

ME 411 / ME 511

Biological Frameworks for Engineers

Class Organization

- Lab 1 due today
- Hw 3 due on Friday
- Lab 2 – Lab-on-a-Chip
 - Fri, More 320
 - Sign up for 2:00-3:15, 3:15-4:30 slots
 - Read the pre-lab instructions
 - Watch the video
 - Report due Mon, 10/27

ME 411 / ME 511

Immunology

Protect the Castle!

Invaders



Defenses



Protect the Body!

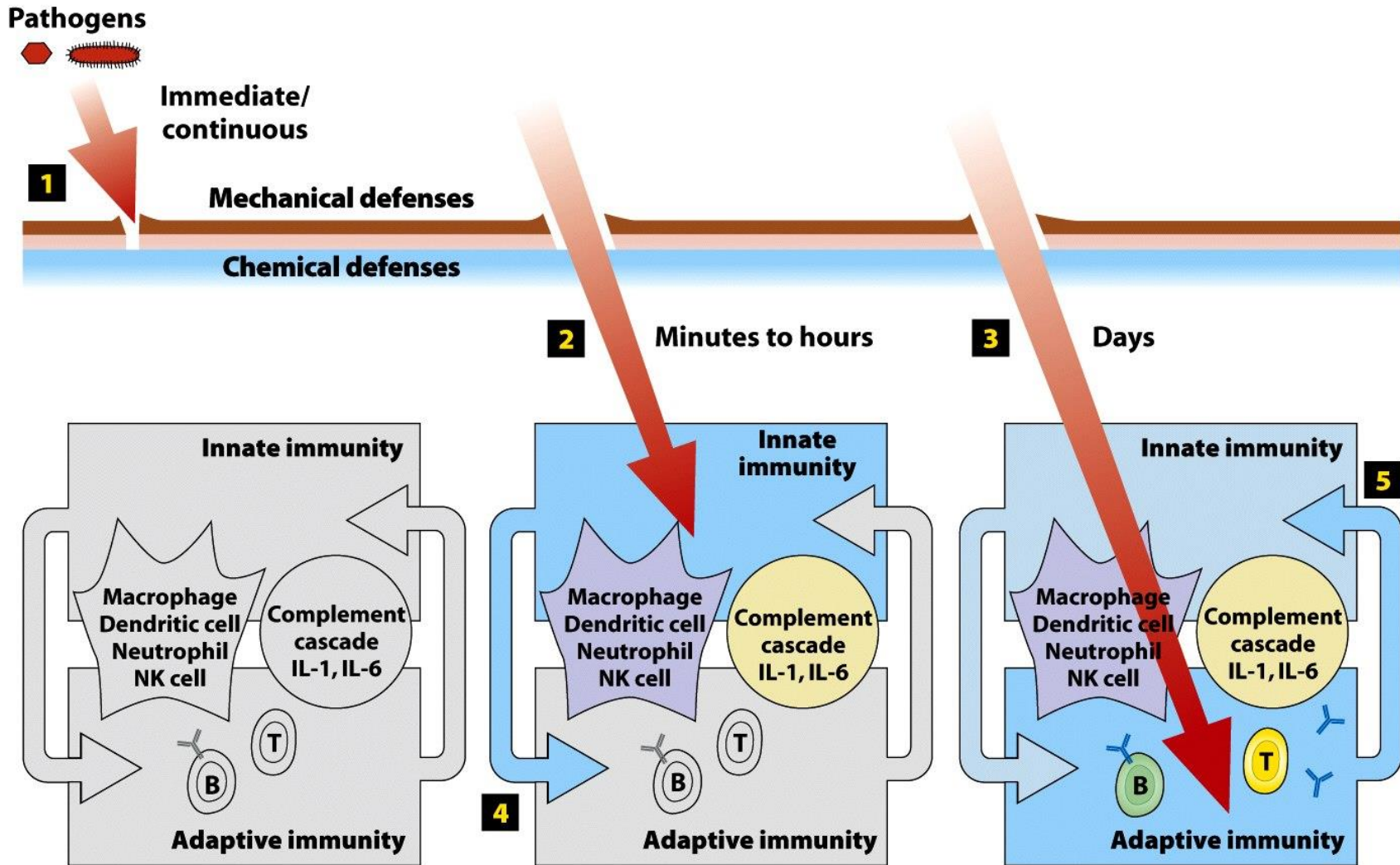


Figure 24-1
Molecular Cell Biology, Sixth Edition
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Lymphatic System

- Circulatory vessels
- Lymph fluid
 - 3 liters of clear fluid
 - Recycled blood plasma
- Function
 - Tissue drainage
 - Fatty acid transport
 - WBC passage

