Micro Exam 2 Practice Review (Oct 27)

Practice run of Oct 27: 52 multiple choice and 15 short answers, graded to his key. **Red highlight = what you got wrong or missed. Green highlight = correct.**

Score

- **Multiple choice:** 34 of 52 right (65%).
- **Short answers:** 18.5 of 50 points (37%).
- **Total:** 120.5 of 206 = 58.5%, about 60 of his 103.
- **Main pattern:** you name the right part but leave out its component, how it works, or the result. That costs half of each point.

B1. Flagella: number, arrangement, assembly

Short answer (3 pts): Describe the basic order of events that occur in the assembly of a bacterial flagellum. You just need to describe the order in which each different section of the flagellum is assembled. (3 pts)

Your answer: 1) M ring 2) S ring 3) rod added and cap 4) L added 5) P ring 6) Hook added and capped 7) Filaments added 8) Mot proteins

Your score: 2.5 of 3. Order is right. You lost half a point for not saying the filament grows at the TIP. Small slip: P ring goes in before the L ring.

Everything he gives points for (all of these):

- **(1 pt)** Basal body first: two rings form in the cell membrane, the rod is added, then two more rings in the cell wall layer or outer membrane **You got it.**
- **(1 pt)** The hook section is added next, after the basal body and before the filament **You got it.**
- **(1 pt)** The filament is formed after the hook, with new flagellin subunits passing through the basal body and hollow filament to be added at the tip You got 0.5 of 1: Filament after the hook is right, but say new flagellin is added at the tip (through the hollow core).

Correct answer: Two rings (M and S) form in the cell membrane, the rod is added, then the P and L rings in the cell wall and outer membrane. The hook is added next. The filament is last, and new flagellin passes through the hollow core and is added at the tip.

Practice: Which section of the flagellum is built last, where are its new subunits added, and how do they get there?

My answer:

M (Mcdonalds), S (sonic), R (resturants), P (powerrade), L (latte), H (Happy hour), F (fries), M (Matcha)

Mot proteins is last step of flagellum assembly and put in the membrane, **H+ flows through them (proton motive force)** to help with motor to control motility

Short answer (4 pts): Describe the number and arrangement of flagella that have been observed in bacterial cells and how flagella move to cause motility in bacteria. (4 pts)

Your answer: one end, both ends, or all over of cells. flagella could move by flagella-meditated (periplasmic) and flagella-nonmeditated (sliding, twitching, gliding), by moving across surface of cell or inside cell

Your score: 1.5 of 4. Arrangement is right. Missing the number (one or many) and the key move: flagella ROTATE at the base. Twitching and gliding are not flagella, so they do not answer this.

Everything he gives points for (all of these):

- **(1 pt)** Number: a cell can have one flagellum or several (many) You got 0 of 1: Number not given: one flagellum or many.
- **(1 pt)** Arrangement: at one end (polar, single or a tuft), at both ends, or all over the cell **You got it.**
- **(1 pt)** In spirochetes the flagella do not stick out; they wrap around the cell in the periplasm You got 0.5 of 1: Say spirochete flagella stay in the periplasm and wrap around the cell.
- **(1 pt)** Movement: the flagellum turns (rotates) at its base, driven by the motor, so the long helical filament spins like a propeller and pushes or pulls the cell You got 0 of 1: How they move: the flagellum rotates at its base (motor), so the helical filament spins like a propeller.

Correct answer: Cells have one to many flagella, at one end (single or tuft), both ends, or all over. In spirochetes the flagella stay in the periplasm and wrap the cell. Flagella move by rotating at the base, so the helical filament spins like a propeller.

Practice: How many flagella can a bacterium have, where can they be placed, and what does the motor do to the flagellum to move the cell?

My answer:

0-many, with being placed at one end, many cells over all end, at both ends of cells and they can be in the periplasm and wrap around the cell. The motor helps controll of movement by rotating CW/CCW and tumble/runs.

Study guide objectives for this area

- 1. Flagella and motility
- Arrangements observed
- Parts and features of flagella
- Order of assembly of flagellum.

Area to check: Study guide B.1 "Arrangements observed" and "Order of assembly of flagellum"; diagram section B (FLAGELLUM ASSEMBLY, steps 1 to 9).

Practice for the whole area (answer these)

1) Overall: Describe the four parts of a bacterial flagellum, the order they are assembled in, and how the flagellum moves the cell (include runs and tumbles with many flagella).

My answer:

4 Parts of a flagellum are the basal body, hook, filament, motor and they can move by the motor in which rotating CW/CCW. Single flagellums when Run = CCW or CW, when Tumble, stop turn and reorient. In Many – they do all at once, cooridnated, to move they run = turning ccw in one coordinated bundle, when to tumble = they turn cw, and the coordination comes apart and stops and reorient.

(You can remmber though the 9 steps)

2) Short: Where are new flagellin subunits added to a growing filament, and how do they get there?

My answer:

Flagellins, through a hollow tube.

B1. Other motility and motility tests

Short answer (4 pts): List two other forms of motility seen in bacteria besides the motility mediated by the typical flagella sticking out from the cell. For each form, also describe how the motility occurs. (4 pts)

Your answer: stalks - for adhesion / nano-tubes to help connect and trasnfer dna between two cells (can be different)

Your score: 0 of 4. Stalks (adhesion) and nanotubes (sharing between cells) are not motility. Pick from: periplasmic flagella, swarming, gliding, twitching, each with how.

Everything he gives points for (any 2 of these):

- **(2 pts)** Periplasmic (axial) flagella of spirochetes: the flagella lie in the periplasm and wrap the cell; their rotation makes the cell wiggle in a helical, corkscrew motion
- **(2 pts)** Swarming: many flagellated cells move together as a group over a solid surface, inside a slime layer
- **(2 pts)** Gliding: smooth movement of cells over a solid surface that is not mediated by flagella
- **(2 pts)** Twitching: type IV pili extend, attach to the surface and retract, pulling the cell forward in jerky movements

You gave 0 full-credit item of the 2 needed.

Correct answer: Twitching: type IV pili extend, attach and retract, pulling the cell. Gliding: smooth movement over a solid surface with no flagella. (Also: periplasmic flagella that corkscrew the cell, or swarming groups on a surface.)

Practice: Pick two motility types that do not use external flagella (not stalks or nanotubes) and say how each one moves the cell.

My answer:

Sliding and Gliding, and they move across surface.

Short answer (3 pts): You have isolated a new bacterial species and sequenced its genome. List three tests or things a scientist could do to demonstrate or give support to a prediction about whether the organism is motile. (3 pts)

Your answer: Electron Microscopy, Gram-stain, Turbidity test.

Your score: 1 of 3. A Gram stain shows the envelope, not motility. Each test needs what it shows. Good options left: flagellar genes in the genome, relatives by 16S phylogeny.

Everything he gives points for (any 3 of these):

- **(1 pt)** Phylogeny: find the closest related species (16S rRNA) and see whether they are motile
- **(1 pt)** Observe motility directly: motility tube or soft agar test, spreading across a plate, or live cells under the microscope (wet mount, hanging drop) You got 0.5 of 1: Name it: motility agar (soft agar stab); turbid all through means motile.
- **(1 pt)** See flagella: a flagella stain or electron microscopy You got 0.5 of 1: Say what EM shows: you look for flagella (or use a flagella stain).
- **(1 pt)** Genome: look for flagellar (and chemotaxis) genes among the predicted genes

You gave 0 full-credit item of the 3 needed.

