PART A. True/False. Indicate in the space whether each of the following statements are true or false.

_______ 1. An epidemic is commonly defined as the occurrence of cases of disease at a frequency greater than expected.

_______ 2. Attenuated vaccines when given to children elicit only IgG antibodies and no Thelper cell responses.

_______ 3. T cells and B cells provide specificity for the adaptive immune response by recognizing distinct pieces of pathogens called antigens.

_______ 4. Giving the tetanus vaccine (an inactivated toxin form called a toxoid) is a form of passive immunization.

_______ 5. The cause of death in smallpox is probably due to an excessive immune response.

_______ 6. Leeuwenhoek was inspired by Spallanzani’s experiments to build microscopes to try to see microbes.

_______ 7. After Spallanzani’s experiments, there was no longer any controversy about whether life could arise by spontaneous generation.

_______ 8. “Yops” are antibodies that can neutralize *Yersinia pestis*.

_______ 9. *Vibrio cholerae* bacteria can be infected with viruses.

_______ 10. *Chlamydia* is a facultative bacterial pathogen.

_______ 11. Endemic means an infection causes less disease than during an epidemic.

_______ 12. Attenuated vaccines when given to children elicit only IgG antibodies.

_______ 13. *Yersinia pestis* has been eradicated from the United States.

_______ 14. Typhoid Mary is an example of an asymptomatic carrier.

_______ 15. Antibiotics are the best approach to treat Cholera.

_______ 16. The 3rd pandemic of cholera (1852-1860) was caused by an O1 Classic strain of *V. cholerae*.

_______ 17. T cell receptors are secreted by T cells to bind ligands on activated B cells.

_______ 18. Antibodies can trigger complement activation which can cause enzymatic lysis of pathogens.

_______ 19. Antibody molecules can only bind to the surface of pathogens and not to secreted molecules.

_______ 20. The adaptive immune system is activated more slowly than the innate immune system and can take 3-7 days after infection to get fully activated.

_______ 21. Measles is an example of an “old world” disease that was lethal when introduced into the “new” world.

_______ 22. Oral rehydration therapy is an effective treatment for pneumonic plague.

_______ 23. If you inject guinea pigs with *Legionella* (mixed in a saline solution) to test if *Legionella* causes Legionnaires’ Disease, then injection with saline only is a positive control for this experiment.

_______ 24. One positive control and one negative control is sufficient to prove that you have the correct interpretation of a given experiment.

_______ 25. Koch invented the Gram stain.
Matching. In the space next to the words in column A, put the appropriate letter from column B. Obviously, not every letter in Column B will be used.

**Column A.**

_____ B cells

_____ Cytotoxic T cells

_____ Helper T cells

_____ Macrophages

**Column B.**

A. perform mucociliary clearance

B. control immune responses by producing cytokines

C. produce immunoglobulin

D. phagocytize bacteria

E. express CD8

F. produce complement

G. bind IgE

Matching. Match the discovery to the person who made the discovery by putting the correct letter from Column B in the space in Column A. Not all names in column B will be used.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
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<tbody>
<tr>
<td>_____ Discovered that bacteria can move (motility)</td>
<td>A. Koch</td>
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<tr>
<td>_____ First discovered <em>Vibrio cholerae</em></td>
<td>B. Leeuwenhoek</td>
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<tr>
<td>_____ Performed an experiment with swan-necked flasks</td>
<td>C. Hooke</td>
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<tr>
<td>_____ Isolated bacterial colonies on potato slices</td>
<td>D. Pacini</td>
</tr>
<tr>
<td>_____ Discovered <em>Yersinia pestis</em></td>
<td>E. Spallanzani</td>
</tr>
<tr>
<td>_____ Coined the word “cell”</td>
<td>F. Shibasaburo</td>
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<tr>
<td></td>
<td>G. Pasteur</td>
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</tbody>
</table>

Fill in the chart below about the antibody isotypes IgA, IgG, IgM.

<table>
<thead>
<tr>
<th></th>
<th>Efficient at Neutralization (Yes/No)</th>
<th>Abundant in blood (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgA</td>
<td></td>
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<tr>
<td>IgG</td>
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<tr>
<td>IgM</td>
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</tbody>
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Multiple Choice. Circle ONE letter corresponding to the best answer.