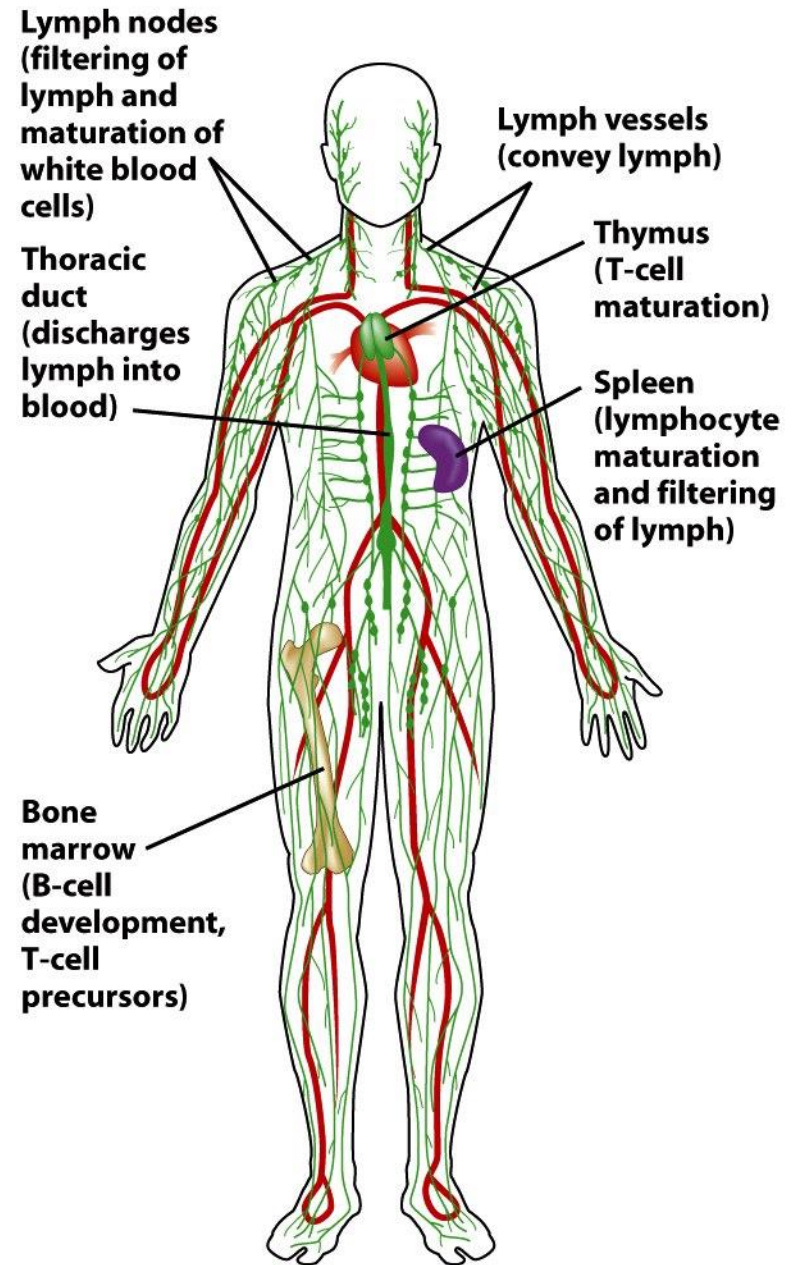
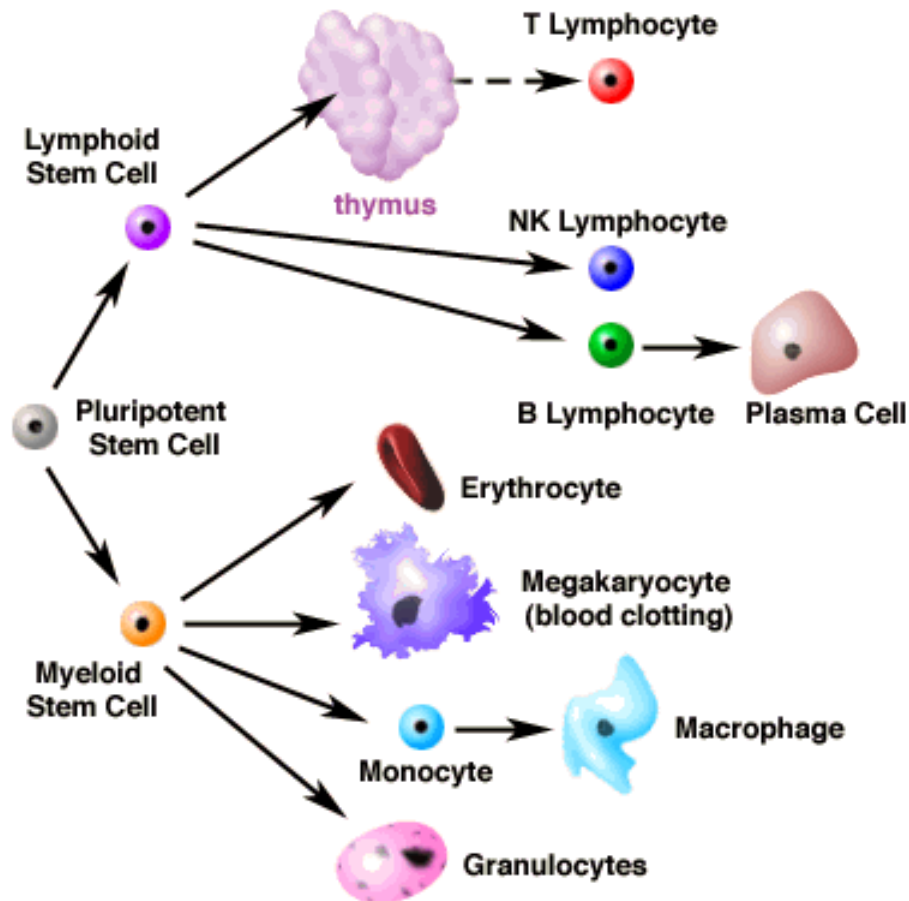


