CONCEPT: ANTIBODY

Summary of Immunity

●Organisms are continually subject to attack by pathogens that cause disease & need an _____ system for defense.

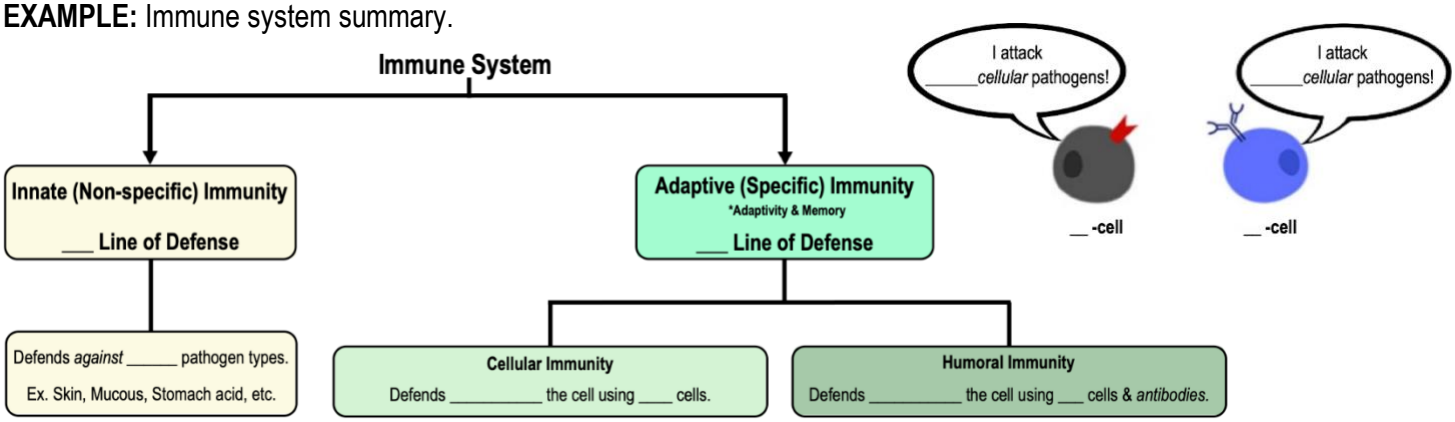
●____ general types of immunity: 1) _____ immunity (1st line of defense) & 2) Adaptive immunity (2nd line of defense)

- □ *Innate immunity*: generalized, nonspecific immunity used against all pathogens (ex. skin, mucous, etc.).
- □ _____ *immunity*: specific immunity with an adaptive & memory component (includes T cells & B cells).

●Adaptive immunity is further split into _____ types: 1) _____ immunity & 2) _____ immunity.

- □ *Cellular immunity*: primarily targets intracellular pathogens using ____ cells.
- □ *Humoral immunity*: primarily targets extracellular pathogens using *antibodies* & ____ cells.

EXAMPLE: Immune system summary.



PRACTICE: Humoral immunity refers to the part of the immune response mediated by:

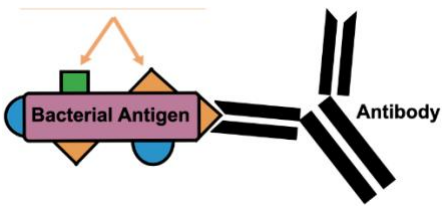
a) T lymphocytes.
b) Antigens.
c) The thymus.
d) The skin.
e) Antibodies.
f) C lymphocytes.

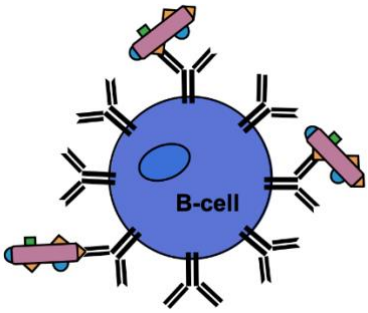
Antibodies

●_____ (*immunoglobulin* or *Ig*): ____-shaped proteins that recognize & bind to an *antigen*'s *epitope*.

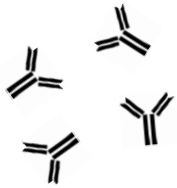
- □ _____: any compound that provokes an immune response.
- □ _____: the exact binding-site on an *antigen* that an antibody binds to.
- □ Antibodies have a strong affinity (_____ K_d) to their epitope via an *induced-fit*.

●Antibodies: produced by ____-cells (_____ immunity) but are also isolated for biochemical techniques (ex. ELISA).





