Name: KEY

Microbiology Chapter 7/20

Review Guide

Microbial Growth Terms and Basics (7 Questions)

1. What category of microbes do antimicrobial substances, such as antibiotics, affect? Bacteria

2. What two reasons can make a disease difficult to treat?
   a. Too similar to human cells (Eukaryotic pathogens)
   b. Hide inside cells (viral infections).

3. Fill in the table below regarding terms related to microbial control.

Term	Definition	Kills Endospores (yes/no)	Example(s)
Sterilization	Destroys all forms of microbial life	yes	Autoclave
Disinfection	Destroys only vegetative (non-endospore) forming pathogens on non-living surfaces.	no	
Antisepsis	Destroys only vegetative (non-endospore) forming pathogens on living surfaces.	no	
Antibacterial	Affects prokaryotic cell component types (uses selective toxicity)	yes	antibiotics

4. Fill in the table below regarding words related to microbial control.

Term	Definition of Suffix	Example	Will growth resume if the substance is removed? (Yes/No)
-Cide/-Cidal	Kills	Fungicide - kills fungus	No
-Stat/-Static/-Stasis	Inhibits	Bacteriostatic- inhibits bacterial growth	yes

Disk-Diffusion Testing of Antibiotics (3 Questions)

5. Describe when you would utilize a Mueller-Hinton plate. Used to test for antibiotic sensitivity/resistance

6. Example problem using table 25-1 in the lab manual.
   a. Staph: If the measured zones for Va=14mm and E=21mm. Which is best?

      Va, sensitivity/susceptibility starts @ 12mm

   b. Even if an antibiotic tests as "S," why might it NOT be appropriate or not work?

      (1) Allergic reaction (patient is allergic)
      (2) Resistant bacteria have evolved

7. Fill in the table below regarding the Mueller-Hinton plate test done for the antibiotic Ampicillin (AM).

Result	What does the plate look like? depends on GP / GN	
Sensitive	>29mm	>17mm
Intermediate	—	14-16mm
Resistant	<28mm	<13mm

8. If *Enterobacter cloacae* had the following zone of inhibition sizes, what antibiotic would you prescribe? Why?

Antibiotic Name	Zone Size (mm)
Erythromycin	16
Streptomycin	14
Vancomycin	12
Bacitracin	12

unless testing/treating enterococci. It falls in the susceptibility range the others are only intermedic in effectiv-ness

Broth Dilution Test (4 Questions)

9. Fill in the table below regarding broth dilution tests

	Definition	Advantage	Used to determine:	Does Not determine:
Broth Dilution	A series of wells with decreasing concentrations of antibiotics	Precise MIC. most diluted antibiotic to to use.	MIC: minimum inhibitory concentration	MBC unless a 2nd subculture test is performed

10. Compare and Contrast MIC and MBC.

inhibits | kills | Both require a subculture to distinguish between

11. Use the table below to fill out the MIC and MBC for the drugs AM and CIP.

		Staph		*E. coli*	
Drug	Dilution	Growth	Subculture	Growth	Subculture
AM	1:2	-	-	-	-
"	1:10	-	+	+	+
"	1:20	-	+	+	+
"	1:100	+	+	+	+
CIP	1:4	-	-	-	-
"	1:60	-	-	-	-
"	1:80	+	+	-	+

	Staph	Ecoli
MIC ~~CIP~~	1:80	1:80
MBC ~~CIP~~	1:60	1:60
MIC ~~NB~~ AM	1:20	1:2
MBC ~~NB~~ AM	1:2	1:2
Which drug most effective? Explain.	CIP	CIP

can be given in lowest possible concentrations to treat/kill bacteria in subculture.

Antibiotics (7 Questions):

12. Who discovered the first antibiotic? Flemming
    a. How was the antibiotic discovered? mold on bread
    b. What was the first antibiotic? Penecillin

13. What is selective toxicity? targets components of prokaryotic cells not present in eukaryotic cells
    a. How does this apply to antibiotics?
    Design antibiotics to only affect bacterial cells

14. Fill in the table below regarding antibiotic terms.

Term	Definition	Benefits/Drawbacks
Narrow-Spectrum	Only a select group of bacteria are affected.	• targeted therapy • doesn't eliminate normal flora
Broad Spectrum	Affects a large # of bacterial groups	• kills normal flora -yeast infections
Synergism	A combination of drugs that has a much greater effect than either alone.	• uses a much smaller concentration of antibiotics when combined. • ↓ # of resistant strains

15. Fill out the table below regarding targets of antibiotics.

Target	How is this structure different from Eukaryotic cells?	How does this disrupt bacteria function?	What danger is there to Eukaryotic cells?
Cell Wall	Euk cells don't have a cell wall	destroys peptide bonds in peptidoglycan causing osmotic lysis	None
Folic Acid Synthesis	Euk cells obtain folic acid from diet, bacteria make folic acid.	stops bacterial growth	None
Ribosomes	Euk - 80s Prokaryotic - 70s	stops protein & enzyme synthesis	- some: mitochondria in Euk have 70S ribosomes
Outer Membranes	not very different	causes osmotic lysis	some: affects cell membranes of Euk cells (esp. kidney cells)
DNA synthesis /transcription	Euk + Prokaryotic DNA gyrase are slightly different in structure	prevents DNA from relaxing (no replication or transcription)	None

16. What are the best three targets for antibiotics? cell wall, folic acid synthesis, DNA synthesis/transcription
    a. Why are these targets best?
    Most different from normal eukaryotic cells.