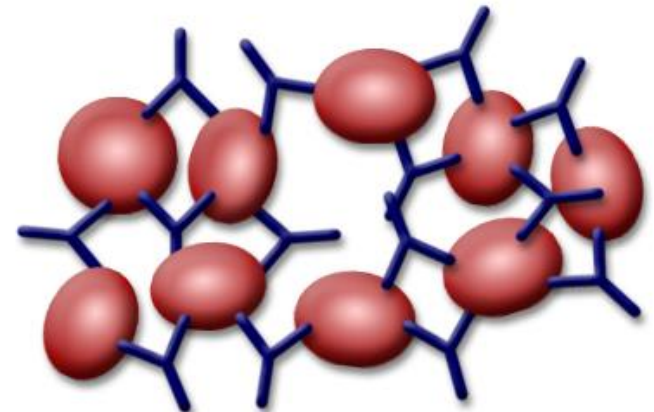
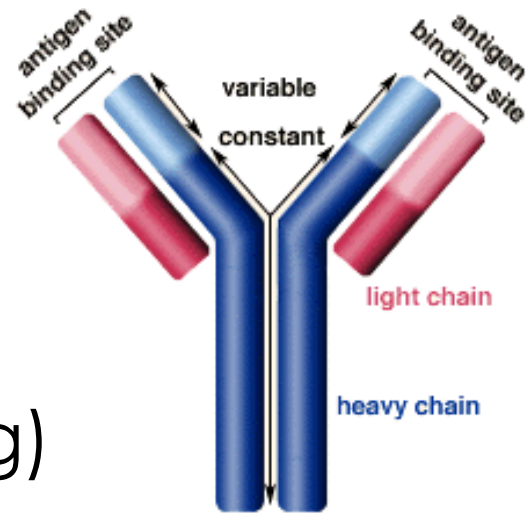
Figure 24-2
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Cells of the Immune System



Antibodies

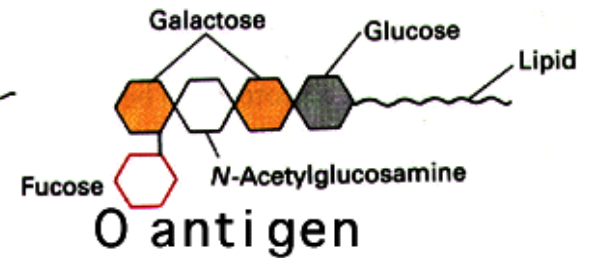
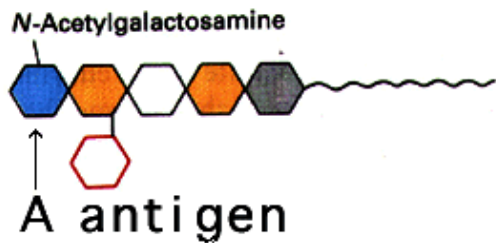
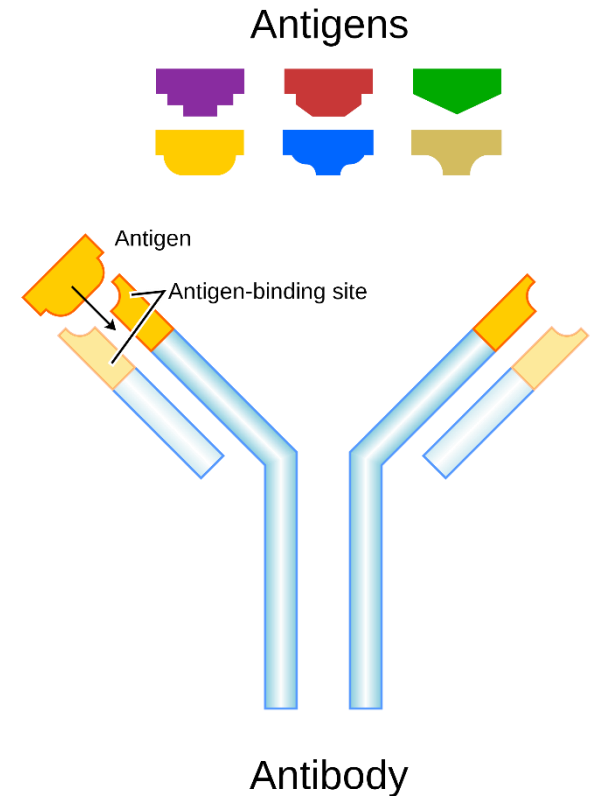
- B-cells make them
- Not antibiotics
- Immunoglobulins (Ig)
- Structure
 - Heavy chain, light chain
 - 2:1 binding
 - Fab – antibody fragment
 - Fc – crystallizable fragment