Correct answer: Look for flagellar (fli, flg, mot) genes in the genome. Check whether close relatives (16S phylogeny) are motile. Watch live cells in a wet mount or stab motility agar (turbid all through = motile). Look for flagella with a flagella stain or EM.

Practice: Give three ways to test if a new isolate is motile, and say what result each one would show.

My answer:

Walking (Purposeful walking, aka Wet mount), Feet stain (flagellar staining), EM (see microscope of flagellar), Moblie agar (cloud – turbbity), Swarm plate (spread in circle). They can use the closet related spceies thouhg phylogeny (motile), Genome (looks for flagellar genes through predicted genes)

Multiple choice: Which of the following is a form of motility observed in bacteria that is NOT mediated by flagella?

A. Twitching motility on a surface
B. Gliding motility across a surface (your answer)
C. Swarming motility on a surface.
D. Corkscrew, wiggling swimming motility of spirochetes in liquid
E. A and B (correct)

Your answer: B. Gliding motility across a surface

Correct answer: E. A and B

Why: Twitching (type IV pili) and gliding (membrane motility proteins) do not use flagella. Swarming and spirochete motility are flagella mediated.

Practice: Which two forms of motility on a surface do NOT use flagella, and which surface motility DOES use flagella?

My answer:

Non-motility Sliding (passive, need extra surfactants), twitching (extend,attach,shorten), gliding (smooth not well understood) – all on across solid surface

Motility – Swimming (liquid, rotate runs + tumbles), Periplasmic (liquid, in periplasm wrap cell, rotation, wiggle, corkscrew good for burrowing mucus), swarming (across surface, raft cells together needs slime layer, may be lateral)

Study guide objectives for this area

- **Types of motility observed in bacteria - know how each mediated** - 6 types (3 meditated: (periplamic (wiggle, corkscrew) , swimming (run + tumble) , swarming (together) and non meditated: twitching (pili iv), gliding (unknown), sliding (lube)
- **Swimming motility mediated by flagella** – CW/CCW to run , other way to tumble ; many does all at once with CCW to run , tumble same other way to tumble
- **Periplasmic flagella in spirochetes** – flagella each pole in periplasm that wrap around cell ,
- Swarming motilityto do the wiggle corkscrew burrow.
- **Gliding motility** – non-meditated unknown mechanism across surface
- **Twitching motility** – uses extend, attach, short, pull cell- uses Type IV pilli
- **Chemotaxis - what is it –** stimulus, receptor in membran that senses attractrant, runs to attractant with flagella, create longer runs with fewer tumbles.
- **How one could determine if a bacterium is motile and if has flagella –** by tests such as wet mount (movement), flagellar stain/EM (see flagella), motility agar (motile by cloudy), swarm plate (spread in circle), chemotaxis (attractants) plates, genome (genes)

Area to check: Study guide B.1 "Types of motility observed", "Gliding", "Twitching" and "How one could determine if a bacterium is motile"; diagram section B (HOW EACH MOTILITY WORKS, IS IT MOTILE? TESTS).

Practice for the whole area (answer these)

1) Overall: Name three kinds of motility that are not done by external flagella and explain how each works. Then give three tests that show a new isolate is motile, with the result you expect from each.

- **My answer:** - 6 types (3 meditated: (periplamic (wiggle, corkscrew) , swimming (run + tumble) , swarming (together) and non meditated: twitching (pili iv), gliding (unknown), sliding (lube) ;

by tests such as wet mount (movement), flagellar stain/EM (see flagella), motility agar (motile by cloudy), swarm plate (spread in circle), chemotaxis (attractants) plates, genome (genes)

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2) Short: In a motility agar stab, what result means the cells are motile?

My answer:

Cloudy – motile

C1. Envelope layers (Gram-positive, Gram-negative, Mollicutes)

Short answer (4 pts): Describe the layer and components that can be found in the envelope of a Gram-positive bacteria. (4 pts)

Your answer: capsule , s layer, cell wall, periplasm, cell membrane made up of proteins, lipid.

Your score: 2.5 of 4. Layers are right, but each layer needs its component. The wall answer must say thick peptidoglycan with teichoic acid. Drop the periplasm for Gram-positives.

Everything he gives points for (all of these):

- **(1 pt)** Capsule (glycocalyx) of sugars and/or protein, present in some You got 0.5 of 1: Give its component: sugars and/or protein.
- **(1 pt)** S-layer of protein, present in some You got 0.5 of 1: Give its component: protein.
- **(1 pt)** A thick peptidoglycan wall with teichoic acids You got 0.5 of 1: Say THICK peptidoglycan with teichoic acid.
- **(1 pt)** Cell membrane of phospholipids and proteins **You got it.**

Correct answer: Capsule (some) of sugars and/or protein. S layer (some) of protein. Thick peptidoglycan wall with teichoic acid. Cell membrane of phospholipids and proteins.

Practice: For each layer of a Gram-positive envelope, give the layer and what it is made of.

My answer:

Cancer (capsule), Serotonin (S layer), Collagen (Cell wall with teioich acids + peptidgoylcan thick), Cell membrane , This one lacks outer-membrane.

Capsule is sugars + proteins, S layer is proteins, Cell wall is peptidoglycan + teichoic acids, Cell membrane is phosholipids + proteins

Short answer (3 pts): Describe the layers and the components found in each layer of the envelope of a Gram-negative bacterium. (3 pts)

Your answer: s layer, capsule/glycolax, outer membrane, cell wall, periplasm, cell membrane with proteins and lipids and etc

Your score: 2.25 of 3. All layers are there. Missing components: LPS in the outer membrane and peptidoglycan for the wall.

Everything he gives points for (all of these):

- **(1 pt)** Outer membrane made of lipopolysaccharide (LPS), proteins such as porins, and phospholipids You got 0.5 of 1: Give its components: LPS, proteins (porins), phospholipids.
- **(0.5 pts)** Cell wall made of peptidoglycan (a thin layer) You got 0.25 of 0.5: Say it is (thin) peptidoglycan.
- **(0.5 pts)** Periplasm, the space between the outer and inner membranes **You got it.**

- **(1 pt)** Cell (inner) membrane made of phospholipids and proteins **You got it.**

Correct answer: Outer membrane of LPS, proteins (porins) and phospholipids. Thin peptidoglycan wall in the periplasm (the space between the two membranes). Inner (cell) membrane of phospholipids and proteins. A capsule or S layer may sit outside.

Practice: For each layer of a Gram-negative envelope, give the layer and what it is made of (include the three parts of LPS).

My answer:

S layer – proteins, Capsule – sugars, outer membrane (LPS (O antiegen (sugar) , core polysarrachide (same within species), lipid a (inflammation) , porins, phosopholipids), cell wall (periplasm watery, thin peptidgoylcan, periplasm) , cell membrane with phosholipids + proteins

Multiple choice: Which of the following is an unusual feature of the envelope of Mollicutes like Mycoplasma?

A. Cell membrane has isoprenoids instead of phospholipids (your answer)
B. Has an outer membrane
C. Cell wall contains teichoic acid
D. Cell wall composed of pseudopeptidoglycan instead of peptidoglycan
E. Lacks a peptidoglycan cell wall (correct)

Your answer: A. Cell membrane has isoprenoids instead of phospholipids

Correct answer: E. Lacks a peptidoglycan cell wall

Why: Mollicutes such as Mycoplasma have no peptidoglycan cell wall; their membrane contains sterols for strength.

