Assessment of Immune Function

Tammy Nesbitt, DNP, RN, CNE

Instructional Module 4

AY 2020-2021

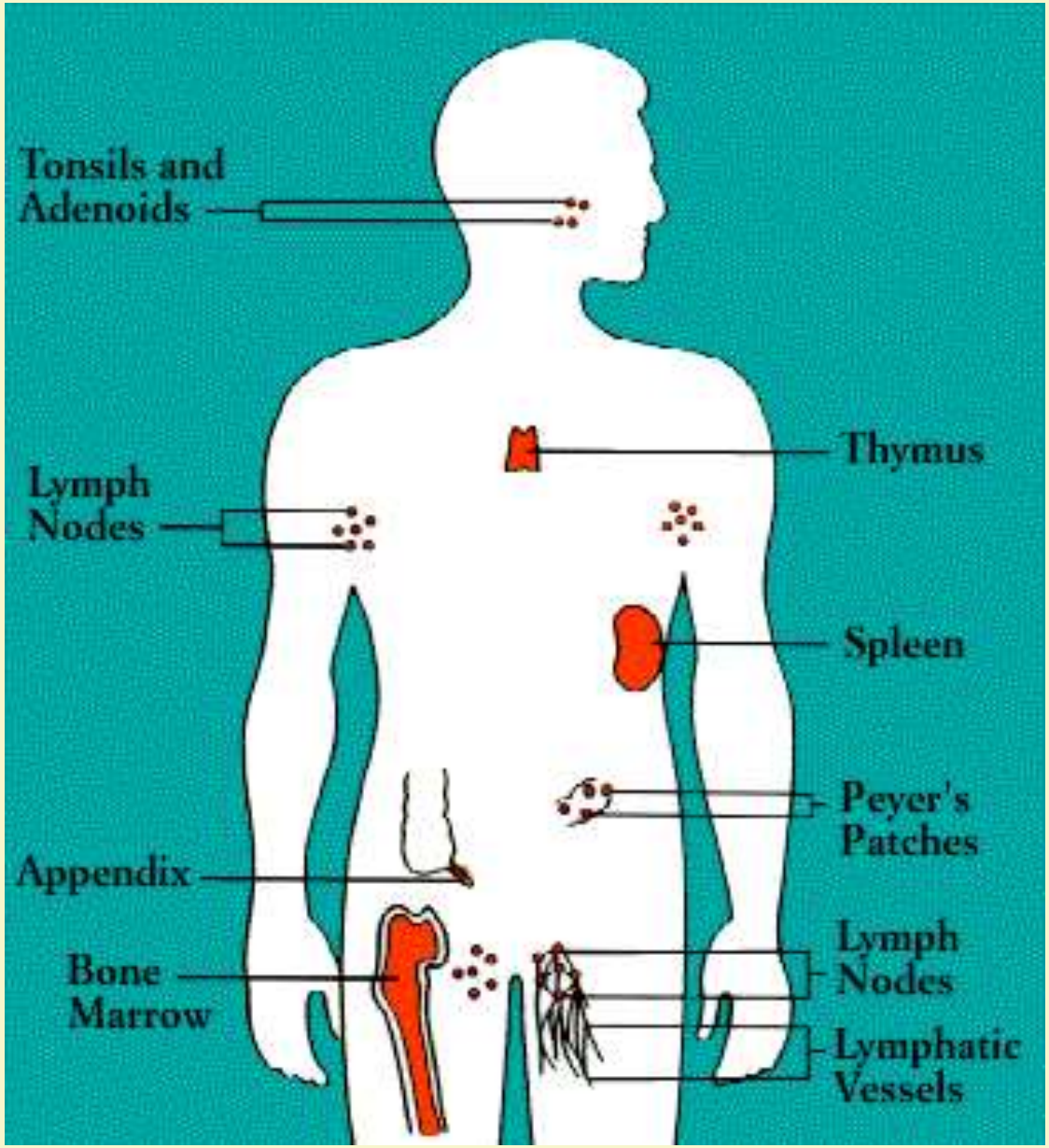
Student Learning Outcomes

- **Describe the functions and components of the immune system.**
- **Understand the pathophysiology of hypersensitivity reactions and immune system disorders.**

