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UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME

FOURTH BPHARM PART II EXAMINATION – JUNE 2017

PH 4231 –MOLECULAR GENETICS (SEQ)

TIME: TWO HOURS

INSTRUCTIONS

- Answer **all** questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

1. *Escherichia coli* bacteria is used as a model for genetic engineering.
   1.1. Draw a labeled diagram of the genetic map of *Escherichia coli* (***20 marks***)
   1.2. Describe the importance of studying the genetic map of *Escherichia coli* (***20 marks***)
   1.3. Describe **Hfr** conjugation (***20 marks***)
   1.4. Describe interrupted mating (***20 marks***)
   1.5. Describe the term "F prime" (***20 marks***)

2. Transduction is the process of moving bacterial DNA from one cell to another using a bacteriophage.
   2.1. Describe the following terms
      2.1.1. Exogenote (***10 marks***)
      2.1.2. Endogenote (***10 marks***)
      2.1.3. Merodiploid (***10 marks***)
      2.1.4. Generalized Transduction (***15 marks***)
      2.1.5. Specialized Transduction (***15 marks***)
   2.2. Briefly describe the term "transduction mapping experiment". (***30 marks***)
   2.3. Name **one** example that transduction process is used in clinical practice. (***10 marks***)

3. All biochemical processes are genetically controlled. Different steps of the reaction involve different enzymes.
   3.1. Briefly describe the gene expression process seen in eukaryotes. (***15 marks***)
   3.2. Briefly describe frame shift mutation and its consequences in the process of gene expression. (***15 marks***)

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3.4. A -----> B -----> C-----> D

x y z

Above reaction shows a biochemical reaction involving metabolism of substrate A in to product B. The enzymes involved are x, y and z. A patient was diagnosed as having a nonsense mutation in the coding region of the gene responsible for enzyme Z.

Briefly describe the pathogenesis of the phenotype. ***(25 marks)***

3.5. State the karyotypes of the following conditions

3.5.1. Down syndrome ***(05 marks)***

3.5.2. Edward syndrome ***(05 marks)***

3.5.3. Klinefelter syndrome ***(05 marks)***

3.5.4. Turner syndrome ***(05 marks)***

3.5.5. Cystic fibrosis ***(05 marks)***

3.5.6. Thalassaemia ***(05marks)***

4.

4.1. Briefly describe Mendel`s laws in genetics. ***(30 marks)***

4.2. Consider **three** gene pairs, *Aa*, *Bb* and *Cc*, each of which affects a different character. In each case, the uppercase letter signifies the dominant allele. The three genes are located on different chromosomes. Calculate the probability of obtaining:

4.2.1. An *Aa BB Cc* zygote from a cross of *Aa Bb Cc* x *Aa Bb Cc*

4.2.2. An *Aa BB cc* zygote from a cross of *aa BB Cc* x *AA bb CC*

4.2.3. An *A B C* phenotype from a cross of *Aa Bb CC* x *Aa Bb cc*

4.2.4. An *a b c* phenotype from a cross of *AA BB CC* x *AA BB CC* ***(40 marks)***

4.3. The tailless trait in the mouse results from an allele of a gene in chromosome 17. The cross tailless × tailless produces tailless and wild type progeny in a ratio of 2 tailless: 1 wild type. All tailless progeny from this cross when mated with wild type, produce a 1 : 1 ratio of tailless to wild type progeny.

4.3.1. Is the allele for the tailless trait dominant or recessive?

4.3.2. What genetic hypothesis can account for the 2: 1 ratio of tailless: wild type and the results of the crosses between the tailless animals? ***(30 marks)***

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