Practice: What is unusual about the Mycoplasma envelope, and what molecule helps stabilize its membrane?

My answer:

Compared to others, no cell wall, uses sterols to stabilizes and only a sugar layer.

Study guide objectives for this area

- 1. Know the layers and components of the envelope in each of the following types of bacteria? How similar and different from each other
- a. Gram positive bacteria – Capsule, S-layer, Cell wall (peptidogylcan + teicohic acids), cell membrane
- b. Gram negative bacteria – S layer , capsule, outer membrane (LPS (o-antigen,core polyssarachide,lipid a), porins, phosholipids), cell wall (periplasm, peptidogylcan, periplasm), cell membrane
- c. Mycobacteria – capsule, cell wall of (mycloic acids -> arabaobian -> galatacan), cell membrane
- d. Archaea – s layer – pseudopeptidgican that has nat instead of Nat and is L-amino instea dof D.
- e. Mollicutes (Mycoplasma) – sugar layers, cell membrane that stablzie by sterols.

Area to check: Study guide C.1 "a. Gram positive", "b. Gram negative", "e. Mollicutes"; diagram section C (envelope columns: Layer (all/some): content).

Practice for the whole area (answer these)

1) Overall: From outside to inside, list every layer and its components for a Gram-positive, a Gram-negative and a mycobacterial envelope.

My answer:

Gram + = capsule (sugar,protein), s layer (proteins), cell wall (thick peptidgoylan + techihcoic acids) , cell membrane (proteins,phosholipids)

Gram - = s layer (proteins) , capsule (sugar) , outer membrane (LPS (o-antigen, core polysarrachide, Lipid-A), phosholipids, porins) , cell wall (periplasm, thin peptidgoylcan, periplasm) , cell membrane (proteins,phosholipids)

Mycobacterial = capsule (sugar, protein), cell wall (mycloic acids , arabinos + galatacnesin, peptidglycan) , cell membrane of phosplpids + proteins

Mollicutes – sugar layer , cell mebrane that phosoholipids + sterols to stablize

Archea – S layer – proteins , cell wall made up of pseudopeptiglycan (NAG + NAT , 1,3 linkage) , cell membrane with isopreonoids (no phosohlopids)

2) Short: What is the unusual feature of the Mycoplasma envelope, and what does it mean for penicillin?

My answer:

Because it has no cell wall so it ignores.

C1. How the envelope affects cells, and confirming Gram-positive

Short answer (3 pts): Describe three ways the nature of the envelope affects the properties of a bacterium. (3 pts)

Your answer: transport, protection from drying out and protection from phagocytosis

Your score: **0.5 of 3.** Drying out and phagocytosis are capsule roles, not the envelope effects he wants. Use his list: shape, staining, what enters, drug and acid sensitivity, osmotic protection.

Everything he gives points for (any 3 of these):

- **(1 pt)** The cell wall determines (helps determine) cell shape
- **(1 pt)** It decides how the cell stains, including Gram and acid-fast staining results
- **(1 pt)** It controls which chemicals and molecules can enter the cell (permeability) You got 0.5 of 1: Say the envelope controls which chemicals and molecules can ENTER the cell.
- **(1 pt)** It affects sensitivity to drugs, antibiotics, detergents, acids and bases
- **(1 pt)** The wall protects the cell from osmotic pressure (bursting) in hypotonic water

You gave 0 full-credit item of the 3 needed.

Correct answer: The cell wall helps set cell shape. The envelope decides Gram and acid-fast staining. It controls which chemicals enter and how sensitive the cell is to drugs, acids and bases.

Practice: Name three properties of a bacterium that the envelope affects (not capsule roles), with one example for each.

My answer:

Cell shape – S layer, Cell wall

Cell stain results – cell wall (peptigoylcan)

Controls molecules/chemical that can enter cell – porins (periplasm), carriers/ion transport (uni/sym/aniports) , abc transport (atp powered), pts (sugar change proteins)

Affects sensisitvity to drugs and antibiotics – pencillins (peptigoylcans or resistnatn of outer membrane), caphalosporins (block cross-link for peptidgoylcan syntehsis in cell wall -> holes and lysed) + vancomycin (prevent cross link by d-ala-d-ala bindd,

Wall protect cell from bursting in hypotonic water (periplasm)

Short answer (3 pts): You have isolated a new bacterial species from the gut of an insect. You did a Gram stain, and the cells were purple. Describe two techniques or experiments one could do to support or confirm that the bacterial strain has a Gram-positive envelope. (3 pts)

Your answer: EM and DYEING THE CELLS

Your score: 0.75 of 3. Dyeing the cells repeats the Gram stain, so it earns 0. Every test needs its expected result.

Everything he gives points for (any 2 of these):

- **(1.5 pts)** Transmission electron microscopy of the envelope shows a thick peptidoglycan wall over one cell membrane and no outer membrane You got 0.75 of 1.5: Say the result: a thick peptidoglycan layer and no outer membrane.
- **(1.5 pts)** Chemically test the envelope for its components: teichoic acid found in the cell wall, or no LPS found, supports a Gram-positive envelope
- **(1.5 pts)** Test sensitivity to a penicillin such as penicillin G; being killed or inhibited supports Gram positive, since it works well on Gram-positive and poorly on Gram-negative bacteria
- **(1.5 pts)** Plate it on a medium selective for Gram-negative bacteria, such as MacConkey agar; no growth supports Gram positive
- **(1.5 pts)** Search the genome: no genes for LPS synthesis, outer membrane proteins or periplasmic proteins, and genes for teichoic acid synthesis, support Gram positive
- **(1.5 pts)** Do an acid-fast stain; a negative result (cells not red) rules out the mycobacterial envelope with mycolic acids

You gave 0 full-credit item of the 2 needed.

Correct answer: TEM shows one thick peptidoglycan layer and no outer membrane. Teichoic acid isolated from the wall, or no LPS, supports Gram-positive. (Also: killed by penicillin G, no growth on MacConkey, no LPS genes.)

Practice: Give two experiments, each with its expected result, that would show a purple-staining isolate has a Gram-positive envelope.

My answer:

Search genome for genes for teichoic acids; TEM test for one thick layers (b/c peptidogylcan thick).

Study guide objectives for this area

- How do scientists determine the structure of the envelope of bacteria? By testing such as TEM, Acid-Fast, Genome, Staining.
- How the nature of envelope affects bacterial cells? Shape, transport, protection, drug sensitiveity m, testing

Area to check: Study guide C.1 "How the nature of envelope affects bacterial cells?" and "How do scientists determine the structure of the envelope"; diagram section C (ENVELOPE affects box).

Practice for the whole area (answer these)

1) Overall: Give three ways the envelope affects a bacterium. Then describe two experiments, each with its expected result, that would confirm a purple-staining isolate has a Gram-positive envelope.

My answer:

Transport of molecules/chemicals, Sentsitiivity to drugs/antibiotics, Structural/Shape with like S layer or Cell wall. TEM test to see if there is one thick dark layer (peptidogylcan) or Pencillin testing to see if it is sensitive to it.

2) Short: What would a TEM picture of a Gram-positive envelope show?

