

**Microbiology for Nursing
Exam #2 Review**

1. Matching lecture terms

Questions

1. What is a virus?

Genetic material (DNA or RNA) surrounded by protein.

2. What types of genetic material are found in viruses?

DNA or RNA, either single or double stranded.

3. Be able to explain what the capsid and envelope are. What are attachment proteins (spikes)?

Capsid: The protein layer that surrounds the genetic material of a virus.

Envelope: A layer of proteins, lipids, and glycoproteins that surrounds the capsid in some viruses. Naked viruses have no envelope.

Attachment Proteins: Glycoproteins found on the surface of the capsid or envelope that attach the virus to it's host cell.

4. What is a complex virus? What parts does it have?

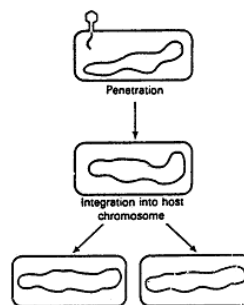
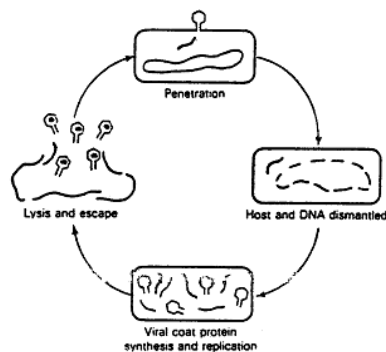
Complex viruses have a complex structure that either have a number of layers of proteins around the nucleic acid or a polyhedral capsid with a helical tail. They usually have a head, tail and tail fibers. Most complex viruses are bacteriophages.

5. What is a retro virus? What is a bacteriophage?

Retro virus: Genetic material is RNA, that back codes DNA (changes the DNA in the host cell), requires enzyme 'reverse transcriptase'.

Bacteriophage: A virus that infects bacteria.

6. Explain the difference between the lytic and lysogenic life cycles in viruses.



Lytic Cycle

In the lytic cycle the virus makes many copies of self and then kills the cell (lysed) to release the copies.

In the lysogenic, the virus is duplicated when the cell replicates. Lysogenic are frequently tumors.

Lysogenic cycle**7. What is a prophage and what do repressor genes do?**

Prophage (provirus): DNA from a virus that is incorporated into a bacteria's DNA loop.

Repressor genes: Genes that maintain the virus as a prophage incorporated in the host cells DNA. When the host cells DNA is damaged, the repressor gene is inactivated (induction) and the virus changes to a lytic life cycle. Also, repressor genes keep other similar viruses from infecting the cell by inhibiting their replication and blocking the sites where viruses infect cells.

8. What is lysogenic conversion and what can it do to bacteria?

Lysogenic conversion is when a virus changes the genetic characteristics of a bacteria. In some bacteria the pathogenic strains are the result of lysogenic conversion (caused by viral genes).

9. What is transduction? How is generalized transduction different from specialized transduction?

Transduction is the movement of DNA from one bacteria to another by bacteria phages. There are two ways the virus can move the genes from their current bacteria cell to a new one.

Generalized transduction: Can transfer any bacteria DNA as all of the DNA is degraded (in small pieces), when the virus is building copies of itself, a few phage heads may envelope fragments of the bacteria's DNA.

Specialized transduction: The DNA of the phage is integrated in the bacteria cells DNA. When the phage is replicated, bacteria DNA from either side of the phage DNA may be taken mistakenly and will then be integrated into the next cell the new phage infects.

10 What are the four major modes of viral transmission to animals?

Enteric viruses: Ingested material contaminated with feces. (hepatitis A&E)

Respiratory viruses: Inhaled in water droplets. (mumps, measles)

Zoonosis: transmitted from animals to humans. (Yellow fever, rabies).

Sexually Transmitted: Transmitted via sexual activity (herpes, HIV, Hepatitis B,C...).

11. How do enveloped viruses and naked viruses enter into animal cells?

Enveloped viruses: Endocytosis or membrane fusion

Naked viruses: Bond to attachment proteins and endocytosis or eat a hole in the cell membrane.

12. How do animal viruses leave cells?

Budding: Similar to exocytosis. A section of the cell membrane forms the viral protein spikes on the outside, then the matrix proteins form on the inside and the virus separates.

Transcapsidation: If two different viruses infect the same cell, they can switch protein capsids, therefore the viruses will have different attachment proteins and can infect a different set of animals.

