MOLECULAR AND CELL BIOLOGY 111 (MLB 111)
MOLEKULÊRE EN SELBIOLOGIE 111 (MLB 111)

SECOND SEMESTER TEST / *TWEEDE SEMESTERTOETS*

2006-05-12

MARKS / *PUNTE* : 100
TIME / *TYD* : 100 MIN

EXAMINER / EKSAMINATOR:
Dr Q Kritzinger

The test paper consists of 13 questions and 12 pages. **VERIFY IT !!**
Die toetsvraestel bestaan uit 13 vrae en 12 bladsye. ***KONTROLEER DIT !!***

QUESTION / *VRAAG* 1: **[7]**

Indicate whether the following statements are **true or false**. **Motivate** your answer. */ Dui aan of die volgende stellings* ***reg of verkeerd*** *is.* ***Motiveer*** *u antwoord.*

1.1 In his transformation experiments, Griffith observed that mixing a heat-killed nonpathogenic strain of bacteria with a living pathogenic strain makes the pathogenic strain nonpathogenic. */ In sy transformasie eksperiment, het Griffith waargeneem dat die menging van 'n hitte-dood nie-patogeniese tipe bakterie met 'n lewende patogeniese tipe, die patogeniese tipe nie-patogenies gemaak het.*

.....

.....

1.2 It became apparent to Watson and Crick after completion of their model that the DNA molecule could carry a vast amount of hereditary information in its phosphate-sugar backbones. */ Na afloop van die bou van hul model, het Watson en Crick opgemerk dat die DNA molekule 'n groot hoeveelheid oorerflike inligting in sy fosfaat-suiker ruggraat kon dra.*

.....

.....

1.3 Complementary base pairing always pairs a purine with a pyrimidine. */ Komplementêre basis-paring paar altyd 'n purien met 'n pirimidien.*

.....

.....

1.4 Bacteriophages used in Hershey and Chase's experiments showed that DNA remained on the outer membrane of bacteria. */ Bakteriofage, wat in eksperimente van Hershey en Chase gebruik is, het gewys dat DNA agter bly op die buitemembraan van bakterieë.*

.....

.....

1.5 The wobble hypothesis states that certain tRNA anticodons can pair with more than one codon sequence. / *Die 'wobble' hipotese stel dat sekere tRNA antikodons met meer as een kodon-volgorde kan paar.*

.....

.....

1.6 Beadle and Tatum's experiments led to the one gene – one polypeptide hypothesis. / *Beadle en Tatum se eksperimente het gelei tot die een geen – een polipeptied hipotese.*

.....

.....

1.7 In order to produce many copies of a protein fast, the prokaryotic cell uses accelerated uncoupled transcription and translation. / *Om baie kopieë van 'n proteïen vinnig te produseer, maak die prokariotiese sel gebruik van versnelde, ongekoppelde transkripsie en translasie.*

.....

.....

QUESTION / *VRAAG* 2: **[4]**

2.1 Cytosine makes up 38% of the nucleotides in a DNA sample from an organism. Approximately what percentage of the nucleotides in this sample will be thymine? / *Die nukleotiedes in 'n DNA monster van 'n organisme word uit 38% sitosien saamgestel. Wat sal die persentasie timien van die nukleotiedes in diè monster min of meer wees?*

.....

2.2 What kind of chemical bond is found between paired bases of the DNA double helix? / *Watter tipe chemiese binding ontstaan tussen gepaarde basisse in die DNA-heliks?*

.....

2.3 What happens to a nucleoside triphosphate when added to the 3' end of the growing DNA strand? / *Wat gebeur met 'n nukleosied trifosfaat wanneer dit aan die 3' ent van 'n groeiende DNA draad bygevoeg word?*

.....

2.4 According to Meselson and Stahl, the manner in which DNA replicates is known as? / *Volgens Meselson en Stahl, staan die manier hoe DNA repliseer bekend as?*

.....