Antibodies *attached* to B-cell.


Antibodies *secreted* by B-cell.

CONCEPT: ANTIBODY

Antibody Structure

●Antibodies consist of _____ polypeptide chains: two *identical* _____ (L) chains & two identical _____ (H) chains.

□ These 4 chains are *covalently* linked together via _____ bonds.

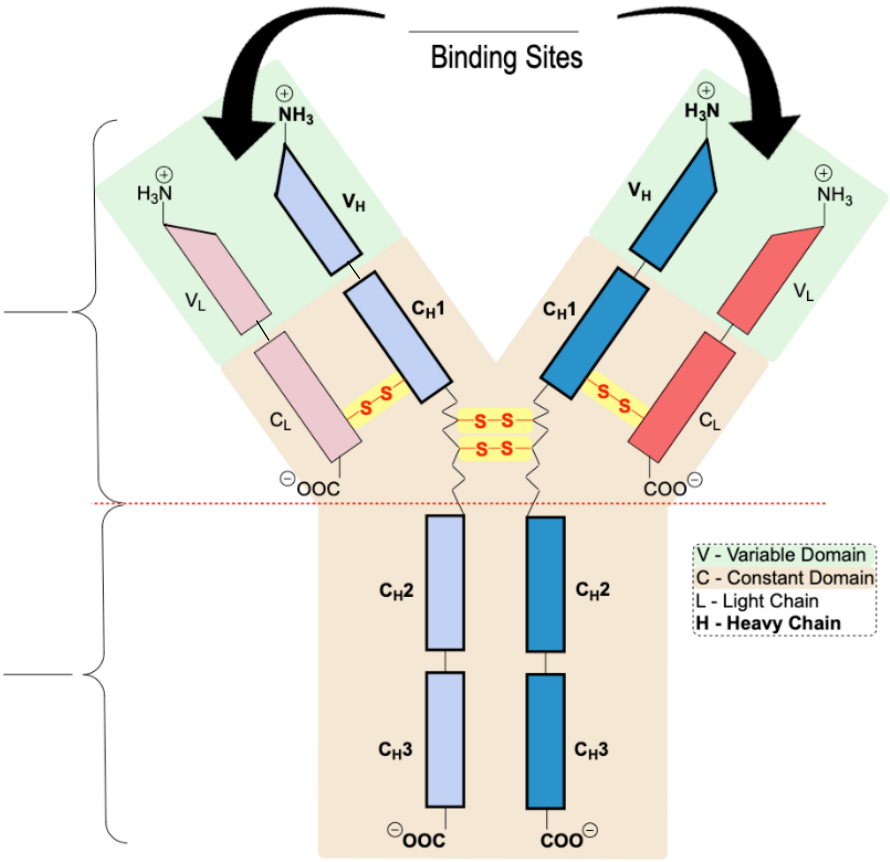
●Each light & heavy chain has a *variable* region (____ domain) and a *constant* region (____ domain).

□ *V domain*: located at the tip (N-terminal) of each prong of the "Y" and contains the _____ binding site.

□ *C domain*: located at the hinge & stem of the "Y" and is recognized by _____ system cells.

□ If antibody is broken at the hinge of the "Y", it leaves the prongs (_____) and the stem (____).

EXAMPLE: Antibody Structure:



PRACTICE: What is the subunit structure of IgG, one of the 5 classes of antibodies produced by our immune system?

a) 2 light chains and 2 heavy chains.
b) 2 light chains, 2 heavy chains, and a J chain.
c) 4 light chains, 4 heavy chains, and a J chain.
d) 10 light chains, 6 heavy chains, and a J chain.

PRACTICE: Which of the following parts of an IgG molecule is not involved in binding to an antigen?

a) F_{ab}.
b) Heavy chain.
c) Variable region.
d) F_c.

