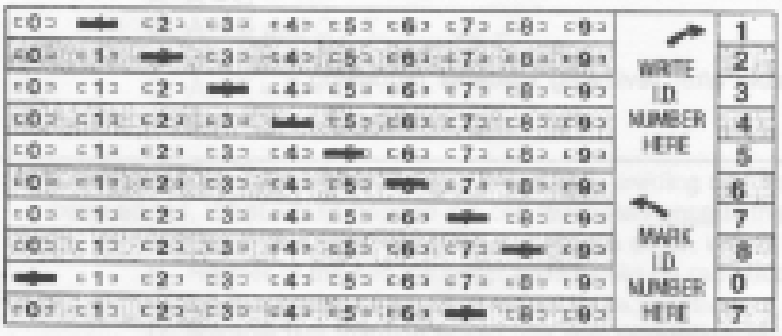
84 + 38.5 = 122/150

Bio 1A Lecture Exam 2 Summer 2002

Biology 1A - Lecture Exam #2 – August 5, 2002

NAME _____ **SECTION #** 106 **GSI NAME** Gary Underkofler

1. Sit in every fourth seat as directed. Sit in your assigned area. All books and papers should be placed on the floor. NO CALCULATORS ARE PERMITTED!
2. PRINT CLEARLY on this cover sheet: Your name, section # and GSI name.
3. Leave your exam face UP. When told to begin, check your exam to see that you have all of the pages.
4. Read all questions very carefully. If you have a question, raise your hand. A GSI will help you. The GSI will not give you the answer or explain scientific terms. Trivial answers will not receive credit. Each multiple choice question is worth two points unless stated otherwise. Always pick the one best answer.
5. Do not talk during the exam. The exam is closed book. No calculator is necessary, nor permitted.
6. Use a #2 pencil for the scantron form. **ERASE ALL MISTAKES COMPLETELY AND CLEARLY.**
7. On the scantron sheet, write in your student ID #, and the last two digits of your section number below that. Bubble in the appropriate numbers to the left as shown in the example below.



Your SID goes into the first 8 boxes, from top to bottom. (e.g. 12345678).

The last 2 digits of your section number goes into the bottom 2 boxes. (eg. 07).

8. On the back of the scantron, print your name **CLEARLY** in the space provided. Print your GSI's name in place of "subject".
9. You should have13 numbered pages. The exam is worth 150 pts. You have 80 minutes. You are NOT PENALIZED for guessing! (GUESS EVEN IF YOU NOT SURE)
10. LOCATE YOUR SECTION. Turn in your SCANTRON form to the SCANTRON ENVELOPE and your EXAM to the EXAM ENVELOPE for your section. YOU MUST TURN IN **BOTH** or else you will get a ZERO.
11. WHEN TOLD TO STOP- **STOP!** Bubble in guesses **BEFORE** THIS TIME!

DO NOT READ OR WRITE BELOW THIS LINE TODAY. FOR REGRADE USE LATER: _____

Regrade Instructions

To the Student:

Please review your regrade requests with your GSI first to make sure that the requests are valid. If the request is valid, please write your request on the back of this sheet. Your GSI must then initial it. (GSI's need to initial requests--otherwise, request will not be read.)

You may request **up to 3 questions only** to be regraded. Additional instructions are on the back of this sheet.

All regrade requests are due **Thursday August 14th by NOON** in the mailbox outside of 2088 VLSB. (If late, no regrading!)

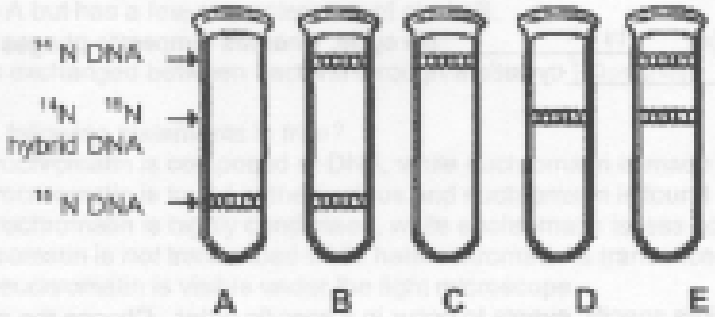
For the multiple choice portion of the exam there is always one best answer. Select it.

1. What does transformation involve in bacteria?
   A. the creation of a strand of DNA from an RNA molecule
   B. the creation of a strand of RNA from a protein molecule
   C. the infection of cells by a phage DNA molecule
   D. conservative replication shown by DNA
   (E) uptake of external DNA into a cell

2. All of the following statements apply to the Watson and Crick model of DNA *except*:
   A. The two strands of the DNA form a double helix.
   B. The distance between the strands of the helix is uniform.
   C. The framework of the helix consists of sugar-phosphate units of the nucleotides.
   (D) The two strands of the helix are held together by covalent bonds.
   E. The diameter of the DNA remains constant due to the pairing of a purine with a pyrimidine.