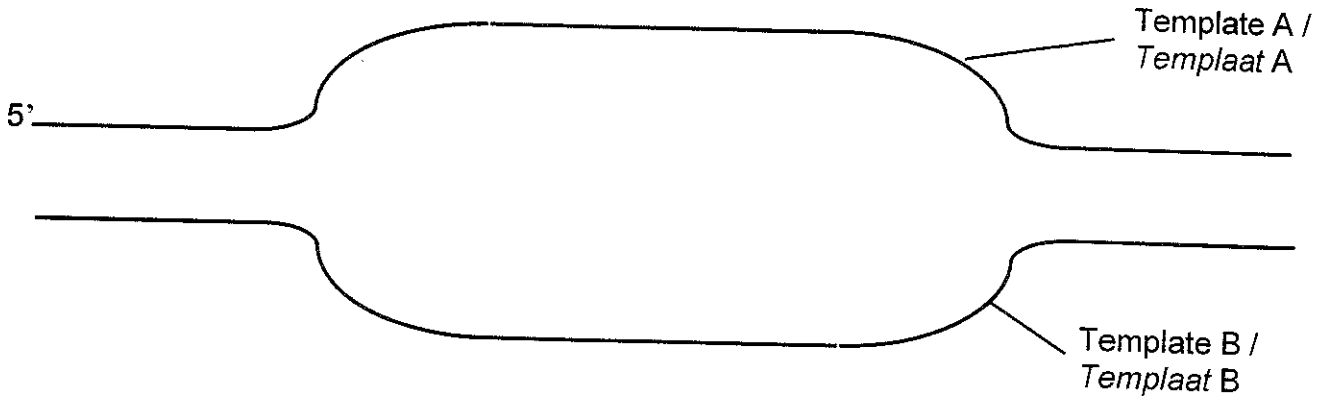
QUESTION / *VRAAG* 3: **[12]**

3.1 Match each enzyme with its most suitable function or description. Write the letter of the function next to the correct enzyme in column B. / *Pas elke ensiem by sy mees toepaslike funksie of beskrywing. Skryf die letter van die funksie langs die korrekte ensiem in kolom B.*

(5)

A	B	C
3.1.1 helicase / *helikase*		a. removes the RNA nucleotides of the primer and adds equivalent DNA nucleotides to the 3' end of Okazaki fragments / *verwyder die RNA nukleotiedes van die primer (voorvoerder) en voeg ekiwalente DNA nukleotiedes aan die 3' ent van Okazaki fragmente by*
3.1.2 nuclease / *nuklease*		b. covalently connects segments of DNA / *las segmente van DNA d.m.v. kovalentbindings*
3.1.3 ligase / *ligase*		c. synthesizes short segments of RNA / *sintetiseer kort segmente van RNA*
3.1.4 DNA polymerase I / *DNA polimerase I*		d. separates the DNA strands during replication / *skei die DNA drade tydens replikasie*
3.1.5 primase / *primase*		e. DNA-cutting enzymes used in the repair of DNA damage / *DNA-uitsnydingsensieme gebruik in die herstel van DNA skade*

3.2 The following incomplete diagram of a replication bubble indicates a region on a DNA molecule where DNA replication is taking place. The two DNA templates are indicated by A and B, respectively. Complete the diagram by indicating the following **very clearly on the diagram**: / *Onderstaande onvoltooide skets van 'n replikasieborrel dui die plek op 'n DNA molekule aan waar DNA replikasie plaasvind. Die twee DNA template word aangedui deur A en B. Voltooi die skets deur die volgende baie **duidelik op die skets** aan te dui:*



(a) The synthesis of the leader strand on **template B**. You have to indicate the nucleic acid components of the strand and the direction in which strand elongation is occurring. / *Die sintese van die leierdraad op **templaat B**. U moet die nukleïensuurkomponente van die draad sowel as die rigting van kettingverlenging aantoon.*

(2)

(b) The synthesis of an Okazaki fragment on **template A**. You have to indicate the nucleic acid components of the strand and the direction in which strand elongation is occurring. / *Die sintese van 'n Okazaki fragment op **templaat A**. U moet die nukleïensuurkomponente van die draad sowel as die rigting van kettingverlenging aantoon.*