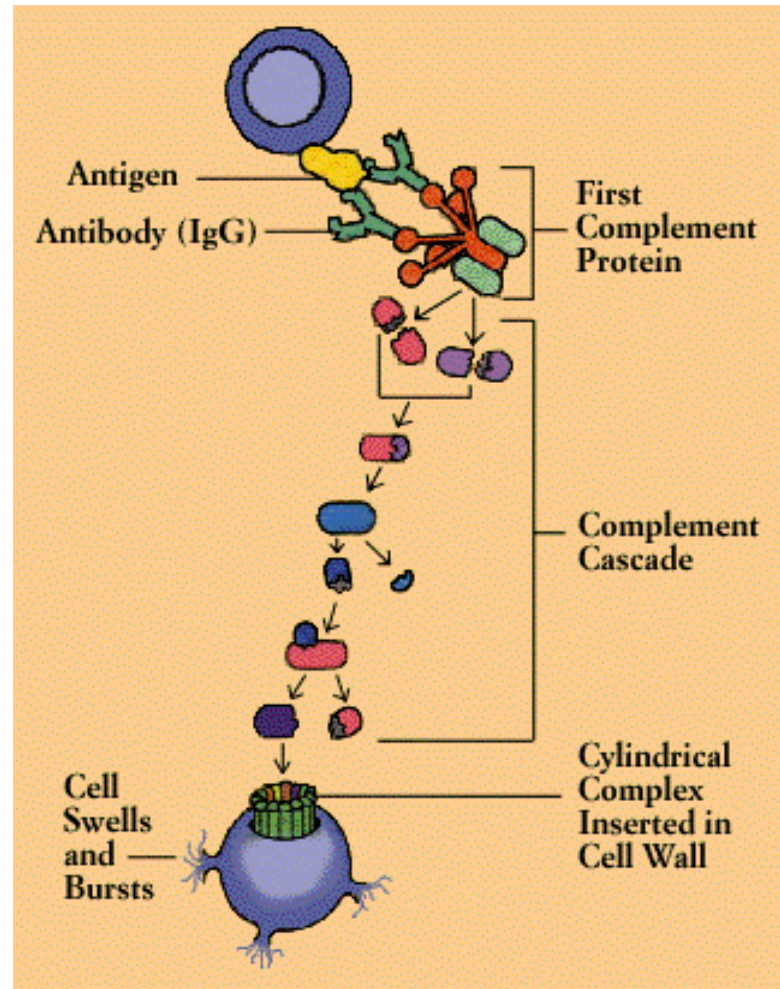
Blood agglutination

Antigens

- Molecules that initiate an immune response
 - Antibodies bind to specific antigen
 - Antigens can be protein, glycan, or lipid
- Surface markers on foreign cells or bacteria are antigens



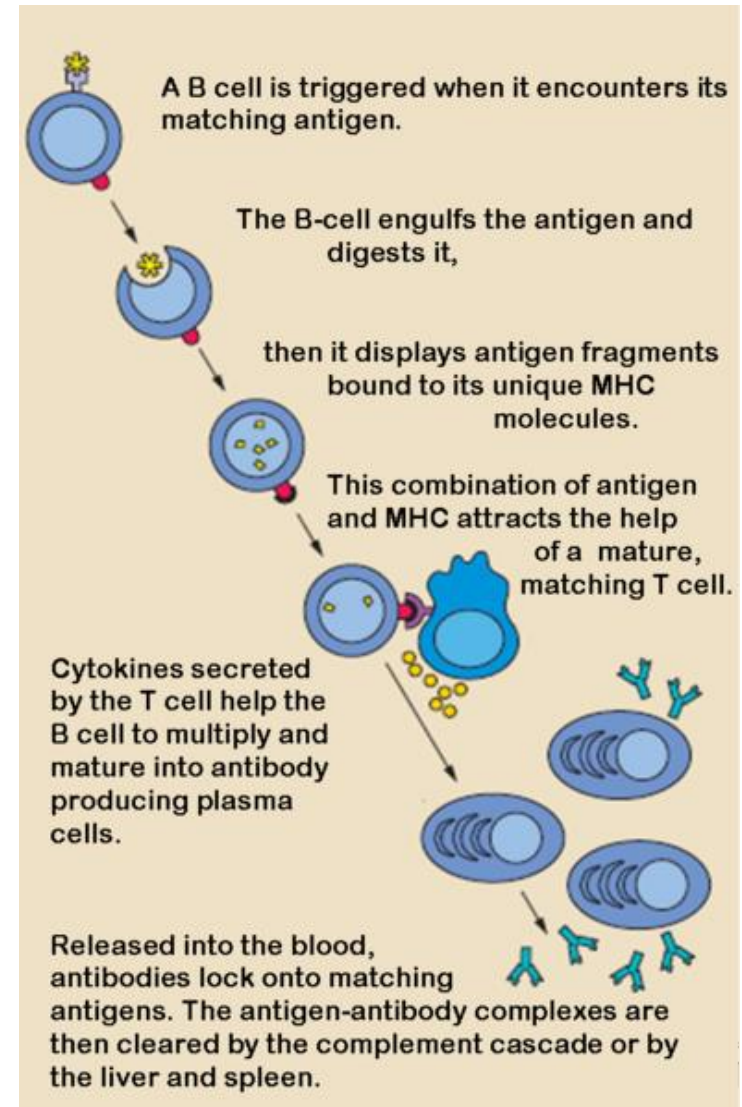
Complement System



Adaptive Immune Response

- Cell Hunters
 - B cell lays a trap...
 - Eats its prey...
 - Shows off the trophy...
 - Antibodies sent to kill...

