Chapter 1

Introduction to Pathophysiology

the study of functional or physiologic changes in the body that result from disease processes.

Health and Disease

- Health
  - Physical, mental, and social well-being
- Disease
  - Deviation from the normal state of homeostasis
  - Homeostasis is the maintenance of a relatively stable internal environment regardless of external changes. Includes such factors as blood pressure, body temperature, and fluid balance.

Health Indicators

- "Normal" values:

  occur within a range of values and may vary depending on technology used for measurement as well as the lab used.

- Normal range varies with:
  - Age
  - Gender
  - Genetics
  - Environment
  - Activity level

Seven Steps to Health

- Be a nonsmoker and avoid second-hand smoke.
- Eat 5 to10 servings of vegetables and fruit a day. Choose high-fiber, lower fat foods. Limit alcohol intake.
- Physical activity on a regular basis
- Protection from the sun
- Follow cancer screening guidelines.
- Doctor or dentist visit if any changes in the normal state of health
- Follow health and safety guidelines at home and at work when using, storing, and disposing of hazardous materials.

Pathophysiology

- Functional (physiologic) changes in the body as a result from disease
- Uses knowledge of basic anatomy and physiology
- Includes aspects of pathology, which describes structural changes in body tissues caused by disease
- Cause and effect relationships, defined by signs and symptoms, guide the study of a specific disease.

Disease Prevention

- Has become a primary focus in health care
  - Maintaining routine vaccination programs
  - Participation in screening programs
  - Community health programs
  - Regular routine doctor visits

Medical History

- Current and prior illnesses
- Allergies
- Hospitalizations
- Treatment
- Specific difficulties
- Any type of therapy or drugs
  - Prescription
  - Nonprescription
  - Herbal items, including food supplements

Physical Exam - Levels

Language of Pathophysiology

- Gross level
  - Organ or system level
- Microscopic level
  - Cellular level
- Biopsy
  - Excision of small amounts of living tissue
- Autopsy
  - Examination of the body and organs after death

- Diagnosis
  - Identification of a specific disease
- Cause
  - Causative factors in a particular disease
- Predisposing factors
  - Tendencies that promote development of a disease in an individual
- Pathogenesis
  - Development of the disease

- Acute disease
  - Develops quickly, marked signs, short term
- Chronic disease
  - Often milder, develops gradually, persists for a long time
- Subclinical state
  - Pathologic changes, no obvious manifestations
- Latent state
  - No symptoms or clinical signs evident

- Incubation period
  - Time of exposure to a microorganism and onset of signs and symptoms
- Prodromal period
  - Early development of a disease
  - Signs nonspecific or absent
- Manifestations
  - Signs and symptoms of disease
- Syndrome
  - Collection of sign and symptoms
  - Often affects more than one organ

- Remissions
  - Manifestations of the disease subside or are absent.
- Precipitating factor
  - Condition that triggers an acute episode
- Complications
  - New secondary or additional problems
- Therapy
  - Treatment measures to promote recovery or slow the progress of a disease

- Sequelae
  - Unwanted outcomes of primary condition
- Convalescence
  - Period of recovery
- Prognosis
  - Probability for recovery or for other outcome
- Rehabilitation
  - Maximizing function of diseased tissues

- Epidemiology
  - Science of identifying the causative factors and tracking the pattern or occurrence of disease
- Morbidity
  - Indicates the number of people with a disease within a group
- Mortality
  - Indicates the number of deaths resulting from a particular disease within a group

- Epidemics
  - Occur when a higher than expected number of cases of an infectious disease occur within a given area