(2)

(c) The region on **template B** where the DNA polymerase III enzyme is active. / *Die gebied op **templaat B** waar die DNA polimerase ensiem III aktief is.* (1)

(d) The region where single-stranded proteins are active. / *Die gebied waar enkel-draad proteïene aktief is.* (1)

(e) The region on **template A** where new primers will form. / *Die gebied op **templaat A** waar nuwe primers (voorvoerders) gaan vorm.* (1)

QUESTION / *VRAAG* 4: [6]

How does a transcription initiation complex form? Your answer must include the different components thereof and the functions of the components. / *Hoe word 'n transkripsie inisiasiekompleks gevorm? In jou antwoord, moet jy die verskillende komponente noem sowel as elkeen se funksie.* (6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

QUESTION / *VRAAG* 5: [8]

5.1 Why is it advantageous for the cell to use RNA as a template for protein synthesis instead of translating proteins directly from the DNA? / *Hoekom is dit voordelig vir die sel om RNA te gebruik as 'n templaat vir proteïensintese eerder as om proteïene direk vanaf DNA te vertaal?* (2)

.....

.....

.....

.....

5.2 Explain what happens to both the 5' and 3' ends of a pre-mRNA strand during mRNA alteration in eukaryotes. Name the functions of these alterations. / *Verduidelik wat gebeur met beide die 5' en 3' ente van 'n pre-mRNA draad tydens mRNA wysiging. Noem die funksies van hierdie wysigings?* (5)

.....

.....

.....

.....

.....

.....

.....

.....

.....

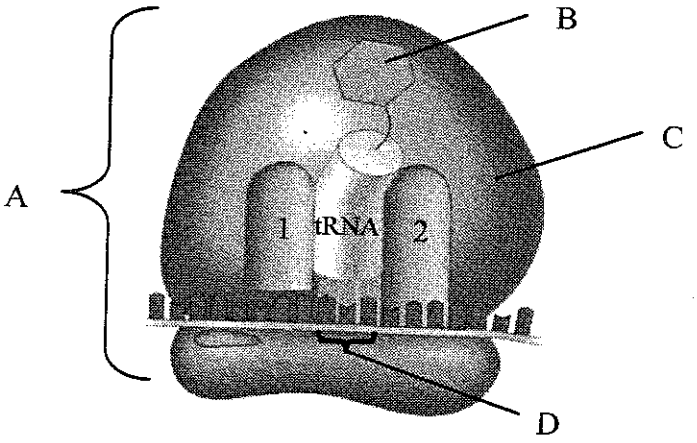
.....

5.3 Where in the cell do these alterations take place? / *Waar in die sel vind hierdie wysigings plaas?* (1)

.....

QUESTION / *VRAAG* 6: [14]

Answer the following questions by referring to the supplied figure. / *Beantwoord die volgende vrae aan die hand van die gegewe figuur.*



6.1 Where in the cell would this structure (A) be found? / *Waar in die sel sal die struktuur (A) voorkom?* (1)

.....

6.2 Name the enzyme responsible for the attachment of structure B to the tRNA molecule. / *Noem die ensiem verantwoordelik vir die hegting van struktuur B aan die tRNA molekule.* (1)

.....

6.3 By clearly indicating **on** the figure, give the orientation (direction) of the mRNA strand. / *Dui duidelik aan **op** die skets, die orientasie (rigting) van die mRNA draad.* (1)

6.4 Provide the correct labels for A, C en D. / *Verskaf die korrekte byskrifte vir A, C en D.* (3)

A. .....

C. .....

D. .....

6.5 Name the sites 1 and 2 on structure C. State what happens at these two sites, respectively. / *Noem die setels 1 en 2 op struktuur C. Wat gebeur by elk van die setels, onderskeidelik?* (4)

1. .....

.....

.....

.....

2. .....

.....

.....

.....