MHC: major histocompatibility complex... "Self" receptor



If it doesn't kill you at first...

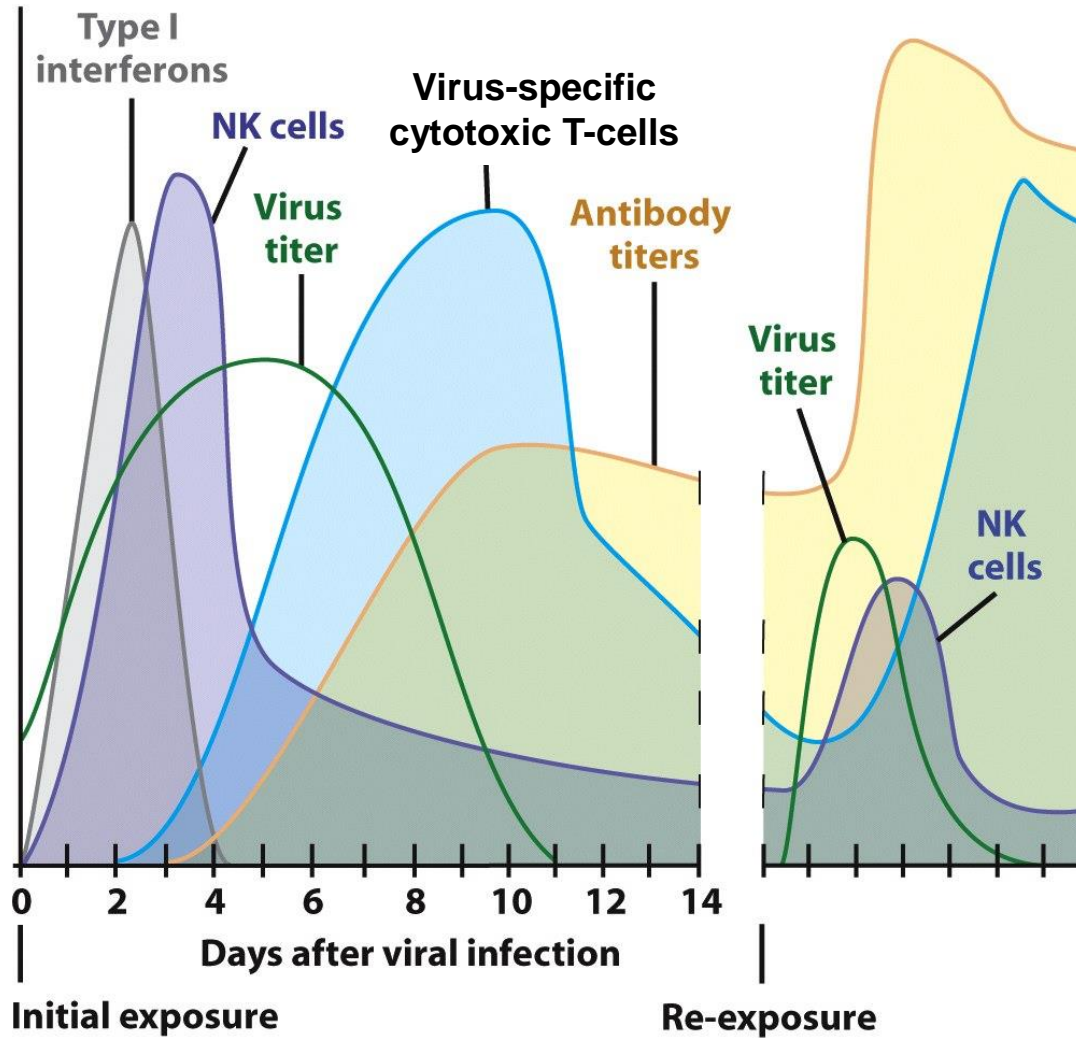


Figure 24-37
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BLOOD TYPING

Terry Barbera
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What is a Blood Type?

A blood type (also called a blood group) is a classification of blood based on the presence or absence of substances on the surface of red blood cells (RBCs)



