TMP/SMX (Bactrim DS, Septra DS) PO BID

Pathogens (Osteomyelitis)

Staph aureus (MRSA)

Anaerobes

Enterobactereriaceae

Pseudomonas aeruginosa (esp. in diabetics)

Drugs of Choice (Osteomyelitis)

Vancomycin 15 mg/kg/dose IV Q12H

PLUS

Piperacillin-Tazobactam (Zosyn) 3.375 gm IV Q8H


PHARMACY
CLOSED