Immune Crash Course

- **Immune System Natural Born Killer***
  - https://www.youtube.com/watch?v=CeVtPDjJBPU
- **Immune System Part I**
  - https://www.youtube.com/watch?v=GIJK3dwCWCw
- **Immune System Part II Humoral Response**
  - https://www.youtube.com/watch?v=2DFN4IBZ3rI
- **Immune System Part III Cell-Mediated Response**
  - https://www.youtube.com/watch?v=rd2cf5hValM

Anatomy of Immune System



Immune System

- **Antigens**
  - Substances the body recognizes as foreign that elicit an immune response
- **Antibodies**
  - Immune globulins produced by lymphocytes in response to antigens
  - Attach to antigens and attract cells to destroy the pathogen

Immunity Lines of Defense

- **Innate** (natural)
  1. **Barriers-** physical, biochemical, mechanical
  2. **Inflammatory response**
     - Interferon (IFN)
     - Complement
     - Phagocytosis
- **Acquired** (adaptive)
     - Infection
     - Vaccine
     - Antigen

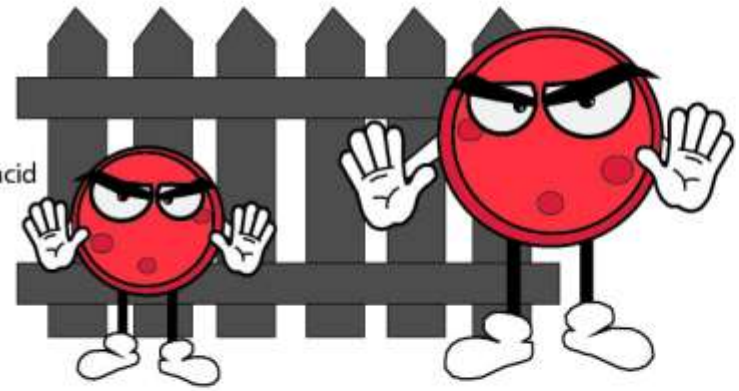
Immune Physiology

- **Innate immune response** (1st defense)
  - Physical and mechanical barriers
  - Biochemical barriers
- **Inflammatory response** (2nd defense)
  - Acute cellular injury
- **Initiation of inflammatory response**
  - Vasodilation with increased capillary permeability
  - Increases blood flow and leukocyte movement

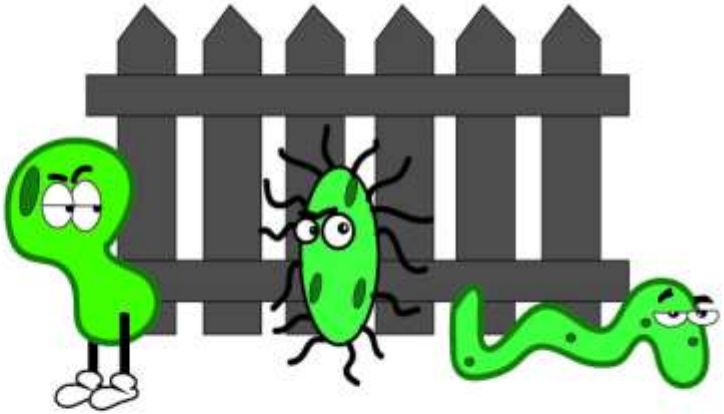
The Innate Immune System: The first line of defense

Physical and chemical barriers that try to keep foreign invaders from getting into the body.

Physical barriers like ...
- Skin
- Tears
- Earwax
- Mucus
- Urine
- Stomach acid



Bacteria, viruses and fungi are constantly invading.

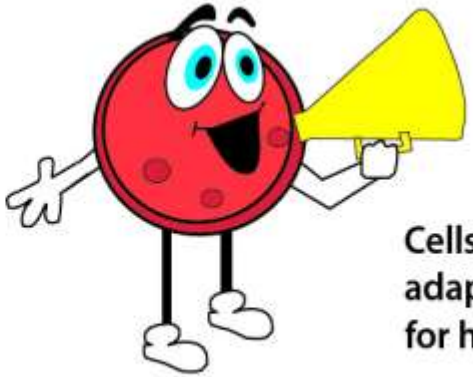


Sometimes some get around the barriers

Innate immune cells
try to do what they can.

They are like the garbage man and target anything foreign.

Sometimes backup is needed.



Cells signal to the adaptive immune system for help!