My answer:

One dark layer (thick layer)

C2a. Glycocalyx

Short answer (3 pts): Answer these two questions about the glycocalyx capsule of bacteria. a. What types of molecules can be found in the glycocalyx capsule of bacteria? (1.5 pts) b. Describe two roles of the glycocalyx of bacterial cells. (1.5 pts)

Your answer: A) sugars and proteins b) protection from dessication and phagocytosis

Your score: **2.5 of 3.** Part b is full. Part a is missing DNA.

Everything he gives points for (all of these):

- **(0.5 pts)** Part a: sugars (polysaccharides, EPS) **You got it.**
- **(0.5 pts)** Part a: peptides or proteins (for example polyglutamic acid) **You got it.**
- **(0.5 pts)** Part a: DNA You got 0 of 0.5: DNA is the third molecule type.
- **(0.75 pts)** Part b, role 1, any one of: attachment to surfaces, protection from phagocytosis, protection from desiccation, matrix for forming biofilms **You got it.**
- **(0.75 pts)** Part b, role 2: a second, different role from the same list **You got it.**

Correct answer: a. Sugars, peptides (proteins) and DNA. b. Attachment and biofilms, protection from phagocytosis, protection from drying out.

Practice: What three types of molecules can be in a glycocalyx?

My answer:

Sugars, peptides, dnas

Study guide objectives for this area

- a Glycocalyx (capsule and slime layer) -
- Role and composition

Area to check: Study guide C.2 "a Glycocalyx" and "Role and composition"; diagram section C (glycocalyx box).

Practice for the whole area (answer these)

1) Overall: Compare a capsule and a slime layer, and give the three kinds of molecules and three roles of the glycocalyx.

My answer:

Sugars, peptides, dna.

Role in anti-phagocytosis, anti-desiccation (drying out) , attachment to surfaces + biofilms ,

2) Short: Name the three types of molecules found in a glycocalyx.

My answer:

Peptides, sugars, dna.

C2c. Outer membrane and LPS

Multiple choice: Which of the following is NOT true about the outer membrane?

A. Contains lipopolysaccharide
B. Contain phospholipids
C. Almost all molecules that cross the membrane go through porin channel proteins (your answer)
D. Prevents some antibiotics from entering and acting against the bacteria
E. Contains isoprenoids (correct)

Your answer: C. Almost all molecules that cross the membrane go through porin channel proteins

Correct answer: E. Contains isoprenoids

Why: Isoprenoid lipids belong to archaeal cell membranes; the Gram-negative outer membrane has LPS, phospholipids and porins.

Practice: Name three things found in the outer membrane, and one thing NOT found there (and where it belongs instead).

My answer:

LPS (O-aniogen , core polysaarrachide, Lipid-A) , phosholipids, proteins; Peptidoglycan is not found in the Outer membrane but is found in the cell wall.

Multiple choice: Which of the following is found only in the outer membrane of Gram-negative bacteria?

A. Mycolic acids
B. Teichoic acids (your answer)
C. Lipopolysaccharide (correct)
D. Peptidoglycan
E. A and B

Your answer: B. Teichoic acids

Correct answer: C. Lipopolysaccharide

Why: Lipopolysaccharide is found only in the outer leaflet of the Gram-negative outer membrane.

Practice: Which molecule is found only in the Gram-negative outer membrane, and where are teichoic acids found?

My answer:

LPS, and teichoic acids are found in the gram + cell wall together with the thick peptidgoylcan.

Study guide objectives for this area

- c. Outer membrane
- LPS

Area to check: Study guide C.2 "c. Outer membrane" and "LPS"; diagram section C (LPS: O antigen, core, lipid A).

Practice for the whole area (answer these)

1) Overall: Describe the outer membrane: its components (the three parts of LPS, porins, phospholipids) and how it blocks hydrophobic and hydrophilic molecules.

My answer:

O-antigen + Core polysaccharide + lipid a attach to each toher – makes it packed tightly so that hydrophobics molcuesl cannot get in and only small (<700 daltons) can get in through the porins. Phosolopipids bilayer blocks the hydrophillic molecules

2) Short: Name two molecules that are NOT in the outer membrane and say where each one belongs.

My answer:

Peptigyoglycan – cell wall ; and DNA - capsule

C2d. Peptidoglycan and mycolic acids

Short answer (3 pts): Describe the basic structure of the peptidoglycan layer in Gram-negative bacteria. You do not have to be able to name the components in peptidoglycan, but you should be able to state the kind of molecules within the peptidoglycan. (3 pts)

Your answer: made up of peptides, proteins, glycoproteins, bilayer.

Your score: 0.5 of 3. Peptidoglycan is sugars plus peptides, not proteins or glycoproteins. "Bilayer" is a membrane word. Say thin, 1 to 2 layers, in the periplasm.

Everything he gives points for (all of these):

- **(1 pt)** Long chains of two alternating (repeating) sugars, NAG and NAM You got 0 of 1: Two alternating sugars (NAG and NAM) in long chains.
- **(1 pt)** The sugar chains are cross-linked by short peptides (about 4 amino acids) attached to NAM You got 0.5 of 1: Say the short peptides CROSS-LINK the sugar chains.
- **(1 pt)** In Gram-negative cells it is thin, only one or a couple of layers, located in the periplasm (between the two membranes) You got 0 of 1: Gram-negative: thin, 1 to 2 layers, in the periplasm. Not a bilayer.

Correct answer: Long chains of two alternating sugars, NAG and NAM. The chains are cross-linked by short peptides (about 4 amino acids) coming off NAM. In Gram-negatives it is thin, 1 to 2 layers, in the periplasm.

Practice: What two kinds of molecules make up peptidoglycan, how are they connected, and how thick is it in Gram-negatives and where does it sit?

My answer:

NAG-NAM alternating sugar chain crossed link 1-4 ; is much thinner 1-2 layers, in gram negative than gram position that sits in the periplasm

Multiple choice: Which of the following is a difference between the peptidoglycan found in Gram-positive staphylococcal bacteria and the peptidoglycan found in Gram-negative bacteria?

A. The amino acids in the peptide cross-link
B. The peptidoglycan in Gram-positive is thicker because it has more layers
C. The linkage between the two sugars is different (your answer)
D. The two sugars in the peptidoglycan are different
E. A and B (correct)

Your answer: C. The linkage between the two sugars is different

Correct answer: E. A and B

Why: Staphylococcal peptidoglycan uses L-Lys with a pentaglycine bridge instead of DAP, and it has 3 to 20 layers versus 1 to 2 in Gram-negative bacteria. The sugars and their link are the same.

Practice: Give two real differences between E. coli and Staphylococcus peptidoglycan, and one thing that is the SAME in both.

My answer:

Staphyloccocal – thicker, E coli , thinner peptigylcan (3-20 vs 1-2), Staphylococcal cross-link; while E coli just links directly

Multiple choice: Molecules of an unique, large hydroxylated, branched fatty acid with 60-90 carbons is found in _____

A. in the peptidoglycan layer of Gram-positive bacteria
B. in the peptidoglycan layer of Gram-negative bacteria (your answer)
C. in the outer membrane of Gram-negative bacteria
D. in the envelope of acid-fast bacteria such as mycobacterium (correct)
E. in the membrane of Archaea bacteria

Your answer: B. in the peptidoglycan layer of Gram-negative bacteria

Correct answer: D. in the envelope of acid-fast bacteria such as mycobacterium

Why: Mycolic acids, long (60 to 90 carbon) branched, hydroxylated fatty acids, are in the envelope of acid-fast bacteria such as Mycobacterium.

Practice: What are mycolic acids made of (how many carbons), and in which bacteria and which envelope layer are they found?