13. What is transcapsidation and why can it be important in causing disease? (i.e. how can it change the genetics of viruses)

Transcapsidation is described above, it's important because after transcapsidation a virus can then infect a different set of animals (for one lifecycle), so a virus that once was not dangerous to humans could later become dangerous.

14. How do viruses cause tumors?

Viruses cause tumors by activating some genes and inactivating others. Specifically they turn on genes that make the cells divide abnormally rapidly (protooncogenes on, tumor suppressor genes off). Most commonly these viruses are using the lysogenic lifecycle (cell division).

15. What are prions and how do they affect organisms?

Infection proteins, not actually viruses. Prions are a new category of infectious agents. They are proteins that move into cells changing cell proteins making them toxic to the cell. They also causes cells to form more prions. I.e. mad cow disease.

16. Name five major viral diseases.

A. HIV

B. Chicken Pox

C. Measles

D. Mumps

E. Influenza

17. How are plaque assays and hemagglutination used to determine viral numbers?

Both of these are used to measure the amount of virus in the body.

Plaque assays: Used to determine the number of virus particles present. Plaques are the areas of a tissue culture that turn

clear because the cells have been killed by the virus.

Hemagglutination: Measures the number of many animal viruses, because these viruses make red blood cells agglutinate (bond together).

18. Name five characteristics that are used to identify viruses?

A. Type of genetic material (DNA vs. RNA & Single vs double stranded).

B. Replication method

C. Capsid shape and structure.

D. Presence/absence of envelope.

E. Size

F. Id of viral antigen proteins.

19. What are the characteristics of the kingdom Monera?

Prokaryotic

No Sex Cycle

Single Cell

Autotrophic & Heterotrophic

Cell Wall

20. How are the Archaeobacteria different from the Eubacteria?

Archaeobacteria:

- Cell walls lack muramic acid and peptidoglycan

- Cell walls lack protein-carbohydrate cross links

Eubacteria:

- Cell walls have muramic acid and peptidoglycan

- Cell walls have protein-carbohydrate cross links

21. Contrast the Archaeobacteria groups: Methanogens, Thermoacidophiles, and Halophiles.

Name	Energy Source	Result	Env/Notes
Metanogens	Hydrogen gas	Reduces CO ₂ creating CH ₄ (methane)	
Thermoacidophiles	H ₂ S	Oxidize it to H ₂ SO ₄ sulfuric acid	Hot acidic env. pH near 1 and temps over 105C.
Halophiles	Photosynthetic	No chlorophyll	High salt env. (Great Salt Lake, etc.)

Metanogens: Use hydrogen gas as energy source and reduce CO₂ as a electron acceptor forming CH₄ (methane)

Thermoacidophiles: Live in hot acidic environments (i.e. hot springs), most anaerobic and use H₂S as energy source, oxidizing

it to H₂SO₄ (sulfuric acid). Have been found in springs with pH near 1 and temps over 105°C.

Halophiles: Live in high salt environments (Great salt lake), are photosynthetic, but do not have chlorophyll.

22. What is a plasmid? What is conjugation?

Plasmid: An extrachromosomal loop of DNA.

Conjugation: The exchange of plasmids between bacteria through a connection called a sex pilus.

23. What three basic shapes are found in bacteria? What are prosthecae and what is a capsule?

Three basic shapes of bacteria are:

Cocci: Spherical/round

Bacilli: Rod shaped

Spirilla: A long rod shape like a spiral/spring

Prosthecae are extensions on the surface of the bacteria that give them a star shape. Function is unclear.

Capsule: (glycocalyx) a gelatinous layer of polysaccharides that surrounds some bacteria.

24. What are the strep and staph arrangements of bacteria?

Strep: bacteria arranged in long chains (divide in one plane)

Staph: bacteria arranged in clusters (like grapes), divide in two planes.

25. How are the cell walls different in gram negative and gram positive bacteria? How does this protect gram negative bacteria from certain antibiotics like penicillin?

Gram+ walls have a thick peptidoglycan wall surround the phospholipids bi-layer where gram- has a thin peptidoglycan wall with an additional phospholipid bi-layer surrounding it. In the gram- wall, the outer phospholipid bi-layer protects the peptidoglycan wall from penicillin and other drugs which damage the peptidoglycan wall.

Gram+ stain with crystal violet, Gram- stain with saffron.

26. Contrast endotoxins and exotoxins. What part of the cell do endotoxins come from. How are exotoxins produced and released.

Do both Gram- and Gram+ bacteria produce both these toxins?

