**Chapter 14 Epidemiology**

**Symbiotic Relationships**

• Symbiosis means “to live together”

• Describes the relationship between microorganisms and their host

**The Three Types of Symbiotic Relationships**

• Mutualism

• Commenalism

• Parasitism

**Normal Microbiota**

• Also termed normal flora and indigenous microbiota

• Refers to the organisms that colonize the body’s surfaces without normally causing disease

• Two types

• Resident microbiota

• Transient microbiota

**Resident Microbiota**

• Are a part of the normal microbiota throughout life

• Most are commensal

**Transient Microbiota**

• Remain in the body for only hours to months before disappearing

• Found in the same regions as resident microbiota

• Cannot persist in the body

• Competition from other microorganisms

• Elimination by the body’s defenses cells

• Chemical or physical changes in the body

**Acquisition of Normal Microbiota**

• Development in the womb is generally free of microorganisms (axenic)

• Microbiota begins to develop during the birthing process

• Much of ones resident microbiota established during the first months of life

**Opportunistic Pathogens**

• Normal microbiota that can cause disease under certain circumstances

• Conditions that provide opportunities for pathogens

• Immune suppression

• Changes in the normal microbiota- changes in relative abundance of normal microbiota may allow opportunity for a member to thrive and cause disease

• Introduction of normal microbiota into unusual site in the body

**Contamination versus Infection**

• Contamination- the mere presence of microbes in or on the body

• Infection- results when the organism has evaded the body’s external defenses, multiplied, and become established in the body

**Portals of Entry**

• Sites through which pathogens enter the body

• 4 major types

• Skin

• Mucous membranes

• Placenta

• Parenteral route

**Skin**

• Outer layer of packed, dead, skin cells usually acts as a barrier to pathogens

• Some pathogens can enter through openings or cuts

• Others enter by burrowing into or digesting the outer layers of skin

**Mucous Membranes**

• Line the body cavities that are open to the environment

• Provides a moist, warm environment that is hospitable to pathogens

• Respiratory tract is the most commonly used site of entry- entry is through the nose, mouth or eyes

• Pathogens able to survive the acidic pH of the stomach may use the gastrointestinal tract as a route of entry

**Parenteral Route**

• Not a true portal of entry but a means by which they can be circumvented

• Pathogens deposited directly into tissues beneath the skin or mucous membranes

**Adhesion**

• Process by which microorganisms attach themselves to cells

• Required to successfully establish colonies within the host

• Uses adhesion factors

• Specialized structures

• Attachment proteins

**Attachment Proteins**

• Found on viruses (attachment proteins) and many bacteria (adhesins)

• Surface lipoproteins or glycoproteins, called ligands, that bind host cell receptors

• Interaction of ligand with host receptor can determine specificity for host cells

• Ability to change or block the ligand or its receptor can prevent infection

• Inability to make attachment proteins or adhesins renders the microorganisms avirulent

**Infection versus Disease**

• Infection is the invasion of the host by a pathogen

• Disease results only if the invading pathogen alters the normal functions of the body

• Disease is also referred to as morbidity

**Manifestations of Disease:**

• Symptoms- subjective characteristics of disease felt only by the patient

• Signs- objective manifestations of disease that can be observed or measured by others

• Syndrome- group of symptoms and signs that characterize a disease or abnormal condition

• Asymptomatic, or subclinical, infections lack symptoms but may still have signs of infection

**Etiology**

• Study of the cause of disease

• Germ theory of disease- disease caused by infections of pathogenic microorganisms

• Robert Koch developed a set of postulates one must satisfy to prove a particular pathogen causes a particular disease

**Virulence Factors of Infectious Disease**

• Pathogenicity- ability of a microorganism to cause disease

• Virulence- degree of pathogenicity

• Virulence factors contribute to an organisms virulence

• Adhesion factors

• Extracellular enzymes

• Toxins

• Antiphagocytic factors

**Extracellular Enzymes**

• Enzymes secreted by the pathogen

• Dissolve structural chemicals in the body

• Help pathogen maintain infection, invade further, and avoid body defenses

**Toxins**

• Chemicals produced by the pathogen

• Harm tissues or trigger host immune responses that cause damage

• Toxemia refers to toxins in the bloodstream that are carried beyond the site of infection

• 2 types

• Exotoxins

• Endotoxins

**Antiphagocytic Factors**

• Certain factors prevent phagocytosis by the host’s phagocytic cells

• Bacterial capsule

• Often composed of chemicals found in the body and not recognized as foreign

• Can be slippery making it difficult for phagocytes to engulf the bacteria

• Antiphagocytic chemicals

• Some prevent fusion of lysosome and phagocytic vesicles

• Leukocidins directly destroy phagocytic white blood cells

**The Stages of Infectious Disease**

• Following infection, sequence of events called the disease process occurs

• Many infectious diseases have five stages following infection

• Incubation

• Prodromal

• Illness

• Decline

• Convalescence

**Movement of Pathogen Out of Host**

• Pathogens leave host through portals of exit

**Reservoirs of Infection**

• Most pathogens cannot survive long outside of their host

• Sites where pathogens are maintained as a source of infection are termed reservoirs of infection

• 3 types of reservoirs

• Animal reservoir

• Human carriers

• Nonliving reservoir

**Animal Reservoirs**

• Zoonoses- diseases that are naturally spread from their usual animal host to humans

• Acquire zoonoses through various routes

• Direct contact with animal or its waste

• Eating animals

• Bloodsucking arthropods

• Humans are usually dead end host to zoonotic pathogens

**Human Carriers**

• Infected individuals who are asymptomatic but infective to others

• Some individuals will eventually develop illness while others never get sick

**Nonliving Reservoirs**

• Soil, water, and food can be reservoirs of infection

• Presence of microorganisms is often due to contamination by feces or urine

**Modes of Infectious Disease Transmission**

• Transmission from either a reservoir or portal of exit

• 3 groups

• Contact transmission

• Vehicle transmission

• Vector transmission

**Classification of Infectious Diseases**

• Many different methods of classification

• The body system they affect

• The taxonomic groups of the causative agent

• Their longevity and severity

• How they are spread to their host

**Epidemiology**

• Study of where and when diseases occur and how they are transmitted within populations

• Track occurrence of diseases using two measures

• Incidence- number of *new* cases of a disease in a given area during a given period of time

• Prevalence- number of *total* cases of a disease in a given area during a given period of time

• Occurrence also evaluated in terms of frequency and geographic distribution

**Nosocomial Infections**

• Infections acquired while in a health care facility

• Types of nosocomial infections

• Exogenous- pathogen acquired from the health care environment

• Endogenous- pathogen arise from normal microbiota due to factors within the health care setting

• Iatrogenic- results from modern medical procedures

**Control of Nosocomial Infections**

• Involves precautions designed to reduce the factors that result in disease

• Universal Precautions instituted by the CDC to limit exposure to pathogens

• Hand washing is the most effective way to reduce nosocomial infections

**Epidemiology and Public Health**

• Agencies at the local, state, national, and global level share information concerning disease

• The United States Public Health Service is the national public health agency

• World Health Organization (WHO) coordinates public health services internationally

• Public health agencies work to limit disease transmission

• Monitor water and food safety

• Public health agencies campaign to educate the public on healthful choices to limit disease