17. When may antibiotics that target the outer membrane in bacteria cells be used?
    1. when resistant strains are present.
    2. if the patient is allergic to other antibiotic options
    3. GN

18. Compare and contrast antibiotic diffusion vs disinfectant diffusion plates.

largest zone of inhibition may NOT be the most effective	largest zone of inhibition is the most effective	BOTH require a 2nd test subculture to determine bacteriostatic or bacteriocidal.

Drug Resistance (3 Questions):

19. Fill in the table below regarding chemical forms of drug resistance.

Drug Resistance			
Natural Process	How does it occur?	Examples:	Result
Exchange of Plasmids	Bacteria exchange plasmids horizontally within current generations.	Penicillinase- an enzyme excreted by bacteria to break down B- lactam on Penicillin making it ineffective	- leads to ineffective drugs/therapies - leads to the manufacturing of modified antibiotics (synthetic).
Human Activities			
Incomplete Therapy	How does it occur? susceptible bacteria are killed leaving resistant ones behind to reproduce	Examples:	Result population becomes more resistant
Inappropriate/Over prescribing of Antibiotics	Antibiotics don't affect virus, but increase bacterial resistance		increased bacterial resistance
Livestock/Animal Feed	some antibiotics are used on animals & humans.	salmonella	bacteria on livestock become resistant and are passed on to humans
Hospitals and Nursing Homes	proper hygiene & aseptic precautions aren't followed & restistant strains are passed from one patient to the next.		resistance spreads and immuno-compromis patients get a hospital acquired infection.

Chemical Methods of Controlling Bacterial Growth (4 Questions)

20. Fill in the table below regarding **chemical** forms of microbial inhibition.

Substance	Uses
Alcohol	to clean skin prior to shots
Soap	Physically removes oils that microbes cling to
Halogens (Cl_2, I_2, Br_2 etc)	I_2 - cleans skin prior to surgery, purifies H_2O Cl_2 - cleans pools, treat sewage, acts as a disinfectant Br_2 - cleans pools

Substance	Uses
Phenol	Antimicrobial used to compare effectiveness
Phenolics/Bisphenols	Antimicrobial used in hospitals (less irritating)
Heavy Metals (Silver Nitrate, Zinc chloride)	→ prevent blindness in newborns → mouthwash silver dressings → ~~synergism w/ antibiotics~~ - prevent resistant bacteria thriving in wounds

21. Alcohol:
    a. What concentrations are effective against bacteria? 40–95%
    b. What concentrations are ineffective against bacteria? ↓40% + ↑95%

22. List the life-forms, in order, from most resistant to least resistant to chemical control.
    Virus < GP < GN < Pseudomonas < Mycobacteria < Endospores < Prions

23. What four factors affect microbial death rate?
    a. # of microbes originally present
    b. Presence/Absence of other organic matter
    c. Length of exposure to the control treatment
    d. Microbial characteristics: GN, GP, endospores, etc

Physical Methods of Microbial Control (10 Questions)

24. Fill in the table below regarding physical controls to microbial growth.

Type of Physical Control	Description (What is it?)	What does it kill/prevent?	What does it NOT kill?	Examples	Sterilization (Yes/No)	Bactericidal (Yes/No)
Moist Heat	increasing temperature with the use of water	vegetative (non-endospore) forming microbes	endospores	Boiling - disinfects	no	yes
		All life including endospores	X	Autoclave - sterilizes	yes	yes
Pasteurization	uses just enough heat to prevent spoilage while retaining nutrients	vegetative (non-endospore) forming pathogens	endospores	pasteurizing - milk - cheese	no	yes
Dry Heat	using heat to destroy microbial life	All life	X	Flaming - exposing loops to high heat Incineration - burning bandages	yes	yes
Filtration	used to clean heat sensitive (labile) materials by separating bacteria from suspending liquid	All life	X	vaccines enzymes antibiotic solutions	yes	yes

Type of Physical Control	Description (What is it?)	What does it kill/prevent?	What does it NOT kill?	Examples	Sterilization (Yes/No)	Bactericidal (Yes/No)
Low Temps	decreasing temp to delay spoilage	prevents/ slows growth	bacteria endospores	Refrigeration	no	no
Lyophilzation	freeze-drying	slows/ prevents growth	bacteria endospores	used to store & ship specimen long-term	no	no
Osmotic Pressure	creating a hyperteric environment	bacteria growth	endospores	preservation of food w/ salt, sugar, etc	no	yes
Ionizing Radiation	uses shorter wavelengths of light to create free radicals	destroys DNA (bacteria + endospores)	X	Gamma Rays, X-Rays, e- beams	yes	yes
Nonionizing Radiation	causes thymine dimers to form in DNA	damages DNA (bacteria + endospores)	X	UVA UVB UVC	yes on surfaces	yes