My answer:

Waxy lipids in which has 60-90 carbons, that is in cell walls of mycobacteria

Study guide objectives for this area

- d. Cell Wall – Role – structural/shape/suport semi rigid stops lysis,
- 1) Peptidoglycan - structure – sugars – NAM/NAG sugars,
- Know how differs in Gm neg. vs Gm pos – thin and thicker
- Basic order of events in Synthesis – (N + N, PENTAPEPTIDE, Bacteoprenol, NAG, FLIP (MURJ), PBPS link + crosslink, bactoprenol recycle.
- 2) Pseudopeptidoglycan - how differs from peptidoglycan – 1,3 instead of 1,4 crosslink plus NAT instead of NAM, and also all L-aminos, and lyzosomes cant cut.
- 3) Teichoic acids – inside Gram + (shape,divisiom,identifiy)
- 4) Mycolic acids – inside mycobacteria (blocking difussion plus resisintat acid drugs bases drying)

Area to check: Study guide C.2 "1) Peptidoglycan", "Know how differs in Gm neg. vs Gm pos" and "4) Mycolic acids"; diagram section C (PEPTIDOGLYCAN SYNTHESIS, steps 1 to 7).

Practice for the whole area (answer these)

1) Overall: Describe the structure of peptidoglycan, then explain two ways Gram-negative (E. coli) peptidoglycan differs from Gram-positive (Staphylococcus) peptidoglycan.

My answer:

Peptigoylcan is made up of sugar links, NAM-NAG in a 1,3 linkage, and they link and crosslink. Gram-negative has a (1-2 layer) vs a (3-20) of gram +. It also have a DAP linkage on 3 instead of the L-lys seen in gram +.

2) Short: What are mycolic acids, and in which bacteria are they found?

My answer:

Found in mycobacteria and is part of the cell wall, 60-90 carbons, are waxy lipids, that difussion are resistrors acids drugs bases drying

C2f. Cell membrane differences

Short answer (3 pts): Describe two ways the components of the membranes of bacteria can differ. The differences can be components that differ in different types of bacteria including Archaea or components that can change in response to the environmental conditions the bacteria are experiencing. (3 pts)

Your answer: If they have outer membrane to help protect or if they have mycloic acids for mycobacteria (acid fast) to see.

Your score: 0 of 3. Mycolic acids are in the wall, not the membrane. The outer membrane alone earns nothing; tie LPS to it. Best two: archaea isoprenoids vs bacterial phospholipids; fatty acids change with temperature.

Everything he gives points for (any 2 of these):

- **(1.5 pts)** Archaea have isoprenoid lipids joined to glycerol by ether links, while bacteria have phospholipids with fatty acids joined by ester links
- **(1.5 pts)** Some bacteria have hopanoids (5-ring, sterol-like molecules) in the membrane while others have cardiolipin
- **(1.5 pts)** Fatty acid chains change with temperature: more or less saturated (number of double bonds), and chain length changes
- **(1.5 pts)** Gram-negative bacteria have LPS in their outer membrane
- **(1.5 pts)** The types of phospholipids vary, for example in their head group
- **(1.5 pts)** Membrane proteins differ between species and between bacteria living in different conditions

You gave 0 full-credit item of the 2 needed.

Correct answer: Archaea have ether-linked isoprenoid lipids, while bacteria have ester-linked phospholipids. Bacteria change fatty acid saturation and length with temperature (more unsaturated in the cold).

Practice: Give two ways membrane components differ: one between archaea and bacteria, and one change bacteria make with temperature.

My answer:

Archea – has a pseudopeptogylcan compare to peptidogylcan , they have different sugar linakges at 1,3 and NAG-NAT isntead of NAG-NAM. Also with ISOPRENOIDS that ether linked. Change in struadation or length.

Multiple choice: Twenty (20) or forty (40)-carbon long, terpene isoprenoids are found in the

_____

A. Cell membrane of archaeal bacteria (correct)

B. Outer membrane of Gram-negative bacteria

C. Cell wall of acid-fast Mycobacterium

D. Cell wall of Gram-positive bacteria
E. Cell membrane of Mycoplasma (your answer)

Your answer: E. Cell membrane of Mycoplasma

Correct answer: A. Cell membrane of archaeal bacteria

Why: C20 (phytanyl) and C40 (biphytanyl) isoprenoid chains, ether-linked to glycerol, make up archaeal cell membranes.

Practice: Where are 20 or 40 carbon isoprenoid lipids found, and how are they linked to glycerol?

My answer:

Found in the bilayer of arachea – in the cell membrane .

Study guide objectives for this area

- f. Cell membrane
- Role, function of hopanoids, isoprenoids,
- Components (Types of lipids, etc) observed in bacteria
- Components observed in Archaea and how different? Isoprenoids
- How do types of fatty acids present change in response to temperature?

Area to check: Study guide C.2 "Components (Types of lipids, etc)", "Components observed in Archaea" and "How do types of fatty acids present change in response to temperature?"; diagram section C (CELL MEMBRANE components).

Practice for the whole area (answer these)

1) Overall: Describe how bacterial and archaeal membranes differ, and how bacteria change their membrane lipids when the temperature drops.

My answer:

Sugar linkages , pseudopeptdeglycan vs peptidiglycan , they can change length and saturated of fatty acids.

2) Short: Which lipids have 20 or 40 carbons, and in which membrane are they found?

My answer:

Phoshoplipid bilayer

C4. Penicillin and other wall drugs

Short answer (4 pts): Describe how the penicillin family members of antibiotics act against bacteria. Describe their mechanism of action (what they target or act against) and what effect the antibiotic has on bacterial cells. (4 pts)

Your answer: They target cell wall (peptidoglycans) , so no peptidoglycans means bacteria type is resistant and is also less effective iwth those with outer membranes. They create holes in the cell wall til like water comes in (osomosis) and then holes form til it lysed.

Your score: 1.5 of 4. The effect (holes, then lysis) is full credit. Missing the mechanism: D-Ala-D-Ala look-alike that blocks the PBP transpeptidase.

Everything he gives points for (all of these):

- **(1 pt)** Penicillins inhibit synthesis of new peptidoglycan (cell wall) You got 0.5 of 1: Say they block SYNTHESIS of new peptidoglycan.
- **(1 pt)** Penicillin is structurally similar to the D-Ala-D-Ala end of the peptide in peptidoglycan You got 0 of 1: Penicillin looks like D-Ala-D-Ala.

- **(1 pt)** It binds and inhibits the transpeptidase (and perhaps transglycosylase) of the penicillin-binding proteins, so the peptide cross-links are not made You got 0 of 1: It binds PBPs and blocks transpeptidase (cross-linking).
- **(1 pt)** Effect: holes form in the peptidoglycan layer of growing cells, the membrane expands through them and the cell lyses **You got it.**

Correct answer: Penicillins block synthesis of new peptidoglycan. They look like D-Ala-D-Ala and bind PBPs, blocking transpeptidase (cross-linking). Growing cells get holes in the wall, the membrane bulges out, and the cell lyses.

Practice: Write penicillin's mechanism in four steps: what it blocks, what it looks like, which enzyme it binds, and what happens to the cell.

My answer:

Help create new peptidgoylcan and is structurally smialr to D-ala-d-ala end of the peptide in peptidglycan , it binds/inihbits the transpeptidase and transglocslyase so that peptide corsslinks are not made, and hols form in peptiglycan of gorwing cells as memrbane expand thorugh them and cell lyses.

