

MECHANISMS OF DISEASE

STUDYING DISEASE

A. Disease terminology

- a. Health – physical, mental, and social wellbeing – not merely the absence of disease
- b. Disease – an abnormality in body function that threatens health
- c. Etiology – the study of the factors that cause a disease
- d. Idiopathic – refers to a disease with an unknown cause
- e. Signs and symptoms – the objective and subjective abnormalities associated with a disease
- f. Pathogenesis – the pattern of a disease’s development

B. Patterns of disease

- a. Epidemiology is the study of occurrence, distribution, and transmission of diseases in human populations
- b. Endemic diseases are native to a local region
- c. Epidemics occur when a disease affects many people at the same time
- d. Pandemics are widespread, perhaps global, epidemics
- e. Discovering the cause of a disease is difficult because many factors affect disease transmission
- f. Disease can be fought through prevention and therapy (treatment)

PATHOPHYSIOLOGY

A. Mechanisms of disease

- a. Pathophysiology – study of underlying physiological aspects of disease
- b. Genetic mechanisms
- c. Pathogenic organisms
- d. Tumors and cancer
- e. Physical and chemical agents
- f. Autoimmunity
- g. Inflammation
- h. Degeneration

B. Risk factors (predisposing conditions)

- a. Genetic factors
- b. Age
- c. Lifestyle
- d. Stress
- e. Environmental factors
- f. Preexisting conditions

PATHOGENIC ORGANISMS

A. Types of organisms

- a. **viruses**

- i. Microscopic, intracellular parasites that consist of a nucleic acid core with a protein coat
- ii. Invade host cells and pirate organelles and raw materials
- iii. Classified by shape, nucleic acid type, and method of reproduction

b. Bacteria

- i. Tiny cells without nuclei
- ii. Secrete toxins, parasitize host cells or form colonies
- iii. Classification
 - 1. By function
 - a. Anaerobic – require no oxygen
 - b. Aerobic – require oxygen
 - 2. By staining properties (composition of the cell walls)
 - a. Gram-positive
 - b. Gram-negative
 - 3. By shape and size
 - a. Bacilli-rod-shaped cells
 - b. Cocci-round cells
 - c. Curved or spiral rods
 - d. Small bacteria-obligate parasites
- iv. Spores – no reproducing forms of bacteria that resist unfavorable environmental conditions

c. Fungi

- i. Simple organisms similar to plants but lacking chlorophyll
- ii. Yeasts –small, single cell fungi
- iii. Molds – large, multicellular fungi
- iv. Mycotic infections—often resist treatment

d. Protozoa

- i. Large, one-celled organisms having organized nuclei
- ii. May infest human fluids and parasitize or destroy cells
- iii. Major groups
 - 1. Amoebas-possess pseudopodia
 - 2. Flagellates-possess flagella
 - 3. Ciliates-possess cilia
 - 4. Sporozoa (coccidian)-enter cells during one phase of a two-part life cycle; borne by vectors (transmitters) during the other phase (malaria)

e. Pathogenic animals

- 1. Large complex multicellular organisms
- 2. Parasitize or otherwise damage human tissues or organs
- 3. Major groups

- a. Nematodes—roundworms
- b. Platyhelminths-flatworms and flukes
- c. Arthropods
 - i. Parasitic mites, ticks, lice, fleas
 - ii. Biting or stinging wasps, bees, mosquitoes, spiders
 - iii. These are often vectors of disease

B. Prevention and control

a. Mechanisms of transmission

- i. *Person to person contact*
 - 1. Can be prevented by education
 - 2. Can be prevented by using aseptic technique
- ii. *Environmental contact*
 - 1. Can be prevented by avoiding contact
 - 2. Can be prevented by safe sanitation practices
- iii. *Opportunistic invasion*
 - 1. Can be prevented by avoiding changes in skin and mucous membrane
 - 2. Can be prevented by cleansing of wounds
- iv. *Transmission vectors*
 - 1. Can be prevented by reducing the population of vectors and reducing contact with vectors

b. Other prevention and treatment strategies

- i. Vaccination – stimulates immunity
- ii. Chemicals – destroy or inhibit pathogens
 - 1. Antibiotics – natural compounds derived from living organism
 - 2. Synthetic compounds (for example ACV and AZT)

