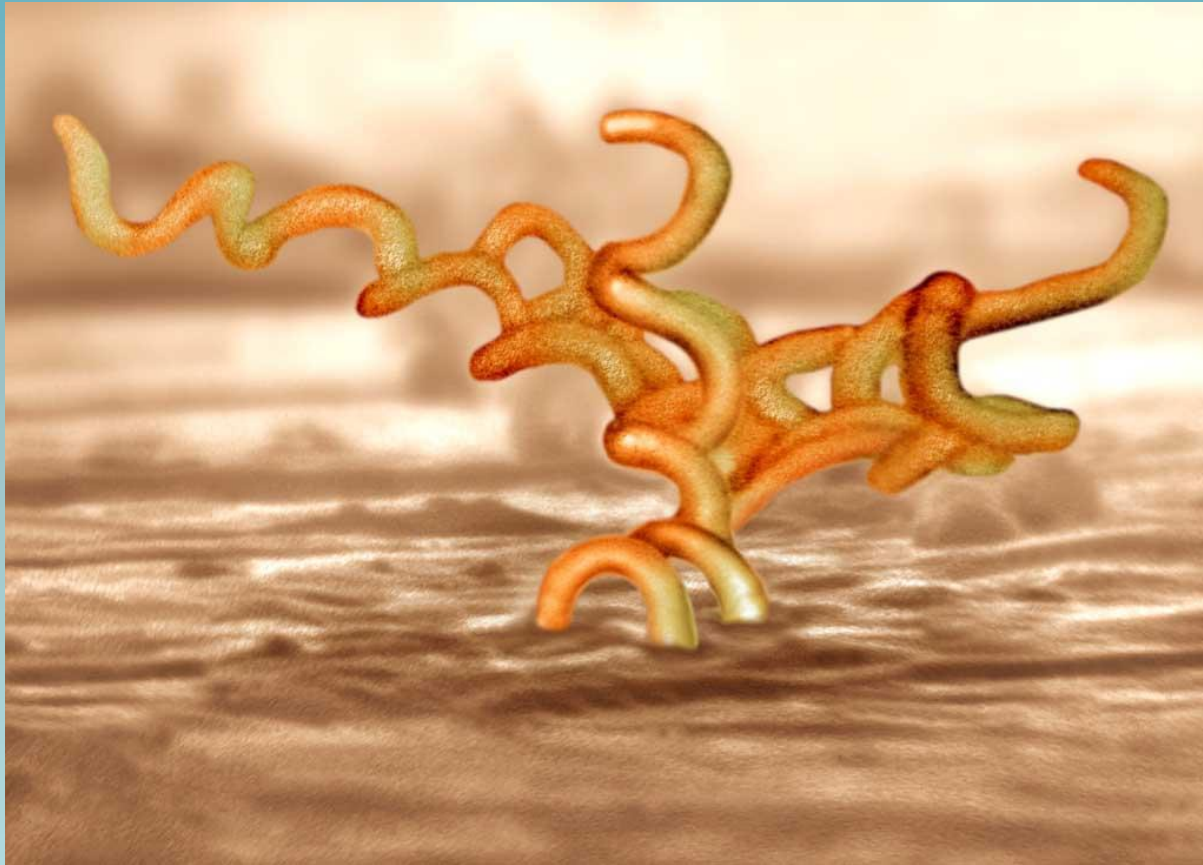


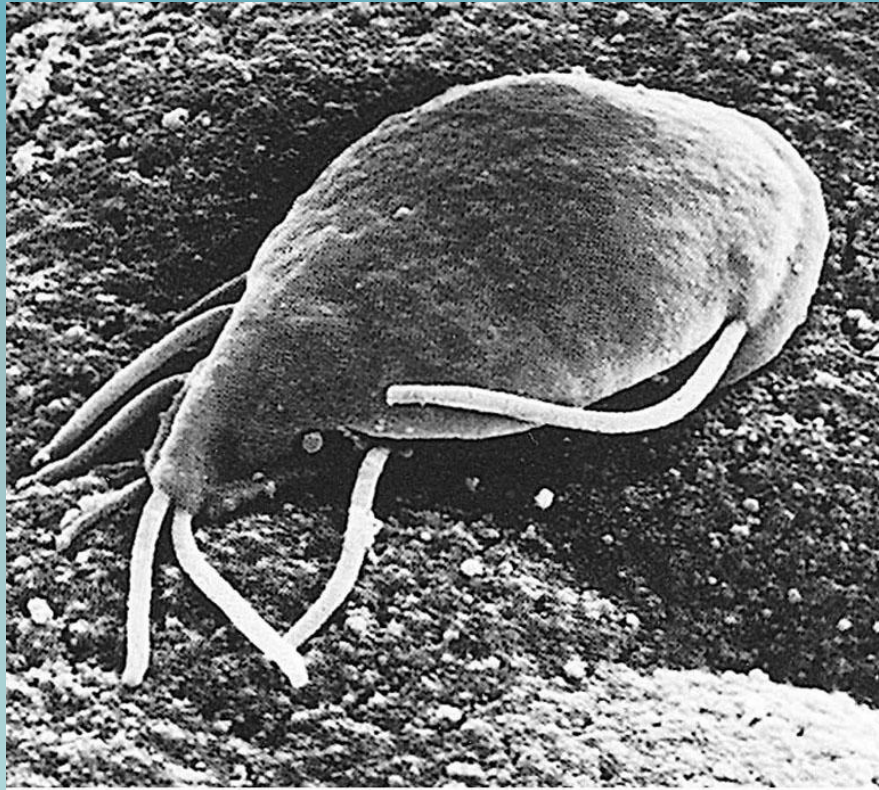
# Chapter 5

## Mechanisms of Disease

# Spirochete bacteria causing Syphilis

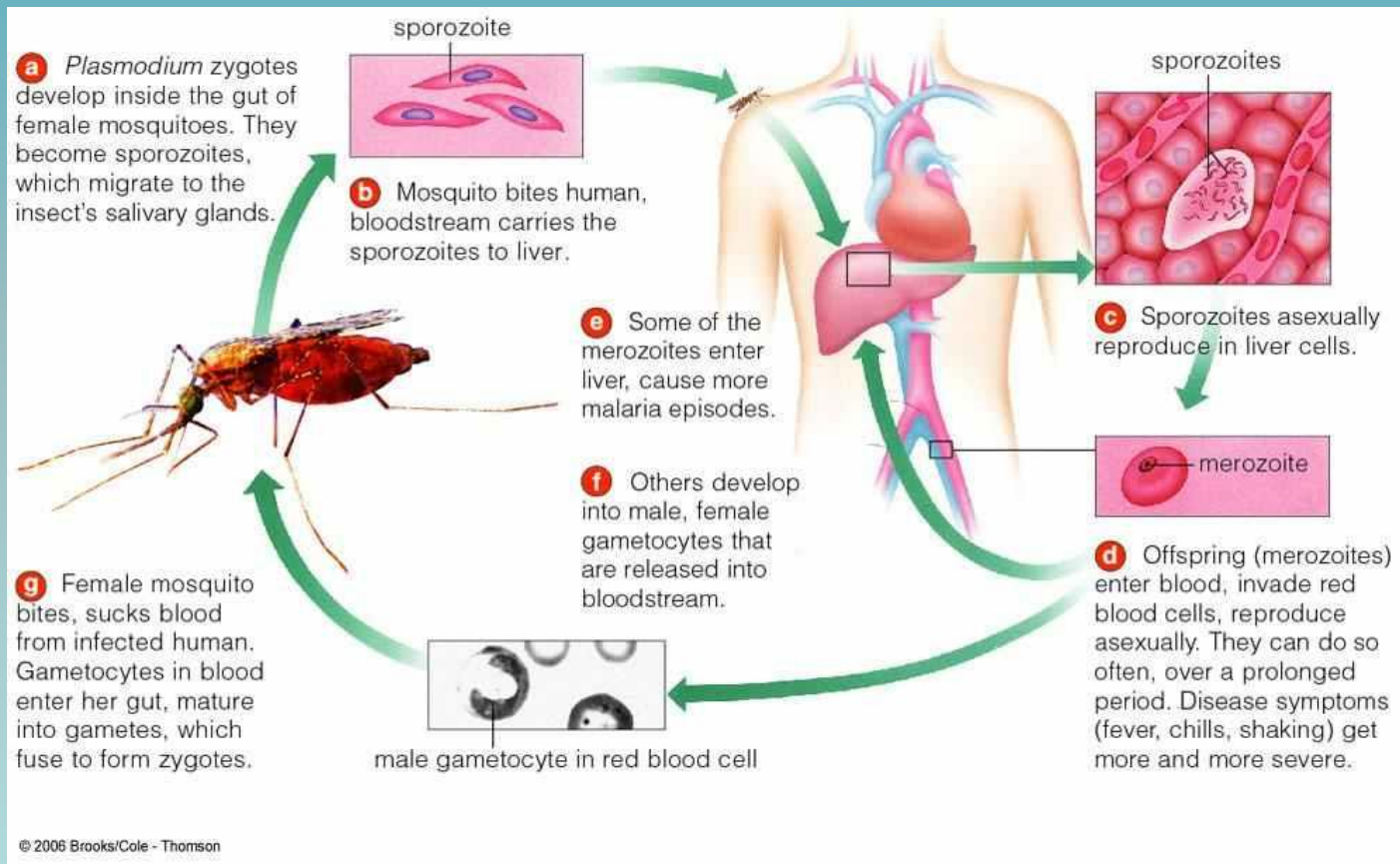


# Diplomonad protozoa that causes Giardia

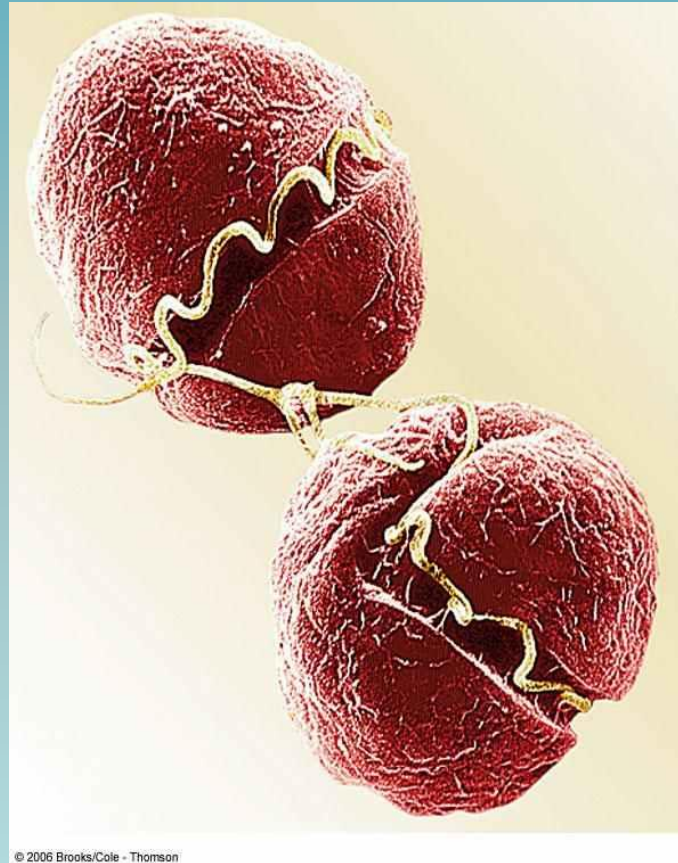


© 2006 Brooks/Cole - Thomson

# Protozoan causing malaria



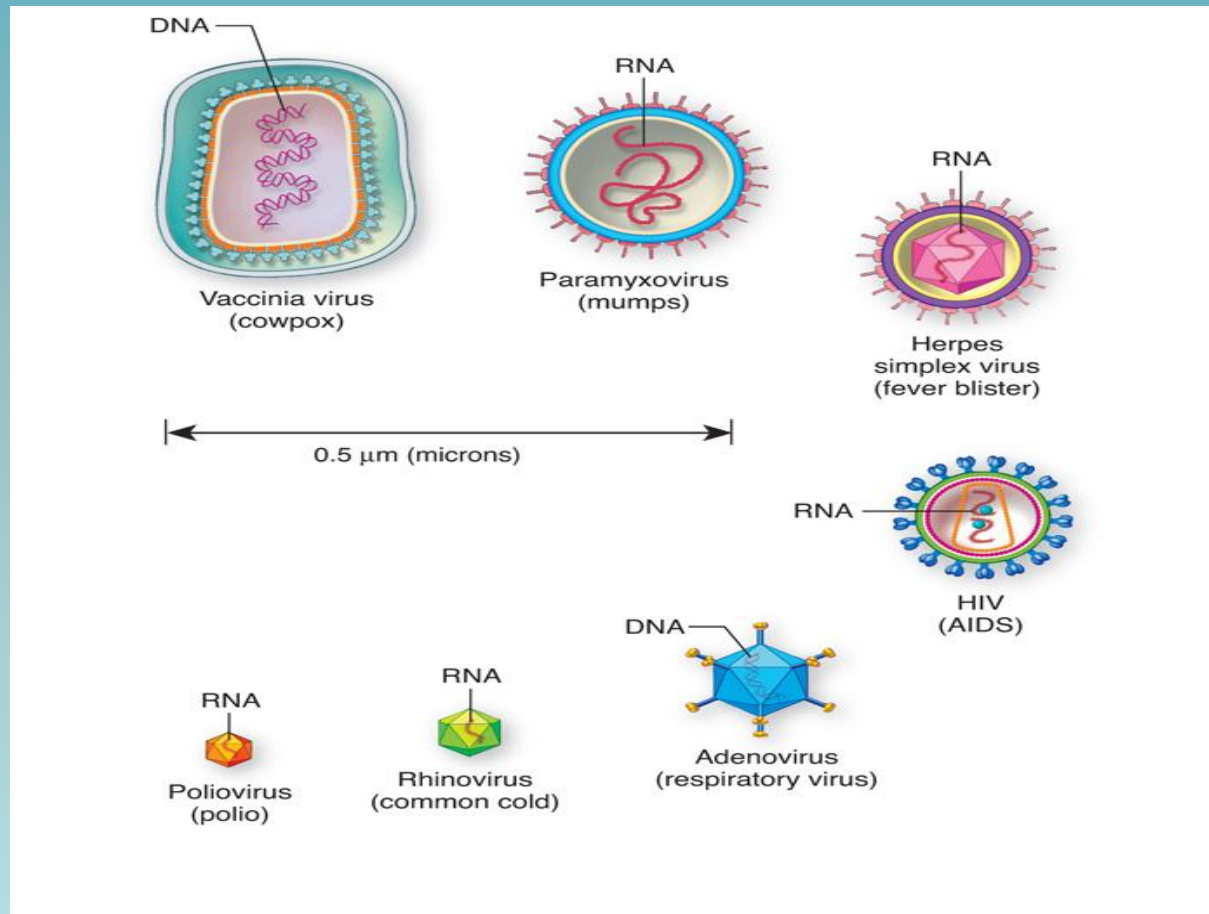
# Protist causing red tide



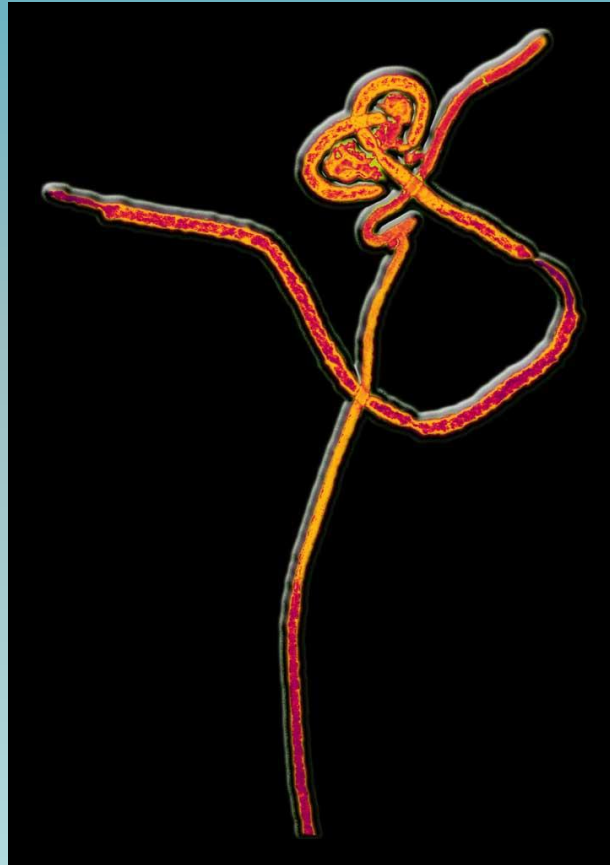
© 2006 Brooks/Cole - Thomson



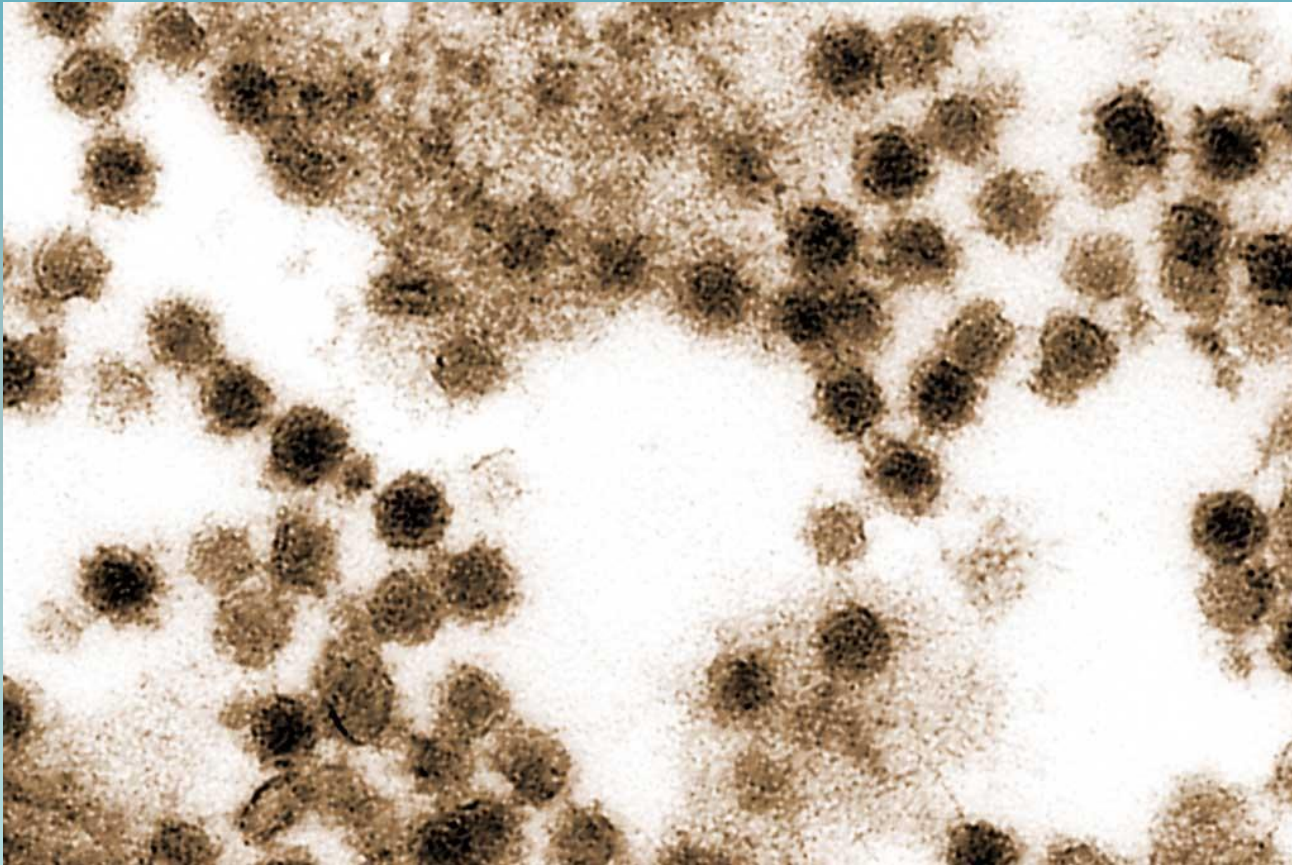
# Types of Viruses



# Ebola Virus-Hemorrhagic fever

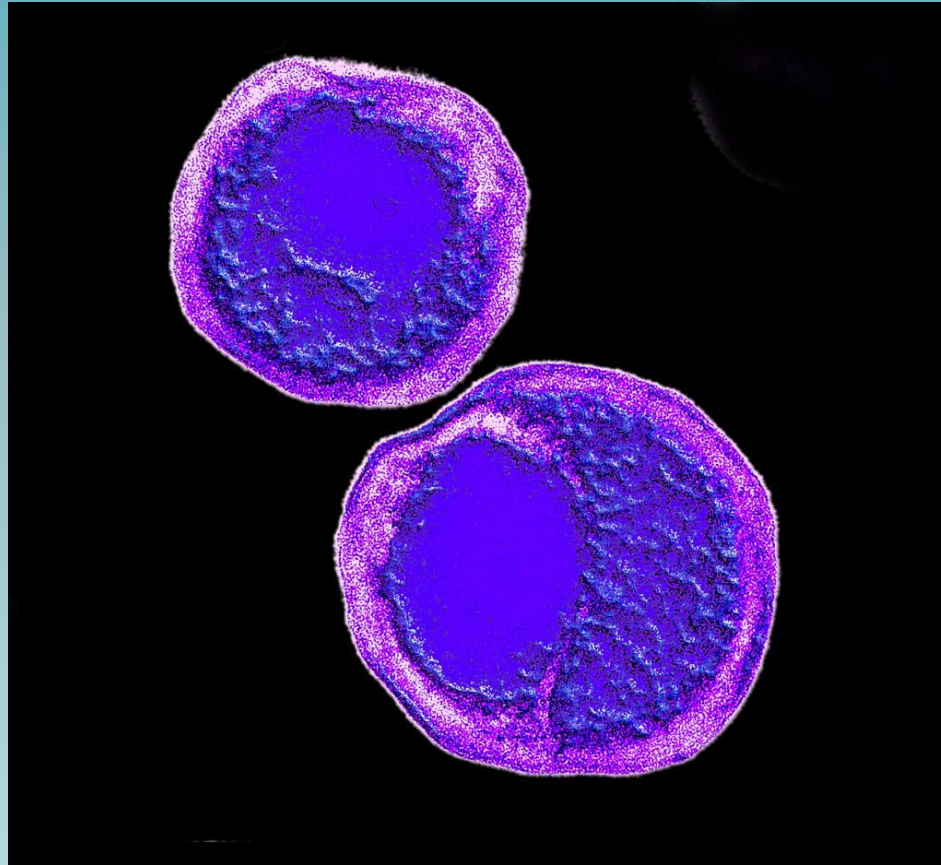


# West Nile Virus





# Chlamydia bacteria—gram negative



# Spirchete bacteria causing lyme disease



© 2006 Brooks/Cole - Thomson

