BIO 2133 GENETICS
Midterm examination #1
Version 1 – BIO2133AA
Worth either 15% or 20% of your final grade
Total points on this exam is 65 pts

Saturday, February 4th, 2012

a) Place your name and student number in the space provided below. Be sure that your name, or student number, is on the top of each of the following pages – the exam may be separated for grading purposes.

b) Answer all questions in the space provided on the exam. **Do not transfer answers to the back of the page!!!!**

c) You may use either pencil or ink for your answers.

d) Answers as written paragraphs are preferred but point form is acceptable as long as the points are logically organized and not random statements or facts.

e) This is not an open book exam.

f) A uOttawa approved calculator is permitted.

g) Answers to multiple choice questions must be provided on the scantron card. Please fill in your information on the scantron **and enter the course code as BIO2133AA**

Name: _____

Student number: _____

Course Section (circle your section):

Section A , Section B, Section C

Name:_____ Student#:_____

SECTION A: MULTIPLE CHOICE QUESTIONS (20 PTS)
Choose the single best answer. Note: some questions have 4 choices and others 5.

1. The DNA of an organism is studied and found to contain 14% guanine. This organism should have ____% thymine and ____% cytosine in its DNA.

   a. 36; 36
   b. 14; 36
   c. 36; 14
   d. 14; 86

2. Which of the following nucleotide sequences represents the complementary sequence that would bind to the DNA strand 5'-GACGTT-3'?

   a. 5'TCATGG̃3'
   b. 3̃'TCATGG̃5'
   c. 3̃'CTGCAÃ5'
   d. 3̃'AGTACC̃5'

3. Every protein is assembled on ____ according to instructions that are copied from ____.

   a. tRNAs; mRNAs
   b. mRNAs; tRNAs
   c. tRNAs; DNA
   d. ribosomes; DNA

4. The place where RNA polymerase first associates with DNA so that transcription can begin is called the ____ and is located ____ of the transcribed region.

   a. promoter; upstream
   b. initiator; downstream
   c. initiator; upstream
   d. promoter; downstream

Name:_____ Student#:_____

5. Suppose that during transcription of a eukaryotic gene, the RNA polymerase does not encounter a poladenylation signal. What transcription of this gene would be affected?

   a. no effect (the gene is transcribed normally)
   b. the pre-mRNA would be elongated
   c. the introns would be removed sooner
   d. the 5' cap would dissociate

6. At the start of translation the initiator tRNA is basepaired with the start codon at ____ in the ribosome.

   a. the A site
   b. first the A site, then the E site
   c. the P site
   d. first the A site, then the P site

7. Substitution of one base pair for another in a coding region of a gene can result in a ____ mutation where the changed codon codes for a stop codon where an amino acid was previously coded for.

   a. silent
   b. chromosomal
   c. nonsense
   d. missense

8. Assume that an mRNA molecule is synthesized using the following DNA template

   3̃'CTTACATGGCATCC̃5'

   See the genetic code table (last page of your exam). The second codon (counting the start codon as the first codon) directs incorporation of which amino acid in the polypeptide?

   a. asparagine
   b. tyrosine
   c. arginine
   d. proline

Name:_____ Student#:_____

9. Posttranslational modification includes

a. cleavage of poly-A tails from mRNA.
b. the binding of miRNAs to mRNA.
c. the chemical modification, processing, and degradation of proteins.
d. chromatin remodelling.

10. Eukaryotic chromosomes contain two general domains that relate to the degree of condensation. These two regions are _____.

a. called heterochromatin and euchromatin
b. void of introns
c. uniform in the genetic information they contain
d. separated by large stretches of repetitive DNA
e. each void of typical protein-coding sequences of DNA

11. Which of the following lists steps of mRNA production in eukaryotes in the correct order?

a. Transcription, 5' cap addition, addition of poly-A tail, exon splicing, passage through nuclear membrane
b. 5' cap addition, addition of poly-A tail, exon splicing, passage through nuclear membrane, transcription
c. Transcription, 5' cap addition, addition of poly-A tail, passage through nuclear membrane, exon splicing
d. Transcription, addition of poly-A tail, 5' cap addition, exon splicing, passage through nuclear membrane

12. If a typical somatic cell has 64 chromosomes, how many chromosomes are expected in each gamete of that organism?

a. 8
b. 16
c. 32
d. 64
e. 128

Name:_____ Student#:_____

13. In humans, the genetic basis for determining the sex "male" is accomplished by the presence of _____.

a. a portion of the Y chromosome
b. multiple alleles scattered throughout the autosomes
c. a balance between the number of X chromosomes and the number of haploid sets of autosomes
d. high levels of estrogen
e. one X chromosome

