NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF HEALTH SCIENCES

QUALIFICATION: BACHELOR OF MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BMLS	**LEVEL: 5**
COURSE CODE: IMY521S	**COURSE NAME:** IMMUNOLOGY
SESSION: NOVEMBER 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION PAPER	
EXAMINER(S)	**MAURICE NYAMBUYA**
MODERATOR:	**FREDRIKA ENGELBRECHT**

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Pen
2. Calculator

THIS QUESTION PAPER CONSISTS OF 9 PAGES (including this front page)

SECTION A [40]

QUESTION 1 **[20]**

Select the one-lettered answer that fits best in each question. You only need to write down the letter of the correct answer.

1.1 In the immune response to a hapten-protein conjugate, in order to get anti-hapten antibodies, it is essential that;

(a) Hapten be recognized by helper T-cells.
(b) The hapten be recognized by natural killer-cells.
(c) The hapten be recognized by suppressor T-cells.
(d) The protein be recognized by B-cells.
(e) The protein be recognized by helper T-cells. (1)

1.2 Antigen-presenting cells that activate helper T-cells must express which one of the following on their surface?

(a) CD4
(b) Class I MHC
(c) Class II MHC
(d) IgM
(e) Thy-1 (1)

1.3 One principal function of complement is to

(a) Bind antibodies attached to cell surfaces and to lyse these cells.
(b) Cross-link allergens.
(c) Inactivate perforin.
(d) Mediate the release of histamine.
(e) Phagocytose antigens. (1)

1.4 Cytokines always act

(a) Antagonistically with other cytokines.
(b) Act long range.
(c) By binding to specific receptors.
(d) In an autocrine manner.
(e) Synergistically with other cytokines. (1)

1.5 Which of the following cytokines is characteristically produced by Th2 lymphocytes which provide help for antibody production?

(a) GM-CSF
(b) IL-1
(c) IL-4
(d) IFN-γ
(e) TNF-α (1)

1.6 High-affinity B cell clones are usually generated by

(a) Class switching.
(b) Expression of high affinity precursors in the naive B cell population.
(c) Positive selection.
(d) Negative selection.
e) Somatic hypermutation. (1)

1.7 Prior to class-switching, B cells express

(a) IgA
(b) IgA and IgG
(c) IgD
(d) IgD and IgM
(e) No surface antibody (1)

1.8 Which of the following is a primary lymphoid organ?

(a) Lymph nodes
(b) Peyer's Patches
(c) Spleen
(d) Thymus
(e) Tonsil (1)

1.9 When antigen reaches the lymph node

(a) There is an increase in the number of cells leaving the lymph node.
(b) There is a decrease in the number of cells leaving the lymph node.
(c) There is an immediate increase in the number of activated B cells.
(d) It is transported to the spleen.
(e) It is immediately destroyed by the macrophages. (1)

1.10 The specialised cell type involved in the entry of lymphocytes into a lymph node is called

(a) HEV endothelial cells
(b) M cells
(c) PALS cells
(d) Selectins
(e) Synovial cells (1)

1.11 The following is characteristic of B cells but not T cells:

(a) CD3
(b) CD40 ligand
(c) MHC class I
(d) Polyclonal activation by concanavalin A
(e) Surface immunoglobulin (1)

1.12 A Fab fragment

(a) Is produced by pepsin treatment.
(b) Is produced by the separation of heavy and light chains.
(c) Binds antigens.
(d) Lacks light chains.
(e) Has no interchain disulphide bonds. (1)

1.13 Pattern recognition receptors include

(a) PAMPs
(b) LPS
(c) Lipotechoic acid
(d) Lectin-like molecules
(e) Bacterial peptidoglycan (1)

1.14 The complement component C3 is cleaved by

(a) Factor D
(b) C4b2a3b
(c) C3bBb
(d) C3b
(e) C1s (1)

1.15 C3b

(a) Opsonises bacteria.
(b) Is an anaphylatoxin.
(c) Is chemotactic.
(d) Is the inactive form of C3.
(e) Directly injures bacteria. (1)

1.16 Positive selection in the thymus is mediated by:

(a) B cells.
(b) Cortical epithelial cells.
(c) Follicular dendritic cells.
(d) Interdigitating medullary cells.
(e) Macrophages. (1)

1.17 Specific antibodies are readily detectable in serum following primary contact with antigen after

(a) 10 minutes.
(b) 1 hour.
(c) 5-7 days.
(d) 3-5 weeks.
(e) Only following a second encounter with the antigen. (1)

