

1. (8 points) You are a doctor in central North Carolina. It is a nice day in the November. Your first patient is an older man brought in by his son. He is having difficulty walking; his movements are rigid and he is trembling. He is an avid gardener and has been removing a holly hedge from the front of his house.

What disease is this likely to be? _____

What is the major virulence factor of the organism involved? _____

Describe its mechanism of action.

2. (8 points) Your next patient is a homeless woman, who seems very undernourished and has been on the street for the past few months. Her fingers are frostbitten by the November cold. She has a bad cough and often coughs up blood; however upon examination you find that her throat is not inflamed.

What is this disease likely to be? _____

How would you confirm your diagnosis? (be specific about the test results you expect)

How would you treat this disease? How long would you treat her and why?

Would penicillin-type antibiotics be useful? Yes or No (circle one)?

Why or why not?

3. (14 points) Next you have a male patient who got really drunk during Franklin Street's Halloween party. He got so drunk that he had unprotected sex with a woman he says he barely knew. A few weeks later he said there was a painless sore on his groin that only lasted for 2 days. Now (5 weeks after his one night stand) he has a nasty rash, a fever, and feelings of weakness. You suspect he has contracted a STD and test him for Chlamydia and 3 other STDs.

Name the three other STDs you test him for.

| |
|----|
| 1. |
| 2. |
| 3. |

He tests positive for the STD which caused the ulcer and for the most common STD. What caused the ulcer? _____ What is the most common STD? _____

Describe the life cycle of the most common STD.

| |
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| |
|--|

What sort of antibiotics would you treat him with and why?

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| |
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Should any Public Health measures be taken with this patient? If so, what?

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4. (10 points) Your next patient is small girl; she has a red rash all over her body. Her mother tells you that the rash first appeared a few days ago on girl's hands and feet, and that she thought that it was just poison ivy or something like that.

What is her disease likely to be? _____

How would you treat this disease? (be specific) Why?

What type of tissue does this pathogen affect? _____

What type of agent causes the symptoms? _____

Briefly describe the lifecycle of the pathogen and how it is transmitted?

5. (8 points) You are a doctor who volunteers a lot of a time at a free clinic in Chapel Hill. Your first patient of the day is a 72 year old Army Veteran who is complaining of chest pain and shortness of breath. You run some tests and diagnose him with pneumonia and give him a prescription for a fluoroquinolone called moxifloxacin. You instruct him to take it for 10 days and come back to see you.

The patient returns three weeks later with complaints of diarrhea, fever, chills and dizziness. You diagnose him with a serious diarrheal disease. What is the **most likely** causative agent?

Explain how the antibiotics predisposed him to this disease.

You gave the patient an antibiotic to treat the pneumonia, why didn't it kill the possible causative agent too?

You know this won't be the last time you see a patient with this diarrheal disease caused by this agent. Name two reasons it has been characterized an Emerging Disease by the Center for Disease Control?

1.

2.

6. (10 points) Use the word bank below to answer the questions below.

| | | |
|-------------------------|-----------|-----------------|
| PAMPs | IgG | B cells |
| Antigen presentation | IgM | T-helper cells |
| Bacterial cell walls | IgA | IgE |
| Microbial nuclei | Antibody | LPS |
| Macrophages | Innate | Adaptive |
| Microbial cell membrane | DNA | flagellin |
| Plasma cells | Platelets | Red blood cells |

Once a patient gets a bacterial infection the _____ on the bacterial surface induce an immune reaction after recognition by special receptors in plants and animals. Special cells called _____ phagocytose these invaders and destroy them. Two examples of molecules that can induce an immune reaction after recognition are _____ and _____.

Phagocytes break down the invading bacteria in an effort to prepare it for _____ to special cells that can stimulate inflammation. One of these special cells that can stimulate inflammation with the release of antibodies is called _____. During a primary infection _____ is the antibody that is released but during a secondary infection _____ is the antibody that is released.

Circulating antibodies are found in _____ immunity; whereas they are not made in _____ immunity.

7. (6 points) You are working with Doctors Without Borders in a refugee camp near the Afghanistan-Pakistan border in November. What diseases are you particularly concerned about and why and what can you do about them?

| disease | reason for concern | what can you do |
|---------|--------------------|-----------------|
| | | |
| | | |

8. (11 points) The WHO has asked you to indicate which of the following diseases could be eradicated.

| disease | Can it be eradicated? yes or no | reasons (give 3 reasons if yes and all the important reasons up to 3 if no) |
|-----------------------------------|------------------------------------|--|
| tetanus | | 1. 2. 3. |
| measles | | 1. 2. 3 |
| typhoid fever (<i>S. typhi</i>) | | 1. 2. 3 |
| polio | | 1. 2. 3 |
| gonorrhea | | 1. 2. 3 |
| Lyme disease | | 1. 2. 3. |

9. (12 points) Predict the phenotype of the following mutants of bacteria and viruses which cause plant disease (avirulent, reduced virulence, normal virulence, or increased virulence or other response, specify)

| mutant | phenotype when inoculated onto a wounded plant |
|---|--|
| wild type <i>Agrobacterium tumefaciens</i> | |
| pTi minus <i>A. tumefaciens</i> | |
| <i>A. tumefaciens</i> with a constitutive <i>virG</i> | |
| <i>A. tumefaciens</i> with the T DNA replaced by carotenoid biosynthesis genes cloned behind a constitutive eukaryotic promoter | |
| soft rot bacteria which can not secrete proteins | |
| TMV with a frame shift in the movement protein gene | |

10 (1 point) True or false (circle one) Twenty years from now when you see a case of streptococcal pneumonia it will look and behave just as it does now.

11. (10 points) Complete the following table:

| | Electron donor | Final electron acceptor | Benefit to organism: produces (circle one) | Are these organisms likely to be autotrophs or heterotrophs? (What is their likely carbon source?) |
|-----------------------------|----------------|-------------------------|--|--|
| Cyclic photophosphorylation | | | ATP Reducing power Both | |
| Anaerobic photosynthesis | | | ATP Reducing power Both | |
| Oxygenic photosynthesis | | | ATP Reducing power Both | |