

I. (7 points) You are a first year resident working at UNC. It is a nice summer day and you are wishing that you could be out in the sun. Your first patient is a man who is brought in by the EMT service in an ambulance. He is limp and appears to be paralyzed. His wife tells you that yesterday they went swimming and to a picnic where they ate chicken salad, tuna fish salad, three bean salad, and banana pudding. Afterwards they played softball. What is the most probable causative agent of the man'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?

Would you treat this disease with antibiotics? yes or no (circle one)

Why or why not? _____

Are there any public health measures you should take? If so, what are they?

II. (9 points) Your second patient is a young man who has a nasty-looking ulcer on his thigh and a mild fever.

What is the most probable disease diagnosis? _____

Do you treat this disease with antibiotics? yes or no (circle one)

Why or why not? _____

Do you test for any other diseases? yes or no (circle one)

If so, which diseases? _____

Are there any public health measures you should take? If so, what are they?

If untreated what are the possible long term effects of this disease?

III. (10 points) Your third patient is a young girl, the daughter of migrant farm workers. Both she and her mother speak only limited English. The girl has a fever and a very sore throat. List three possible causes of this disease.

1. _____
2. _____
3. _____

Which of these are serious? _____

Which of these do you treat with antibiotics? _____

You test for your first guess listed above and the result is negative. The girl comes back very sick and her throat now has a thick tough coating of white pus over the infected area.

What disease do you now think likely? _____

What is the mechanism of action of the principle virulence factor of the causative organism?

IV. (5 points) Fill in the following table to indicate which component of the immune system is most likely to be important in fighting infection by each of the following (indicate your answer by placing an x in the appropriate column).

disease	IgG	IgA	activated T cells	immune system does not help in fighting this infection
streptococcal pneumonia				
gonorrhea				
noninvasive enteric infection with <i>E. coli</i>				
Rocky Mountain spotted fever				
yellow fever				

V. (6 points) Using the following list of components of the immune system fill in answers to the questions below (most answers will involve several of the listed components).

- | | |
|--------------------|--------------------------------------|
| 1. T cells | 8. IgM |
| 2. B cells | 9. IgG |
| 3. memory cells | 10. IgA |
| 4. helper T cells | 11. IgD |
| 5. killer T cells | 12. IgE |
| 6. macrophages | 13. chemicals released by mast cells |
| 7. dendritic cells | 14. release of cytokines |

A. In order to stimulate a response to a toxic protein which the patient had not encountered previously which of the above would you wish to stimulate? _____

B. In order to suppress the rejection of a graft which of the above would you want to inhibit? _____

C. In order to inhibit an inflammatory response which of the above would you wish to inhibit? _____

D. In order to inhibit an allergic reaction which of the above would you want to inhibit? _____

E. In order to stimulate an immune system response to a bacterial infection encountered previously which of the above would you want to stimulate? _____

F. In order to stimulate an immune response to a bacterial infection not previously encountered which of the above would you want to stimulate? _____

VI. (6 points) Your roommate likes to grow flowering plants on the window sill. One day he notices that his favorite plant has developed yellowish lesions on the leaves. He wishes to know what is causing this disease. You decide to attempt to isolate the causative organism and to prove it caused the disease. You have the following available: healthy plants of the same species and variety as your roommate's sick plant, a microbiology lab with media, etc., mice, goats, and a microscope. How do you proceed? Be sure to state your answer clearly and completely.

VII. (12 points) You are investigating an emerging gastrointestinal disease which appears to be caused by a bacterium. The symptoms of the disease include bloody diarrhea. You have isolated what you believe to be the causative organism and wish to clone a gene for a toxin which you think is probably involved in the disease. You notice that although patients who have recovered from bacillary dysentery (caused by *Shigella*) get the new disease they do not show the bleeding which usually accompanies it. You have available the materials listed. Fill in the following table for a procedure to attempt to clone the toxin gene from the bacterium which causes the new disease.