6.6 Briefly explain the events during termination of translation. / *Beskryf kortliks die gebeurtenisse tydens terminering van die translasie.* (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

QUESTION / *VRAAG* 7: **[6]**

Complete the following statements. / Voltooi die volgende stellings.

7.1 Only ..... are found in mature mRNA transcripts, because the ..... were removed by the action of ..... , which consist of proteins and several snRNP's. /

In volwasse mRNA-transkripte sal slegs ..... voorkom want die ..... is verwyder deur die werking van ..... , wat uit proteïene en menige snRNP's bestaan.

7.2 A ribozyme is a ..... molecule that acts like an ..... . /

'n Ribosiem is 'n ..... molekule, wat soos 'n ..... optree.

7.3 ..... is linked with proteins in forming large and small subunits of a cytoplasmic structure. /

..... is met proteïene verbind om groot en klein subeenhede van 'n sitoplasmiese struktuur te vorm.

QUESTION / *VRAAG* 8: **[9]**

Given below is the first part of the template or coding strand of a DNA molecule. Answer the questions and use the codon table at the back of the paper where required. / *Hieronder is die eerste gedeelte van die templaat of kodeerdraad van 'n DNA molekule. Beantwoord die vrae en gebruik die kodontabel agter aan u vraestel waar nodig.*

3'-TACTTGTCCGATATC-5'

8.1 Give the corresponding mRNA sequence. Indicate the orientation (direction) of the nucleic acid. / *Gee die ooreenstemmende mRNA-volgorde.* Dui die orientasie (rigting) van die nukleïensuur aan. (3)

.....

8.2 How many amino acids would you find in the corresponding polypeptide? / *Hoeveel aminosure is daar in die ooreenstemmende polipeptied?* (1)

.....

8.3 Name the final amino acid that will be incorporated. / *Noem die laaste aminosuur wat ingebou sal word.* (1)

.....

.....

8.4 The first base of the fourth codon (on the DNA template) mutates from a G to a C, after exposure of the DNA to a mutagen. What will the effect of this type of point mutation be? Be sure to give the name of this type of point mutation. / *Die eerste basis van die vierde kodon (op die DNA-templaat) muteer vanaf 'n G na 'n C, na blootstelling van die DNA aan 'n mutagens. Wat sal die effek van hierdie puntmutasie wees? Onthou om die naam van hierdie tipe puntmutasie te gee.* (2)

.....

.....

.....

.....

8.5 What will happen if, due to the action of a mutagen, an extra base is inserted between the first codon (TAC) and the second codon (TTG) of the DNA template? / *Wat sal gebeur indien daar, as gevolg van die aksie van 'n mutagens, 'n ekstra basis ingevoeg word tussen die eerste kodon (TAC) en die tweede kodon (TTG) van die DNA-templaat?* (2)

.....

.....

.....

QUESTION / *VRAAG* 9: [4]

9.1 Who first proposed the idea of mobile genetic elements, transposons? / *Wie het eerste die idee van beweeglike genetiese elemente, transposons, voorgestel?* (1)

.....

9.2 By which two mechanisms do transposons move within the genome? / *Deur watter twee meganismes kan transposons in die genoom beweeg?* (2)

.....

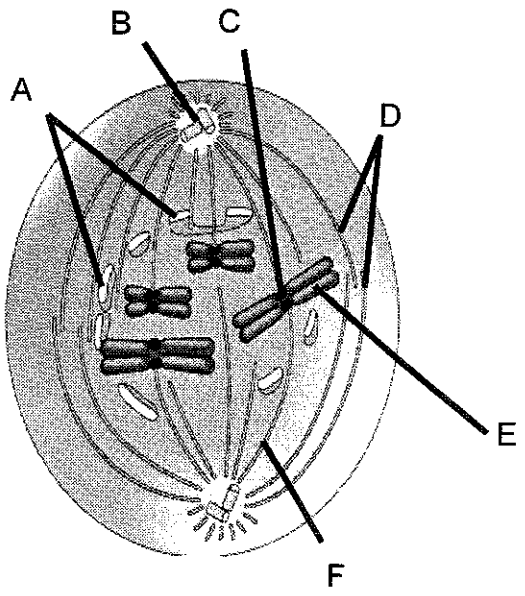
.....

