Immune & Lymphatic System – Class Notes

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Primary Lymphoid Organs

- Red Bone Marrow
- Thymus

Bones Containing Marrow:

- Children – most bones contain marrow
- Adults – skull, sternum, ribs, clavicle, pelvis, vertebral column

Lymphocytes: begin in bone marrow

- B Cells (Bone) – mature in bone marrow
- T Cells (thymus) – mature in thymus

Thymus – soft, bilobed gland, largest @ puberty, shrinks w/ age, only 5% of T cells ever exit thymus

Secondary Lymphoid Organs

Lymphocytes -> blood stream -> secondary lymphoid organs, activated -> blood stream -> sites of inflammation / infection

Spleen –

- mostly red pulp, blood vessels & sinuses, microphages remove old & defective blood cells.
- White pulp, lymphoid tissue, lymphocytes react to invaders in blood; spleen also removes older red blood cells (RBC) & platelets.

Lymph nodes – small, ovoid structures, divided into nodules, packed w/ B & T cells, contain a sinus, macrophages engulf pathogens (viruses & bacteria).

Tissue fluid -> lymph

Heart -> arteries -> arterioles -> capillaries -> tissues (now called, "tissue fluid" -> lymphatic capillaries (now called, "lymph") -> lymph vessels -> lymph nodes

Lymphatic vessels – one way system, begins @ lymphatic capillaries; capillaries join together to make lymphatic vessels

Lymphatic capillaries – tiny, closed-ended vessels; walls simple squamous epithelium, absorb excess tissue fluid; mostly water & solutes (nutrients, electrolytes, & oxygen).

Lymphocytes – white blood cells mainly responsible for adaptive immunity

Innate immunity – fully functional w/out previous exposure to these substances

Adaptive immunity (only vertebrates) – imitated and amplified after specific recognition of these substances

Inflammatory response – inflammation walls off infection, increase exposure and access to immune system

Cardinal signs of Inflammation –

Due to capillary changes in area

- Redness
- Heat
- Swelling
- Pain

Mast cells – type of immune cell found in skin, lungs, and connective tissue

Phagocytes & natural killer cells

Phago – eating

Cytes – cell

Neutrophils – first white blood cells (WBC) to enter an inflamed area, accumulate to form pus

Monocytes (in blood) / macrophages (in tissues)

Complement system (complement):

Complement proteins (C) – blood plasma proteins designated by C (complement); example C3

- Some bind to mast cells & trigger histamine release
- Some attract phagocytes to the scene
- Some bind to surface of pathogens

Membrane attack complex/sytem – complement proteins joined together; produces holes in surface of bacteria and some viruses; fluids & salts enter cell & they burst

Interferon – proteins produced by (virus infected) cells; cell's warning to other cells; cells prepare for possible attack

3 Germ Layers:

Endoderm – develops into epithelium; lines digestive tract, its glands; dermis and associated glands; lining of the bladder

Mesoderm – develops into muscles, bone, heart, vessels, reproductive system

Ectoderm – nervous system & epidermis of the skin

Autoimmune disease – 80 chronic illnesses, great severity, involved (nearly) all organ systems, misdirection of immune system, attacking instead of protecting; difficult to diagnose

Innate immune response (continued…)

Complement

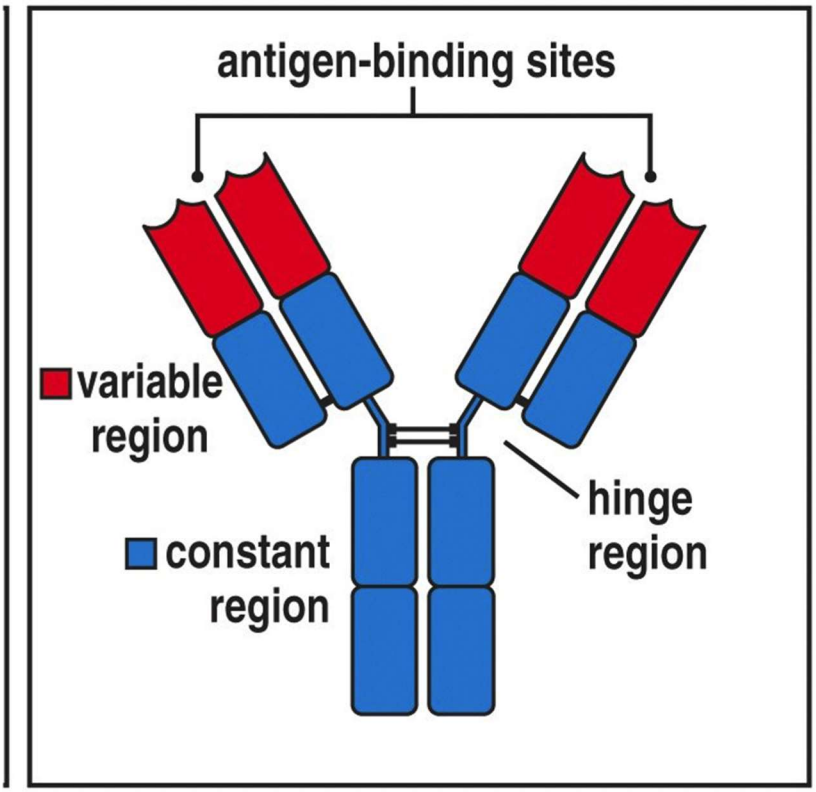
- Invite phagocytes
- Bind to surface of pathogen
- Interferons
- Innate

Adaptive immune response (continued…)

Antibody mediated immunity (humoral immunity)

B Cells – activated in lymph node or spleen

Clonal expansion – helper T cells stimulate B cells to divide; most resulting clone cells become plasma cells, specialized for the secretion of antibodies some become memory B Cells (long term immunity)



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Antibody structure – Y shaped molecule w/ 2 arms; each has a heavy/long polypeptide chain & a light/short polypeptide chain

C (constant) Regions – constant, amino acid sequence is set

V – Regions – variable, amino acid sequence varies between antibodies

C.R. = Cell receptor; example: BCR, TCR

T Cell Receptor (TCR) – similar to B Cell Receptor (BCR) on B-Cells, no secreted form of TCR, unable to recognize antigen w/out help

Major Histocompatibility Complex (MHC)

- Active immunity
- Presentation of antigens to T Cells
- Tissue Transplant Rejection
- Adaptive Immune Responses

Two major types:

- Helper T Cells (T_H Cells)
- Cytotoxic T Cells (T_C Cells) or (CTLs)

T_H Cells recognize MHC II (major histocompatibility complex class II)

> T_H Cells only recognize antigen presented by specialized APCs (antigen presenting cells) with MHC class II on their surface

T_C Cells recognize MHC I (major histocompatibility complex class I)

> T_C Cells only recognize antigen presented by specialized APCs (antigen presenting cells) with MHC class I on their surface

Immunity – condition where body is protected from various threats, usually by the adaptive immune system.

Adaptive immunity – can be induced actively or passively.

Active immunity – individual alone produces an immune response against an antigen; develops naturally after infected with pathogen; induced artificially to prevent future infection – immunization/vaccination.

Passive immunity – receives antibodies or cells from another individual; receives another individual's antibodies or immune cells; IgG antibodies cross placenta; breast feeding IgG & IgA antibodies, colostrum (first milk) particularly rich in antibodies; placenta – immunity lasts a few months; breast feeding – prolongs passive immunity.

Gama globulin – antibodies in serum, injection used when patient has been exposed.

Main source: inquiry into life – Mc Graw Hill