

I. (8 points) You are a first year resident working at UNC. It is a beautiful spring Saturday and you are planning your wild and crazy Saturday evening out when in rushes a mother whose infant appears extremely lethargic and dehydrated. Upon observation of the very messy diaper, you find bloody stool with hints of mucous. About the same time, the mother comments that the child had to be kept out of daycare on Friday due to these very same symptoms.

What is the most probable causative agent of the infant's symptoms? _____

What is the most likely source of the agent? _____

What is the mechanism of action of the major virulence factor produced by this agent?

If the organism could no longer produce the major virulence factor would it still be capable of causing disease? If so what would be the symptoms?

II. (8 points) Your second patient which interrupts your Saturday night planning session, will not stop talking about his trips "abroad." He presents with a fever, headache, intense muscle pain, nausea and vomiting. The white of his eyes and his skin have a yellowish color. After a physical exam you observe an abnormal number of insect bite marks. The patient explains that in his recent extensive travels he encounter massive mosquito infestations.

What is the most probable disease diagnosis? _____

What should this "world traveler" have done before his excursions?

You check your original diagnosis and it turns out to be incorrect. What is another possible cause of these symptoms? _____

How would he most probably have become infected with this agent?

III. (7 points) Before you leave for the day you decide to check on a patient who was admitted earlier. This patient appears malnourished and was admitted with fever, cough, and general weakness. His chest X-ray has just come back and shows white spots on his lungs. This confirms the tentative diagnosis you had made earlier.

What is the most likely disease that this patient could be afflicted with?

What is the route of infection? _____

What type of restrictions should this patient have been under in the hospital?

One of the janitors who has been cleaning his room comes to you in some agitation and reports that he emptied the patient's waste basket which contained a lot of Kleenex without wearing gloves. What can the janitor do if he comes down with symptoms of this disease?

IV. (8 points) Just as you are going out the door your final patient of the day comes wheeled in by a friend who is ranting and raving about his friends "delirium". Upon a glance at the patient, you RUSH him (and his friend) to a treatment room, due to the obvious dark splotches on his skin. You immediately examine his lymph nodes and find them to be extremely swollen, dark, and sore to the touch. From his blood pressure and temperature, you find him to also be in shock. About this time, his rambling friend indicates they have just moved to Chapel Hill from Texas (a southwestern state). Upon a second glance at "the friend" you notice small flea like bites on his extremities.

What is the most likely disease diagnosis? _____

What is the causative agent and mode of transmission of this disease?

What if any treatment would you give the sick man?

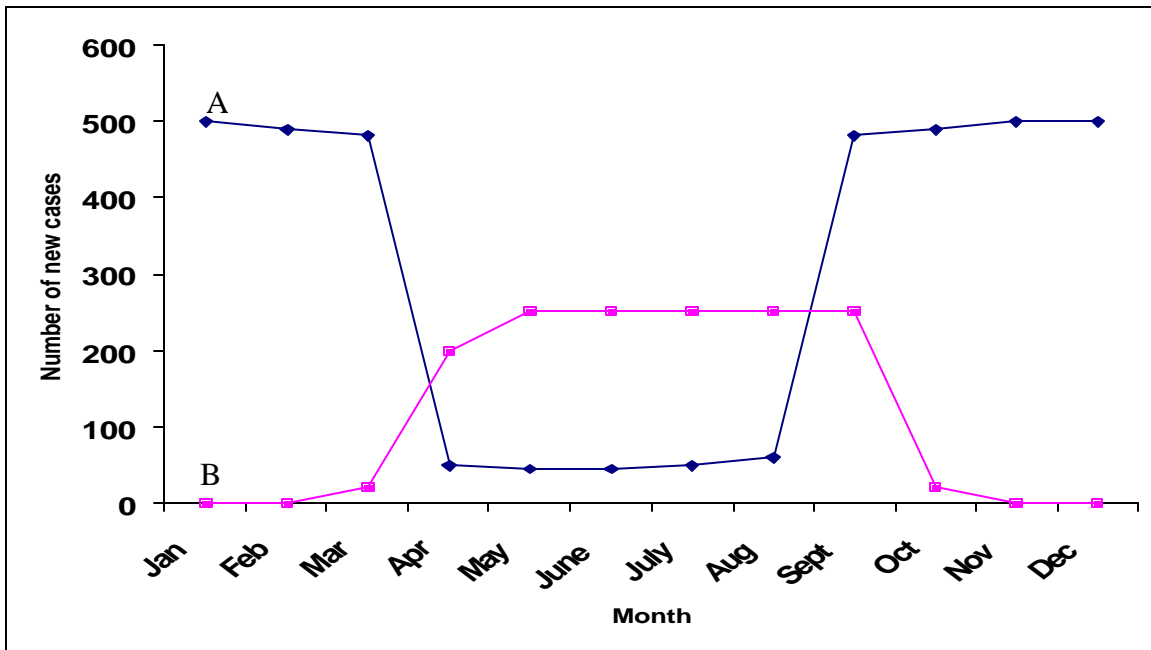
What if any treatment would you give "the friend"?

