(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE MEDICAL BIOTECHNOLOGY MAIN EXAM

COURSE CODE: BMB 423

COURSE TITLE: HUMAN GENOMICS, PROTEOMICS AND PROTEIN ENGINEERING

DATE: 24TH MAY 2019 **TIME:** 3.00 -5.00 PM

INSTRUCTIONS TO CANDIDATES

This paper is divided into three sections, **A B** and **C,** carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**).

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

1. Which treatment is an example of somatic gene therapy?

    A. growing a replacement organ from a person's stem cells

    B. injecting a functional dominant allele into the liquid in the eye to correct a retinal disease

    C. introducing an extra allele for a growth hormone into sheep embryos

    D. joining a sperm cell, mother's nucleus and an enucleated donor oocyte to make a healthy baby

2. Two men who are identical twins marry two women who are also identical twins. Each couple has a daughter. The daughters are more genetically similar than is usual for first cousins.

Which statement describes the degree of genetic similarity between the daughters?

A. They are genetically different from each other due to independent assortment in meiosis.

B. They are genetically different from each other due to random mutation.

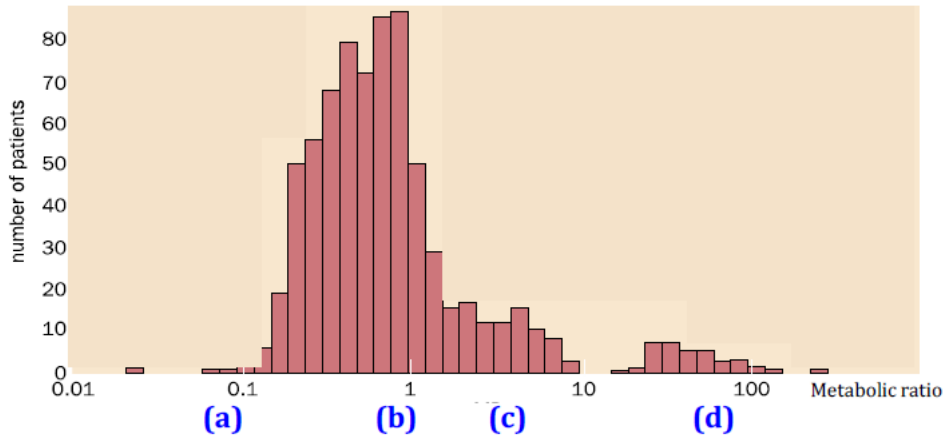
C. They are genetically identical because random mutation is rare.

D. They are genetically identical because they share the same parental gene pool.

3. Which of the following descriptions, if any, is false? A person's ability to absorb or metabolize a drug that is intended to treat a genetic disorder

A. is entirely due to genetic factors.
B. depends on a person's lifestyle.
C. is not modified by having a bacterial infection.
D. is independent of a person's diet.

4. The diagram below shows the urinary metabolic ratio as a measure of CYP2D6 enzyme activity in a total of about 700 individuals. After individuals were given a standard dose of a drug known to be metabolized by CYP2D6 the metabolic ratio was obtained by measuring the urinary concentration of the substrate drug and dividing it by the concentration of the metabolic product resulting from CYP2D6 acting on the drug. Classify individuals with metabolic ratios in the four ranges shown as (a) to (d) in terms of their drug-metabolizing abilities and describe the expected genotypes associated with each group.



5. Which of the following statements, if any, is false?
   A. Gene therapy involves the direct genetic modification of the cells of a person (or animal model) to achieve a therapeutic goal.
   B. Current gene therapy is directed at modifying somatic cells.
   C. The only successful gene therapies are those in which cells are removed from a patient, genetically modified, and then returned to the patient.
   D. Gene therapy successes have largely involved treatment of recessively inherited disorders.

6. Which, if any, of the following statements is false?
   A. The great majority of clinical gene therapy trials have had limited success
   B. The only successful gene therapies have been for recessive blood disorders.
   C. The only successful gene therapies have been *ex vivo* gene therapies.
   D. Gene therapy for inherited disorders represents a minority of clinical gene therapy trials.