# Pathogenic animal-Ticks-transmit spirochete bacteria



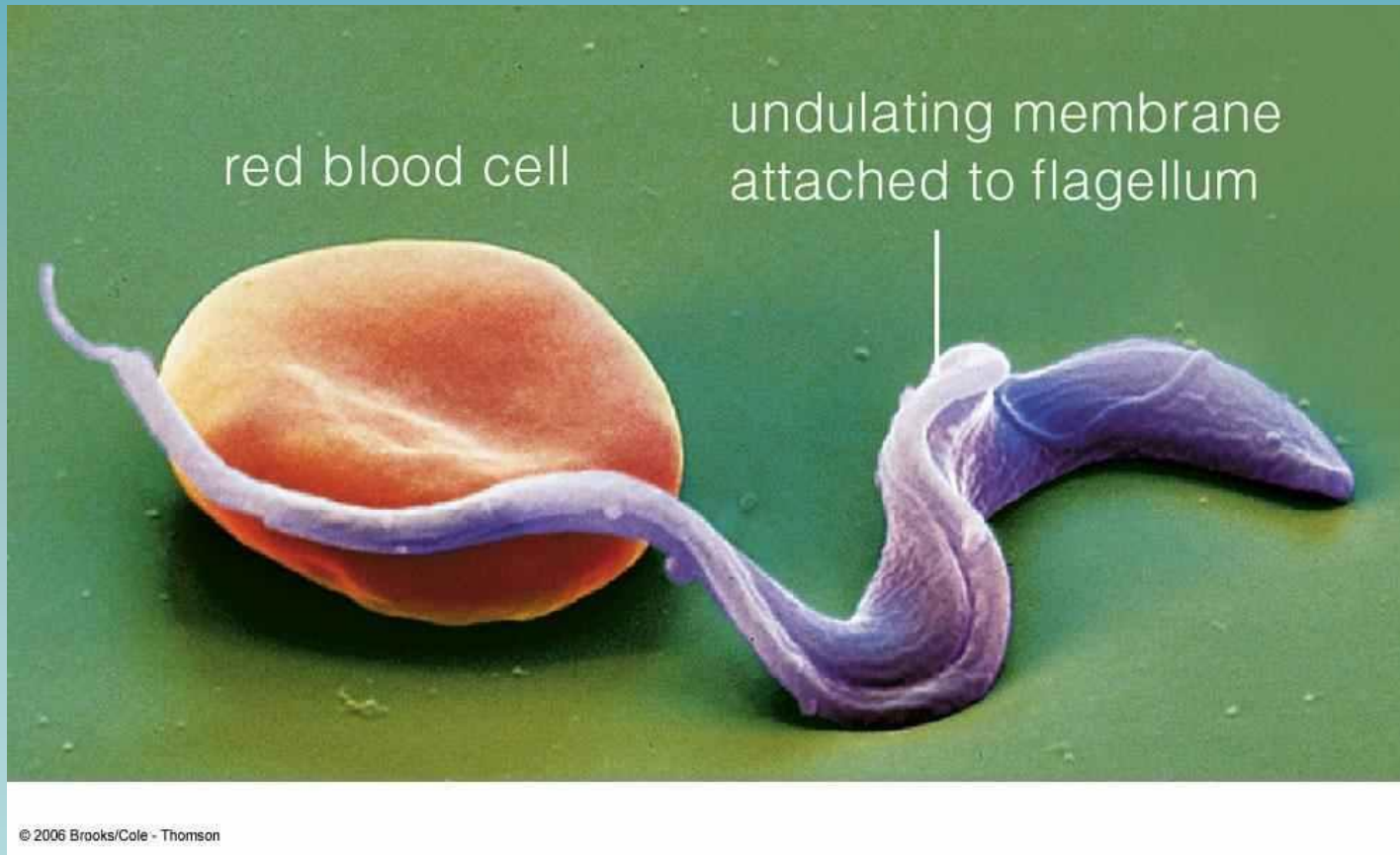
© 2006 Brooks/Cole - Thomson

# Rash is sign of lyme disease



© 2006 Brooks/Cole - Thomson

# Trypanosome protist carried by tsetse fly Causes African Sleeping Sickness





# Tinea fungus causing athlete's foot



© 2006 Brooks/Cole - Thomson

# What do we want to learn from chapter 5

- Define the terms *health* and disease
- List and describe the basic mechanisms of disease and risk factors associated with disease
- List and describe five categories of pathogenic organisms and explain how they cause disease

- Distinguish between the terms *benign* and *malignant* as they apply to tumors
- Describe the pathogenesis of cancer
- Outline the events of the inflammatory response and explain its role in disease