- Pandemics
  - Involve a higher number of cases in many regions of the globe

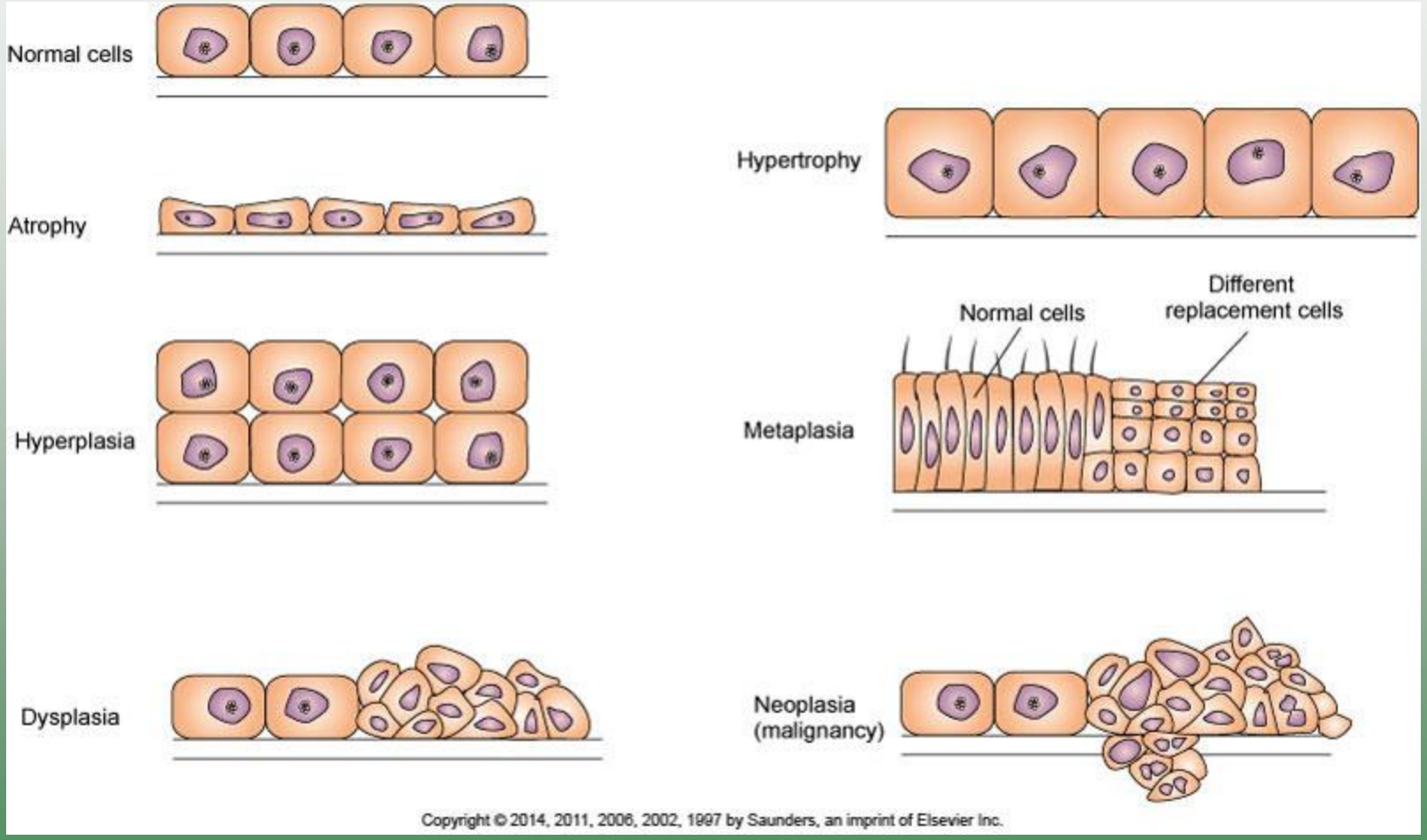
- Occurrence of disease
  - Tracked by incidence and prevalence
- Incidence
  - Number of new cases in a given population within a specified time period
- Prevalence
  - Number of new and old or existing cases in a specific population within a specified time period

- Communicable diseases
  - Infections that can spread from one person to another
- Notifiable or reportable diseases
  - Diseases that must be reported by the physician to certain designated authorities
- Autopsy or postmortem examination
  - Performed after death to determine the exact cause of death