7. What is pharmacogenomics?

   A. Branch of pharmacology that studies genes in drug safety

   B. Branch of pharmacology that studies genes in drug efficacy

   C. Branch of pharmacology that allows drug dosing and selection based on genetic makeup of the individual

   D. All of the above

8. Pharmacogenomics may optimize drug therapy by:
   A. identifying patients who may have a decreased response to a drug
   B. identifying patients who may have increased metabolism of certain drugs
   C. identifying patients who may be at risk for increased toxicity for certain drugs
   D. all of the above

9. Which of the following is/are true regarding a synonymous single nucleotide polymorphism (SNP)?

A. A change in a nucleotide in the DNA sequence results in coding of a different amino acid
B. A change in a nucleotide in the DNA sequence results in coding for the same amino acid
C. Will always result in a change in function of the protein
D. A and C

10. Issues regarding implementation of pharmacogenetic testing include:

A. Lack of data correlating DNA polymorphisms and efficacy

B. Lack of data correlating DNA polymorphisms and toxicity

C. Concerns for inequality in health care

D. All of the above

11. Which of the following is a true statement regarding polymorphism?

A. It is a variation in a DNA sequence

B. It may affect only one nucleotide in a DNA sequence

C. It may involve deletion of an entire gene

D. All of the above

12. Which, if any, of the following statements is false?

A. Most of the inherited changes in our DNA arise because of exposure to extracellular mutagens, including radiation sources and chemical mutagens.
B. Most of the inherited changes in our DNA arise because of unavoidable endogenous errors in cellular mechanisms and harmful effects of certain natural molecules and atoms within our cells.
C. Errors in DNA replication and DNA repair are a major source of mutations in our cells.
D. Significant chemical damage is sustained by DNA because of its proximity to water molecules in our cells.

13. Protein-coding genes can be identified by

A. Transposon tagging
B. ORF scanning
C. Zoo-blotting
D. Nuclease S1 mapping

14. The function of genes can be determined by

A. Gene inactivation

B. Homology search
C. Exon trapping
D. Zoo-blotting
E. Northern analysis

15. Dideoxynucleotides are used in
A. PCR
B. Southern hybridization
C. Transformation
D. Cloning
E. DNA sequencing
F. Culturing of bacteria

16. ORF scanning
A. Is used to find exons
B. Is used to find intergenic sequences
C. Is used to find gene homologies
D. Is used to find protein-coding genes

17. The proteome
A. can only usefully be studied in conjunction with the phenome
B. refers to the entire complement of proteins
C. is what functional genomics is primarily interested in understanding
D. is now most commonly studied using RNA microarrays

18. RNA microarrays
A. make use of SNPs
B. utilize microsatellites
C. monitor 1000s of genes simultaneously
D. monitor 100s of genes simultaneously

19. Some have argued that environmental influences that affect behavioural development operate on a family-by-family basis. However, it is probably better to view environmental influences as operating on an individual-by-individual basis. This means
A. environmental effects are going to be relatively specific to each child, rather than general for all children in a family
B. the concept of shared environment is antiquated and should be eliminated from behavioural genetics
C. that family experiences are unimportant in child development
D. that two children growing up in the same family will be more alike than children growing up in different families

20. Passive genotype-environment correlations involve interactions between _____ and are typically most significant in _____ because they have _____ to modify their environment.

A. genetic relatives, adolescents, increasing ability
B. genetic relatives, children, limited ability
C. anyone or anything, adults, high ability

D. anyone or anything, children, no ability
E. non relatives, children, low capacity

Section B: Short answer questions

1. Differentiate between reverse and functional genomics (6 marks)
2. Briefly outline the principle behind reverse genetics (6 marks)
3. Briefly discuss any four challenges associated with genetic therapy (8 marks)

Section C: Essay questions

1a. Define genetic disorders (2 marks)
1b. Outline several causes of genetic disorders (8 marks)
1c. Briefly discuss the various classifications of genetic disorders (10 marks)

2. Discuss pharmacogenomics highlighting its importance in line with the current healthcare practice and disease management (10 marks)