Physiology (cont.)

- **Adaptive immune response** (3rd line)
  - **Active**
    - Invasion of foreign substance (natural or artificial)
    - Body forms long-lasting immunity
    - Ex: Chicken pox, mumps, measles

  - **Passive**
    - Receive antigen instead of create their own (natural or artificial)
    - Body immunity is short duration
    - Ex: Mom to baby via placenta or colostrum

      Gamma globulin injections

Physiology (cont.)

- **Adaptive immune response (3rd line)**
  - Cellular-mediated response (T cell)
    - Activated to defend against intracellular microorganisms
  - Humoral-mediated response (B cell)
    - Occurs in reaction to an antigenic challenge

The Adaptive Immune Response:

Cells that are called in to fight the infection. This response is specific to the type of invader.

Meet the team:

The Special Defense Unit: T cells and B cells

The Helper

Uses chemical signals to call on the B cells and other T cells to help fight the invader.

The B Cell

Creates anitbodies that identify foreign invaders that need to be killed.

The Killer

Indentifies infected host cells and employs chemical signals to cause them to die and be eliminated from the body.

Types of Acquired Specific Immunity

Natural

- **Active**
  - Natural contact with antigen through actual infection (e.g., chickenpox, measles, mumps)
- **Passive**
  - Transplacental and colostrum transfer antibodies from mother to child (e.g., maternal immunoglobulins passed to baby)

Artificial

- **Active**
  - Immunization with antigen (e.g., vaccines for chickenpox, measles, mumps)
- **Passive**
  - Injection of serum with antibodies from one person (e.g., injection of hepatitis B immune globulin, or snake antivenom) to another person who does not have antibodies

Hypersensitivity Reactions - Types

knowmedge

Mnemonic: "ACID"

Hypersensitivity Reaction	*Description*
Type I **IgE-mediated; quick onset after exposure** **A**llergic	Bee stings Latex Certain medications (e.g. Penicillin)
Type II **Cytotoxic/antibody-mediated** **C**ytotoxic	Hemolytic reactions Goodpasture syndrome Hyperacute graft rejection
Type III **Immune complex/IgG/IgM mediated** **I**mmune complex deposition	Hypersensitivity pneumonitis Systemic lupus erythematosus Polyarteritis nodosa Serum sickness
Type IV **Delayed or cell-mediated** **D**elayed	Chronic graft rejections PPD test Latex Nickel Poison ivy

Assessment

History

- Current problem
- Age & allergies
- Nutrition
- Med- surg history
- Immunization
- Immune deficiencies
- Family history
- Social history

Physical

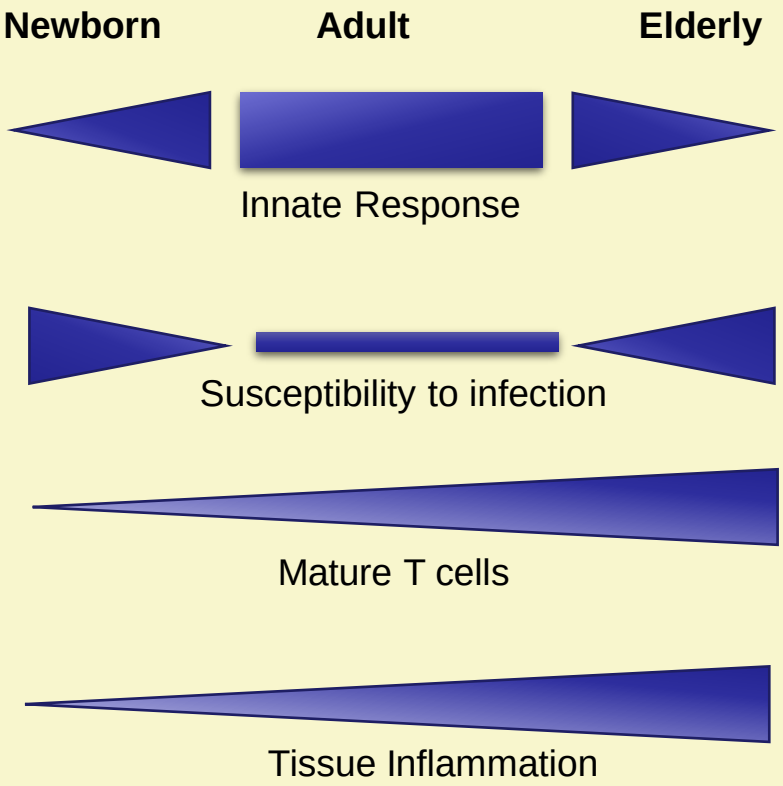
- Inspection
- Auscultation
- Palpation & percussion

