Following directions on the mark-sense form, write your **name**, **student number** and **major** (PP=Pharmacy; SS=Special Permission) in the blanks and fill in the bubbles. On the blanks above, write your **lab section** and **name**. In addition, write your **name** on the back of this exam. When finished with the test, place the mark-sense form inside the exam form and **turn in the exam and mark-sense form together**.

### FILL-IN THE BLANKS:
**Write your answers on this page. (2 points each)**

<table>
<thead>
<tr>
<th>A. What type of bond tends to form between adjacent water molecules?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Name any specific n-6 fatty acid.</td>
<td></td>
</tr>
<tr>
<td>C. Name a location where a high endothelial venule could be found.</td>
<td></td>
</tr>
<tr>
<td>D. Name a substance that is both released by platelets and activates platelets.</td>
<td></td>
</tr>
<tr>
<td>E. What is the general term for a regulatory molecule that is a small protein that helps coordinate an immune response (mainly released by white blood cells)?</td>
<td></td>
</tr>
<tr>
<td>F. Name any specific opsonin.</td>
<td></td>
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<tr>
<td>G. Name the cell containing large vesicles of histamine and other inflammatory paracrines.</td>
<td></td>
</tr>
<tr>
<td>H. Name an important inflammatory paracrine released by macrophages.</td>
<td></td>
</tr>
<tr>
<td>I. In a couple words, what is a thromboembolus?</td>
<td></td>
</tr>
<tr>
<td>J. What change caused by inflammatory paracrines results in edema in the affected area?</td>
<td></td>
</tr>
</tbody>
</table>
K. Two eicosanoids related to blood clotting are prostacyclin and thromboxane A2. (5 points)
   - Name the cell or location where each of these molecules is made.
   - In a couple of words, what does each do?

L. Describe the sequence through which a peptide from a viral protein winds up displayed on the surface of a cell. If you like, use the figure below to help with your explanation. (5 points)
MULTIPLE CHOICE: Choose the BEST answer. (2 points each)

1. What level of structure refers to the exact three dimensional shape of a single polypeptide chain?
   a. primary
   b. secondary
   c. tertiary
   d. quaternary

2. Where is the most likely location for a protein to be glycosylated?
   a. polyribosome
   b. mitochondrion
   c. Golgi apparatus
   d. lysosome
   e. mitochondrion

3. Which of the following pairs of atoms, when covalently bonded, has a nonpolar covalent bond?
   a. C and H
   b. C and O
   c. O and H
   d. N and C
   e. N and H

4. Which one of the following is the proper unit of energy in the international system?
   a. kilocalorie
   b. kilojoule
   c. newton
   d. kilogram

5. The body continually does maintenance work, such as removing aged red blood cells and synthesizing new red blood cells as replacements. What fraction of the energy expended in this activity winds up as heat?
   a. 100%
   b. 66%
   c. 25%
   d. 5%
   e. zero
6. Which one of the following occurs during a **spontaneous reaction** (a reaction with negative free energy)?
   a. increase in entropy
   b. decrease in entropy
   c. no net change in entropy

7. What type of molecule is the **substrate** of lipoxygenase (LOX)? (that is, on what molecule does it act?)
   a. membrane phospholipid
   b. prostacyclin
   c. leukotriene
   d. thromboxane A2
   e. arachidonic acid

8. Which one of the following decreases following treatment with **lipoxygenase inhibitor** (such as Zileuton)?
   a. prostaglandin
   b. thromboxane
   c. arachidonic acid
   d. leukotriene
   e. ADP

9. **Aspirin** is an anti-inflammatory drug. Which one of the following best describes why aspirin is ineffective for the **asthma**?
   a. asthma usually does not feature inflammation.
   b. COX2 inhibition is required.
   c. LOX is much more important that COX in asthma.
   d. aspirin does not inhibit COX2
   e. aspirin only acts in the brain

10. **Refer to the figure to the right.** Which one of the following is shown by the arrow? (choose best)
    a. esterfied cholesterol
    b. triacylglycerol
    c. phospholipid
    d. apolipoprotein
    e. **BOTH** choices “a” and “b” are correct
11. Which one of the following is directly produced by phagocyte oxidase? (choose most direct)  
   a. superoxide radical  
   b. hydroxyl radical  
   c. hydrogen peroxide  
   d. hypochlorite  
   e. carbon dioxide and water

12. Which one of the following best describes interferon-gamma (IFN-gamma)? (choose best)  
   a. blocks platelet aggregation  
   b. causes macrophages to synthesize more oxygen radicals  
   c. blocks fibrin aggregation  
   d. causes cells to synthesize more anti-viral proteins  
   e. binds to glycoprotein Ib/IIa

13. Which one of the following converts hydrogen peroxide to the hydroxyl radical?  
   a. catalase  
   b. superoxide dismutase  
   c. myeloperoxidase  
   d. phagocyte oxidase  
   e. iron ion