# Studying Disease

- Disease terminology
  - Health—physical, mental, and social well-being—not merely the absence of disease
  - Disease—an abnormality in body function that threatens health
  - Etiology—the study of the factors that cause a disease

# Studying Disease

- Disease terminology
  - Idiopathic—refers to a disease with an unknown cause
  - Signs and symptoms—the objective and subjective abnormalities associated with a disease
  - Sign-observed by a doctor, objective
  - Symptom-felt by the patient
  - Pathogenesis—the pattern of a disease's development



# Studying Disease

- Patterns of disease
  - Epidemiology is the study of occurrence, distribution, and transmission of diseases in human populations
  - Endemic diseases are native to a local region
  - Epidemics occur when a disease affects many people at the same time

# Studying Disease

- Patterns of disease, cont'd
  - Pandemics are widespread, perhaps global, epidemics--AIDS
  - Discovering the cause of a disease is difficult because many factors affect disease transmission
  - Disease can be fought through prevention and therapy (treatment)

# Pathophysiology

- Mechanisms of disease
  - Pathophysiology—the study of underlying physiological aspects of disease
  - Genetic mechanisms-ex. Sickle cell, hemophillia. Litterally hundreds
  - Infectious mechanism (pathogenic organisms and particles)
  - Neoplastic mechanism (tumors and cancer)
  - Traumatic mechanism (physical and chemical agents)

# Pathophysiology

- Mechanisms of disease, cont'd
  - Metabolic mechanism (endocrine imbalances or malnutrition ex. Graves dis.)
  - Inflammatory mechanism
    - Autoimmunity
    - Inflammation
    - Degeneration

# Pathophysiology

- Risk factors (predisposing conditions)
  - Genetic factors
  - Age
  - Lifestyle
  - Stress
  - Environmental factors
  - Preexisting conditions



# Pathogenic Organisms

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

# Pathophysiology

- Mechanisms of disease
  - Physical and chemical agents
  - Autoimmunity-own immune system over-responds and attacks body
  - Inflammation
  - Degeneration-breaking apart of tissue, ex snakebite, poison

# Pathophysiology

- Risk factors (predisposing conditions)
  - Genetic factors
  - Age
  - Lifestyle
  - Stress
  - Environmental factors
  - Preexisting conditions