9.3 What do retrotransposons need in order to move within the genome? / *Wat benodig retrotransposons sodat hulle in die genoom kan beweeg?* (1)

.....

QUESTION / *VRAAG* 10: [12]

10.1 Answer the following questions by referring to the supplied figure. / *Beantwoord die volgende vrae aan die hand van die gegewe figuur.*



10.1.1 Which mitotic phase is represented in the figure? / *Watter mitotiese fase word deur die figuur aangedui?* (1)

.....

10.1.2 Provide the labels for A – F. / *Verskaf byskrifte vir A – F.* (6)

A. ..... B. .....

C. ..... D. .....

E. ..... F. .....

10.1.3 What is the function of structure D? / *Wat is die funksie van struktuur D?* (1)

.....

.....

10.2 Differentiate between chromatin and chromosomes: / *Onderskei tussen chromatien en chromosome:* (4)

.....

.....

.....

.....

.....

.....

QUESTION / *VRAAG* 11: [6]

Provide the correct term for each of the following descriptions. / *Gee die korrekte term vir elk van die volgende beskrywings.*

11.1 The phase of the cell cycle where DNA synthesis occurs. / *Die fase van die selsiklus waar DNA sintese plaasvind.*	
11.2 The proteins that associate with DNA to achieve the first level of DNA packaging. / *Die proteïene wat met DNA assosieer om die eerste vlak van DNA verpakking te bereik.*	
11.3 Regulatory proteins required by kinases to become active. / *Regulator proteïene wat deur kinases benodig word om aktief te word.*	
11.4 The mitotic phase in which nuclei reform in the daughter cells. / *Die mitotiese fase waar kerne hervorm in die dogterselle.*	
11.5 The physical or chemical expression of an organism's genes. / *Die fisiese of chemiese uitdrukking van 'n organisme se gene.*	
11.6 The type of cell division that bacteria use as a means to reproduce. / *Die tipe seldeling wat bakterieë gebruik om te kan voortplant.*	

QUESTION / *VRAAG* 12: [7]

12.1. Explain how cytokinesis is different in plant and animal cells. / *Verduidelik hoe sitokinese in plant- en dierselle verskil.* (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

12.2 What will happen to a cell if it does not receive a go-ahead signal at the G_1 checkpoint in the cell cycle? / *Wat sal met 'n sel gebeur as dit nie 'n "gaan-voort" sein by die G_1 beheerpunt in die selsiklus ontvang nie?* (1)

.....

.....

.....

12.3 How does the M-phase promoting factor (MPF) promote mitosis? / *Hoe bevorder die M-fase bevorderingsfaktor (MPF) mitose?* (2)

.....

.....

.....

QUESTION / *VRAAG* 13: [5]

13.1 Why is it necessary for prokaryotes to regulate their gene expression? / *Waarom is dit vir prokariote nodig om hulle geenuitdrukking te beheer?* (2)

.....

.....

.....

13.2 Describe what happens to the *trp* operon when tryptophan levels are high? / *Verduidelik wat met die* trp *operon sal gebeur indien triptofaan vlakke hoog is?* (2)

.....

.....