History: Current problem

- Constitutional
- Neurologic
- Respiratory
- GI system
- Lymph nodes
- Mobility & pain

History: Age

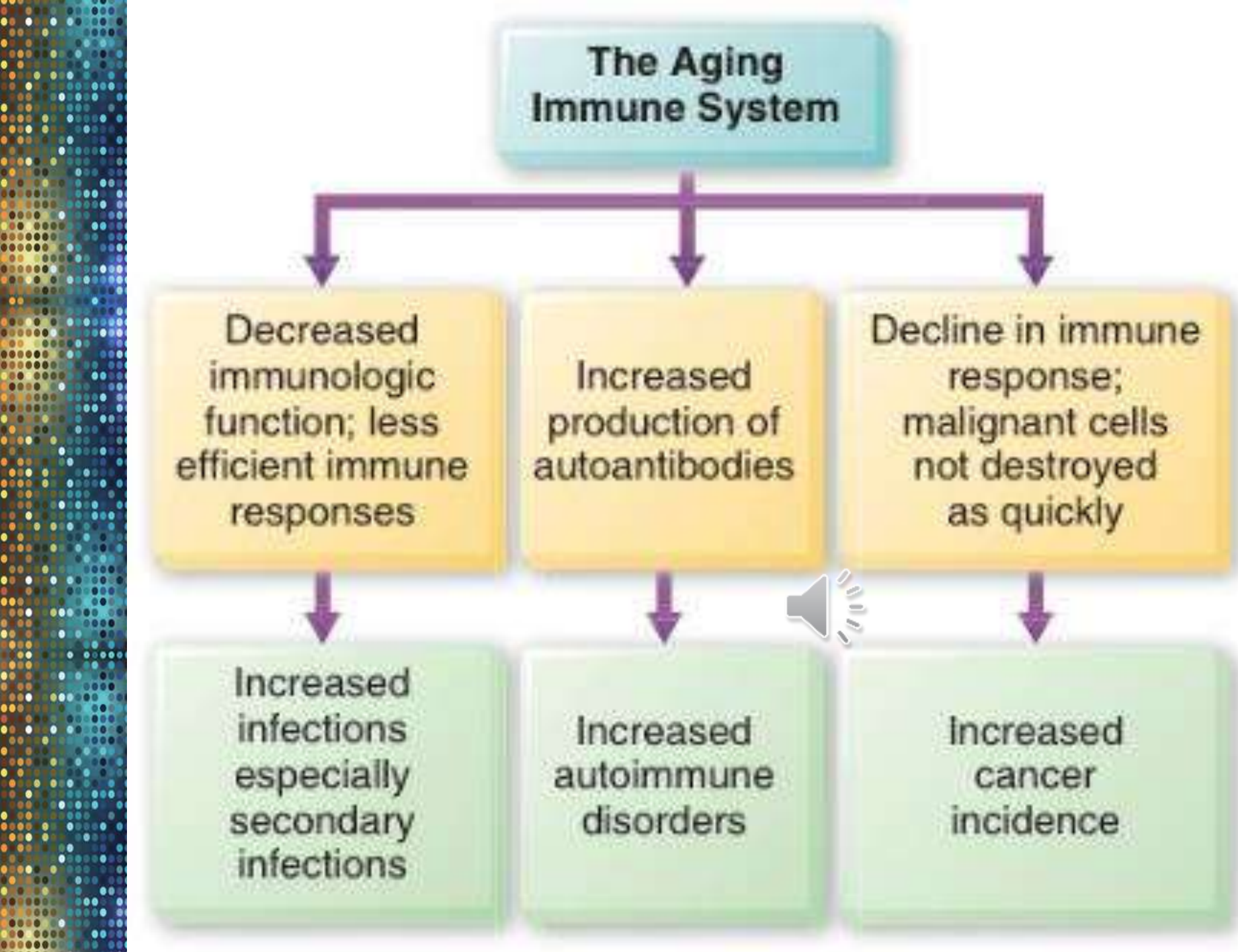
- Associated with immunological changes
  - Impact susceptibility to infection
  - Regulation of inflammation



