Benha University — Credit hours students

Faculty of Science — Summer Term 2016.

Botany Department — Time allowed: 2 hrs.

Medical Microbiology Exam (213B)

Answer the following questions:

1. Compare between **two** only of the following: **12 mark**
   a) Microbial pathogenicity and microbial virulence.
   b) Non-specific and specific host defense mechanisms.
   c) Antigens and antibodies.
2. Explain the pathogenicity of the following: **12 mark**
   a) *Escherichia coli.*
   b) *Salmonella.*
3. Mention the disease symptoms, structure, transmission and laboratory diagnosis of **two** viruses only: **12 mark**
   a) HCV
   b) HIV
   c) Influenza
4. Give reasons for **two** only the following: **12 mark**
   a) Appearance of new influenza viruses.
   b) HIV is a fatal viral infection.
   c) Acute rheumatic fever is produced by *Streptococci*.

"With my best wishes"

Dr. Mohamed Atef

The model answer for Medical Microbiology Exam (213B) (25/8/2016).

1. Compare between: **12 mark**

a. Microbial pathogenicity and microbial virulence.

Microbial pathogenicity	Microbial virulence
Pathogenic bacteria utilize a number of mechanisms to cause disease in hosts, and those species are capable of multiplying in living tissues causing disturbance of physiological function of the body. Pathogenicity is character of the species of microbe e.g *Salmonella typhi* is a pathogenic species because it is responsible for production of typhoid fever in man.	Virulence is a character of individual strains with species. So a certain strain of diphtheria bacillus is capable of producing severe disease if it is highly virulent, while another strain produces a mild disease if it is of low virulence. Virulence factors help bacteria to (1) invade the host, (2) cause disease, and (3) evade host defenses. The following are some types of virulence factors: Adherence Factors: Many pathogenic bacteria colonize mucosal sites by using *pili* (fimbriae) to adhere to cells. Capsules: Many bacteria are surrounded by capsules that protect them from opsonization and phagocytosis. Endotoxins: The

	lipopolysaccharide endotoxins on Gram-negative bacteria cause fever, changes in blood pressure, inflammation, lethal shock, and many other toxic events.

b. Non-specific and specific host defense mechanisms.

Non-specific host defense mechanism	**Specific host defense mechanisms**
Non-specific host defense mechanism is an important subsystem of the overall immune system. • Intact, unbroken skin: Skin and mucosa or within the body (endothelial cells and basement membranes). Intact skin is unpenetratable by most bacteria and viruses. bacteriocidal secretion by the sebaceous glands destroy the cell wall of many bacteria. • Respiratory tract: – Nose - nasal hair, mucus secretions (phagocytes and antibacterial enzymes). – Cough reflexes helps to expel foreign particles • Gastrointestinal tract Mouth and lower digestive tract – lots	The humoral and cell-mediated immune defense mechanisms induced against an infectious agent are specific in nature, i.e. the specific immune mechanisms act only against the microbe against which the responses were induced and not against other microbes. Antibodies and complement components are the important mediators of humoral immune responses. Binding of the Fab regions of antibodies with specific antigen epitopes on the surface of microbes initiates the humoral defense mechanisms against the microbes.

of bacteria (mostly anaerobes e.g. *Bacteroides)* which opposes establishment of pathogenic bacteria • Mucus • Saliva (contains lysozyme) • Bile (alkaline) in small intestine • Stomach acids are bactericidal • Genital system Secretion (vaginal and seminal fluid) Low pH of vagina (presence of several *Lactobacillus* sp., *Candida albicans*) inhibits growth of pathogens. • Eyes – Blinking of eyelids – Tears containing lysozymes • Outer ear canal – Wax contains antibacterial components • Phagocytosis Viruses may be phagocytosed to different degrees by polymorphonuclear leukocytes and macrophages. The effect of phagocytosis may be virus inactivation, persistence, or multiplication; consequently, the	Helper T cells are central to the development of specific immune responses against microbes. i. Helper T cells help the B lymphocytes for their activation. Thus helper T cells also play an important role in humoral responses mediated by antibodies. ii. IFNγ secreted by helper T cells activate macrophages and augment the phagocytic and intracellular killing activity of the macrophages. iii. Helper T cells also augment the NK cell activity and thus play important role in fight against viral infections. iv. Helper T cells help the activation of cytotoxic T cells and thus they help in the killing of viral infected cells.

result may be clearance of virus, transportation to distant sites, or enhanced infection. • Fever Replication of most viruses is reduced by even a modest rise in temperature. During viral infection, fever can be initiated by several endogenous pyrogens, such as interleukins-1 and -6, interferon, prostaglandin E2, and tumor necrosis factor. • Inflammation Inflammation inhibits viral replication through (1) elevated local temperature, (2) reduced oxygen tension, (3) metabolic alterations, and (4) acid production. The effects of these mechanisms are often additive.	

c. Antigens and antibodies

Antigens	**Antibodies**
A substance that stimulates the production of an antibody when introduced into the body. Antigens include toxins, bacteria, viruses, and other foreign substances.	These are specialized serum protein capable to react specifically with antigens that stimulated their production. These antibodies called immunoglobulin.