Short answer (3 pts): A doctor sees a patient and thinks he has a serious bacterial infection but does not know what type of bacteria is causing the infection. The doctor wants to put the patient on antibiotic immediately and prescribe penicillin without waiting for any tests that would characterize the bacteria that is causing the infection. Give two reasons why the treatment with penicillin may not work or would not kill all the bacterial cells that are causing the disease? (3 pts)

Your answer: pencillin would not work if there is a outer membrane in gram negative bacteria as it would prevent antibtioic from entering. It would also not work if there is no peptidogylcan to attach to .

Your score: 1.5 of 3. First reason is full credit. "No peptidoglycan" is the same line (kinds of bacteria it cannot work on), so it counts once. Use resistance or not growing for reason two. Penicillin binds PBPs, not peptidoglycan.

Everything he gives points for (any 2 of these):

- **(1.5 pts)** The strain may be resistant to penicillin, for example by making beta-lactamase or an altered penicillin-binding protein
- **(1.5 pts)** Penicillin does not work on all kinds of bacteria: Gram-negative bacteria (the outer membrane keeps it out), Mycobacteria (waxy mycolic acid envelope), or Mycoplasma (no wall) **You got it.**
- **(1.5 pts)** Some cells in the population are not growing (dormant, stationary), and penicillin only kills cells making new cell wall You got 0 of 1.5: Second reason should be different: resistance (beta-lactamase) or cells not growing.
- **(1.5 pts)** The infection may not be bacterial (a virus or a eukaryotic microbe), which has no peptidoglycan for penicillin to act on

You gave 1 full-credit reason of the 2 needed.

Correct answer: The bacteria may be resistant (beta-lactamase or altered PBP). Gram-negatives or Mycobacteria keep it out (outer membrane, mycolic acids). Cells that are not growing are not killed.

Practice: Give two DIFFERENT reasons penicillin may fail to cure an infection (not two versions of "it cannot get in").

My answer:

Strain resistnat to pencillin that is shwoed by making abeta-lactamse or alter pbp; pencillin doesn't work for all kinds of bacteria, as some cells in population are not growing and pencillin only klls gorwing cells, and the infection not bacterial (virus or eukaryotic -> no peptidgoylcan) for pencillin to act on .

Short answer (3 pts): You have gone to help in an area hit by a hurricane. The hurricane has knocked out the municipal water treatment facility and individuals are asking how they can treat water from a stream to make it safe to drink. One person asks if they could treat the water with penicillin. The individual states he has some pills of penicillin left over from when he was sick and said he was told penicillin kills bacteria. Give two reasons why treating the water with penicillin may not work to make the water safe to drink. (3 pts)

Your answer: Pencillin can't pass through outer membrane or cant get to cell wall

Your score: 1.5 of 3. Outer membrane is full credit. "Cannot get to the cell wall" is the same reason again. Add not growing, resistance, or dose too low in that much water.

Everything he gives points for (any 2 of these):

- **(1.5 pts)** The bacteria in the water may not be growing; penicillin kills only cells that are growing and making new cell wall (peptidoglycan) You got 0 of 1.5: Second reason should be different: cells in water are not growing, so penicillin does not kill them.
- **(1.5 pts)** Penicillin may not work on the kind of bacteria causing the illness, such as Gram-negative bacteria whose outer membrane keeps it out, Mycobacteria, or Mycoplasma with no cell wall **You got it.**
- **(1.5 pts)** The bacteria may be resistant to penicillin, for example by making a beta-lactamase or an altered penicillin-binding protein
- **(1.5 pts)** The penicillin may not reach a high enough concentration in the volume of water
- **(1.5 pts)** The illness may not be caused by bacteria at all, such as a virus or a eukaryotic microbe; peptidoglycan synthesis is unique to bacteria, so the drug does nothing to them

You gave 1 full-credit reason of the 2 needed.

Correct answer: Bacteria in stream water may not be growing, and penicillin only kills cells making new wall. Gram-negatives keep it out with the outer membrane. They may be resistant, and the dose would be too low in that much water.

Practice: Give two DIFFERENT reasons penicillin pills would not make stream water safe to drink.

My answer:

Pencillin doesn't work on kind of bacteria causing the illness, or may be resisitn to pencilin by making beta-lacataasmase or alters pbp, or not a hihg enough conc. Of pencillin or ilness is not bacterial, or bacteria is not growing.

Multiple choice: Lysozyme acts to _____

A. cleave the sugars off lipopolysaccharide
B. cleave the linkage between the sugars in peptidoglycan (correct)
C. inhibit the synthesis of D-alanine
D. inhibit the recycling of bactoprenol (your answer)
E. inhibit the transpeptidase reaction that crosslinks the peptide chains

Your answer: D. inhibit the recycling of bactoprenol

Correct answer: B. cleave the linkage between the sugars in peptidoglycan

Why: Lysozyme is an enzyme that breaks the beta-1,4 bond between the NAG and NAM sugars, cutting the glycan chains of peptidoglycan.

Practice: What does lysozyme cut, and which drug blocks recycling of bactoprenol?

My answer:

Cuts 1-4 bond in NAG and NAM

Study guide objectives for this area

- 4. How do different antibiotics interfere with peptidoglycan synthesis?
- Target of antibacterial drugs/antibiotics:
- Know specific mechanism of action of each of the following
- Penicillin,
- Cephalosporin
- Bacitracin
- Vancomycin
- D-cycloserine
- Lysozyme
- How do bacteria resist the effects of antibiotics?

Area to check: Study guide C.4 "Penicillin," "Lysozyme" and "How do bacteria resist the effects of antibiotics?"; diagram section C (HOW WALL BLOCKERS KILL, drug arrows on PEPTIDOGLYCAN SYNTHESIS).

Practice for the whole area (answer these)

1) Overall: Explain how penicillin kills bacteria (what it blocks, what it looks like, which enzyme, what happens to the cell), and give three different reasons it might not work.

My answer:

So it help with synthesis of new peptidoglycan of cell wall, looks like the d-ala-d-ala of the peptide of peptidoglcan end, uses a lyzosome to cut 1-4 linkage NAM-NAG and create holes in the wall til membrane expands and then lyse.

works for only growing cells, works for only certain types of bacteria, needs to be bacteria, too little conc. Or restiant is bult by bet-alactose.

2) Short: What does lysozyme cut, and which drug blocks bactoprenol recycling?

My answer:

1-4 linakge , bactitracin

D. Internal structures

Short answer (4 pts): List two examples of compartments that have been found inside bacterial cells. Then describe their structure and their role or function in bacterial cells. You can include a drawing. (4 pts)

Your answer: invagaitions are folds inside the inner membrane that help with structure. nuceloids are inside that have non-ribosome and use histone-like proteins

Your score: **0 of 4.** A nucleoid has no membrane, so it is not a compartment. Membrane folds count only as photosynthesis sites (thylakoids, invaginations), not for structure. Each pick needs structure plus role.