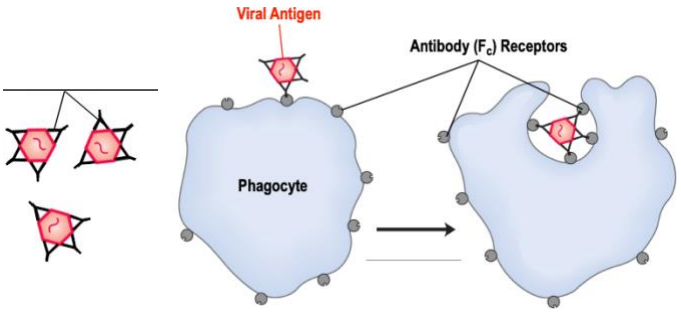
CONCEPT: ANTIBODY

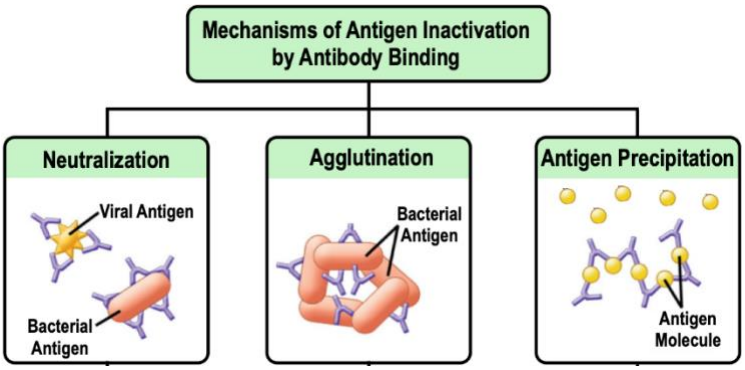
Antibody Function

●Antibodies have many functions including _____ toxins & _____ invading pathogens for destruction.

□ *Phagocytes*: cells that engulf & neutralize pathogens tagged by _____.

EXAMPLE: Antibody Functions:





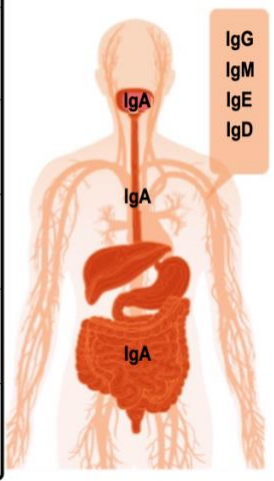
Antibody Classes

●There are _____ classes of immunoglobulins based on differences in their *heavy* chains:

1) Ig___ 2) Ig___ 3) Ig___ 4) Ig___ 5) Ig___

EXAMPLE: Classes of Antibodies.

Ig Class	Structure	Heavy Chain	Light Chain	Molecular Mass (kDa)	Primary Feature
IgG		γ	κ or λ	150	Protects against _____ types of infections.
IgA		α	κ or λ	180-720	Highly concentrated in _____ membranes.
IgM		μ	κ or λ	950	_____ antibody produced upon infection.
IgE		ε	κ or λ	190	Defends against _____.
IgD		δ	κ or λ	160	_____ B-cells.



PRACTICE: Immunoglobulin/antibody classes are distinguished by:

a) The light chains they possess.
b) Carbohydrates on their light chains.
c) Constant regions in their light chains.
d) The heavy chains they possess.
e) None are true.

CONCEPT: ANTIBODY

Antibody Diversity

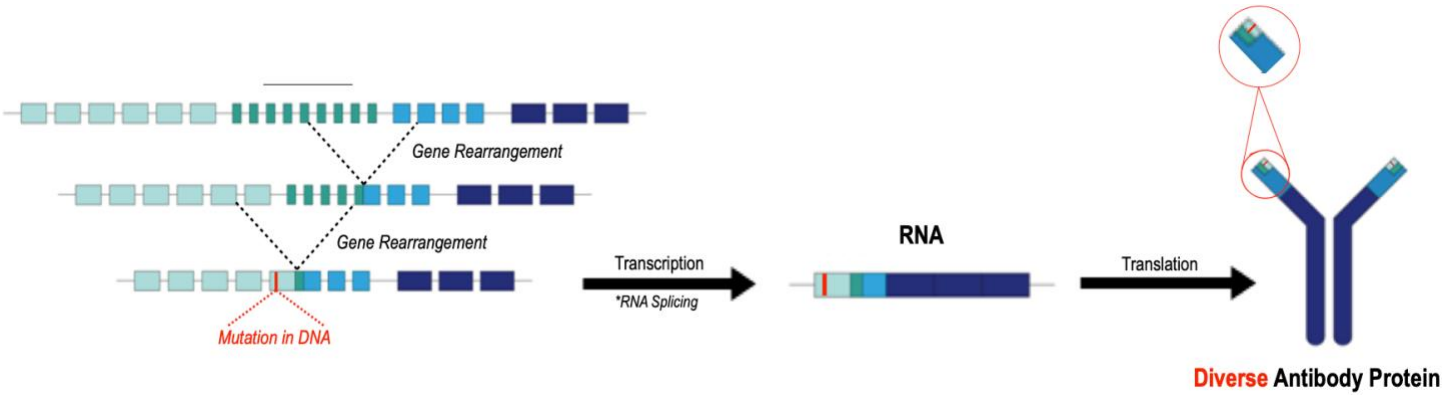
●Our immune system has *potential* to produce an _____ number of *different* antibodies (perhaps > 10^{18}).