- | | |
|--------------------------------------|--|
| new disease bacteria (NDB) | mouse antibodies to cholera toxin |
| competent NDB | mouse antibodies to diphtheria toxin |
| <i>E. coli</i> K12 | mouse antibodies to Shiga toxin |
| competent <i>E. coli</i> K12 | fluorescent goat anti-mouse IgG antibodies |
| <i>Shigella</i> | |
| competent <i>Shigella</i> | |
| the indicated vector pCLONE DNA | |
| all necessary enzymes, buffers, etc. | |
| all necessary media | |
| all necessary chemicals | |
| mice, goats, rabbits | |

1. Extract _____ (compound) from _____ and digest it with _____.
2. Digest _____ DNA with _____.
3. Mix the products of steps 1 and 2 and add _____ and _____.
4. Transform the product into _____.
5. Plate the transformants on media containing _____.
6. Identify the clone(s) which carry the toxin gene by

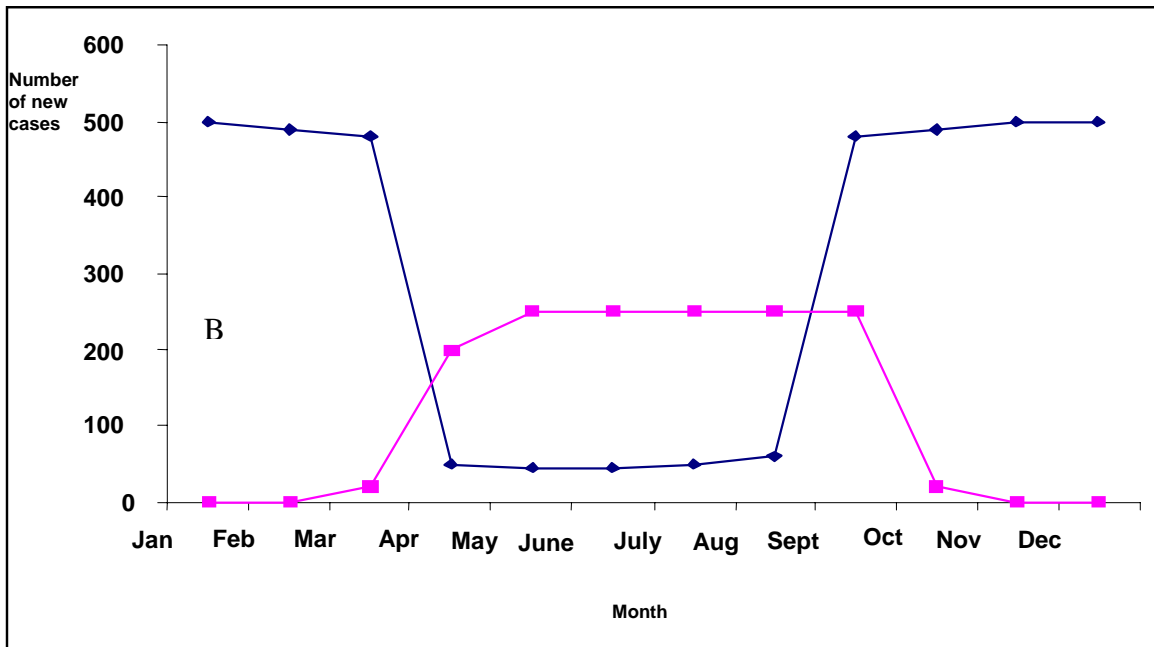
VIII. (4 points) What are the major factor(s) which may have been responsible for the emergence of the following infectious diseases in the US in the last few years?

- Lyme disease _____
- SARS _____
- Legionaire's disease _____
- hemorrhagic *E. coli* (O157:H7) _____

IX. (9 points) You are working for the UN in a refugee camp in Pakistan. List 3 diseases which you would be concerned could become epidemic in the camp.

Disease	causative agent	why would you expect to find it in these conditions
1.		
2.		
3.		

X. (8 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 A



	Example of disease	Route of Transmission
Curve A		
Curve B		
Curve C		
Curve D		

XI. (28 points) Fill in the following table.

reaction	electron donor	final electron acceptor	example of an prokaryote which does this	likely source of carbon for growth
cyclic photophosphorylation				
anaerobic photosynthesis (noncyclic)				
aerobic photosynthesis				
anaerobic respiration				
aerobic respiration				
fermentation				