2. Explain the pathogenicity of the following: 12 mark

a) Pathogenicity of *Escherichia coli*

Escherichia coli typically colonizes the gastrointestinal tract of human infants within a few hours after birth. Usually, *E. coli* and its human host coexist in good health and with mutual benefit for decades.

Certain isolates of *E. coli* have been implicated in a wide range of diseases that affect either animals or humans worldwide.

E. coli causes*:*

- Urinary tract infection.
- Traveler's diarrhea.
- Wound infection.
- Bacteremia and meningitis especially of the new born.

b) Pathogenicity of *salmonella*

Salmonella infection, or salmonellosis, is a bacterial disease of the intestinal tract. *Salmonella* is a group of bacteria that causes typhoid fever, food poisoning, gastroenteritis, enteric fever and other illnesses. People become infected mostly through contaminated water or foods, especially meat, poultry and eggs.

- *Salmonella typhi* causes enteric fever
- *Salmonella paratyphi* A and B cause paratyphoid enteric fever.
- Many types of Salmonella bacteria cause salmonellosis in animals and people. *S. typhimurium* and *S. enteritidis* are the most commonly met with in outbreaks of food poisoning.

3. Mention the disease symptoms, structure, transmission and laboratory diagnosis of two viruses only: 12 mark

a) HCV

b) HIV

c) Influenza

a) Disease Symptoms of HCV:

- Fatigue
- Muscle pain
- Poor appetite
- Low-grade fever
- Yellowing of the skin and eyes

Structure of HCV:

- Core: single stranded RNA.
- Capsid: spherical
- Envelope with projections
- There are multiple serotype

Transmission of HCV:

- By infected blood transfusion.
- Sharing of contaminated needles between drug users who use syringes.
- Engaging in sexual intercourse with a person who is infected with hepatitis C.

Laboratory diagnosis for HCV:

- Liver enzymes are elevated
- Detection of Anti-HCV antibodies by ELISA
- Detection of HCV-RNA by PCR

b) Symptoms of HIV:

- Flu-like illness - occurs one to six weeks after infection.
- Infected person can infect other people.
- The immune system deteriorates.
- Opportunistic infections and cancers start to appear.

Structure of HIV:

- Core: ssRNA , RT enzyme, Core protein (p24).
- Capsid: spherical.

- Envelope: with viral glycoproteins projections (gp 41, 120, 160.).
- Virus strain: HIV-1 world wide & HIV-2 west Africa.

Modes of HIV/AIDS Transmission:

- By infected Blood products transfusions
- Sexual contact
- From mother to fetus

Laboratory diagnosis of HIV:

- Detection of specific antibodies related to infection using ELISA if +ve it should be repeated by Western blot technique.
- Detection of viral structure by RT-PCR for Viral RNA.
- Virus isolation from infected cells and culture on lymphocyte culture.

c) Diseases symptoms of Influenza:

- Fever
- Headache
- Cough
- Rhinitis

Structure of Influenza virus:

- Core: ssRNA segmented (8)
- Capsid: spherical
- Envelope: contains glycoprotein as radial projecting spikes

Transmission of Influenza virus:

- By droplet inhalation
    - Aerosol 100,000 to 1,000,000 virions per droplet.

Laboratory Diagnosis Influenza:

- Virus isolation:

Specimen from throat swabs during the first 3days

Culture on embroynated eggs.

- Detection of virus structure by ELISA as antigens, Or NAH to detect RNA.
- Detection of specific antibodies related to infection by CFT, HIT, and ELISA

4. Give reasons for <u>two</u> only the following: 12 mark

a) Appearance of new influenza viruses.

b) HIV is a fatal viral infection.

c) Acute rheumatic fever is produced by *Streptococci.*

a) Appearance of new influenza virus is due to Antigenic changes:

- Antigenic shift: occurs by reassortment between different segments of the same strain or between segments of human and animals of type A, lead to change in Hemagglutinin (HA) or Neuraminidase (NA). Like H1N1, H2N2, H3N2 AND H5N1.
- Antigenic drift : occurs by changes in some amino acids of HA.

b) HIV is a fatal viral infection

HIV is a virus spread through certain body fluids that attacks the body's immune system, specifically the CD4 cells, often called T cells. Over time, HIV can destroy so many of these cells that the body can't fight off infections and disease. These special cells help the immune system fight off infections.

Specific antibodies do not protect against HIV infection as the virus is hidden inside the cells.

c) Acute rheumatic fever is produced by *Streptococci*.

The strep bacterium contains a protein similar to one found in certain tissues of the body. Therefore, immune system cells that would normally target the bacterium may treat the body's own tissues as if they were infectious agents particularly tissues of the heart, joints, skin and central nervous system. This immune system reaction results in inflammation.

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