Cellular Adaptations

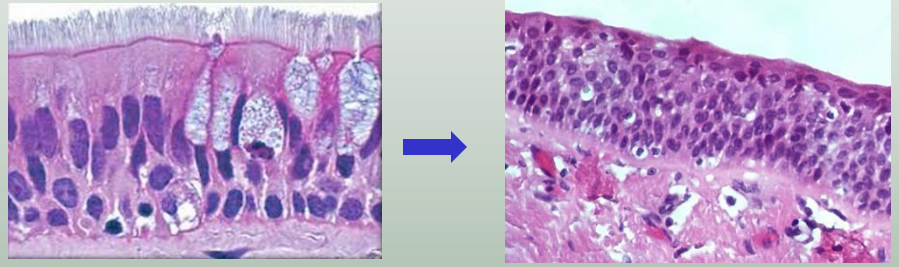
- Atrophy
  - Decrease in the size of cells
    - Results in reduced tissue mass
- Hypertrophy
  - Increase in cell size
    - Results in enlarged tissue mass
- Hyperplasia
  - Increased number of cells
    - Results in enlarged tissue mass

Abnormal Cell Growth Patterns

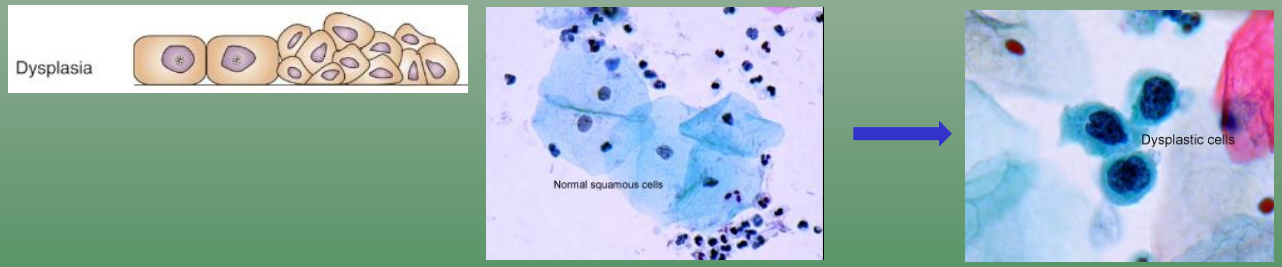


Cellular Adaptations

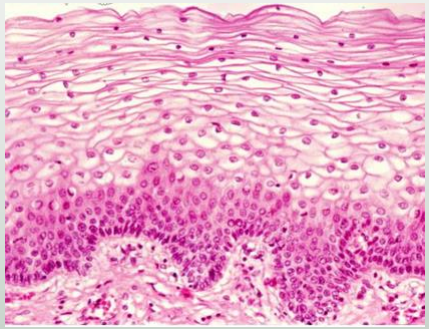
- Metaplasia
  - Mature cell type is replaced by a different mature cell type.



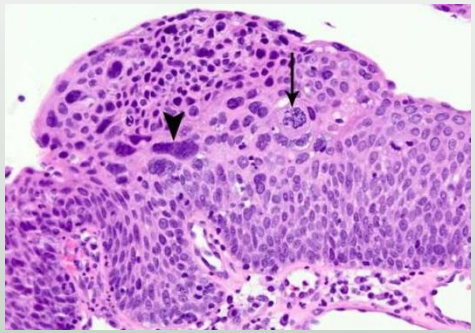
- Dysplasia
  - Cells vary in size and shape within a tissue.

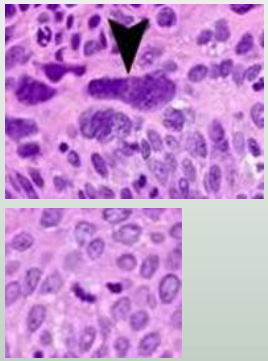


- Anaplasia
  - Undifferentiated cells, with variable nuclear and cell structures



