

Lecture 6

I. Immunology: Types of defensive responses

A. Immunology is the study of _____ to _____ (e.g. bacteria, viruses, and non-self proteins)

B. Defense mechanisms

1. _____ mechanisms

a. Develop _____ and deal with invaders using _____.

b. Weapons include:

i. Physical barriers like _____

ii. _____

iii. _____ factors

iv. _____

2. _____ mechanisms

a. Develop _____ in response to the foreign agent (antigen or immunogen).
_____ against the antigen.

b. Have memory, so they are _____ the antigen is encountered.

c. Depend primarily on specialized cells: _____.

C. Specific immunity

1. _____ immune response

a. The presence of an antigen stimulates _____ to produce _____
(glycoproteins that react specifically with the antigen and target these antigens for _____).

2. _____ immune response

a. _____ and attack cancerous cells, transplanted cells, or host cells that have
been _____ by viruses or microorganisms.

Frank and Ernest



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II. Antibodies and antigens

A. Antibodies (Ab) are _____ (have two equally specific binding sites for the same antigen); _____ with the following structure:

1. _____
 - a. Differences in this region account for antibody specificity
2. _____
3. _____
 - a. Antibodies in the same class have virtually identical amino acid sequences in this region.
4. _____
5. _____
 - a. These are lacking in IgB and IgM classes.

B. Antigens (Ag) are _____. Each antigen has many _____ (antigen _____ that generally consist of 5-10 amino acid or sugar residues).

C. Antibodies can be divided into 5 classes based on their physiochemical, structural, and immunological properties: IgA, IgD, IgE, IgG, and IgM

III. Antigens and antibodies interact with one another in detectable ways. _____ is the science of _____ these antigen-antibody reactions.

A. There are two types of antigen/ antibody reactions

1. Because antibodies are bivalent, they can react with two antigen molecules or cells of the same type. This allows them to _____
_____ of alternating Ag-Ab-Ag-Ab-etc.
2. Eventually, this antigen-antibody lattice network becomes so large that it _____. If the antigen is a _____ antigen, such as a protein or a carbohydrate, this reaction is called a _____. If, instead, the antigen is _____, such as a red blood cell or bacteria, the reaction is called an _____.

How Does It Work?

Antigens

Antibody/Antigen Lattice

B. We will look at two kinds of experiments to demonstrate the two types of antigen-antibody interactions.

1. Agglutination (_____), which includes blood typing for ABO and Rh factor

a. ABO blood typing

i. Mix a drop of blood with Antibody-A, Antibody-B, and Antibody-Rh factor in separate wells. Hemagglutination in the wells indicates that the _____

b. Rh factor:

i. Based on the presence or absence of the RhD antigen on RBCs. An individual who has a blood type of A and is RhD+ is said to have _____ blood.

ii. RhD- people must be _____ to the RhD antigen before their body will start making antibodies.

iii. The Rh factor is important to a Rh- woman who is carrying a child of a Rh+ man. _____. The woman can produce antibodies to the Rh factor and, during subsequent pregnancies, the woman's immune system treats the presence of the Rh factor as an infection and effectively neutralizes it, resulting in abortion. This is called "hemolytic disease of the newborn" or _____. To prevent this, there is a therapy available called _____. This therapy effectively gives the mother bunches of antibodies after the first pregnancy to _____.

Blood +  → _____
 (anti-A)

+  → No agglutination
 (anti-B)

This person must have _____ on the surface of his/her RBCs. This person has _____ blood.



Blood +  → _____
 antibody-A (anti-A)

+  → _____
 antibody-B (anti-B)

This person must have _____ on the surface of his/her RBCs. This person has _____.



Blood +  → _____
 antibody-A (anti-A)

+  → _____
 antibody-B (anti-B)

This person must have _____ on the surface of his/her RBCs.
 This person has _____ blood.



Blood +  → _____
 antibody-A (anti-A)

+  → _____
 antibody-B (anti-B)

This person must have _____ on the surface of his/her RBCs. This person has _____ blood.

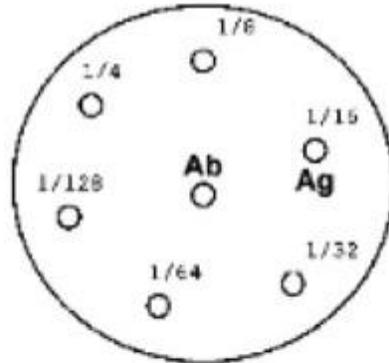


In vivo, people produce antibodies to surface glycoproteins they see as foreign.