14. Which one of the following is a treatment for chronic granulomatous disease? (choose best)  
   a. clopidogrel  
   b. abciximab  
   c. DHA  
   d. interferon-gamma (IFN-gamma)  
   e. interferon-alpha (IFN-alpha)

15. Which one of the following is TRUE of a healthy, undamaged capillary endothelium in your finger?  
   a. readily allows neutrophils to cross  
   b. readily allows platelets to cross  
   c. readily allows blood proteins to cross  
   d. readily allows anything smaller than blood proteins to cross

16. Which one of the following has dense granules containing ADP?  
   a. macrophage or neutrophil  
   b. lymphocyte  
   c. endothelial cell  
   d. fibroblast  
   e. platelet
17. Which one of the following **binds** to glycoprotein IIb/IIIa? (choose best)
   a. clopidogrel
   b. thromboxane A2
   c. thrombin
   d. fibrinogen
   e. apolipoprotein

18. Where is thrombomodulin normally found?
   a. membrane of platelet
   b. membrane of macrophage
   c. membrane of endothelial cell
   d. bound to fibrinogen
   e. bound to collagen

19. Where is tissue factor normally found?
   a. on membrane of fibroblast just outside a blood vessel
   b. on membrane of platelet
   c. on membrane of monocyte/macrophage
   d. in blood plasma
   e. in dense granules

20. In treating a myocardial infarction (heart attack), which one of the following is injected within a few hours?
   a. TNF-alpha
   b. prostacyclin
   c. tPA
   d. thromboxane A2
   e. prothrombin

21. Which of the following describe(s) adenosine in the blood? (choose best)
   a. inhibits action of ADP and thus platelet activation
   b. forms from ADP as phosphates removed by blood enzyme
   c. concentration in the blood is increased by dipyridamole
   d. choices “b” and “c” are both correct
   e. **ALL** of the above are correct

22. Which one of the following best describes dabigatran?
   a. blocks ADP
   b. blocks vitamin K
   c. breaks down fibrin
   d. direct thrombin inhibitor
   e. activates antithrombin
23. Which one of the following is a symptom of *thrombocytopenia*?
   a. petechiae
   b. stroke
   c. venous thromboembolus
   d. granuloma
   e. oral thrush

24. Which one of the following functions as an *innate receptor* on a macrophage or dendritic cell?
   a. T cell receptor
   b. antibody
   c. TNF-alpha
   d. IL-1
   e. toll-like receptor

25. Which one of the following is a *cytokine*?
   a. selectin
   b. integrin
   c. TNF-alpha
   d. ICAM
   e. toll-like receptor

26. What *cells make and release* acute phase proteins such as C-reactive protein? (choose best)
   a. endothelial cells
   b. neutrophils
   c. liver cells
   d. platelets

27. Where is the typical, functional location at which the complement system is activated? (choose best)
   a. at surface of endothelium
   b. at surface of microbe
   c. in phagolysosome of macrophage
   d. in Golgi apparatus of fibroblast
   e. at MHC I molecule

28. Which of the following are promoted following activation of the *complement system*? (choose best)
   a. chemotaxis
   b. inflammation
   c. formation of opsonin
   d. cell lysis
   e. ALL of the above occur
29. Which of the following **activates macrophages**? (choose best)
   - a. interferon-alpha (IFN-alpha)
   - b. interferon-beta (IFN-beta)
   - c. interferon-gamma (IFN-gamma)
   - d. chemokine
   - e. selectin

30. Which one of the following is **NOT** a part of inflammation?
   - a. capillary endothelia become less permeable
   - b. chemokines aid chemotaxis
   - c. small blood vessels dilate
   - d. pain
   - e. selectins expressed on endothelia cells

31. **Refer to the figure to the right.** Which one of the following is shown?
   - a. acute inflammation
   - b. chronic inflammation

32. Which one of the following is characterized by chronic inflammation including formation of **granulomas**?
   - a. hemochromatosis
   - b. leukemia
   - c. tuberculosis
   - d. thrombocytopenia
   - e. hepatitis B

33. What **type of cell** phagocytizes a microbe in the interstitial fluid, displays peptides derived from the microbe on MHC II molecules, and then travels to a lymph node to begin a specific immune response? (choose best)
   - a. neutrophil
   - b. lymphocyte
   - c. eosinophil
   - d. mast cell
   - e. dendritic cell
34. Which one of the following describes a hapten?
   a. peptide bound by MHC molecule
   b. must bind to a protein to become a complete antigen
   c. type of innate receptor
   d. region of antibody molecule
   e. antigen found in rough endoplasmic reticulum

35. What type of antibody is most closely linked to the functioning of eosinophils?
   a. IgA
   b. IgG
   c. IgE
   d. IgM

THIS IS VERSION A.
BE SURE TO MARK THIS ON YOUR MARK SENSE FORM.

PLACE MARK-SENSE FORM INSIDE EXAM
AND TURN THEM IN TOGETHER.