# Pathogenic Organisms

- Types of organisms and particles
  - Viruses
    - Microscopic, intracellular parasites that consist of a nucleic acid core with a protein coat
    - Invade host cells and pirate organelles and raw materials
    - Classified by shape, nucleic acid type, and method of reproduction

# Pathogenic Organisms

- Types of organisms and particles
  - Bacteria
    - Tiny cells without nuclei
    - Secrete toxins, parasitize host cells, or form colonies
    - Classification
      - By growth requirements
        - » Aerobic—require oxygen
        - » Anaerobic—require no oxygen

# Pathogenic Organisms

- Types of organisms and particles
  - Bacteria
    - Classification
      - By staining properties (depend on composition of cell wall)
        - » Gram-positive—stained purple
        - » Gram-negative—not stained

# Pathogenic Organisms

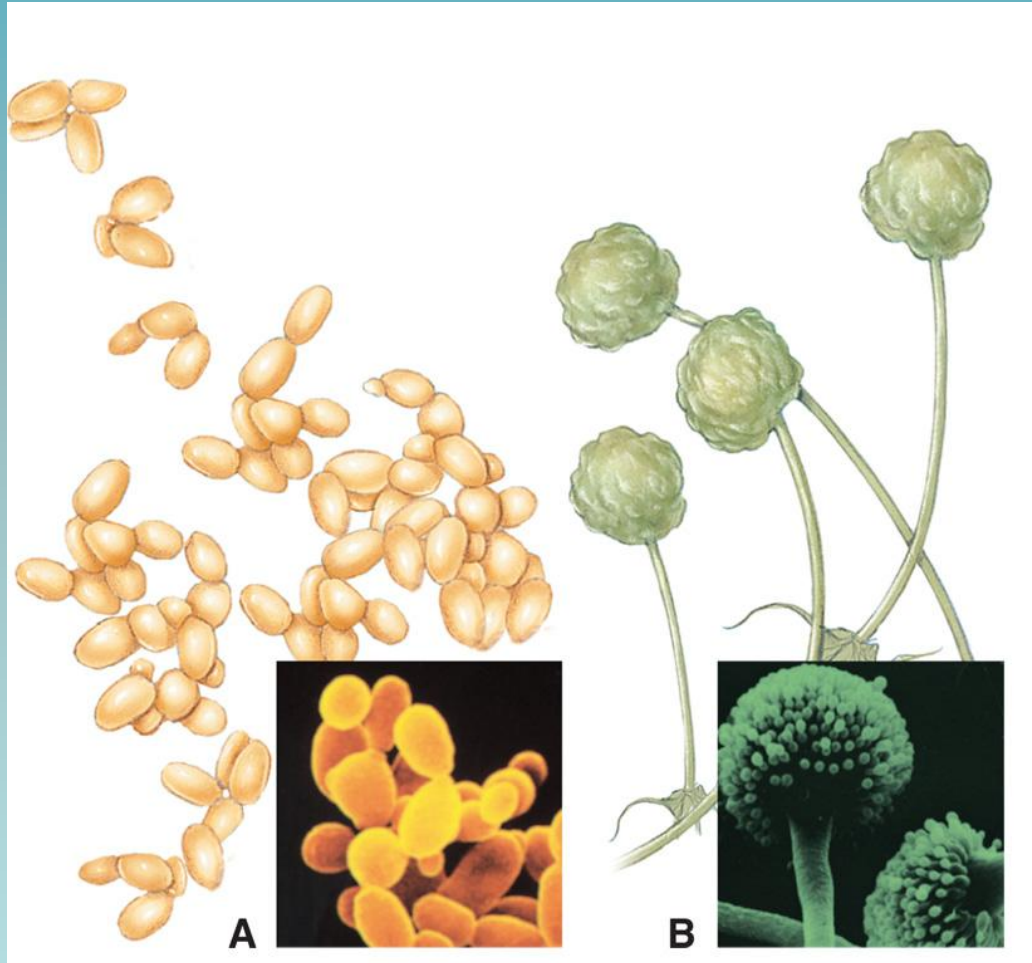
- Types of organisms and particles
  - Bacteria
    - Classification
      - By shape and size
        - » Bacilli—rod-shaped cells
        - » Cocci—round cells, ex. staphylococci
        - » Curved or spiral rods
        - » Small bacteria—ex. chlamydia
      - Spores—bacteria that resist unfavorable environmental conditions. Ex desert, acid

# Pathogenic Organisms

- Types of organisms and particles
  - Fungi
    - Simple organisms similar to plants but lacking chlorophyll
    - Yeasts—small, single-celled fungi , ex. Vaginal yeast infection
    - Molds—large, multicellular fungi
    - Mycotic infections—often resist treatment



# Pathogenic fungi, vaginal and urinary tract yeast (A)



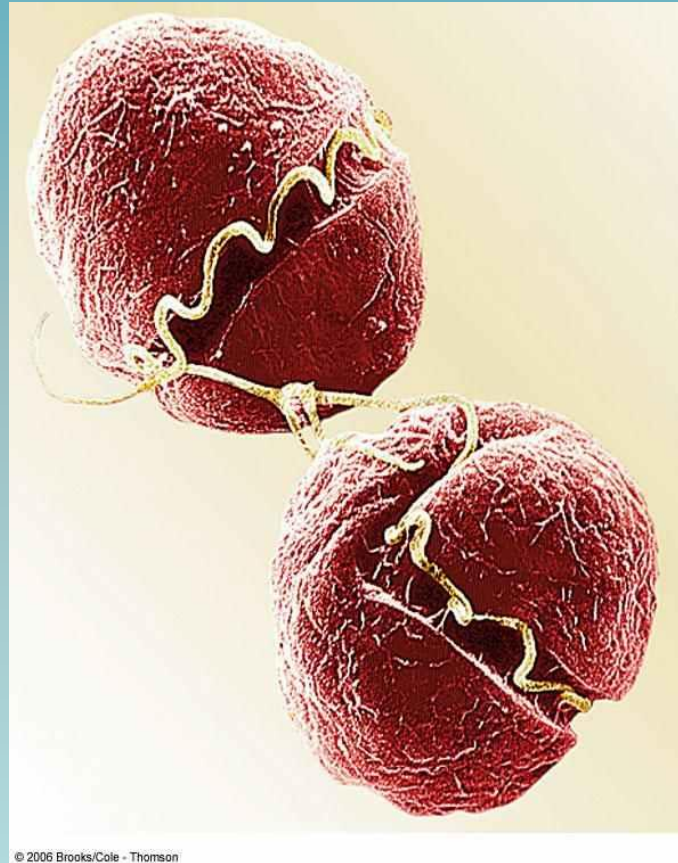
# Pathogenic Organisms

- Types of organisms and particles
  - Protozoa
    - Large one-celled organisms that have organized nuclei
    - May infest human fluids and parasitize or destroy cells