Everything he gives points for (any 2 of these):

- **(2 pts)** Thylakoids or chlorosomes: membrane compartments (thylakoid = full bilayer stacks; chlorosome = lipid monolayer sac) holding the photosynthetic pigments and machinery
- **(2 pts)** Carboxysomes: a protein shell around enzymes (Rubisco) where carbon fixation (CO_2 fixation) happens
- **(2 pts)** Gas vesicles: hollow compartments with a protein shell that fill with gas and make the cell buoyant

- **(2 pts)** A membrane surrounding the DNA (nucleoid) in one type of bacteria (Gemmata, a planctomycete), enclosing the chromosome
- **(2 pts)** Endospore formation: the forespore is a compartment enclosed by two membranes inside the mother cell, which becomes the dormant, resistant spore
- **(2 pts)** Magnetosomes: membrane-bound crystals of magnetite that let magnetotactic bacteria orient along magnetic field lines

You gave 0 full-credit item of the 2 needed.

Correct answer: Carboxysome: protein shell around Rubisco, site of CO2 fixation. Thylakoid: stacked membrane bilayers, site of light-harvesting photosynthesis. Gas vesicle: protein shell holding gas for buoyancy.

Practice: Name two bacterial compartments, and give the structure (membrane or protein shell) and the role of each.

My answer:

2 Trees (thylakoid) get lights - spereate from each other and is cyanobacteria

1 chromosome (chlorosome) wants another light is connected to membrane - green

2 invasive (invagination) surgeries connected with lights on – purple

A lot of stacked metro (methanotroph mebrane) buses are breakind down and are either connected or sepreated – methylococcus

Gas vesicle – protein shell with gas inside that float

Carboxyome – many side protien sheell that have rubisco that fix co2 into sugar to feed

Multiple choice: Which of the following has NOT been observed in the interior of bacterial cells?

A. Gases within a protein shell
B. Granules or aggregates of polyhydroxyalkanoates such as poly-B-hydroxybutyrate
C. Clumps of lipids (correct)
D. Granules of elemental sulfur
E. Crystals of iron magnetite (your answer)

Your answer: E. Crystals of iron magnetite

Correct answer: C. Clumps of lipids

Why: Bacteria store gas in gas vesicles, PHB (polyhydroxyalkanoate) granules, sulfur granules and magnetite crystals; clumps of lipids are not one of the inclusions he lists.

Practice: Name three things that HAVE been observed inside bacterial cells and one that has NOT.

My answer:

Gas vesicles, magnetosomes, sulfur granules

Multiple choice: Which of the following is true?

A. No cytoskeleton filaments have been found in bacteria.
B. Cytoskeleton filaments have been found in bacteria, but the bacterial cytoskeleton proteins are not similar to eukaryotic cytoskeleton proteins
C. Cytoskeleton filaments have been found in bacteria, but they are all formed from a homolog of eukaryotic actin. (your answer)

D. Cytoskeleton filaments have been found in bacteria, but they are all located on the outside of cells and are not similar to eukaryotic filaments.

E. Different types of cytoskeleton filaments have been observed in bacteria and homologs to all three types of eukaryotic cytoskeleton proteins have now been found in bacteria. (correct)

Your answer: C. Cytoskeleton filaments have been found in bacteria, but they are all formed from a homolog of eukaryotic actin.

Correct answer: E. Different types of cytoskeleton filaments have been observed in bacteria and homologs to all three types of eukaryotic cytoskeleton proteins have now been found in bacteria.

Why: Bacteria have several kinds of cytoskeleton filaments, with homologs of all three eukaryotic types: actin (MreB, ParM), tubulin (FtsZ) and intermediate filaments (crescentin).

Practice: Name the bacterial protein similar to each eukaryotic cytoskeleton type: tubulin, actin and intermediate filaments.

My answer:

Tubulin – FtsZ (center divider) ; actin – MreB (define/maintain for elongate) ; intermediatte filaments – CreS (curver)

Multiple choice: Which of the following is NOT true?

A. DNA has been found inside a cytoplasmic membrane compartment in one type of bacteria

B. Proteins interact with DNA in the bacteria cell to help fold and compact the DNA

C. DNA in bacteria is wrapped around an octamer of histone proteins (correct)

D. The location of DNA inside of bacterial cells can be detected with transmission electron microscopy

E. None of the above (all are true). (your answer)

Your answer: E. None of the above (all are true).

Correct answer: C. DNA in bacteria is wrapped around an octamer of histone proteins

Why: Bacteria do not wrap their DNA around histone octamers (that is eukaryotic); they compact it with nucleoid-associated proteins and supercoiling.

Practice: How is bacterial DNA packed, and does it use histones? Name one packing protein.

My answer:

They are compacted by nucleoid-assicoated proteins and sueprcoling (does not use histones) with one example being. Havard University (HU protein) is the number one wrap/package

International Healthy Friends (IHF) bends a lot

Healthy – Netural Structure (H-NS) – Structural support

Friendly inclusive Supporter – (FIS) – stablizies and reguales loops .

Multiple choice: Which of the following has NOT been observed in the cytoplasm of a bacterial cell?

A. Filaments similar to actin cytoskeleton (your answer)

B. Membrane compartments involved in photosynthesis

C. Granules or inclusions of energy reserves

D. Compartments holding gas

E. Membrane enclosed organelles involved in protein processing (correct)

Your answer: A. Filaments similar to actin cytoskeleton

Correct answer: E. Membrane enclosed organelles involved in protein processing

Why: Bacteria have no membrane-enclosed organelles for protein processing like the ER or Golgi; the other structures have all been seen.

Practice: Name one structure that has NOT been found in the bacterial cytoplasm, and two that have.

My answer:

No golgi or membrane enclosed, but do have ribosomes and cytoskeleton

Study guide objectives for this area

- D. Bacterial Internal Structures
- Know types of structures seen in bacteria
- 1. Cytoplasm and cytosol
- 2. Ribosomes
- 3. Cytoskeleton - types found and roles
- 4. Nucleoid - DNA and packing proteins
- 5. Compartments - intracellular membrane structures
- Know some Examples and their role, their possible arrangments
- 6. Inclusions and granules (know examples and their role)
- Gas vesicles, Carboxysomes,
- Energy/carbon storage polymers, Sulfur granules
- 7. Endospore: What they are

Area to check: Study guide D "Compartments", "Know some Examples", "Inclusions and granules", "Gas vesicles, Carboxysomes", "3. Cytoskeleton", "4. Nucleoid"; diagram section D.

Practice for the whole area (answer these)

1) Overall: List two compartments and two inclusions found in bacteria, with the structure and role of each, and name two things that have NOT been found inside bacterial cells.

My answer:

Thyakoids – Light capture ; Methanotroph - breakdown methane Gas vesicles – protien shell that buoyancy and Carbxoomes - fixes co2 for feed ; no memrbane enclsoed organelles like er or golgi

2) Short: Name the bacterial homologs of tubulin, actin and intermediate filaments.

My answer:

FtsZ, MreB, CreS

E. Cell division

Multiple choice: Which of the following is NOT true about cell division in bacterial cells?

A. Most bacteria divide via binary fission
B. A few species of bacteria reproduce by budding off a smaller offspring
C. During cell division, constriction, septation and cytokinesis always occur together (at same time) (correct)
D. A few bacteria can produce multiple offspring at once
E. Some bacteria produce non-identical offspring due to asymmetrical cell division (your answer)

Your answer: E. Some bacteria produce non-identical offspring due to asymmetrical cell division

Correct answer: C. During cell division, constriction, septation and cytokinesis always occur together (at same time)

Why: Constriction, septation and cytokinesis do not always happen together; in some bacteria the septum forms and the cells stay attached (chains, packets) before separating.

Practice: In which bacterium do cytokinesis, septation and separation happen all at once, and in which do they happen at different times?