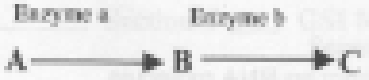
3. In an analysis of the nucleotide composition of DNA, which of the following is true?
   A. A = C
   B. A = G and C = T
   (C) A + C = G + T
   D. A + T = G + C
   E. Both B and C are true.

4. Suppose one were provided with an actively dividing culture of *E. coli* to which radioactive thymine had been added. What would happen if a cell replicated <u>once</u> in the presence of this radioactive base?
   A. One of the daughter cells, but not the other, would have radioactive DNA.
   B. Neither of the two daughter cells would be radioactive.
   C. All four bases of the DNA would be radioactive.
   D. Radioactive thymine would pair with nonradioactive guanine.
   (E) DNA in both daughter cells would be radioactive.



5. In the late 1950s Meselson and Stahl grew bacteria in a medium containing "heavy" nitrogen (^{15}N) and then transferred them to a medium containing ^{14}N. Which of the results in the figure above would be expected after one DNA replication in the presence of ^{14}N?

6. A new form of life is discovered. It has a genetic code much like that of organisms on Earth except that there are five different DNA bases instead of four and the base sequences are translated as doublets instead of triplets. What is the maximum number of amino acids that could be accommodated by this genetic code?
   A. 5
   B. 10
   (C) 25
   D. 64
   E. 32



7. Above is shown a simple metabolic pathway. One strain of a diploid organism is homozygous for a recessive allele coding for a defective enzyme *a*. Another strain is homozygous for a recessive allele coding for a defective enzyme *b*. Crossing those two strains will result in a strain that would grow on which of the following?
   A. A minimal medium supplemented with A
   B. A minimal medium supplemented with B
   C. A minimal medium supplemented with both A and B
   (D) All of the above will support the growth of the new strain.
   E. The new strain will not grow on the media described in choices A, B & C.

8. A particular triplet of bases in the **coding sequence** of DNA is AGT. What is the corresponding triplet in the anticodon of the tRNA molecule ?
   A. 3'- AGT- 5'
   (B) 3'- UCA- 5'
   C. 3'- TCA- 5'
   D. 3'- AGU- 5'
   E. 3'- TCA- 5' in eukaryotes, but UCA in prokaryotes

9. There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that
   A. some tRNAs have anticodons that recognize two or more different codons.
   B. the rules for base pairing between the third base of a codon and tRNA are flexible.
   C. inosine can hydrogen-bond with U, C, or A.
   (D) A and B are true.
   E. A, B, and C are true.

10. Virulent phages undergo a(n) _____ life cycle, whereas temperate phages are capable of undergoing a(n) _____ cycle.
   A. infective; retroviral
   B. lysogenic; lytic
   (C) lytic; lysogenic
   D. retroviral; infective
   E. infective; benign

11. Initiation of translation requires specific events to occur in a specific order. Choose the answer that correctly lists the following events of protein synthesis in the proper sequence. Not all events are listed.
   (2) 1. An aminoacyl-tRNA binds to the A site.
   (4) 2. A peptide bond forms between the new amino acid and a polypeptide chain.
   (3) 3. tRNA leaves the P site and the growing polypeptide attached to tRNA moves to the P site
   (1) 4. A small ribosomal subunit binds with mRNA.
   (5) 5. tRNA exits the ribosome.

   A. 1,3,2,4,5
   B. 4,1,5,2,3
   C. 5,4,3,2,1
   (D) 4,1,2,3,5
   E. 2,4,5,1,3

12. If a nucleotide is lost from the exon of a gene during the process of transcription, which of the following is most likely to happen?
A. snRNPs splice and then remove incorrect amino acids.
B. Normal termination does not occur; transcription continues indefinitely.
C. The reading frame is shifted, resulting in a nonfunctional polypeptide.
D. A signal-recognition protein moves in to correct coding errors.
E. There is little effect on the protein being synthesized due to redundancy of the genetic code.

13. The tryptophan operon is an example of a repressible operon. The enzymes produced by the operon catalyze the synthesis of tryptophan from the precursor molecule glucose. This operon is
A. permanently turned on.
B. turned on only when tryptophan is present.
C. turned off only when glucose is present.
D. turned on only when glucose is present.
E. turned off whenever tryptophan is added to the cell.

Use the following answers for the questions 14-17. The answers may be used once, more than once, or not at all. Select the best answer.
A. transduction
B. transposition
C. translation
D. transformation
E. conjugation

14. DNA from pneumonia-causing bacteria is mixed with harmless bacteria. The bacteria are injected into mice. The mice develop pneumonia and die.

15. DNA is transferred from one bacterium to another by a virus.

16. Bacterial strains A and B have been infected with viruses. Both strains are then grown together in the same medius. After a short period of time, a new strain of bacteria is detected that is very similar to strain A but has a few characteristics of strain B.