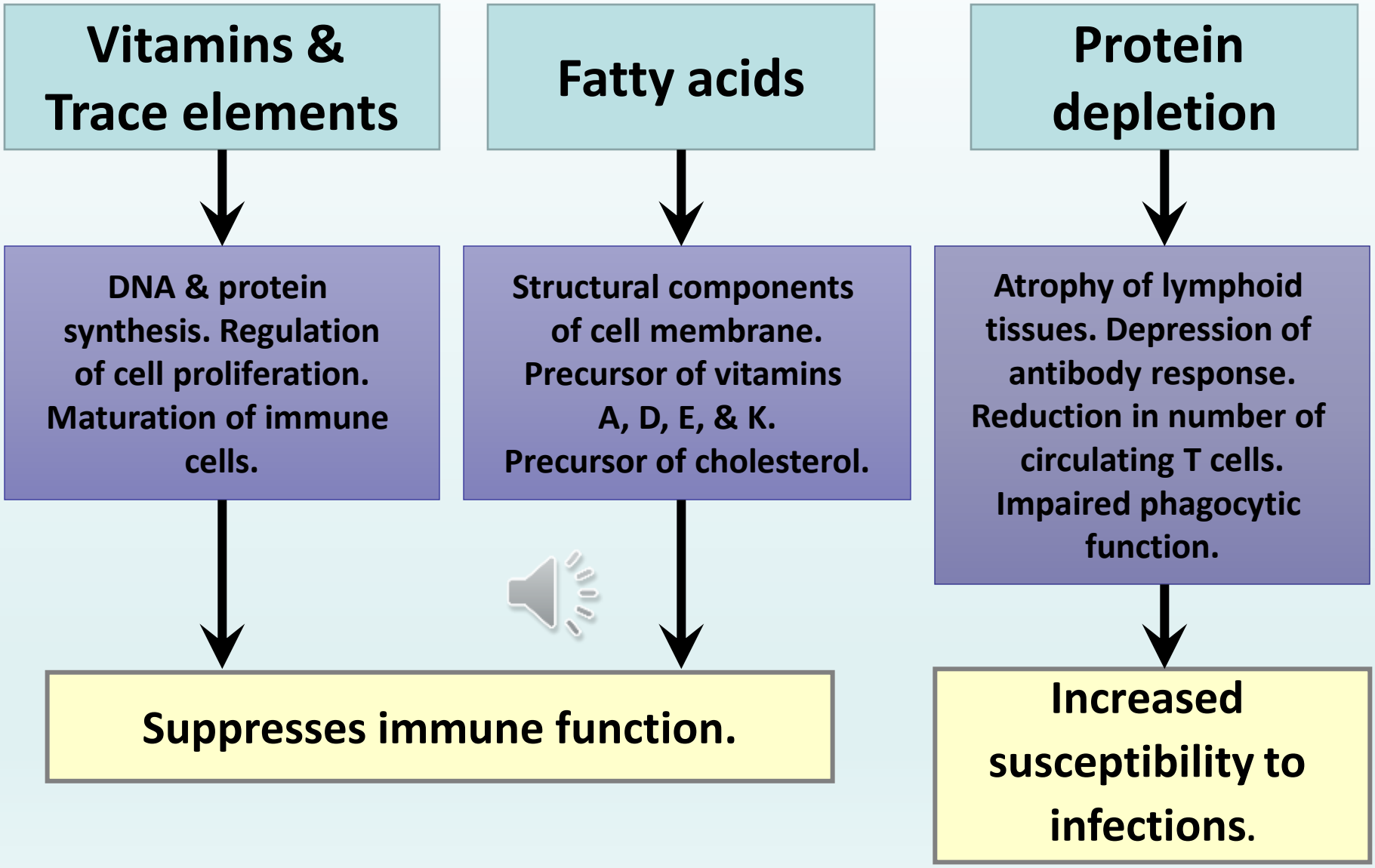
Age-related Changes to Immune System

- **Frequency & severity of infections are increased in older adults R/T:**
  - ↓ ability to respond to invading organisms.
  - ↓ production & function of T & B lymphocytes

- **↓ ability of antibodies to distinguish self from non-self**
- **Fail to recognize abnormal cells**


The Aging Immune System
Decreased immunologic function; less efficient immune responses
Increased production of autoantibodies
Decline in immune response; malignant cells not destroyed as quickly
Increased infections especially secondary infections
Increased autoimmune disorders
Increased cancer incidence

History: **Nutrition**



History: Allergies

- Allergies & types of allergens.
- Seasonal variations.
- Occurrence & severity of symptoms.
- Testing & treatments received.
- Effectiveness of treatments
- VERIFY! VERIFY! VERIFY!

