ZAGAZIG UNIVERSITY FACULTY OF VETERINARY MEDICINE ANIMAL WEALTH DEVELOPMENT DEPT.

Code: ANWD-106



Genetics and Genetic Engineering Exam. First Year Students

June 4, 2014

Time allowed: 2 hours

Answer the following questions: (Total points 100 equal 25 Degrees): (Questions on 1 - 6 pages)

I. Choose the correct answer: (15 points)

- 1. Which of the following describes a DNA molecule?
 - a) Double helix of glucose sugars and phosphates.
 - b) Ladder-like structure composed of fats and sugars.
 - c) Double chain of nucleotides joined by hydrogen bonds.
 - d) A chain of alternating phosphates and nitrogenous bases.

2. If you add thymidine monophosphate in place of thymidine triphosphate in a DNA synthesis reaction, what would happen?

- a) Leading strand synthesis would not occur.
- b) Lagging strand synthesis would not occur.
- c) DNA synthesis would be unaffected.
- d) A and B
- 3. A function of transfer RNA (tRNA) is to:
 - a) Stay in the nucleus and be copied by DNA.
 - b) Carry amino acids to the growing polypeptide chain.
 - c) Copy DNA and carry the information to the ribosome.
 - d) Read the codons and provide the site for protein synthesis.
- 4. A polypeptide found in the cytoplasm of a cell contains 12 amino acids. How many nucleotides would be required in the mRNA for this polypeptide to be translated?
 a) 48. b) 12. c) 24. d) 36.
- **5. During protein synthesis, peptide bonds are formed at the:** a) Nucleus. b) Nucleolus. c) Lysosomes. d) Ribosomes.
- 6. Use the following events to answer the question. 1. mRNA is formed. 2. DNA segment opens. 3. mRNA attaches to ribosomes. 4. amino acids form peptide bonds. 5. tRNA carries amino acids to mRNA. The correct order of events required for protein synthesis is:
 - a) 1, 2, 3, 4, 5. b) 2, 1, 3, 4, 5. c) 2, 1, 3, 5, 4. b) 2, 1, 3, 4, 5. d) 2, 1, 4, 5, 3.

7. A mutation to DNA polymerase that eliminated the 3'-to-5' exonuclease activity would prevent:

- a) Ligation of the okazaki fragments.
- b) Removal of the RNA primer.
- c) Removal of base mismatches.
- d) Repair of deaminated bases.

8. Which of the following statements is NOT correct?

- a) Prokaryotes have a single point of origin for DNA replication.
- b) Eukaryotes can have multiple points of origin for DNA synthesis in each individual chromosome.
- c) Prokaryotes have a circular chromosome.
- d) Eukaryotic organisms exhibit unidirectional DNA replication because they have linear chromosomes.
- 9. Which of the following represents the correct order of events as they occur in the process of DNA replication?
 - a) Helicase opens helix, Pol III elongates primer and synthesizes leading and lagging strands, DNA ligase links fragments of DNA.
 - b) Primase synthesizes primer, Pol I excises primer, Pol III elongates primer and synthesizes leading and lagging strands.
 - c) Primase synthesizes RNA primer, Pol III synthesizes lagging and leading strands, helicase open helix.
 - d) Helicase opens helix, Pol III synthesizes RNA primer of leading strand, Pol I excises primer and fills gap.
- 10. What genetic phenomenon explains the following paradox: There are 64 possible codons, but only 30-40 tRNA types.
 - a) Non-redundancy. b) Commaless code.
 - c) Wobble. d) Translocation.
- 11. E. coli is able to use foods other than glucose in the absence of available glucose, because falling levels of glucose cause an increase of:
- a) cAMP. b) CAP. c) Lactase. d) tRNA. 12. The first level of primary control in eukaryotic gene activity is ------ control.
- a) Feedback. b) Translational. c) Transcriptional. d) Post transcriptional.
- 13. Problems in obtaining large amounts of proteins encoded by recombinant genes can often be overcome by the use of these special cloning vectors
 a) BACs.
 b) Expression vectors.
 c) YACs.

14. Photoreactivation repair mechanism is act by:

a) Damage reversal. b) Damage removal. c) Damage tolerance.

15. changes a sense codon into a nonsense codon:

- a) Missense mutation. b) Nonsense mutation.
- c) Silent mutation. d) Neutral mutation.

II. Complete the following statements: (20 points)

- 1. The loss of a purine base from a nucleotide producing an apurinic site is known as
- 2. Types of Base substitutions -----and -----
- **3.** In ----- method DNA is mixed with calcium phosphate and over layered on the host cells. This results in the uptake of the external DNA by these host cells.
- 4. In inducible operons, transcription is normally ------ and must be turned ------.
- 5. ----- vectors replicate in both prokaryotic and eukaryotic hosts.



7. Label the 5' and 3' ends of DNA and RNA and the amino and carboxyl ends of the protein. Assume it is read left to right and the columns represent transcriptional and translational alignments.