There are 32 blood group systems but the two most important ones are

ABO and **Rh**

Blood Type Systems

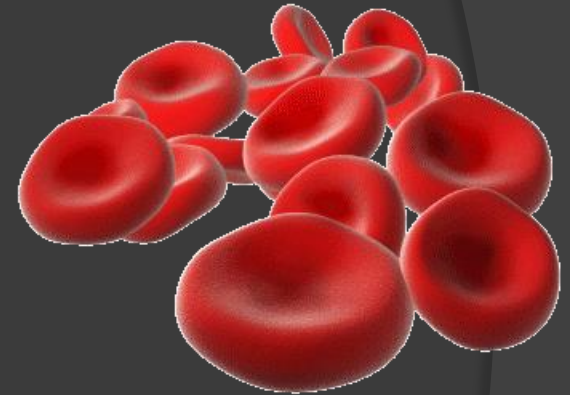
- ABO system

 - A** glycoprotein on the cell surface

 - B** glycoprotein on the cell surface

- Rh system

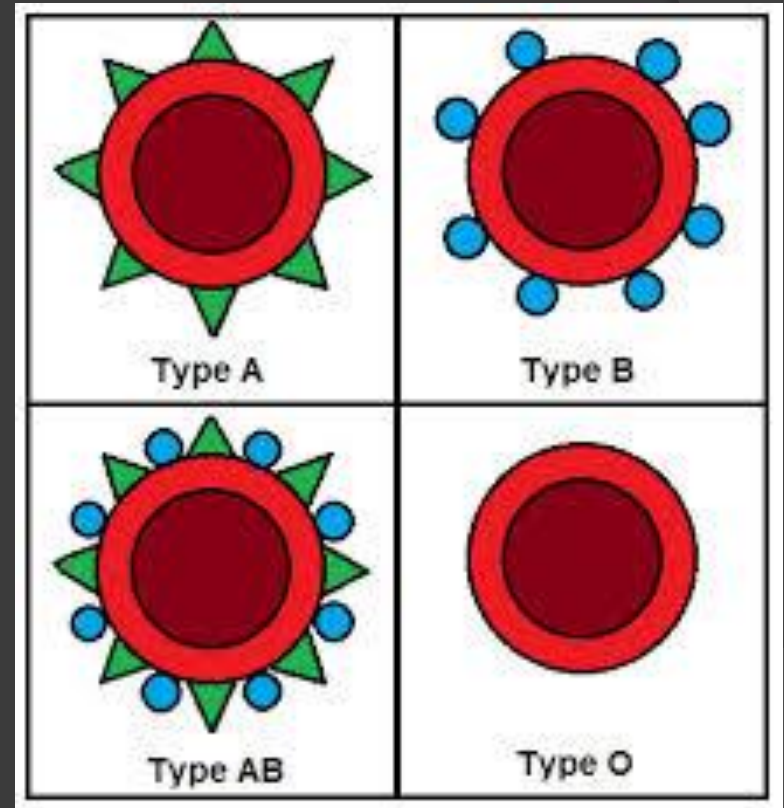
 - D** glycoprotein on the cell surface



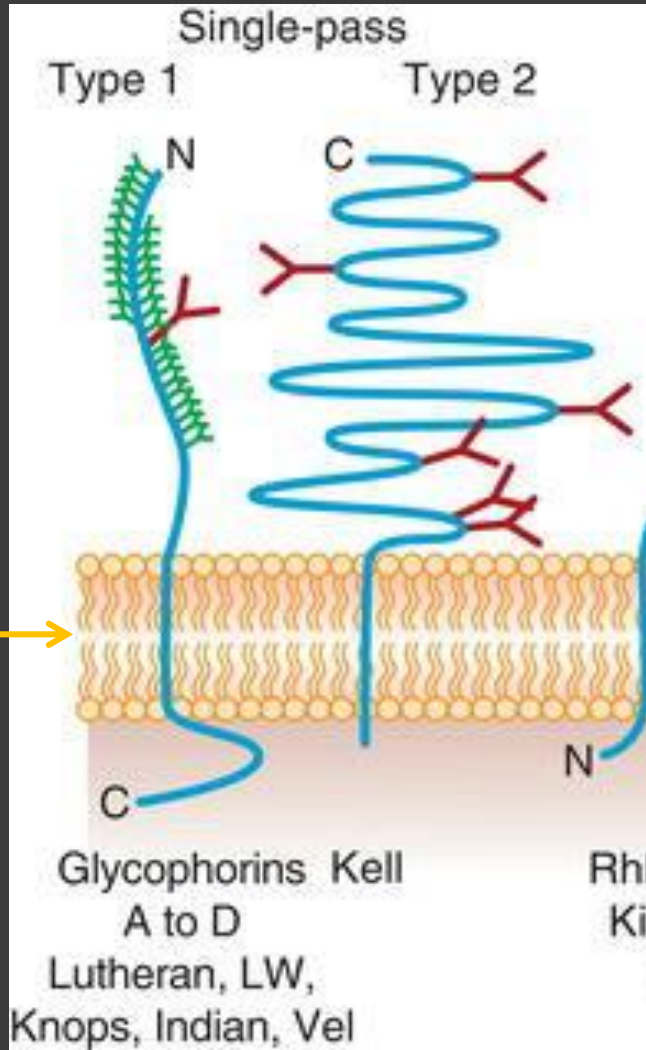
ABO System

Human red blood cells exhibit one of the following combinations of these two glycoproteins

- Only **A** glycoproteins present ▲
- Only **B** glycoproteins present ●
- Both glycoproteins present ▲ ●
- No glycoproteins present