Would there be any containment procedures necessary? IF so, what?

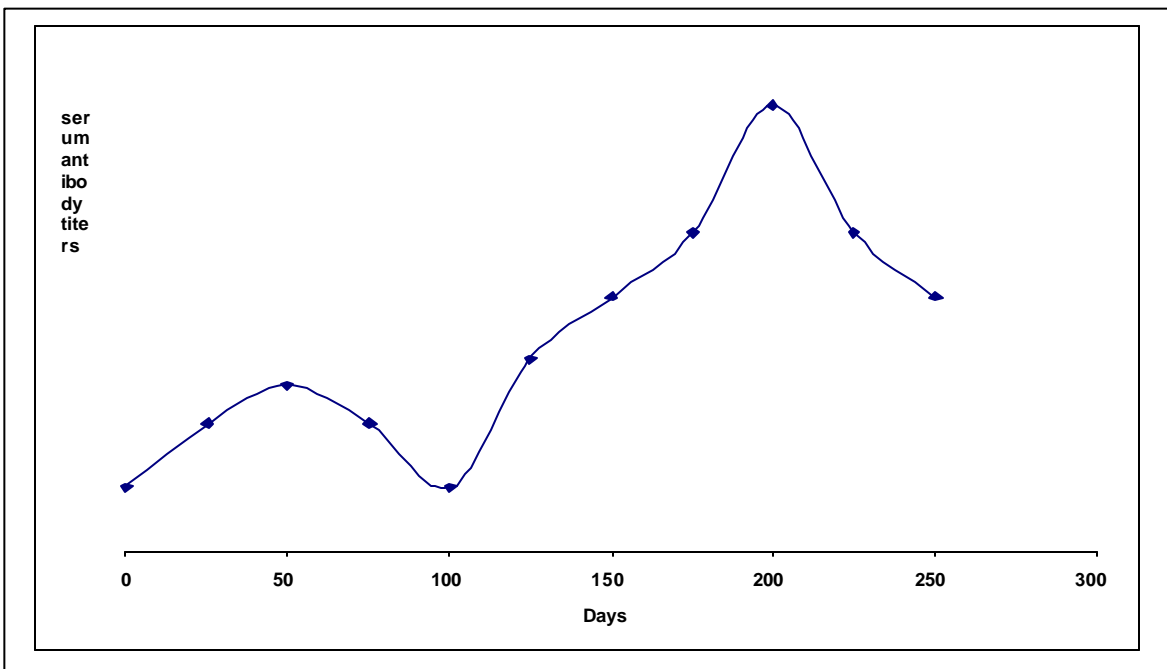
V. (13 points) Disease eradication can be accomplished in some specific cases. Given the chart below, indicate if the disease is a candidate (past or present) for eradication and the indicated number of **different important reasons** as to why or why not?

Disease	Candidate for eradication? (yes or no)	Reasons (why or why not)
HIV		1.
Polio		1. 2.
Small pox		1. 2.
Rubella		1. 2.
Rocky mountain spotted fever		1.

VI. (6 points) Using the following chart, list an example of a disease that could be responsible for each of the following epidemic curves. In addition, list its route of transmission and a potential containment procedure.



	Example of disease	Route of Transmission	Potential containment
Curve A	1.	1.	1.
Curve B	1.	1.	1.