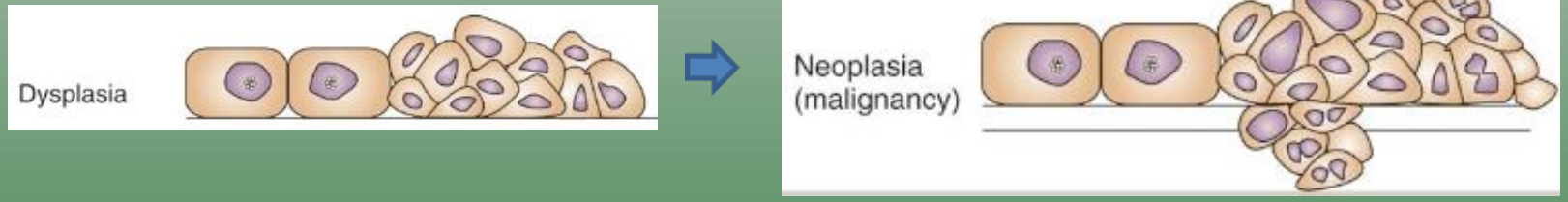
Normal





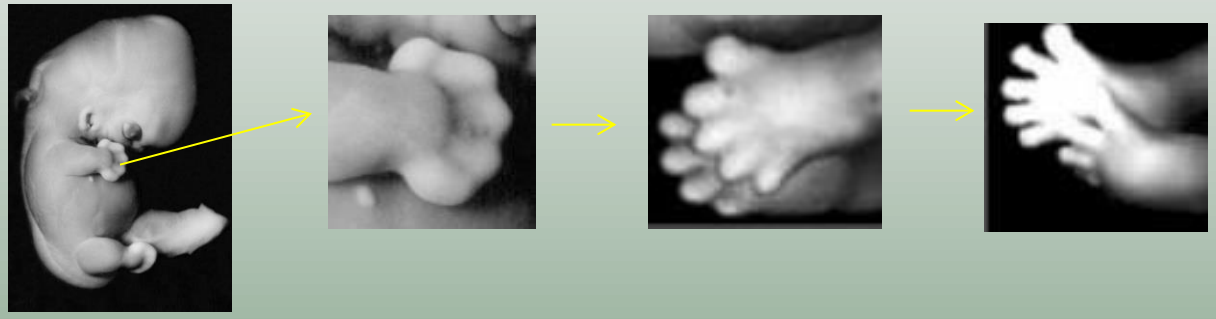
Anaplastic

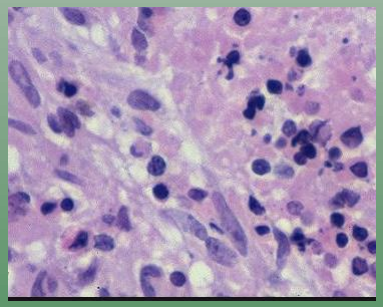
- Neoplasia
  - "New growth"—commonly called *tumor*

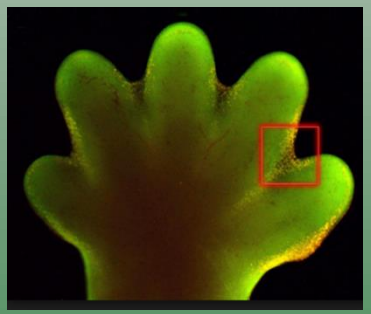


Cell Damage

- Apoptosis
  - Refers to programmed cell death
    - Normal occurrence in the body







- Apoptosis
  - Also used by the body to get rid of genetically defective cells prior to them becoming cancer.
- Ischemia
  - Deficit of oxygen in the cells
- Hypoxia
  - Reduced oxygen in tissues

Cell Damage (Cont.)

- Physical damage
  - Excessive heat or cold
  - Radiation exposure
- Mechanical damage
  - Pressure or tearing of tissue
- Chemical toxins
  - Exogenous: from environment
  - Endogenous: from inside the body

Cell Damage (Cont.)