# Pathogenic Organisms

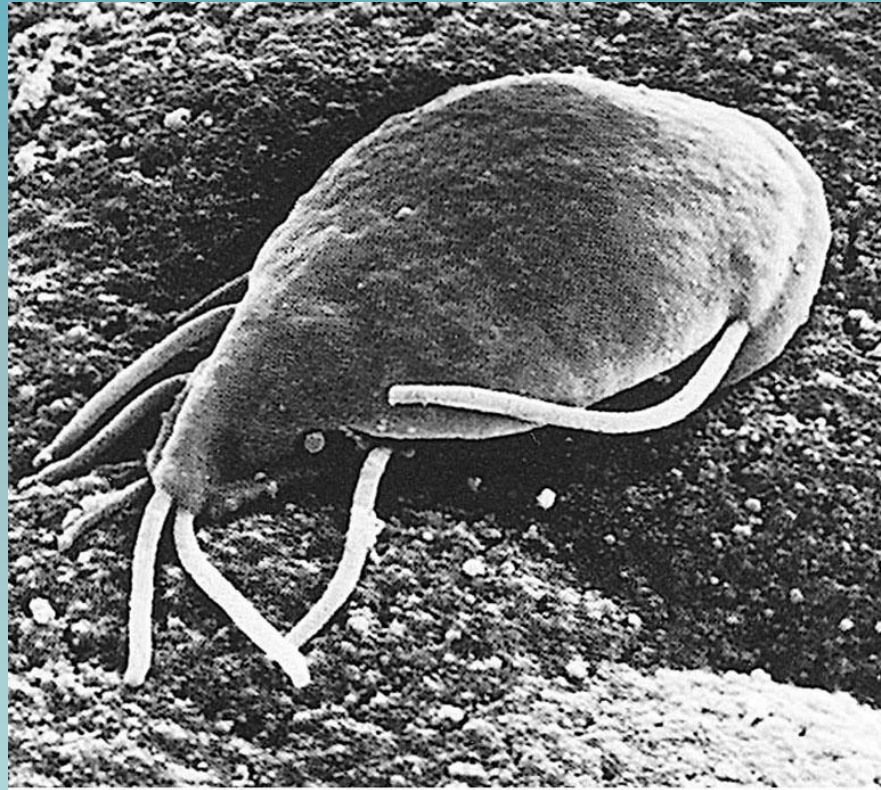
- Types of organisms and particles
  - Protozoa
    - Major groups
      - Amoebas—possess pseudopodia
      - Flagellates—possess flagella
      - Ciliates—possess cilia
      - Sporozoa (coccidia)—enter cells during one phase of a two-part life cycle; borne by vectors (transmitters) during the other phase