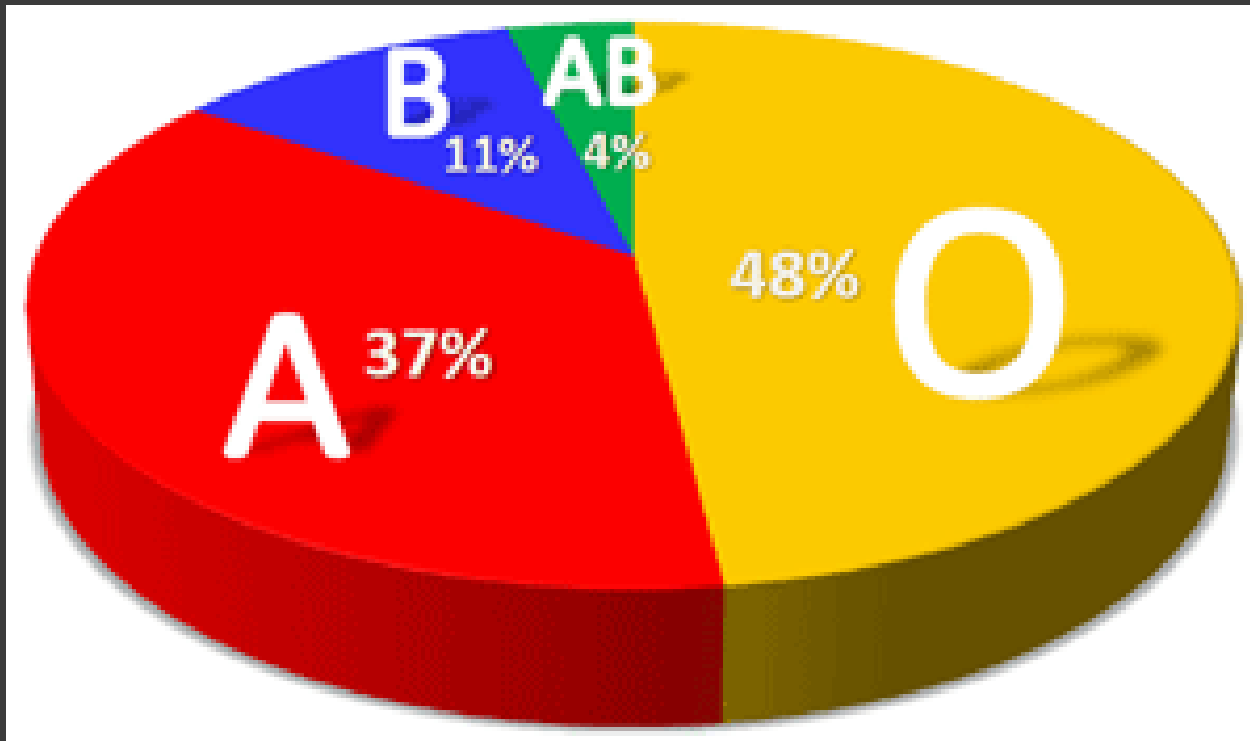
ABO Substances - Glycoproteins



Red Blood
Cell surface



ABO System



Most people are types O and A

Rh Blood Type System

Human red blood cells either have **D** glycoprotein or do not

- If present, then the blood type is “Rh **positive**”
- If not present, then the blood type is “Rh **negative**”

7 to 15% Americans are Rh negative

What we test and what we say

- When typing one's blood, we determine if
 - A** glycoproteins are present
 - B** glycoproteins are present
 - D** glycoproteins are present
- Therefore, there are 8 possible blood types