- Microorganisms
  - Bacteria and viruses, for example
- Abnormal metabolites
  - Genetic disorders
  - Inborn errors of metabolism
  - Altered metabolism
- Nutritional deficits
- Imbalance of fluids or electrolytes

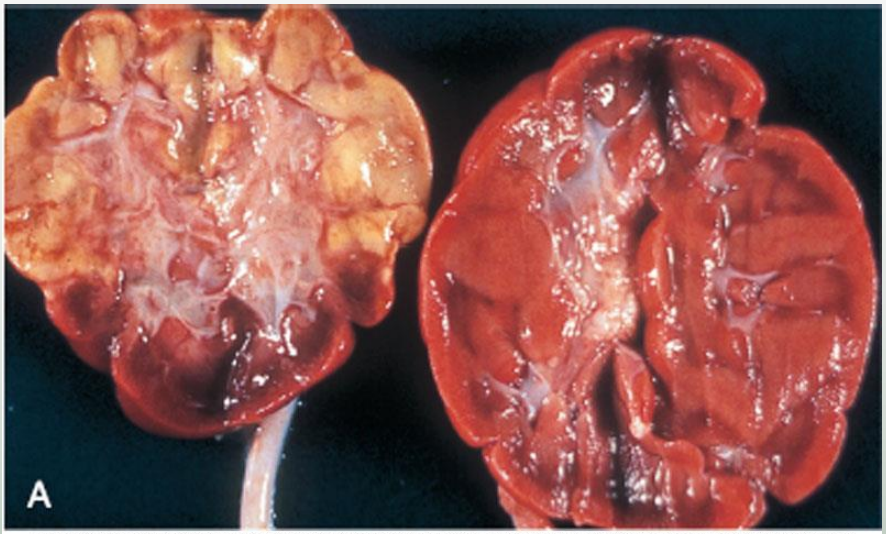
Necrosis

- Liquefaction necrosis
  - Dead cells liquefy because of release of cell enzymes
- Coagulative necrosis
  - Cell proteins are altered or denatured—coagulation
- Fat necrosis (enzymataic)
  - Fatty tissue broken down into fatty acids
- Caseous necrosis
  - Form of coagulation necrosis
  - Thick, yellowish, “cheesy” substance forms

Liquefaction Necrosis in the Brain

A, D From Damjanov I: *Pathology for the Health Professions*, ed 3, Philadelphia, 2006, WB Saunders. B, C From Kumar V, Abbas AK, Fausto M: *Robbins and Cotran Pathologic Basis of Disease*, ed 7, Philadelphia, 2005, WB Saunders.