14. It has been recently determined that the gene for Duchenne muscular dystrophy (DMD) is over 2000 kb (kilobases) in length; however, the mRNA produced by this gene is only about 14 kb long. What is a likely cause of this discrepancy?

a. The introns have been spliced out during mRNA processing.
b. The DNA represents a double-stranded structure, while the RNA is single stranded.
c. When the mRNA is produced, it is highly folded and therefore less long
d. There are more amino acids coded for by the DNA than the mRNA
e. The exons have been spliced out during mRNA processing

15. Loosely aggregated DNA bound to proteins in a eukaryotic cell is called

a. nucleoid.
b. chromatin
c. chromosomes.
d. centromere.
e. chromatid.

16. Complementary base-pairing allows for

a. DNA to serve as its own template for replication.
b. replication to be semiconservative.
c. spontaneous mutations to occur.
d. covalent bonds to form between the opposite bases
e. genes to be expressed as a phenotype

Name:_____ Student#:_____

17. In eukaryotes, precursor mRNA molecules are processed in the

a. mitochondria
b. cytoplasm.
c. nucleolus
d. nucleus
e. ribosomes

18. Which parts of a eukaryotic gene are transcribed?

a. Only the introns
b. Exons, introns, promoter, and terminator sequence
c. Only the exons
d. It depends on the gene
e. Both the exons and introns

19. A mutation during DNA replication causes a G to be inserted after the first base of the codon for tryptophan. How will this affect the growing polypeptide chain?

a. Elongation will stop prematurely.
b. There will be a single amino acid substitution.
c. It will not be affected.
d. The reading frame will be shifted to the left, and the wrong amino acids will be added from this point on.
e. An extra amino acid will be added, but the reading frame will not be affected

20. Which of the following statements is true? All the somatic cells (the cells that do not contribute to the next generation) in your body contain:

a. The same DNA sequences and the same proteins
b. Different DNA sequences and different proteins
c. The same DNA sequences but different proteins
d. Different DNA sequences but the same proteins

Name:_____ Student#:_____

SECTION B: DEFINE TERMS (15 PTS)

Briefly explain what the following terms means. Where possible, include two solid pieces of information with a relevant example to which the term applies. **For this part, provide answers for 5 of the following 8 terms**. (Note: if you explain more than 5 terms, the first 5 will be evaluated). Each is worth **3pts.**

Posttranscription modification:

Mutations:

G-banding:

Homologous chromosomes:

SRY gene:

Genetic code:

Meiosis II:

tRNA:

Name:_____ Student#:_____

SECTION C: SHORTANSWER QUESTIONS: (15 PTS)

Answer 3 of the following 5 questions in the space provided.

1. Discuss the denaturation and renaturation characteristics of nucleic acids.(5 pts)

2. Name 3 common features typically found in a gene unit. For each, briefly discuss their role. (You may provide a diagram to support your answer – this is not required).(5 pts)

Name:_____ Student#:_____

3. What are VNTRs and STRs? Briefly discuss their significance for genetics. (5 pts)

4. Name 3 different types of mutations and describe how each can affect genes and the corresponding mRNAs and proteins. Provide examples for each. (5 pts)

Name:_____ Student#:_____

5. Discuss the sources of genetic variation during meiosis.

(Do not write below this line)

Name:_____ Student#:_____

SECTION D: LONG ANSWER QUESTIONS: (15 PTS)
Answer one (1) of the following two (2) questions. You may use this page and the next for your answer.

(Hint: Use your knowledge of genetics to answer either question)

1. Strepromycin is an antibiotic that binds the P site on the ribosome of *E. coli* and blocks the binding of the tRNA. Chloramphenicol inhibits the peptidyl transferase of bacterial ribosomes. Explain why these drugs can be used as antibiotics against bacterial infections.

Or

2. Alpha amanitin is found in poisonous mushrooms and irreversibly binds RNA polymerase in eukaryotic cells. Explain why eating poisonous mushrooms can be fatal.

Name:_____ Student#:_____

Name:_____ Student#:_____

Second base of codon

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

KEY

Ala = alanine
Arg = arginine
Asn = asparagine
Asp = aspartic acid
Cys = cysteine
Gln = glutamine
Glu = glutamic acid
Gly = glycine
His = histidine
Ile = isoleucine
Leu = leucine
Lys = lysine
Met = methionine
Phe = phenylalanine
Pro = proline
Ser = serine
Thr = threonine
Trp = tryptophan
Tyr = tyrosine
Val = valine