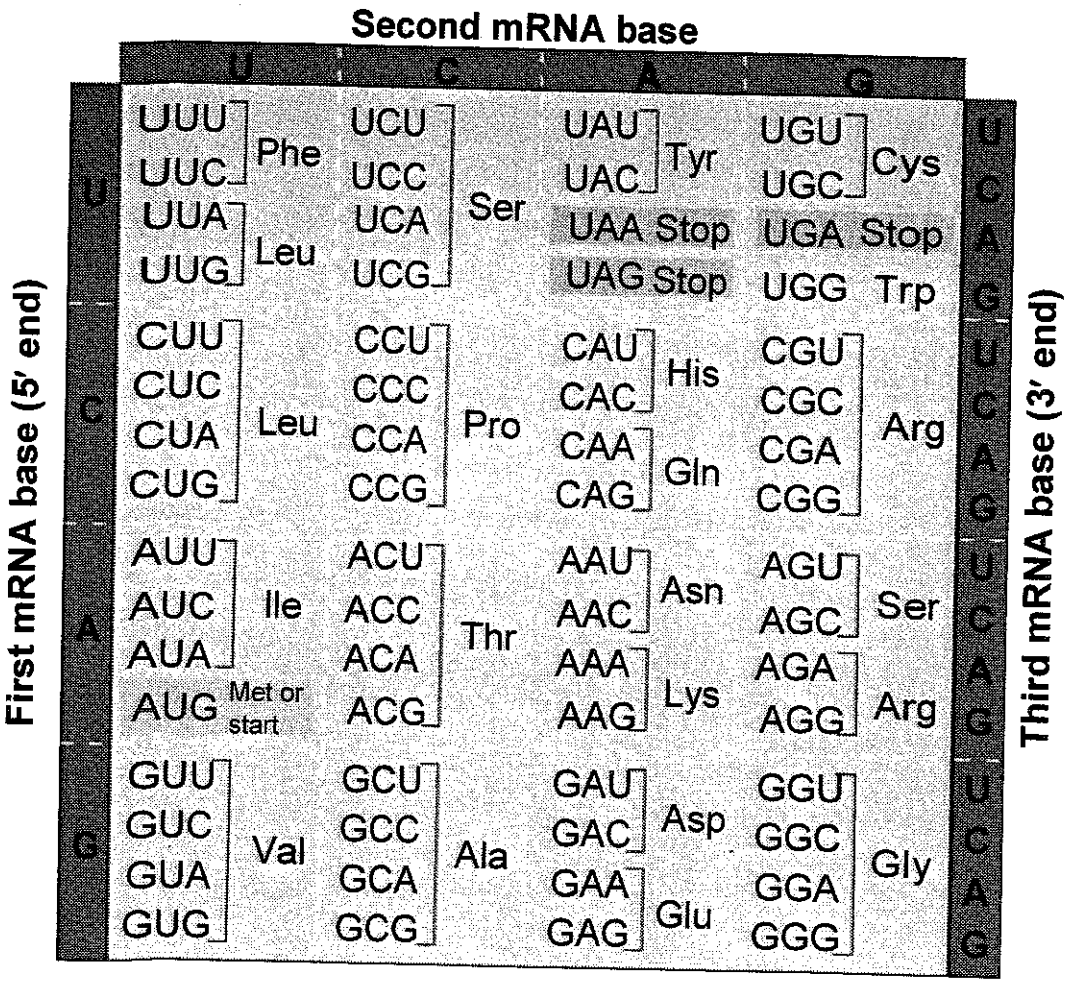
.....

.....

.....

13.3 Name the inducer molecule in the *lac* operon. / *Gee die naam van die induseerende molekule in die* lac *operon.* (1)

.....


Second mRNA base
U
C
A
G
First mRNA base (5′ end)
Third mRNA base (3′ end)
UUU Phe
UUC
UUA Leu
UUG
UCU
UCC
UCA
UCG Ser
UAU Tyr
UAC
UAA Stop
UAG Stop
UGU Cys
UGC
UGA Stop
UGG Trp
CUU
CUC
CUA
CUG Leu
CCU
CCC
CCA
CCG Pro
CAU His
CAC
CAA Gln
CAG
CGU
CGC
CGA
CGG Arg
AUU
AUC
AUA Ile
AUG Met or start
ACU
ACC
ACA
ACG Thr
AAU Asn
AAC
AAA Lys
AAG
AGU Ser
AGC
AGA
AGG Arg
GUU
GUC
GUA
GUG Val
GCU
GCC
GCA
GCG Ala
GAU Asp
GAC
GAA Glu
GAG
GGU
GGC
GGA
GGG Gly