Coagulative Necrosis of the Kidney



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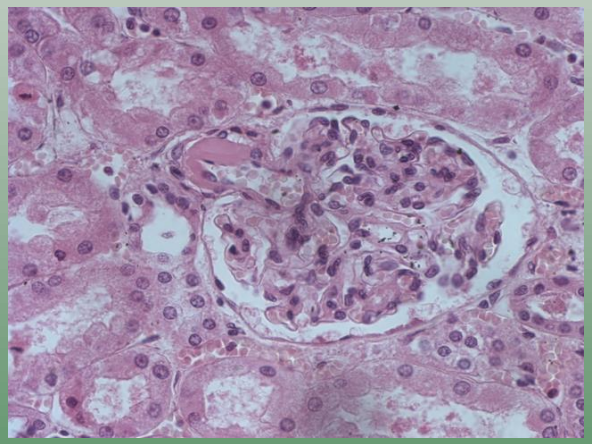
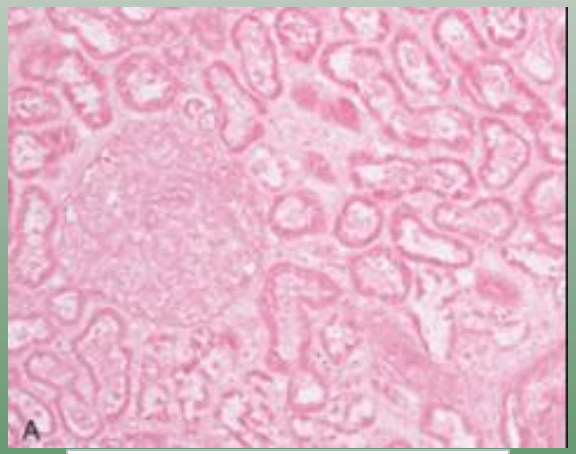
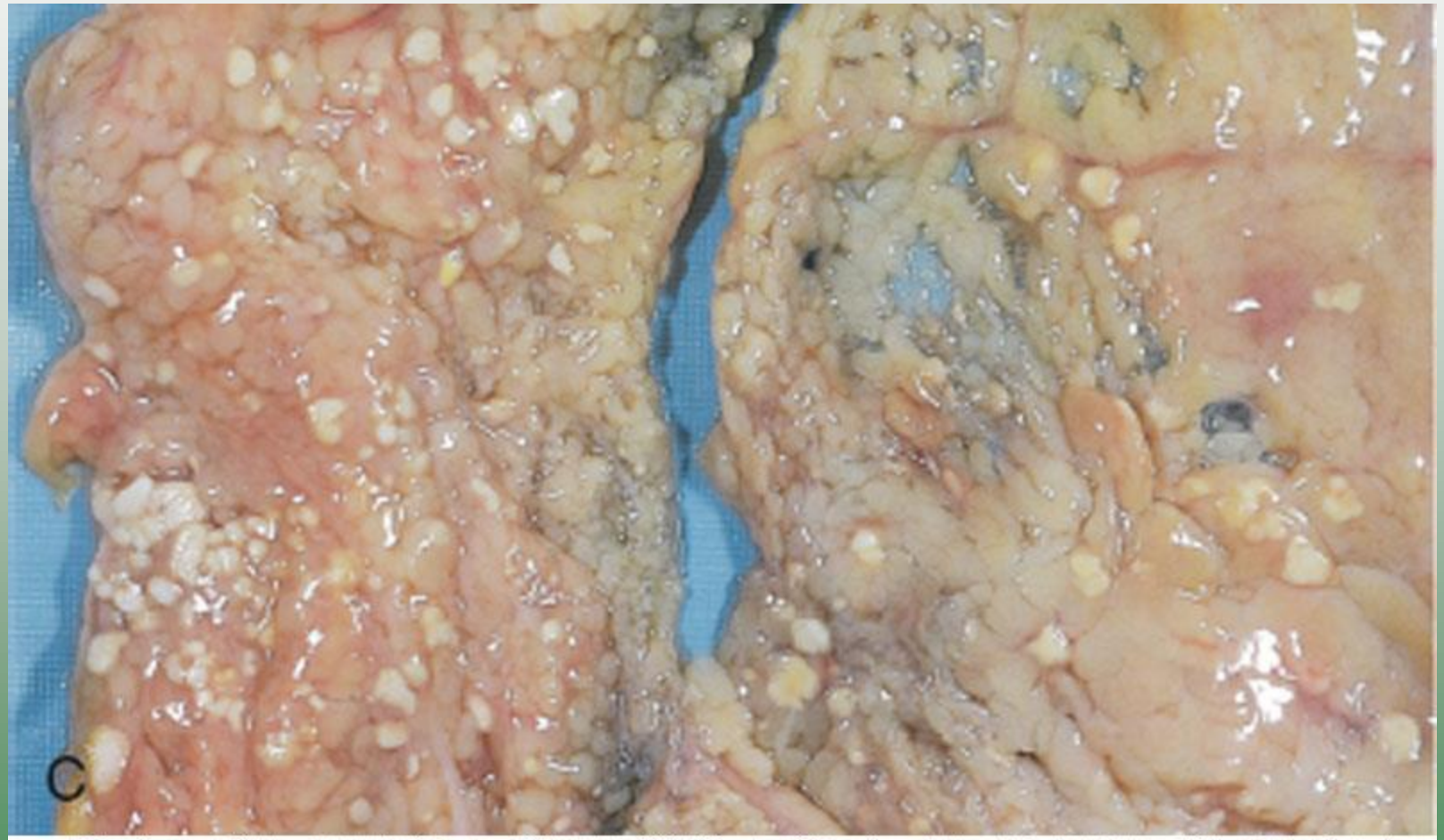


•Normal Kidney - note stain is pink and blue and cell nuclei are easy to see.