What are toxoids, A-B toxins and superantigens?

	Gram+ Gram-	Heat stable? toxoids?	Notes
Endotoxins	Gram-	Stable, no toxoids	Reside in outer bi-layer.
Exotoxins	Both	Generally no, become toxoids	Produced inside the cell, released outside the cell.

		inc. A-B toxins and superantigens	
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Toxioids: Toxins which are made non-toxic by heating or chemicals. Used to immunize against diseases that produce exotoxins.

A-B toxins: Exotoxins made of two parts, usually one part is able to bond to the host cell, and the other part is the toxic enzyme.

Superantigens: Another type of exotoxin, that bonds to the major histocompatibility class II antigens on many T-helper cells, and cause the release of cytokines throughout the body. This can lead to the failure of the circulatory system (and other systems), effect blood pressure and cause shock.

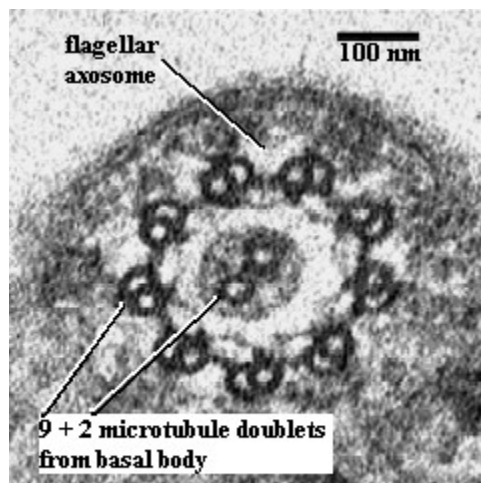
Endotoxins: Reside in the outer phospholipids bi-layer wall of gram- bacteria. Typically they are enzymes that break down proteins (protease) or break down nucleic acids (nuclease). Endotoxins are usually stable when heated and do not convert into toxoids. Tend to cause fevers, tissue damage, etc.

Exotoxins: Proteins produced inside the bacteria cell which are released outside the cell for protection. Generally not stable when heated, and stimulate the host immune system. They can be converted into toxoids. Produced by both gram- and gram+ bacteria.

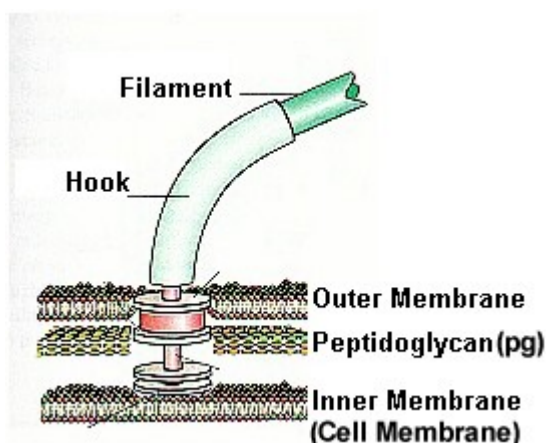
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27. What are pili? What is their function? How are they involved in gene exchange?

Pili: Small hair like extensions on the surface of bacteria cells used to attach the bacteria to surfaces, much thinner than flagella. Pili are also used between bacteria for the transfer of DNA between the cells (sex pili or F-pili).

28. How are the flagella of bacteria different from the flagella found in other kingdoms?



Trimastix: cross section of flagellum near base. From O'Kelly et al. (1999).



Flagella of eukaryotic organisms have the 9+2 arrangement, where each set of tubules contracts in sequence causing the flagella to lean in their direction and thus propel the organism. Flagella of bacteria (all Prokaryotic organisms really) do not have the 9+2 arrangement of microtubules, but are a single microtubule that spins (image on right).

29. What are the cyanobacteria and how are they different from most other bacteria?

Cyanobacteria (blue-green algae), photosynthetic, no flagella. They form thick walled resting cells called akinetes.

30. How do bacteria reproduce?

Bacteria use asexual reproduction, binary fusion.

31. What are endospores and how long do they last?

Endospores are 'resting' or non active forms of bacteria which are extremely hard to destroy. They can live for 100s or even 1000s of years.

32. What are antibiotics? What has caused many bacteria to become antibiotic resistant?

Antibiotics: chemicals (mostly produced by fungi) that kill bacteria.

Many bacteria are becoming resistant to antibiotics through natural selection and/or plasmid transfer.