□ So many potential antibody possibilities that they all cannot be produced in one lifetime.

●*Question*: how is antibody diversity SO LARGE if humans only have ~25,000 genes?

□ Antibody diversity results from significant amounts of *gene* _____, *splicing*, & *mutations*.

EXAMPLE: Antibody diversity.



Monoclonal & Polyclonal Antibodies

●Antibodies are valuable reagents for biochemical assays, but first must be prepared and collected.

□ _____ types of antibody preparations are used: 1) _____. & 2) _____.

●*Monoclonal Antibodies*: _____ antibodies specific to the _____ epitope on the same antigen.

□ Made by B cell _____ grown in cell culture in a lab.

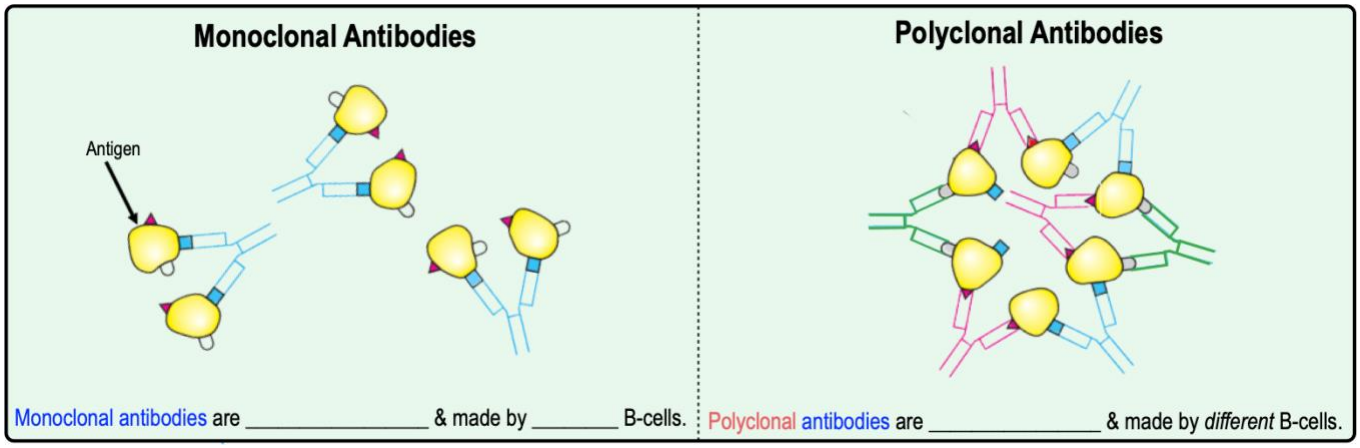
●*Polyclonal Antibodies*: _____ of antibodies specific to _____ epitopes on the same antigen.

□ Made by _____ B cells.

□ Example of polyclonal antibody preparation: injecting one antigen into an entire animal.

□ Animal's B cell population produces *different* antibodies specific to *different* epitopes on the antigen.

EXAMPLE: Monoclonal vs. Polyclonal Antibodies.



CONCEPT: ANTIBODY

PRACTICE: Which of the following mechanisms is not a way that antibody diversity is attained?

a) Gene rearrangements.
b) Apoptosis.
c) Splicing.
d) Mutations.

PRACTICE: What is the difference between monoclonal and polyclonal antibodies?

a) Monoclonal antibodies consist of different immunoglobulins recognizing a single epitope on different antigens, whereas polyclonal antibodies consist of different immunoglobulins recognizing many epitopes on an antigen.
b) Monoclonal antibodies are identical immunoglobulins recognizing a single epitope on different antigens, whereas polyclonal antibodies consist of many different immunoglobulins that recognize many epitopes on an antigen.
c) Monoclonal antibodies consist of different immunoglobulins recognizing a single epitope on the same antigen, whereas polyclonal antibodies consist of identical immunoglobulins recognizing many epitopes on an antigen.
d) Monoclonal antibodies are identical immunoglobulins recognizing a single epitope on the same antigen, whereas polyclonal antibodies consist of different immunoglobulins recognizing different epitopes on the same antigen.