•Kidney with coagulaive necrosis - note stain is all pink and cell nuclei are not blue and are not easy to see.

Fat Necrosis in the Mesentery



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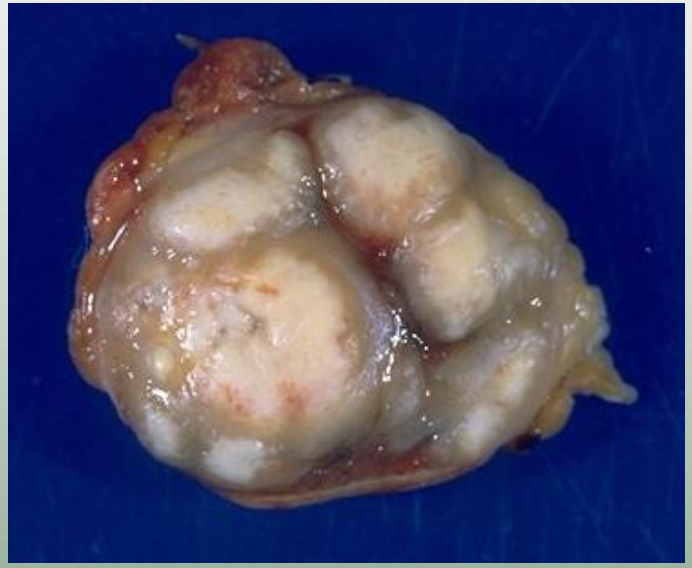
Caseous Necrosis