A Positive

A Negative

B Positive

B Negative

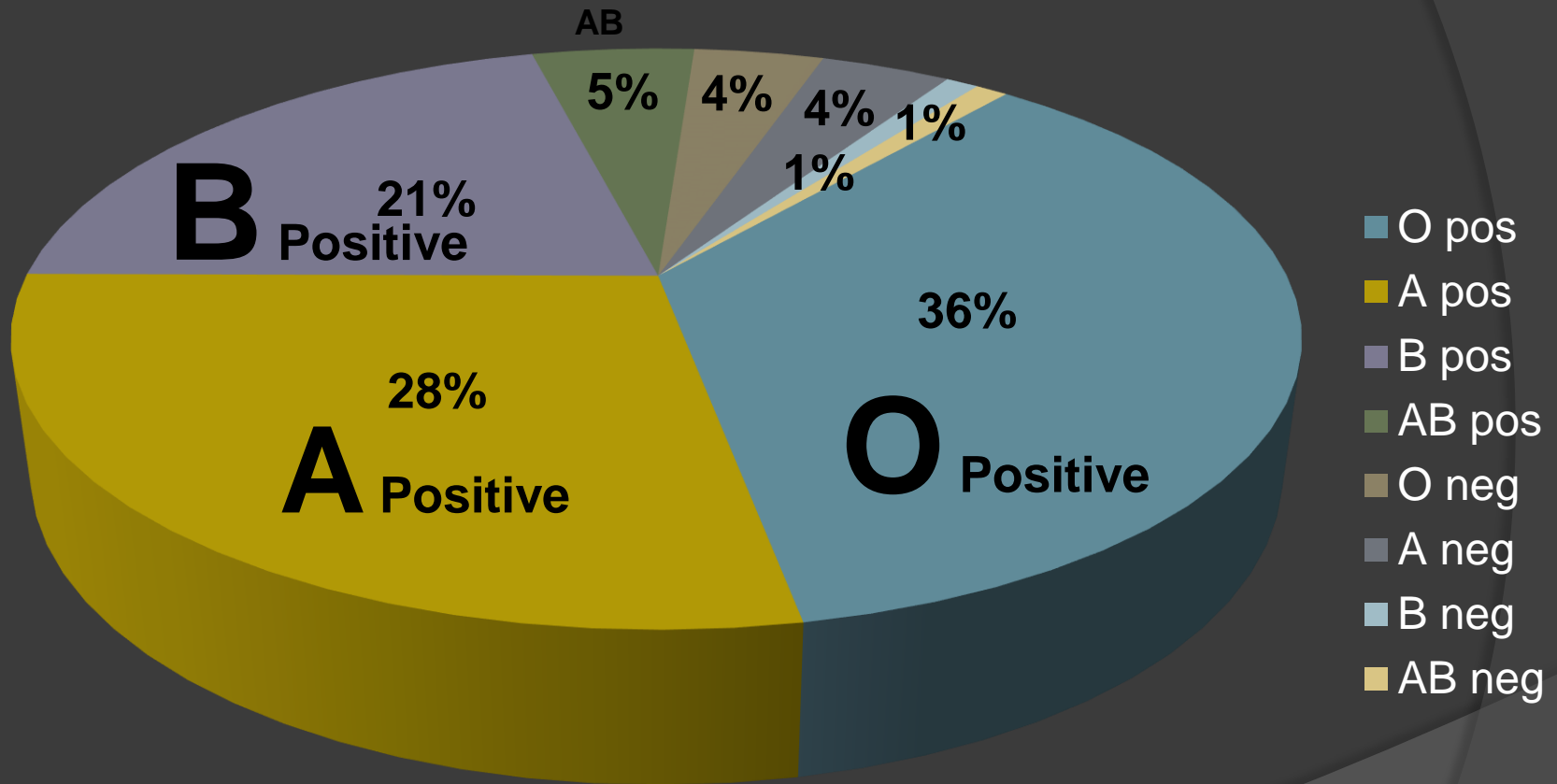
AB Positive

AB Negative

O Positive

O Negative

Blood Type Percentages with both ABO and Rh systems identified

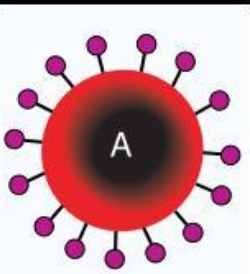
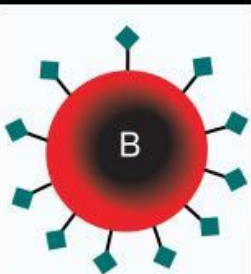
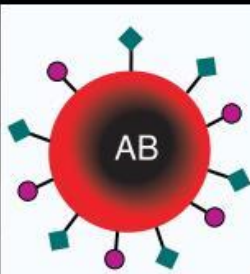
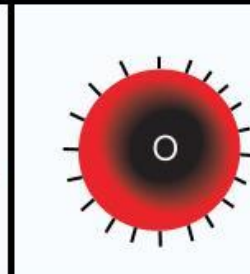
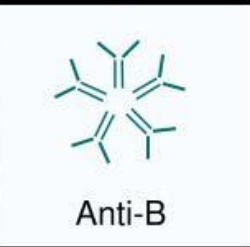
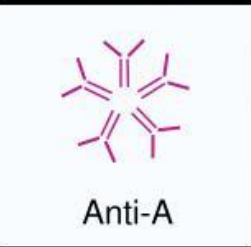
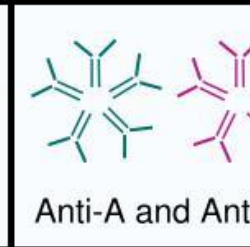





Most people are Rh positive

Blood Types are Inherited

		Father's Blood Type				
		A	B	AB	O	
Mother's Blood Type	A	A or O	A, B, AB, or O	A, B, or AB	A or O	
	B	A, B, AB, or O	B or O	A, B, or AB	B or O	
	AB	A, B, or AB	A, B, or AB	A, B, or AB	A or B	
	O	A or O	B or O	A or B	O	

Your blood also has antibodies against other blood types

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	 A antigen	 B antigen	 A and B antigens	No antigens

These antibodies can **DESTROY** the red blood cells of those other blood types.

Why is Blood Type Important to Know?

For blood transfusions

When you receive a blood transfusion, the blood needs to be compatible with yours. If not, you could die.



During pregnancy

If the mother is Rh-, the father should also be tested. If the father has Rh+ blood, the mother needs to receive a treatment to help prevent the development of substances that may harm the unborn baby.



Who gets blood transfusions?

You may need a blood transfusion if you lose too much blood, such as through:

- ⦿ Injury or surgery
- ⦿ An illness that causes bleeding
- ⦿ An illness that destroys blood cells
- ⦿ An illness in which your body doesn't make enough blood

Where does the blood come from?

Volunteer
blood donors!



Donated blood needs to be compatible with recipient's blood

CAN RECEIVE

TYPE	O-	O+	B-	B+	A-	A+	AB-	AB+
AB+	•	•	•	•	•	•	•	•
AB-	•		•		•		•	
A+	•	•			•	•		
A-	•				•			
B+	•	•	•	•				
B-	•		•					
O+	•							
O-	•							

People with O - blood are called "universal donors" because any patient can receive O-red blood cells.

People with AB+ blood can receive red blood cell transfusions of any blood type, and are known as "universal recipients."

The Micronics ABORhCard for blood typing

Designed for the U.S. Army!



Transmission Risk of BBP

- Risk of infection depends on several factors:



- Pathogen involved
- Type/route of exposure
- Amount of virus in infected blood during exposure
- Amount of infected blood involved in the exposure
- If post-exposure treatment was taken
- Specific immune response of infected individual

Personal Protective Equipment

- Protect your entry points



Questions ?