DATE: 28.12.22   TIME: 180 mins: 9:30 A.M– 12:30 P.M

Instructions:

1. Please write your name and ID on main and supplementary sheets

2. There are two parts- A (Closed book) and B (Open Book). Submit Answer Sheet of Closed Book and then take another Answer sheet for Open Book

3. All questions are compulsory. Please write Question number and part number clearly, answers to all the parts of a particular question at one place. Write to the point answers.

Part A- Closed Book (60M)

1. In West Africa after a wedding meal of wild animal meat (antelope, warthog and bat), there was an acute severe sickness (high fever, seizures, brain inflammation) and high mortality among all the people who visited the wedding within 7 days of exposure (50% mortality rate). In fact, the disease seems to be contagious as the people who attended the wedding when they arrived back home, within 2 days, their contacts (~ average 6-7 people) also contracted similar symptoms and died within 7 days. You were assigned by WHO as the chief microbiologist to investigate the case. Based on your knowledge of microbial mechanism of pathogenicity and epidemiology, answer the following questions:

   (A) The blood samples when tested by various standard microbiology staining methods, tested negative. The blood samples did not show any growth when tested on all the possible growth media. As a microbiologist, what causative agent do you suspect and why? Suggest the most appropriate method to grow these microbes? [**1+ 2M + 3M =6M**]

   (B) Describe briefly most suitable (i) Microscopic (any one) and (ii) molecular biology (any one) based method to identify this unknown causative microorganism when simple microscopy fails? [**2M + 2M = 4M**]

   (C) Briefly describe these terms and their importance in the context of above scenario in particular and public health management in general (i) Etiology (ii) Virulence (iii) incubation period and (iv) Ro number (v) Infectious dose 50 (ID 50) and (vi) Lethal dose 50 (LD50) for this contagious infectious agent. **[4M X 6 = 24M]**

   (D) Koch's postulates were formulated by Robert Koch and Friedrich Loeffler in 1884. Despite the advent of so many new technologies Koch's postulate are still relevant in the current times, explain in detail in the context of above scenario of emergence of a new infectious disease? Is the microbe in the above scenario deviating from Koch's postulate, if yes which postulate and how? **[5M + 1M+ 4M =10M]**

   (E) Describe any three low-cost food preservation technologies most suited to prevent Zoonotic spread of infectious diseases typically spread by consumption of meat. **[6M]**

2. HIV infection is not synonymous with AIDS, but former can lead to latter. (i) Describe terms HIV and AIDS **(2M)** (ii) entry receptor utilized by HIV **(1M)** (iii) cell type that serve as reservoir of HIV inside humans **(1M)** (iv) life cycle of HIV (brief bullet points) and how that gradually leads to clinical symptoms of AIDS **(3 + 3 = 6M)**? **[Total= 10M]**

Submit Answer Sheet of Closed Book and take another Answer sheet for Open Book

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1. Pigs act as **"mixing vessel"** while wild/migratory birds are the **"natural reservoirs"**, but the Influenza viruses are also **"natural drifters"** too. Justify how pig serves as a "mixing vessel". Describe how "mixing" and "drifting" influence (a) host selectivity, (b) transmission, (c) virulence, (d) natural immunity and (e) vaccine efficacy in case of influenza viruses. **[6M + 2MX5 = 16M]**

2. What is the advantage of developing early diagnosis tools and its role in epidemiological studies and disease management? **[6M]**

3. In National Institute of Virology, clinical microbiologist use Hemagglutination test to diagnose Influenza viral infection and also to determine the viral load. (a) what is the basis of Hemagglutination reaction (b) Determine the viral load in HA/ml for the three patients based on figure given below (c) Which of the three patients seems to have pre-existing immunity to Influenza and how that explains the observations? **[4M + 3M + 3M =10M]**
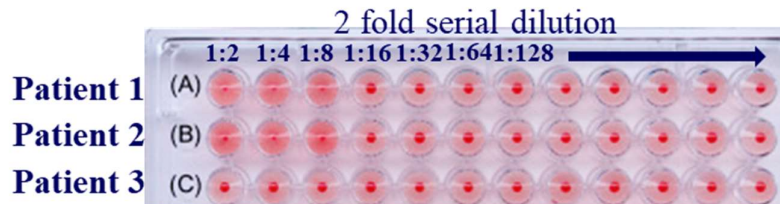
4. Two new vaccine candidates RomX and RomZ were developed by BantaCruz Inc (a company who works closely with American defence organizations) against a lethal bacteria used as a biological warfare agent. The bacterial infection is extremely lethal and has a latency period of only 24 hours. If infected a person develops severe symptoms and can die of acute infection within 72 hours. Based on the antibody titre and profile post vaccination and infection induced by vaccines RomX (Figure A) and Rom Z (Figure B) in human clinical trials, which of these vaccines do you recommend for clinical use in soldiers so that they can be protected against any potential attacks (given the latency period)? [Please note that in the figure, the solid line represents antibody titre on vaccination or exposure to pathogen. And the dotted line represents the minimum antibody levels needed to protect against death post infection] [**4M**]
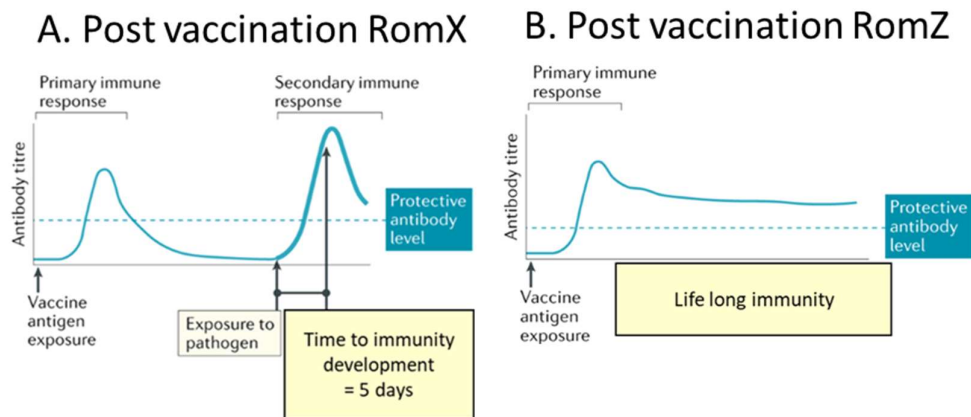
5. Describe briefly the site of action (or mechanism of action) of Polymyxin B and against which particular microbe it can be used as an antimicrobial agent. **[4M]**