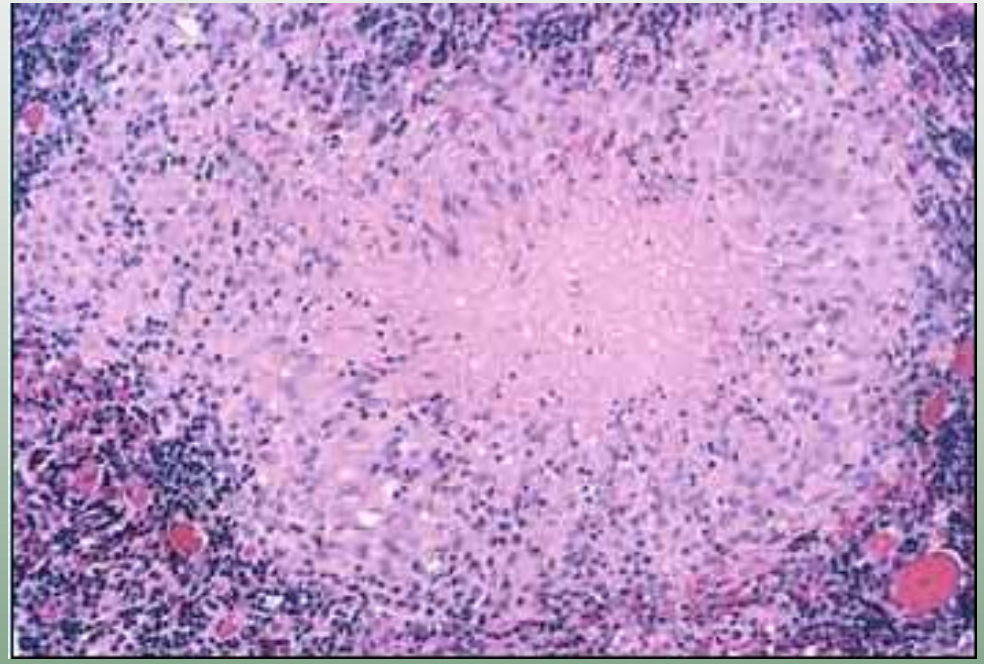
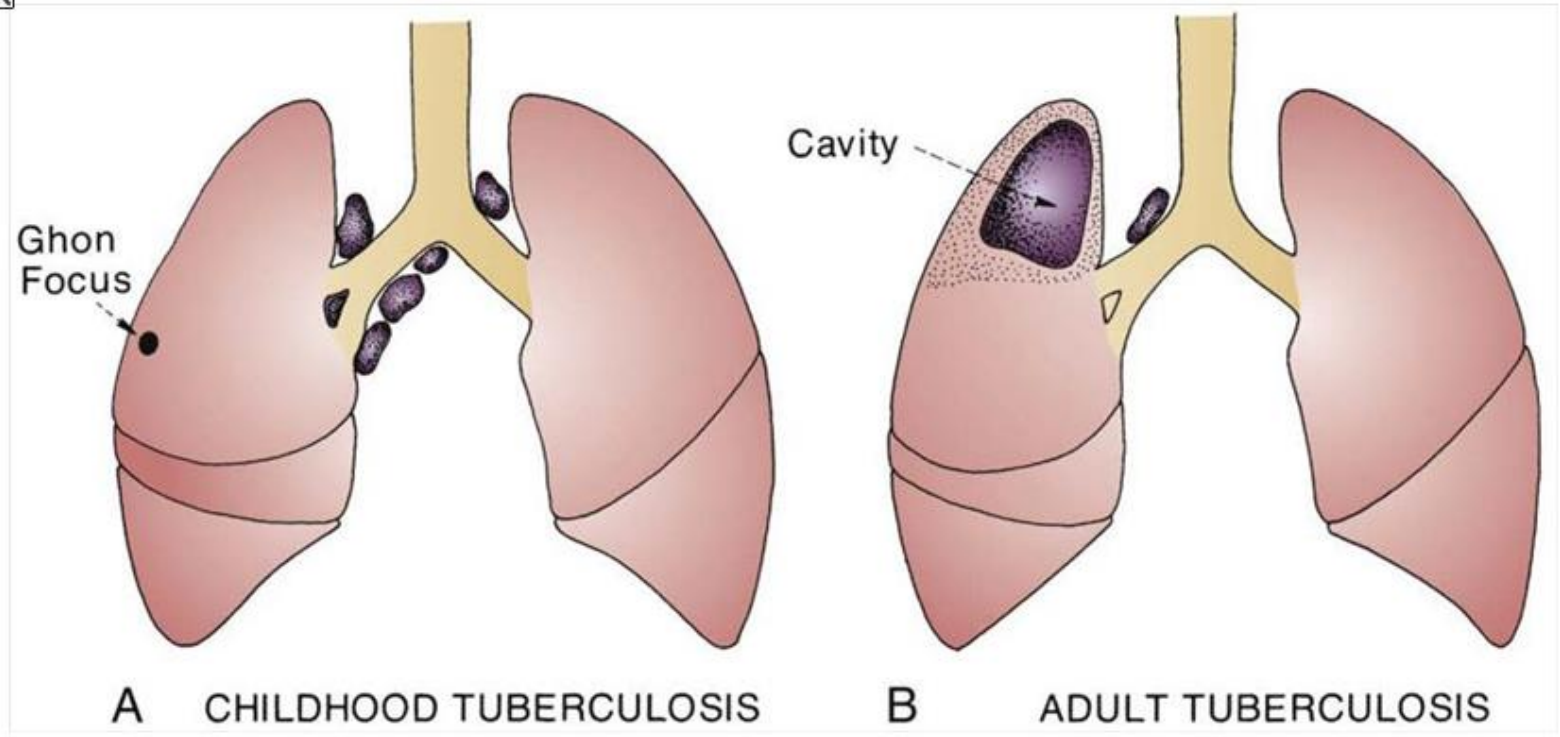


FIGURE 1-4 **A and B**, Pulmonary tuberculosis. **C**, A tuberculous lung with a large area of caseous necrosis.



Necrosis

- Infarction
  - Area of dead cells as a result of oxygen deprivation
- Gangrene
  - Area of necrotic tissue that has been invaded by bacteria

Dry Gangrene of the Toe

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Why might someone not know they have a gangrenous toe or ignore it?

- Peripheral nerve disease – can not feel it.
- Lost sense of smell – can’t smell it.
- Demented