33. The bacteria Rhizobium lives in association with the roots of certain legumes. What does it do?

Rhizobium lives (symbiotically) in the roots of various plants and fixes N_2 (converts the N_2 gas into organic compounds).

34. Name five major bacterial diseases.

- A. Botulism
- B. Tuberculosis
- C. Gonorrhea
- D. Syphilis
- E. Chlamydia

35. What five major characteristics are used to identify most bacteria?

- A. Shape, size and arrangement
- B. Colony shape
- C. Staining characteristics
- D. Biochemical characteristics (what sugars it burns, enzymes it has, antibiotics it can survive, runs anaerobic?, antibody bonding/antigens)
- E. DNA characteristics (C/G ratio in the DNA, fingerprint, codes).

36. Explain the difference between the different types of stains,

simple stains, differential stains, special stains, and negative stains.

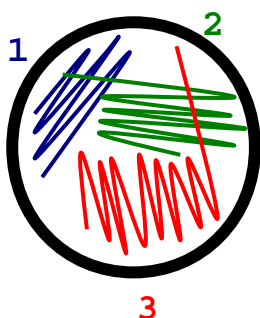
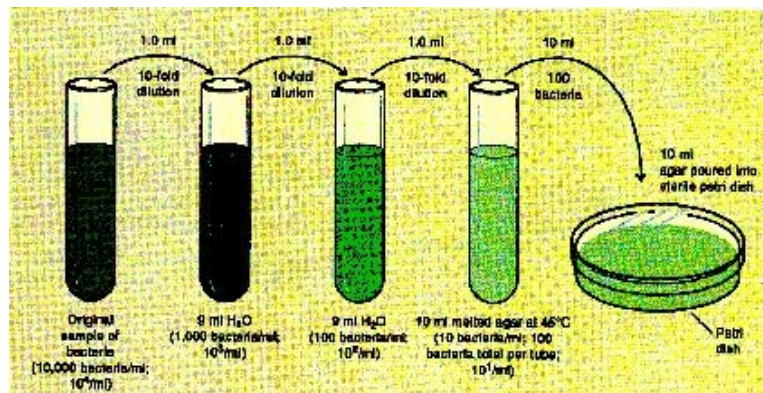
Simple stains: Just color the bacteria so they can be seen better.

Differential stains: Certain characteristics pick up these stains differently.

Special stains: Stain specific structures (flagella, spores, etc.).

Negative stains: Color the background around the bacteria.

37. How can a pure culture of bacteria be obtained using the streak method and the serial dilution method?



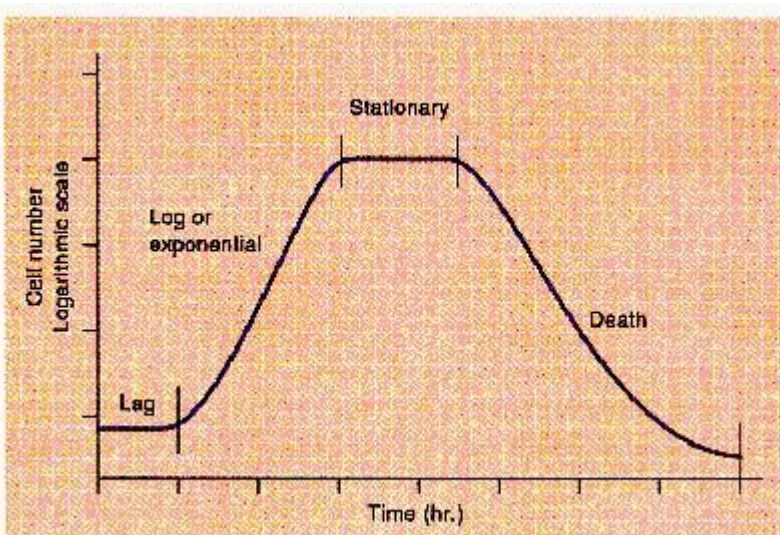
Streak method:

- A. make a short streak of the bacteria on a plate
- B. Flame the loop and make a streak with the loop that crosses the first streak one time (spreads out a bit of the bacteria).
- C. Repeat two more times only crossing the previous streak once (spreading out the bacteria even more).

Serial dilution method:

- A. Dilute a culture (1 ml of bacteria in 9 ml of media or water).
- B. Repeat diluting it a number of times until it is sufficiently diluted.
- C. Mix the diluted culture with 10 ml of agar at 45°C
- D. Pour into sterile Petri dish.

38. Explain the different growth phases of bacteria (i.e., log phase, stationary phase and death phase).



Log: Grows rapidly when first placed on the plate.