TUMORS AND CANCER

A. Neoplasm (tumors) – abnormal cell growths

- a. *Benign* – remain localized
- b. *Malignant tumors* spread, forming secondary tumors
- c. *Metastasis* – cells leave a primary tumor and start a secondary tumor at a new location
- d. Classification of tumors:
 - i. Benign epithelial tumors
 - 1. Papillomas – fingerlike projections
 - 2. Adenoma – glandular tumor
 - 3. Nevus – small, pigmented tumor
 - ii. Benign, connective tissue tumors
 - 1. Lipoma – adipose, fat tumor

- 2. Osteoma – bone tumor
 - 3. Chondroma – cartilage tumor
 - iii. Carcinomas (malignant epithelial tumors)
 - 1. Melanoma – involves melanocytes
 - 2. Adenocarcinomas – glandular cancers
 - iv. Sarcomas (connective tissue cancers)
 - 1. Lymphoma – lymphatic cancer
 - 2. Osteosarcoma – bone cancer
 - 3. Myeloma – bone cancer
 - 4. Fibrosarcoma – cancer of fibrous tissue
- B. The causes of cancer** – varied and still not clearly understood
- a. Cancer involves hyperplasia (growth of too many cells) and anaplasia (development of undifferentiated cells)
 - b. Factors known to play a role in causing cancer
 - i. Genetic factors: ex: oncogenes—cancer genes
 - ii. Carcinogens: chemicals that alter the genetic activity or code
 - iii. Age
 - iv. Injury-chronic exposure to it
 - v. Viruses

C. Pathogenesis of cancer

- a. Early detection is important
- b. Methods of detecting cancers
 - i. Self exam
 - ii. Diagnostic imaging – radiography (ex: mammogram and CT scans), magnetic resonance imaging (MRI), ultrasonography
 - iii. Biopsy (ex: pap smear)
 - iv. Blood tests
- c. *Staging* – classifying tumors by size and extent of spread
- d. *Grading* – assessing the likely pattern of a tumors development
- e. *Cachexia* – a syndrome including appetite loss, weight loss, and general weakness
- f. Causes of death by cancer – secondary infections, organ failure, hemorrhage, and undetermined factors
- g. *Treatments*
 - i. Surgery
 - ii. Chemotherapy
 - iii. Laser therapy
 - iv. Immunotherapy
 - v. New strategies (e.g.: vaccines)

INFLAMMATION

- A. *The inflammatory response* – reduces injury to tissues, thus maintaining homeostasis
- a. Signs—redness, heat, swelling and pain
 - b. Inflammation mediators (histamine, prostaglandins, and kinins)
 - i. Some cause blood vessels to dilate, increasing blood volume (redness and heat) – white blood cells travel quickly to injury site
 - ii. Some increase blood vessel permeability (causing swelling or edema and pain)—white blood cells move easily out of vessels, irritant is diluted and exudates accumulates
 - iii. Some attract white blood cells to injury site (chemotaxis)
- B. *Inflammatory diseases*
- a. Inflammation can be local or systemic (body-wide)
 - b. Fever – high body temperature caused by a resetting of the body’s “thermostat” – destroys the pathogens and enhances immunity
 - c. Chronic inflammation can constitute a disease itself because it causes damage to tissues

WORDS

Amoeba	cocci	microbe	protozoa
Arthropod	edema	nematode	pus
Autoimmunity	flagellate	oncogene	risk factors
Bacilli	fungi	parasite	spore
Bacterium	inflammation	Pathogenesis	sporozoa
Chemotaxis	inflammation mediators	Pathophysiology	vector
Ciliate	inflammatory exudates	platyhelminth	virus

CLINICAL TERMS

Acute	Chondroma	immunotherapy	nevus
Adenocarcinoma	chronic	incubation	Osteoma
Adenoma	communicable	Lipoma	osteosarcoma
Antibiotic	computed tomography	lymphocytes	pandemic
Aseptic technique	(CT)	magnetic resonance	papilloma
Biopsy	endemic	imaging (MRI)	remission
Cachexia	epidemic	melanoma	rickettsia
Carcinogen	etiology	metastasis	syndrome
Chemotherapy	fibrosarcoma	mutagen	ultrasonography
Chlamydia	idiopathic	myeloma	vaccine