INFECTION

(CHAPTER 13)

QUESTION 1

Describe the stages of infection.

colonization – **first** arrival/exposure of host to environmental pathogen

invasion – infiltration of the colony into **surrounding tissues**

multiplication – **proliferation** of the organism within the body

spread – development of **systemic** infection due to presence in blood/lymph

QUESTION 2

Describe the factors of infection.

mechanism of action – **how** does the pathogen cause damage to the body?

(What disease process is involved?)

infectivity – ability of a pathogen to **invade** a host—related to transmissibility

(How easy or hard is it to catch the disease?)

pathogenicity – whether an infectious agent is capable of causing disease in a host

(Is it a **pathogen** or not?)

virulence – a quantitative measure of **how much damage** a pathogen is capable of doing to the host

(Does it cause mild disease or serious, potentially fatal problems?)

immunogenicity – the ability of a substance to induce an **immune response** in the host

(Does the body respond to the presence of the foreign material?)

toxigenicity – ability to **produce substances** which damage the body (endotoxins or exotoxins)

(Does the pathogen cause harm by producing **toxins**?)

portal of entry – the **route** that is used to enter the body from the environment

(How does the pathogen **get into** the body? Inhaled, GI tract, through the skin?)

QUESTION 3

What are the defense mechanisms of pathogens?

- Formation of a protein "S-layer" in many types of bacteria to protect against phagocytosis
- Antigenic drift in viruses, the gradual accumulation of mutations to the surface antigens that inhibit immune response
- Antigenic shift, "donation" of DNA from one virus to another, resulting in quick, drastic changes

QUESTION 4

What are classes of infectious microorganisms?

bacteria – single-celled prokaryotes

fungi – yeasts and molds

helminths – multicellular "worms," e.g. flatworm, tapeworm, etc.

protozoa – single-celled eukaryotes including amoebae

viruses – non-living, organic intracellular parasites

QUESTION 5

Define septicemia.

Septicemia refers specifically to an **infection of the blood** (usually bacterial,) as opposed to solid tissues.

Related to the concept of **sepsis**, a systemic inflammatory response due to widespread infection which can be life-threatening, especially if it progresses to **septic shock**.

QUESTION 6

How does the body respond to bacterial infection?

Cytokines (tiny signaling proteins) produced by the immune system help direct neutrophils towards the site of infection, where they release granules to attack the invading bacteria. Neutrophils and macrophages then attempt to phagocytose (envelop) the bacteria to prevent the infection from spreading.

Antibodies attach onto surface antigens on the exterior of the pathogen, "marking" it as a target for the immune system.

The **complement system**, a complex series of enzyme reactions that contribute to the immune response, is also triggered by antibodies binding to an infectious agent. This system leads to inflammation and the stimulation of phagocytes.

QUESTION 7

Describe the most common fungal infection.

The general term for any type of fungal infection is **mycosis**.

The most common type of mycosis is **candidiasis** (also known as **thrush**,) which is caused by the fungi of the genus Candida (most commonly C. albicans.)

The classic presentation of candidiasis is as a **thick, off-white film** covering the mucous membranes, which can be easily scraped off to reveal underlying **erythema**.

Most commonly, it occurs in the **mouth** and on the **tongue**, but also is the cause of vaginal **yeast infections**.

QUESTION 8

How is malaria transmitted?

Malaria is a deadly infectious disease caused by protozoa of the genus **Plasmodium**, most common in tropical regions and especially in sub-Saharan Africa (90%+.)

Malaria can be caused by any of five species of protozoa, but **P. falciparum** is responsible for **most** deaths due to malaria.

The protozoa that cause malaria are spread via **mosquito bite**; the mosquito bites an infected host, and carries the disease to its next target, infecting them as well.

QUESTION 9

How does the body fight viruses?

Many of the mechanisms that the body uses to fight viruses are the same as for bacteria: B cells produce **antibodies** which help recognize known pathogens, CD8 **cytotoxic T cells** attack infected cells, etc.

However, there is one protective mechanism that is particularly useful in defending against viruses: **interferons**.

Interferons are a type of **cytokine** (small signaling protein) which serve as the body's "alarm bell" vs. viral infection.

Cells infected with viruses release interferons, which both resist viral replication within the cell and warn nearby cells to ramp up their viral defenses.

QUESTION 10

What cells are the target of the HIV virus?

Human immunodeficiency virus (HIV) preferentially targets **CD4 T cells**, also known as **T-helper cells**, part of the active immune system which helps coordinate the immune response to particular types of infection.

Part of what makes HIV so dangerous is that, if not adequately treated, it can kill so many CD4 cells that the body can no longer respond adequately to other infections.

QUESTION 11

Describe acquired immunodeficiency syndrome (AIDS.)

Human immunodeficiency virus (HIV) is the pathogen responsible for acquired immunodeficiency syndrome (AIDS,) but infection with HIV **does not** imply that a person suffers from AIDS.

Rather, AIDS is a **progression** of HIV infection if not adequately treated or if treatment is unsuccessful, such as with drug-resistant strains or in patients who are already immunocompromised.

HIV is particularly dangerous because it preys on the cells of the immune system, simultaneously crippling the immune system while it reproduces and making it difficult for the body to fight back.

Disease progression is monitored through tracking **CD4 count**, or the number of T-helper cells in the blood. AIDS occurs when the CD4 count reaches **dangerously low** levels (<200 cells/mm^3.)

When the CD4 cells are depleted, the body is unable to fight off other infections, and opportunistic infection may occur which can be life-threatening.

With new treatment strategies such as antiretroviral therapy, AIDS-related mortality in HIV patients has declined by about 40% since 2010.

QUESTION 12

Describe the countermeasures used against pathogens.

Incidence of many infections can be prevented through **vaccination**, which results in acquired immunity to a particular pathogen.

Pharmacological treatment after infection begins depends on the pathogen: antibiotics, antiviral drugs, antifungal drugs, etc.