1.18 The antigen portion on an antigen –presenting cell that is recognised by the αβ-TCR is

(a) The native protein antigen together with the Major Histocompatibility Complex molecule.
(b) Processed peptide antigen together with the Major Histocompatibility Complex molecule.
(c) Processed peptide antigen.
(d) Native antigen.
(e) The Major Histocompatibility Complex molecule alone. (1)

1.19 Antigen processing for presentation by an MHC class II molecule involves

(a) Calnexin
(b) HLA-DM
(c) LMP2
(d) Proteasome
(e) TAP 1 and TAP 2 (1)

1.20 Suppression of Th2 lymphocytes by Th1 lymphocytes may be mediated by

(a) IL-4
(b) GM-CSF
(c) IL-1
(d) TNF-β
(e) INF-γ (1)

QUESTION 2 [10]

A 54-year-old female presented at her GP with a history of stiffness in the mornings which normally lasted more than an hour and arthritis in her joints which was becoming progressively worse. Rheumatoid nodules were visible particularly in her hands. Analysis of her blood revealed elevated levels of rheumatoid factors. The doctor placed her on a regimen of medication to control the disease. This included monoclonal antibodies against tumour necrosis factor-alpha (TNF-α) which is implicated in rheumatoid arthritis. Rheumatoid arthritis is more frequently observed in patients with HLA-DR4 allele.

2.1 Define cytokines and list their three (3) major functions. (4)

2.2 Sketch and label the MHC molecule that is associated with rheumatoid arthritis. (6)

QUESTION 3 [10]

Vaccines have changed the face of medical science. Through successful vaccination strategies, the burden of infectious disease has decreased around the world.

3.1 Define the term "vaccination". (2)

3.2 Name the first disease that was successfully eradicated from the world by means of a vaccination campaign. (1)

3.3 Louis Pasteur's work with chicken cholera contributed to our understanding of why vaccination is possible. Describe the "accidental" experiment that he conducted. In your answer, include an explanation of his findings. (7)

SECTION B [60]

QUESTION 4 [30]

A 38-year old woman with severe pre-eclampsia gave birth to a normal girl (Monica) via c-section in her 30th week of pregnancy. The neonate (new born) weighed 50 g and had no obvious congenital abnormalities. As a result of her premature birth, cord blood was sent to the laboratory to establish the immunoglobulin concentration. Her serum IgG was 0.1g/litre. The normal range for IgG in a neonate is normally the same as that of the mother i.e 7.2 – 19 g/litre. A diagnosis of hypogammaglobulinaemia of prematurity was made.

4.1 Why does a neonate normally have the same concentration of IgG as the mother's at birth? (2)

4.2 If Monica were to develop an infection within her first week of life, passive immunity could be administered.

4.2.1 What would passive immunity entail? (1)

4.2.2 Why would passive immunity be administered? (3)

4.2.3 Would the passive immunity give her life-long protection? Motivate your answer. (2)

4.3 On day 10, the infant was diagnosed with bacterial infection. *Staphylococcus aureus* is a bacterial species that causes extracellular infections.

4.3.1 Describe how the bacteria would be processed into peptides which are then presented to T lymphocytes. (10)

4.3.2 Name the type of adaptive immune response that would predominate. Motivate your answer. (2)

4.3.3 Name the class of antibody that would be initially produced after a lymphocyte's first encounter with *Staphylococcus aureus*. (2)

4.3.4 Sketch and label IgG antibody. (8)

QUESTION 5 [30]

A 15 year old male developed pneumonia and was placed on penicillin. He developed puffy eyes, urticaria, swollen face and wheezing. This was not the first time he had been placed on penicillin for the treatment of bacterial infections. Tests to determine the presence of complement proteins revealed that the level of complement was below normal. He was diagnosed with drug-induced serum sickness. Serum sickness results from the formation of small immune complexes in the presence of excess antigen. These small immune complexes are not removed from the circulation and instead are deposited in the tissue. The immune system tries to rid the body of these deposited immune complexes by activating complement proteins. Anaphylatoxins which are released during the activation of complement contribute to the inflammatory responses which manifested in the symptoms he exhibited.

5.1 Normally complement-opsonised immune complexes can be removed from circulation with the aid of phagocytes. Explain how the phagocytes carry out this function. (4)

5.2 Name the complement pathway that is activated in this scenario where immune complexes are deposited in tissues. (2)

5.3 Describe the formation of membrane attach complex (MAC) in the pathway you named in 5.2. (15)

5.4 In the scenario above anaphylatoxins are produced and cause an inflammatory response. What are these anaphylatoxins and describe their role in inflammation? (4)

5.5 Define hypersensitivity and briefly explain how the four types are differentiated from each other. (5)

End of Examination

Total Marks: [100]

Good Luck!