History: Med-Surg Info

- **Autoimmune disorders**
- **Neoplastic disease**
  - Type of CA & date of diagnosis
  - Immunosuppression contributes to CA & CA contributes to Immunosuppression
  - Treatments
    - Radiation
    - Chemo

Med-Surg (2)

Chronic illness & surgery:

- Renal failure =↓ lymphocytes, uremia.
- DM = ↑ infections, vascular insufficiency, & neuropathy.
- COPD = recurrent respiratory tract infections → ineffective airway clearance.
- Surgery = Removal of spleen, lymph nodes, thymus, organ transplantation.

Med-Surg (3)

- **Burns, injury & infection**
  - Impaired skin integrity & compromised first line of defense.
  - Loss of large amounts of serum in burn patients → depletes body of immunoglobulins.

Physiological & Psychological stress

↓

Cortisol release

↓

suppression of normal immune responses

History: **Infection & Immunization**

- **Childhood/recent immunizations & diseases.**
- **TB: Exposure**
- **Recent exposure to infections.**
- **Past & present infections.**
- **Multiple persistent infections, FUO**
- **Lesions/sores, any type of drainage.**

Family History

- Malignancy
- Immune disorders
- Anemia
- TB history

Social History

- Smoking
- Alcohol consumption
- Dietary intake & nutritional status
- Amount of perceived stress
- IV drug use
- Sexual practices
- Occupational or residential exposure to radiation or pollutants

Assessment

- **Physical examination**
  - Inspection
  - Auscultation
  - Palpation and percussion

Diagnostic Studies

- **Evaluate immune system competence**
  - Blood tests
  - Skin tests
  - Cultures
  - Bone marrow aspiration and biopsy
  - Radiological imaging

Autoimmunity

- **Immune system responds against self**
- **Autoimmune Diseases**
  - **Systemic**
    - RA & SLE
  - **Organ specific**
    - Blood
    - CNS
    - Muscle
    - Heart
    - Endocrine
    - GI
    - Kidney

Autoimmune Diseases

Systemic Diseases

- Rheumatoid arthritis
- Scleroderma
- Systemic lupus erythematosus

Organ-Specific Diseases

Blood

- Autoimmune hemolytic anemia
- Hemochromatosis
- Immune thrombocytopenic purpura

Central Nervous System

- Guillain-Barre syndrome
- Multiple sclerosis

Muscle

- Myasthenia gravis

Heart

- Rheumatic fever

Endocrine System

- Addison's disease
- Graves' disease
- Hypothyroidism
- Thyroiditis
- Type 1 diabetes

Gastrointestinal System

- Celiac disease
- Inflammatory bowel disease
- Pernicious anemia

Kidney

- Glomerulonephritis
- Goodpasture syndrome

Liver

- Autoimmune hepatitis
- Primary biliary cirrhosis

Eye

- Uveitis

Practice Questions

The nurse associates which of the following findings to immunosenescence in a 68-year-old woman? Select all that apply.

A. Pneumonia

B. Shingles

C. Cervical dysplasia

D. Cancer

The nurse includes which of the following in the past medical history evaluating the immune response? Select all that apply.

A. Recurrent infections

B. Chronic illness

C. Dietary history

D. History of fractures

E. Medication history

Practice Question:

What functions of the immune system can be found the older adult?

Select all that apply

A.Increased formation of antibodies

B.Thymus enlargement

C.Decreased surveillance for malignant cell changes

D.Decreased delayed hypersensitivity reactions

E.Increased response of T and B cells

Remember

- Review your Reading Guide
- Review the Study Guide
- Do the case Studies
- Check out Lewis Ch 13: Tables 13.1, 13.6, 13.14, 13.16. Practice questions at chapter end.
- Email or text if you have questions