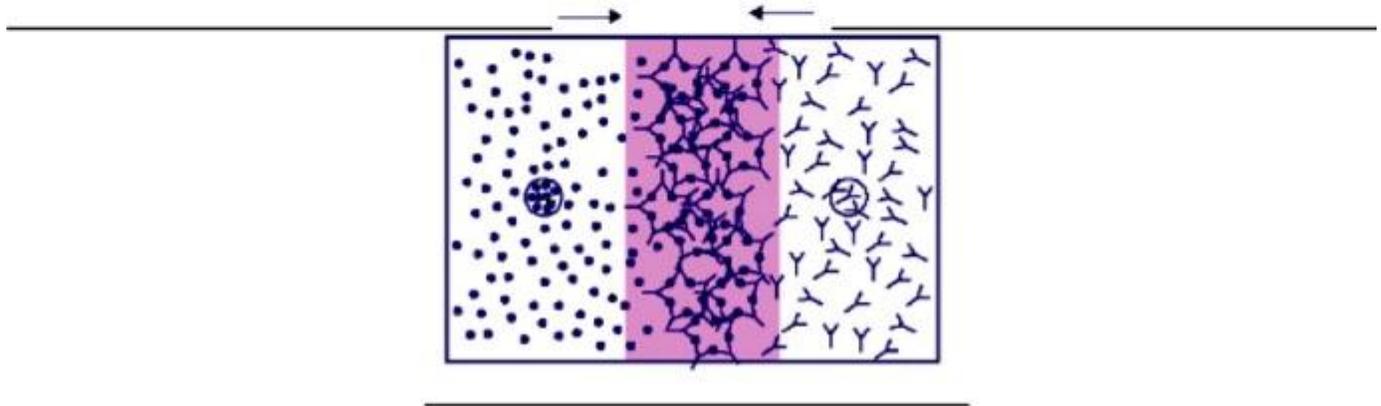
Blood Type	Antibody produced	Ability to accept/donate
A	Antibody-_____	Can accept type _____
B	Antibody-_____	Can accept type _____
AB	_____	Universal _____
O	Antibody-_____	Can accept only type ____; Universal _____

2. Precipitation, which includes observing the interaction between a protein antigen

a. _____



Ag = Bovine Serum Albumin (BSA)
Ab = antibody to BSA (a-BSA)



b. This test will be done on an agar gel to immobilize the precipitates so they are more easily observed.

c. Using this test, we can determine _____ and still give positive precipitation.

i. If the last positive precipitation band is seen for the 1/8 dilution, then the antigen can be diluted 8-fold and still give a positive precipitation reaction. In immunology, this dilution factor is often referred to as the _____, even though it is just a unitless factor.

ii. FYI: Ouchterlony gel precipitations have been used in the understanding of how _____ interact with the immune system— women make antibodies to them.

IV. Wright stained blood smears

A. **Never Let Monkeys Eat Bananas:** What?

1. This is a mnemonic designed to help you remember the names of white blood cells in order of decreasing abundance.

a. **Never**

i. _____ are the most abundant type of white blood cells in our serum. They function mainly in the nonspecific immune response in a _____ manner. They are classified as _____, which means their cytoplasm is filled with granules (or lysosomes).

b. **Let**

i. _____ are agranulocytes — free of granules — that function in the _____ (cell-mediated and humoral).

c. **Monkeys**

i. _____ are eventually phagocytic when they mature into _____. They are predominately involved in the nonspecific immune response and are classified as agranulocytes.

d. **Eat**

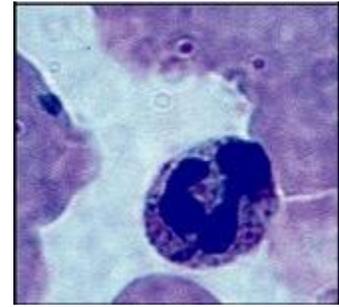
i. _____ are hardly present in our blood and function during _____ in a phagocytic manner. They are classified as granulocytes.

e. **Bananas**

i. _____ are very few and far between. They function during allergic reactions to release heparin and histamine. These cells work in concert with eosinophils. They are classified as granulocytes.

B. Red Blood Cells

1. These are the largest population of blood cells and function to transport oxygen and carbon dioxide. They are a _____ shape which increases the surface area to volume ratio for effective _____.



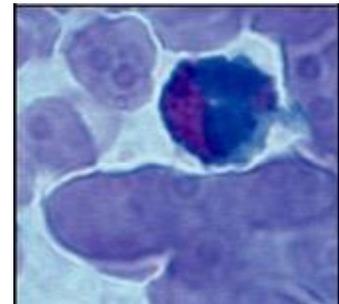
Neutrophils



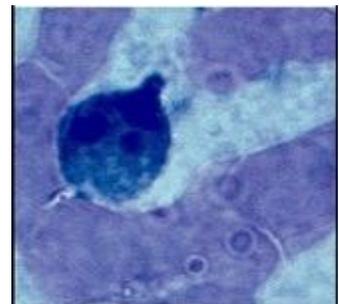
Lymphocyte



Monocytes



Eosinophils



Basophils