VII. (9 points) Fill in the following table using the chart above.

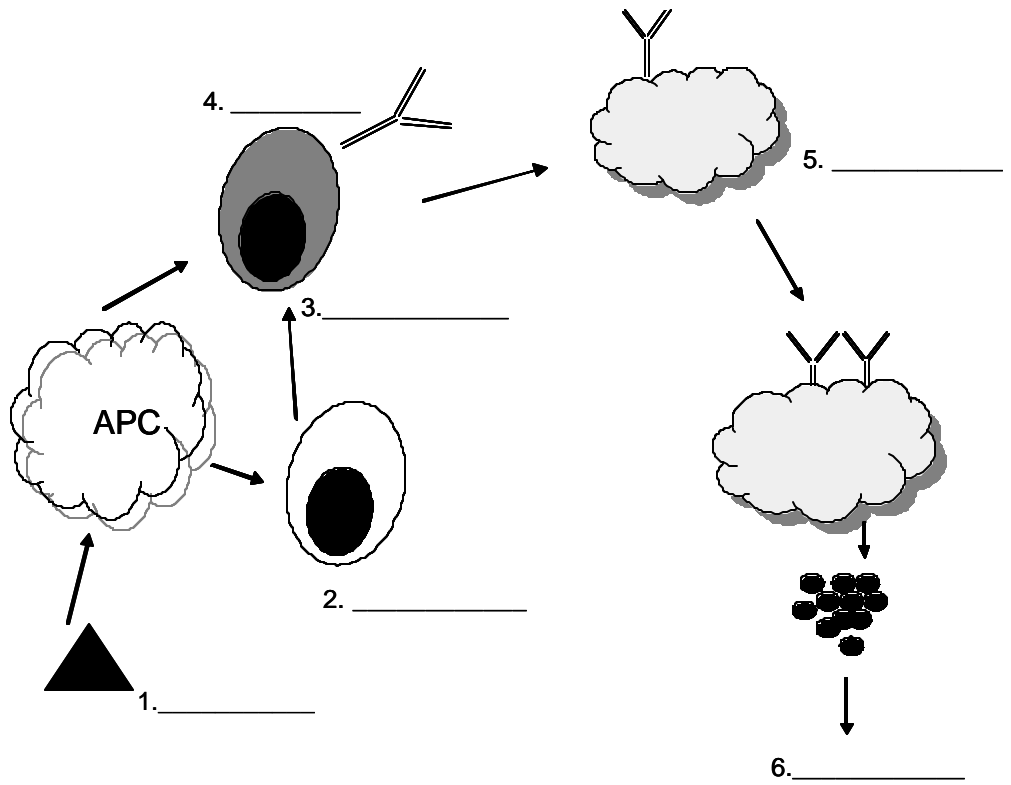
	1° or 2° response?	Class of antibody produced during the response?	What cell type is responsible for the response?
Peak A			1. 2.
Peak B			1.

If a patient has a disease which destroys all their T cells can they mount a primary response? Y or N (circle one)

If a patient has a disease which destroys all their B cells can they mount a secondary response? Y or N (circle one)

VIII. (6 points) The diagram below refers to the immune system response to certain substances. Place the appropriate labels to their spots in the diagram (use the letter). Not all choices will be used, some may be used more than once. Note that 2 and 3 are different cell types.

- A. T cell
- B. IgA
- C. antigen
- D. IgG
- E. Mast Cell
- F. IgE
- G. IgM
- H. IgC
- I. B cell
- J. allergen
- K. allergies
- L. histamines



IX.(7 points) You are working at UNC hospital. A patient with cystic fibrosis is transferred to UNC from another hospital. The paper work which accompanied the patient states that she definitely has a *Pseudomonas aeruginosa* infection and that no signs of *Burkholderia cepacia* were detected. Upon examining the lab work you are not certain that *B. cepacia* is not actually present. Why do you suspect that the other hospital failed to detect this bacterium?

What two tests would you do to ensure more sensitive and accurate identification of *B. cepacia*?

1.

2.

X. (10 points) Which of the following can not be carried by a bacterial mutant which can not make heme? Circle the correct answers.

- | | | |
|-----------------------------|------------------------|-----------------------|
| cyclic photophosphorylation | aerobic photosynthesis | nitrogen fixation |
| anaerobic photosynthesis | aerobic respiration | anaerobic respiration |

Which of the following can not be carried out by a bacteria mutant which can not take up iron? Circle the correct answers.

- | | | |
|-----------------------------|------------------------|-----------------------|
| cyclic photophosphorylation | aerobic photosynthesis | nitrogen fixation |
| anaerobic photosynthesis | aerobic respiration | anaerobic respiration |

Fill in the following table.

process	original electron donor	final electron acceptor
cyclic photophosphorylation		
anaerobic photosynthesis (non cyclic)		
aerobic photosynthesis		

XI. (9 points) A friend of yours who works in agricultural research upon hearing that you are taking microbiology asks you to explain something which has puzzled him. What is the advantage to *Agrobacterium tumefaciens* of its ability to transfer DNA to plants? That is how does the bacterium use this ability to aid its growth in nature?

XII. Fill in the following table. (9 points) For the resulting interaction indicate one of the following:
 none, empty nodules formed (no bacteria present), white nodules formed, or pink nodules formed .

Bacterial genotype	plant genotype	resulting interaction	Will nitrogen fixation occur? yes or no
alfalfa rhizobium	soy bean		
alfalfa rhizobium lacks two component system to sense flavanoids	alfalfa		
alfalfa rhizobium but can not make nod factors	alfalfa		
alfalfa rhizobium but has soy bean two component system for flavanoid sensing	soy bean		
alfalfa rhizobium <i>nifHDK</i> ⁻	alfalfa		
alfalfa rhizobium	alfalfa legume hemoglobin ⁻		
alfalfa rhizobium nod ⁻ <i>nifHDK</i> ⁻	alfalfa		
two alfalfa rhizobia one nod ⁻ <i>nifHDK</i> ⁺ one nod ⁺ <i>nifHDK</i> ⁻	alfalfa		
alfalfa rhizobium	soybean which makes the alfalfa flavanoids		