1. Which of the following is true?
   A. A pandemic is a localized outbreak of infectious disease
   B. Cholera is a pandemic disease
   C. Smallpox is endemic in Africa
   D. All of the above
   E. None of the above

2. Which of the following is true of *Legionella pneumophila*?
   A. It has an RNA genome
   B. It is easily transmitted from person to person
   C. It has caused global pandemics
   D. Outbreaks are often associated with contaminated cooling towers
   E. Pneumonic infections with *Legionella* are associated with almost 100% mortality

3. Which of the following was NOT an accomplishment of Pasteur?
   A. Discovered that molecules can come in different chiral forms
   B. Discovered the silk worm disease Pébrine is caused by a parasite
   C. Discovered that rancid butter flavor comes from fermentation performed by microbes
   D. Coined the term “cell”

4. Which of the following is NOT a characteristic of *Mycobacterium tuberculosis*?
   A. acid-fast
   B. extracellular
   C. takes more than 2 weeks to form colonies on petri plates
   D. discovered by Koch
   E. gram variable

5. Smallpox virus (Variola) was a successful human pathogen because it?
   A. was highly infectious between humans
   B. the virus can be shed before the poxes became visible
   C. encodes for viral proteins that can inhibit complement lysis
   D. encodes for viral proteins that can bind to cytokines
   E. all of the above

6. Which of the following statements is correct?
   A. Prokaryotes have a nucleus
   B. All pathogens are prokaryotes
   C. All prokaryotes require host cells in order to replicate themselves
   D. Eukaryotes tend to be larger than prokaryotes
   E. All of the above

7. Which of the following is a primary function of immunoglobulins (antibodies)?
   A. recognition of MHC
   B. opsonization of viruses
   C. binding T cell receptors
   D. production of cytokines
   E. all of the above

8. The measles virus vaccine is
   A. An attenuated viral vaccine
   B. An inactivated viral vaccine
   C. A recombinant protein vaccine
   D. An inactivated toxin vaccine
   E. None of the above
9. Which of the following is NOT an important issue for vaccine design?
A. Whether the vaccine elicits long-term immune memory.
B. Whether the vaccine might cause worse disease or increased pathogenesis.
C. Whether the vaccine binds to all antigens of the pathogen.
D. Whether the vaccine is stable at room temperature, 4°C or -20°C.

10. Which of the following is not an example of a PAMP?
A. Lipopolysaccharide
B. Flagellin
C. Cytokines
D. Double stranded RNA

11. Which of the following is NOT generally considered to be a characteristic of adaptive immunity?
A. Slower responses
B. Memory responses
C. Non-specific responses
D. Helper T cell responses

12. Which of the following is not one of the types of plague?
A. bubonic
B. flat-type
C. pneumonic
D. septicemic

13. Which of the following is a similarity between gram positive and gram negative bacteria?
A. Both stain light pink with the Gram stain
B. Both have peptidoglycan
C. Both have two membranes
D. Both have lipopolysaccharide
E. None of the above

14. The human papilloma virus vaccine is?
A. An attenuated viral vaccine
B. An inactivated viral vaccine
C. A recombinant protein vaccine
D. An inactivated toxin vaccine
E. None of the above

15. Leeuwenhoek’s animalcules (what we now call bacteria) were approximately ____ microns (µm) in size:
A. 1-2
B. 10-20
C. 50-100
D. 0.01

16. Which of the following is the most appropriate and effective treatment for cholera?
A. Drink lots of water
B. Drink a solution of glucose and salts
C. Take large doses of antibiotics
D. Drink a solution containing the cholera-toxin phage
SHORT ANSWERS -- no need for complete sentences, please be brief and please answer the question (providing other irrelevant information will not be useful).

1. Pasteur’s experiment with the swan-necked flask was a more convincing (better controlled) experiment to disprove the idea of Spontaneous Generation than was Spallanzani’s experiment with a ‘regular’ flask. (a) What possibility might someone who believes in Spontaneous Generation argue that Spallanzani failed to rule out with his experiment? (b) How did Pasteur’s experiment rule out this possibility?

2. Koch’s postulates are a series of experiments that can be used to prove that a microbe is the cause of a particular disease. What are Koch’s four postulates?

3. Why would it be unlikely that the immune system would recognize cholera toxin (CT) as a PAMP? [Hint: what are the two main characteristics of PAMPs (as predicted by Janeway) and why does Cholera Toxin lack these features?]

4. There are two polio vaccines that are currently used in the world today. An attenuated vaccine and inactivated vaccine.
A) What are the differences in how people are vaccinated with the two vaccines?

B) How was the original attenuated vaccine made for polio virus? What does that mean that it is attenuated?

C) What are TWO of the possible disadvantages associated with the inactivated polio vaccine?