******* N.B:(A copy of the codons table is on the last page of this exam)********

DNA double	С									
helix								Т	G	Α
mRNA		С	Α					U		
tRNA anticodon					G	С	Α			
Amino acid				Trp						

III. Put ($\sqrt{}$) or (X) and if (X) correct the underlined words: (10 points)

- 1. <u>Damage reversal</u> is a simplest; enzymatic action restores normal structure without breaking backbone. ()
- 2. In <u>transversion</u> a purine is replaced by a different purine or, alternatively, a pyrimidine is replaced by a different pyrimidine.
- 3. Proteins that block the passage of RNA polymerase are called <u>repressors</u>. (
- 4. In Repressible operons transcription is normally <u>on</u> and must be turned <u>off</u>. (
- 5. Condensed chromatin <u>represses</u> gene expression.
- 6. <u>Type I restriction enzymes</u>: recognize specific sequences and cut the DNA within the recognition sequence. ()
- 7. <u>Bacterial artificial chromosomes (BACs)</u> are the cloning vectors based on the extra- chromosomal plasmids of E. coli called F factor or fertility factor. ()
- 8. In <u>Microinjection method</u> the microscopic particles of gold or tungsten coated with the DNA of interest is bombarded into the cells at a high velocity. ()
- 9. <u>Base analogs</u> are chemicals with structures similar to that of any of the four standard bases of DNA.
- 10. <u>Frameshift mutation</u> is the alternation of a single nucleotide in the DNA. (

IV. Answer the followi	ing questions: (55 p	o int s)	
1.a. What is the requirem	ent for DNA sequence?	,	
1	•••••	2	•••••
5	••••••	4	•••••
b. Relate to the followin gel produced using lanes represent the r which were loaded at	ng diagram, which repute the Sanger chain terre reaction products from t the top of the gel (A,G	resents a region of a I nination technique. the four separate la c,C,T):	DNA sequencing The individual beling reactions
	Reading 5' to 3', the synthesized in this pr	e DNA sequence of t ocedure	he strand being
	Synthesized strand: 5 Template strand : 5'.	;' <u></u>	3' 3'
2. a. The genomic library cDNA library applics 1	is ations:	2	
3		4	••••••
b. Calculate the numbe DNA equal 3 x 10 ⁹ b	r of clones that constitue and use plasmid vectors	ite a genomic library	if genomic
The number of clone	s that constitute a geno	mic library depends	on:
1	-		
2 Number of clones –	•••••		
3. a. Electrophoresis patte	ern of PCR-amplified D	NA fragments repres	sent individuals
from same family (F	ather, Mother, Child)		
1- Lane (1) represent	••••••		
3- Lane (3) represent	L •••••••••••		
h Dool time nelymores	a chain reaction (aDCE) classified into 2 typ	
1			C5.
2	••••••	•••••	
4. a. What is a Primer-Din Primer- dimor is	ner and Factor affectin	g annealing temp.?	
1 1 111101 - UIIII01 15	(ξ)	•••••	

Factor affecting annealing temp......

- **b.** Calculate the PCR Annealing Temp to ATCGGACTACCGA primer Tm =
 - Annealing temp =
- 5. a. Define Genetic marker and enumerate its types.
 - Genetic marker is **Types: 1-**..... 2- 3-
 - 4-
 - b. The accompanying gel diagram includes the phenotype of two parents (A and B) with respect to two different RAPD polymorphism. Each parent is homozygous for an allele associated with a band defining a RAPD polymorphism. the two RAPD polymorphisms are at different loci and undergo independent assortment. In the gel diagram, indicate the expected phenotype of the F1 progeny as well as all possible phenotypes of the F2 progeny, along with their expected proportions.



6.a. What are the application of genetic man	rker ?
1	2
3	4
5	6
b. How many different VNTRs alleles a	and genotypes would be expected in the
population for this locus ?	
Number of alleles =	
Number of genotypes=	
7. Define and classify genetic disorder.	
Genetic disorder is	
Genetic disorder classified into:	
A I example	
1	
2	
3	
4	
A II example	
1	
(°)

2
A III
3. a. Define and classify gene therapy
Gene therapy is
Gene therapy classifed into
b. Diagrammatically describe the method of southern blot:

9. m.RNA processing:

10. Ergosomes:

11. a. Illustrate with diagram (only) the Operon Structure:

b. Mention types of restriction enzymes :

			Secon	d Letter			
		U	с	A	G		
1st letter	U	UUU Phe UUC UUA Leu UUG	UCU UCC Ser UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G	
	с	CUU CUC Leu CUA CUG	CCU CCC Pro CCA CCG	CAU His CAC CAA GIN CAG CAG	CGU CGC Arg CGA CGG	U C A G ^{3rd}	
	A	AUU AUC lie AUA AUG Met	ACU ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U letter C A G	
	G	GUU GUC Val GUA GUG	GCU GCC Ala GCA GCG	GAU Asp GAC GAA GIU GAG GIU	GGU GGC Gly GGA GGG	U C A G	With Our Best Wishes!
	The codons table)	