My answer:

E.coli Gram – happen at once ; gram + (bacillus) , cytokinesis + septation together, then sepreation later.

Multiple choice: For the generation of two new separate bacterial cells, all of the following needs to occur EXCEPT

A. New peptidoglycan synthesis (your answer)
B. Replication of the chromosome
C. Septation or cleavage of peptidoglycan
D. Segregation of chromosome by mitotic spindle fibers composed of microtubules (correct)
E. Cytokinesis or division of the cell into two cells each with its own cell membrane

Your answer: A. New peptidoglycan synthesis

Correct answer: D. Segregation of chromosome by mitotic spindle fibers composed of microtubules

Why: Bacteria have no mitotic spindle of microtubules; their chromosomes are segregated by other systems as the cell grows.

Practice: List the steps needed to make two new bacterial cells, and name the one eukaryotic structure bacteria do NOT use to split chromosomes.

My answer:

Replication, Segregation, Cytokinesis, Septation, Separation

Study guide objectives for this area

- E Cell division and Differentiation
- Features of cell division in bacteria
- Different types of Cell division observed in bacteria
- Bacterial Cell Division Basic Steps in process: Replication, cytokinesis, septation, separation
- How can the process differ?
- Asymmetrical cell divisions and cell polarity
- Role of FtsZ and Min proteins
- Methods used to study cell division proteins

Area to check: Study guide E "Bacterial Cell Division Basic Steps", "How can the process differ?" and "Role of FtsZ and Min proteins"; diagram section E (BINARY FISSION, DIVISION TYPES, Z RING + MIN).

Practice for the whole area (answer these)

1) Overall: Describe the basic steps of bacterial division and how E. coli, Bacillus and Staphylococcus differ in when cytokinesis, septation and separation happen. Include the roles of FtsZ and Min.

My answer:

E coli – does Cytokinesse, Septation and Separation all at once

Bacillus – Does Cytokinesesi and septation at once then separation later

Staphylococcus – does Septation first, then cytokienssis and seperation.

FtsZ – use to split cells by Z ring

Min proteins – are used to help make filaments on the membrane

2) Short: Do constriction, septation and cytokinesis always happen at the same time? Give one example each way.

My answer:

No, like in staphylococcus that it happens in thw ay that septation first, then cytokinesis and then seperation.

F. Viruses

Multiple choice: Which of the following types of viruses contains RNA in its virus particles and generates complementary double-stranded DNA inside the host cell they have infected?

A. DNA virus
B. RNA positive or (+) sense virus
C. RNA negative or (-) sense virus
D. RNA retrovirus (correct)
E. B and C (your answer)

Your answer: E. B and C

Correct answer: D. RNA retrovirus

Why: A retrovirus carries RNA and uses reverse transcriptase to make double-stranded DNA inside the host cell.

Practice: Which virus group has an RNA genome but makes double-stranded DNA in the host cell, and which enzyme does it use?

My answer:

Retrovirus

Multiple choice: Which of the following would have a genome that consists of a single RNA strand that must be first be used as a template to synthesize a complementary strand of RNA and then that complementary RNA strand can be translated into protein and can be used as a template to make additional copies of the genome of the virus?

A. + sense RNA virus
B. - sense RNA virus (correct)
C. RNA retro virus (your answer)
D. DNA virus
E. Gram negative bacteria

Your answer: C. RNA retro virus

Correct answer: B. - sense RNA virus

Why: A minus sense RNA genome cannot be read as mRNA; it is first copied into the complementary plus strand, which serves both as mRNA and as the template for new genome copies.

Practice: Which virus group must first copy its RNA genome into a complementary RNA strand before it can make protein?

My answer:

- Sense rna virus

Multiple choice: Which of the following is NOT a factor used to classify and group viruses?

A. Chemicals found in the viral cell wall (correct)

B. Whether the virus particle contains an envelope (your answer)
C. Shape of the virus particle or viral capsid
D. Type of nucleic acid in the virus particle
E. Organisms the virus is able to infect

Your answer: B. Whether the virus particle contains an envelope

Correct answer: A. Chemicals found in the viral cell wall

Why: Viruses have no cell wall, so wall chemistry cannot be used to group them; envelope, capsid shape, nucleic acid type and host range are all used.

Practice: Name three features used to classify viruses, and one that is NOT used (and why).

My answer:

Genome type, how it replicates, envelope ; not cel wall chemicals as viruses have no cell wall.

Study guide objectives for this area

- F. Viruses
- 1. Size and Shape observed
- 2. Structural features
- Components of virus particles
- Which ones are found in all viruses?
- 3. Features used to classify or group viruses
- 4. Reproduction
- a. General features
- b. Steps in multiplication cycle
- c. Synthesis stage for 7 types of viruses
- 5. Outcomes of Viral infections
- Know different possible outcomes
- Affects on infected cells and populations

Area to check: Study guide F "3. Features used to classify" and "c. Synthesis stage for 7 types of viruses"; diagram section F (Baltimore groups, VIRAL GENOME COPYING).

Practice for the whole area (answer these)

1) Overall: For a (+) ssRNA virus, a (-) ssRNA virus and a retrovirus, describe how each makes its proteins and copies its genome.

My answer:

Positive ssrna - mRna -> translate and makes itself genome -> (+ -> - -> +).

Negative Ss rna - RdRP makes (+) -> (-) -> (+) -> new (-)

- Retro virus – (+) rna -> dna by reverse transcriptase .

2) Short: Name three features used to classify viruses and one feature that is NOT used.

My answer:

Genome type, how it replicates, envelope ; not cel wall chemicals as viruses have no cell wall.

G. Atypical bacteria and viruses

Multiple choice: Recently some unusual or atypical bacteria and viruses have been found that show some similarity or overlap in some of their properties. Which is NOT a similarity observed in these atypical bacteria and viruses?

A. Genomes in the size range of 150 - 1,000 kbp
B. Obligate intracellular parasitism - only multiply inside another cell (your answer)
C. Size between 0.15-0.3 micrometer or micron
D. Both reproduce by binary fission inside cell (correct)

Your answer: B. Obligate intracellular parasitism - only multiply inside another cell

Correct answer: D. Both reproduce by binary fission inside cell

Why: Atypical bacteria divide by binary fission but viruses are assembled from parts, so reproduction by fission is not a shared trait.

Practice: Name two traits Chlamydia shares with viruses and one way it differs (how it reproduces).

My answer:

Obligate intracelluar parasitism and are similar in size and differ in the way that chalmyia can do binary fission comapred to viruses that cant do that.

Study guide objectives for this area

- G. Atypical Bacteria and Viruses (notes)
- Know features of each and how differ from typical bacteria and viruses
- 1. Rickettsia
- 2. Chlamydia
- 3. Endosymbiotic bacteria
- 4. Giant Viruses
- 5. Mitochondria and Chloroplasts
- How can one predict the structures and properties of the cells of a newly discovered bacterium?

Area to check: Study guide G "Know features of each and how differ"; diagram section G (comparison table, CHLAMYDIA CYCLE).

Practice for the whole area (answer these)

1) Overall: Compare Rickettsia, Chlamydia and giant viruses with typical bacteria and typical viruses: size, ribosomes, how they reproduce, and where they live.

My answer:

Live inside hosts, reproduce by stealing or latching off host

2) Short: Which reproduces by binary fission inside the host cell, Chlamydia or a virus? Why?

My answer: chyamydia as viruses cant do fission