Stationary: Growth slows to a steady state because most of the nutrients have been used up.

Death: Bacteria dies due to lack of nutrients.

39. Explain 3 ways the quantity of bacteria in a culture can be measured?

- A. Weight - measure the increase in weight (only for autotrophs)
- B. Light penetration - measure the amount of light that will penetrate the culture.
- C. Plate count - Count the number of colonies on the plate.
- D. Counting chamber - Count the number of colonies in a chamber of known volume. (slide with very small chamber/well).

40. Contrast the carbon source used by autotrophs and heterotrophs? What energy source is used by photo, chemo, and litho bacteria? Be able to tell the carbon and energy source given a word with these roots.

Name	Carbon Source	Energy Source
Photoautotroph	CO ₂	Light
Photoheterotroph	Organics	Light
Chemoautotroph	CO ₂	Inorganic Compounds
Chemolithoautotroph		
Chemoheterotroph	Organics	Organic Compounds

Carbon Source:

Autotrophs - CO₂

Heterotroph - Organics

Energy Source:

Photo - light

Chemo - chemical

Litho - chemical energy from inorganic sources

41. Contrast the following types of media: synthetic, complex, enrichment, selective, and differential?

Complex: Often includes enrichment materials that are undefined. (blood, blood sera, etc.)

Enrichment: Media to which you have added specific compounds to enhance the growth of certain groups of bacteria.

Selective: Media to which you have added specific compounds to kill certain bacteria or only allow certain bacteria to live.

Synthetic: Artificial, you know exactly what it is.

42. What five things should be on a properly labeled bacteria media that is being used?

A. Researcher's name/initials

B. Date

C. Incubation temperature

D. Media Type

E. What the plate was struck with

43. What are the characteristics of the kingdom Protista?

Eukaryotic

Y/N Sex

Single cell

autotrophic/heterotrophic

with or without cell wall

Single cell gametangia

44. What are the key characteristics of the following groups, what are the common names of the groups; Pyrrophyta, Zoomastigina, Ciliophora, Sporozoa, and Rhizopoda.

45. For the groups in the question above be able to name a disease associated with the groups.

<u>Name</u>	<u>Motility</u>	<u>Disease</u>	<u>Disease</u>
<u>Pyrrophyta Dinoflagellata</u>	<u>2 flagella (one trails, one around middle)</u>	<u>Paralytic shellfish poisoning</u>	
<u>Zoomastigina Mastigophora</u>	<u>One or more flagella (never like dinoflagellata)</u>	<u>Giardia</u>	<u>African sleeping sickness</u>
<u>Ciliostora Ciliates</u>	<u>Many short cilia</u>	<u>Pig farmers disease (balantidium coli)</u>	
<u>Sporozoa Sporozoans</u>	<u>Non modal, no flagella or cilia</u>	<u>Malaria</u>	<u>Cyclospora</u>

<u>Rhizopoda</u> <u>Sarcodina,</u> <u>amoebas</u>	<u>Amebiod</u> <u>movement</u> (<u>extends</u> <u>cytoplasm,</u> <u>latches on to</u> <u>something and</u> <u>pulls self in</u> <u>that direction</u>)	<u>Amoebic</u> <u>dysentery</u>	
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46. What is ameboid movement?

Extensions of the cytoplasm (pseudopodia) are pushed from the center of the cell and then used to pull the cell along.

47. What are the characteristics of the kingdom Fungi?

Eukaryotic

Y/N Sex

Single/Multiple cell

Heterotrophic

Single sex cell

48. What are yeasts and what problems do they cause?

Single celled fungi that can be from any of the fungal divisions, but are most commonly from the ascomycota.

49. What are the characteristics of the divisions Ascomycota and Deutromycota? What disease do these groups cause?

Division	Most Hyphae	Dikaryotic stage	Sexual cycle	Sexual type of spores
Zygomycota (Coenocytic fungi)	Coenocytic	No	Yes	Zygosporos (1 spore)
Ascomycota (Cup fungi)	Monokaryotic	Yes	Yes	Ascospores (8 spores)
Basidiomycota (Club fungi)	Dikaryotic	Yes	Yes	Basidiospores (4 spores)
Deutromycota (Imperfect fungi)	Monokaryotic	NO	No	None

Division	Disease	Disease
Ascomycota	St. Anthony's fire	Histoplasma (lung infection)
Deutromycota	Thrush	Blastomycosis (lung infection)