# Protist causing red tide



© 2006 Brooks/Cole - Thomson

# Diplomonad protozoa that causes Giardia



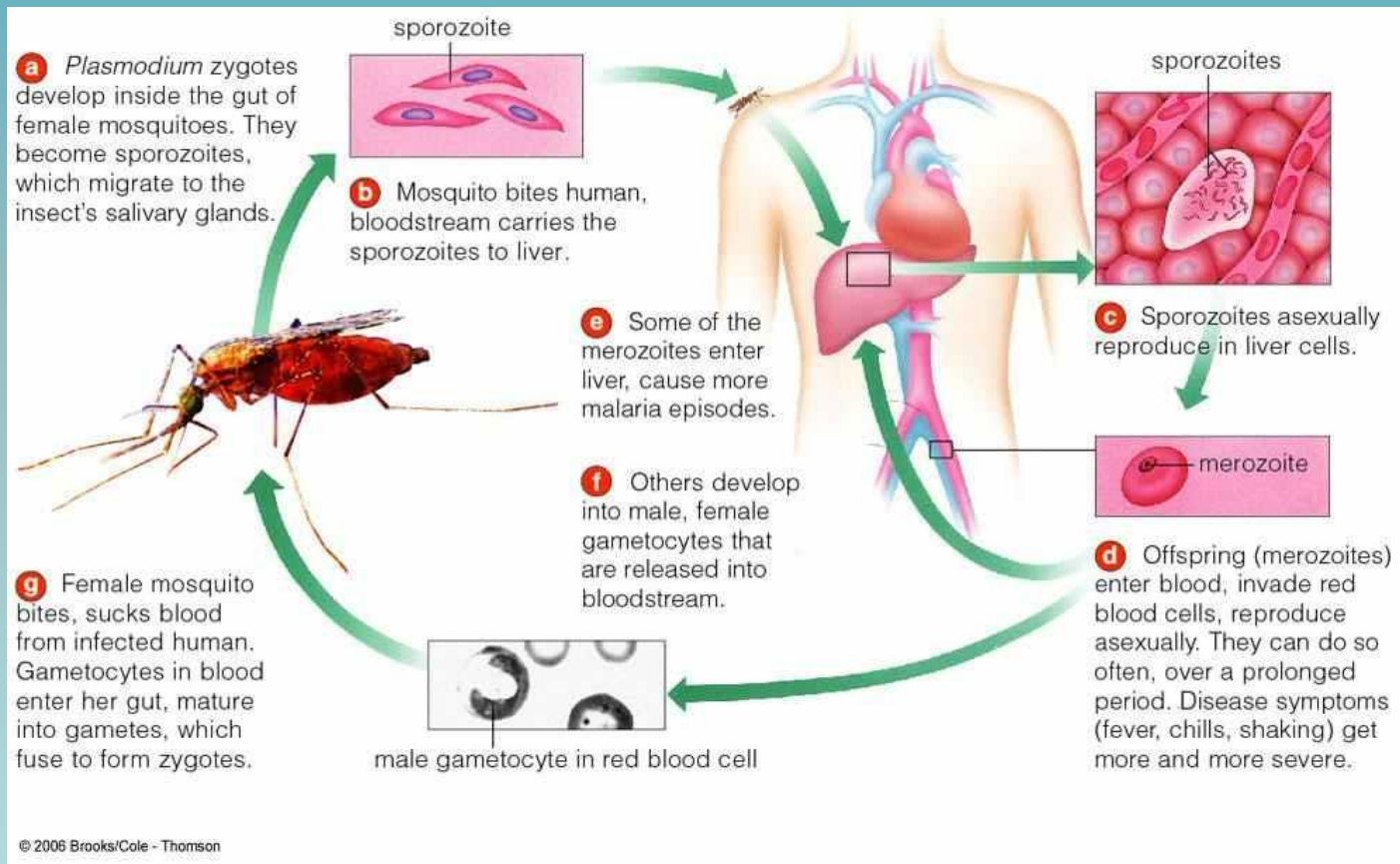
© 2006 Brooks/Cole - Thomson

# Pathogenic Organisms

- Types of organisms and particles
  - Pathogenic animals
    - Large complex multicellular organisms
    - Parasitize or otherwise damage human tissues or organs



# Protozoan causing malaria



# Pathogenic Organisms

- Types of organisms and particles
  - Pathogenic animals
    - Major groups
      - Nematodes—roundworms
      - Platyhelminths—flatworms and flukes
      - Arthropods—these are often vectors of disease
        - » Parasitic mites, ticks, lice, fleas
        - » Biting or stinging wasps, bees, mosquitoes, spiders



# Prevention and Control

- Mechanisms of transmission
  - Person-to-person contact
    - Can be prevented by education
    - Can be prevented by using aseptic technique
  - Environmental contact
    - Can be prevented by avoiding contact
    - Can be prevented by safe sanitation practices

# Prevention and Control

- Mechanisms of transmission
  - Opportunistic invasion
    - Can be prevented by avoiding changes in skin and mucous membranes
    - Can be prevented by cleansing of wounds
  - Transmission by a vector-lyme disease carried by deer tick
    - Can be prevented by reducing the population of vectors and reducing contact with vectors

# Prevention and Control

- Other prevention and treatment strategies
  - Vaccination—stimulates immunity
  - Chemicals—destroy or inhibit pathogens
    - Antibiotics—natural compounds derived from living organisms
    - Synthetic compounds (e.g., ACV and AZT for HIV)

# Tumors and Cancer

- Neoplasms (tumors)—abnormal growths of cells
  - Benign tumors remain localized
  - Malignant tumors spread, forming secondary tumors
  - Metastasis—cells leave primary tumor and start a secondary tumor at new location

# Tumors and Cancer

- Classification of tumors
  - Benign, epithelial tumors
  - Benign, connective tissue tumors

# Tumors and Cancer

- Classification of tumors
  - Carcinomas (malignant epithelial tumors)
    - Melanoma—involves melanocytes
    - Adenocarcinoma—glandular cancer
  - Sarcomas (connective tissue cancers)
    - Lymphoma—lymphatic cancer
    - Osteosarcoma—bone cancer
    - Myeloma—bone marrow tumor
    - Fibrosarcoma—cancer of fibrous tissue

# Tumors and Cancer

- Causes of cancer—varied and still not clearly understood
  - Cancer involves hyperplasia (growth of too many cells) and anaplasia (development of undifferentiated cells)

# Tumors and Cancer

- Causes of cancer
  - Factors that play a role in causing cancer
    - Genetic factors (e.g., oncogenes—cancer genes)
    - Carcinogens—chemicals that alter genetic activity
    - Age—changes in cell activity over time or accumulated effects of cell damage
    - Environment—chronic exposure to damaging substances
    - Viruses—cause change in genetic “machinery”



# Tumors and Cancer

- Pathogenesis of cancer
  - Signs of cancer
  - Methods of detecting cancers
    - Self-examination
    - Diagnostic imaging—radiography (e.g., mammogram and CT scan), magnetic resonance imaging (MRI), ultrasonography
    - Biopsy (e.g., Pap smear)
    - Blood tests

# Tumors and Cancer

- Staging—classifying tumors by size and extent of spread
- Grading—assessing the likely pattern of a tumor's development
- Cachexia—syndrome including appetite loss, weight loss, and general weakness
- Causes of death by cancer—secondary infections, organ failure, hemorrhage, and undetermined factors

# Tumors and Cancer

- Treatments
  - Surgery
  - Chemotherapy (chemical therapy)
  - Radiation therapy (radiotherapy)
  - Laser therapy
  - Immunotherapy
  - New strategies (e.g., rational drugs that target specific molecules, enzymes, or receptors )

# Inflammation

- Inflammatory response—reduces injury to tissues, thus maintaining homeostasis
  - Signs—redness, heat, swelling, and pain
  - Inflammation mediators (histamine, prostaglandins, and kinins)
    - Some cause blood vessels to dilate, increasing blood volume (redness and heat); white blood cells travel quickly to injury site

# Inflammation

- The inflammatory response reduces injury to tissues, thus maintaining homeostasis
  - Inflammation mediators (histamine, prostaglandins, and kinins)
    - Some increase blood vessel permeability (causing swelling or edema and pain); white blood cells move easily out of vessels; irritant is diluted; and exudate accumulates
    - Some attract white blood cells to injury site (chemotaxis)

# Inflammation

- Inflammatory diseases
  - Inflammation can be local or systemic (body-wide)
    - Fever—high body temperature caused by a resetting of the body’s “thermostat”; destroys pathogens and enhances immunity
    - Chronic inflammation can constitute a disease itself because it causes damage to tissues