17. A plasmid is exchanged between bacteria through a pilus.

18. Which of the following statements is *true*?
A. Heterochromatin is composed of DNA, while euchromatin is made of DNA and RNA.
B. Heterochromatin is found in the nucleus and euchromatin is found in the mitochondria.
C. Heterochromatin is highly condensed, while euchromatin is less compact.
D. Euchromatin is not transcribed while heterochromatin is transcribed.
E. Only euchromatin is visible under the light microscope.

19. Assume that you are trying to insert a human gene into a plasmid. You are provided with human DNA fragments generated by digesting human DNA with the restriction enzyme X. Your gene of interest is flanked by DNA sequences which are recognized by the restriction enzyme Y. Your cloning vector, a plasmid, has a single site for Y, but not for X. Your best strategy should be to
A. ligate the human DNA fragments directly into the plasmid without cutting the plasmid.
B. cut the plasmid with restriction enzyme X and ligate the human DNA fragments
C. cut the human DNA fragments with restriction enzyme Y and ligate these fragments into the plasmid cut with the Y restriction enzyme.
D. cut the plasmid with restriction enzyme Y and ligate the human DNA fragments
E. cut the human DNA fragments with restriction enzyme Y and ligate these fragments into the plasmid cut with the X restriction enzyme.

20. Which of the following is an example of transcriptional control of gene expression?
    A. mRNA is stored in the cytoplasm and needs a control signal to initiate translation.
    B. mRNA exists for a specific time before it is degraded.
    C. Numerous ribosomes translate the same molecule of rRNA. (polyribosomes).
    D. RNA processing occurs before mRNA exits the nucleus.
    E. Transcription factors bind to the enhancer and promoter regions.

21. The human genome contains approximately 30,000 genes but encodes more than 100,000 proteins. This is achieved primarily through
    A. genetic recombination
    B. changing chromatin structure
    C. protein degradation
    D. alternative splicing
    E. independent assortment during meiosis

22. Developmental information can come from
    A. maternal substances
    B. induction by neighboring embryonic cells
    C. proteins encoded by the embryo's DNA
    D. all of the above
    E. only A and B are true

23. Cancer cells
    A. ignore density-dependent inhibition
    B. exhibit anchorage dependence
    C. are stuck in G_0
    D. result from a single mutation
    E. obey cell cycle controls

24. Once absorbed, most food molecules are used
    A. for biosynthesis
    B. for heat production
    C. for cellular respiration
    D. in excretion
    E. none of the above

25. Cells containing mitochondria include
    A. parietal cells
    B. epithelial cells of microvilli (brush border)
    C. red blood cells
    D. all of the above
    E. only A and B.

26. Blood exiting the right ventricle first enters the pulmonary artery
    A. right atrium
    B. left ventricle
    C. pulmonary artery
    D. pulmonary vein
    E. aorta

27. Which of the following statements is incorrect?
    A. some amino acids are essential
    B. some unsaturated fatty acids are essential
    C. some nucleic acids are essential
    D. some vitamins are fat soluble
    E. no essential minerals are toxic when in excess

28. Which of the following is true concerning the control of heart rhythm?
   A. The AV node is typically the pacemaker
   B. The SA node is located in the left atrium
   C. The left atrium and left ventricle contract simultaneously
   D. The left atrium and the right atrium contract simultaneously
   E. The nervous system does not affect heart rhythm

29. While cloning a gene, a student forgot to add antibiotic to the media. He did remember to add Xgal and LB (food). Once he plates out his transformation experiment, what will his petri dish look like?
   A. blue and white colonies
   B. only blue colonies
   C. white lawn
   D. blue lawn
   E. white lawn and some blue colonies

30. Gene therapy
   A. is commonly used to treat retroviral diseases
   B. cannot correct genetic defects
   C. involves a retroviral vector
   D. induces tumors
   E. is illegal

31. Hemoglobin
   A. binds oxygen cooperatively
   B. binds oxygen more tightly when the pH drops
   C. contains iron
   D. all of the above are true
   E. only A and C are true

32. Cellular differentiation occurs as a direct result of
   A. cell division
   B. morphogenesis
   C. differential gene expression
   D. changes in the DNA sequences
   E. all of the above

33. The cells that line the lungs are
   A. epithelial cells
   B. stratified squamous cells
   C. simple squamous cells
   D. both A and C are true
   E. both B and C are true

34. A stroke would most likely result from
   A. atherosclerosis in the carotid artery
   B. hemorrhaging of a coronary artery
   C. arteriosclerosis in the renal artery
   D. cholesterol deposits in the liver
   E. a heart murmur

35. Which of the following prevents self digestion of the stomach?
   A. stomach cells are arrested in G_0
   B. pepsin is secreted in an inactive form called pepsinogen
   C. the bacterium *Helicobacter pylori* lines the stomach wall
   D. the presence of hydrochloric acid
   E. the enzymes carboxypeptidase and aminopeptidase

36. The secretion of NaHCO3 by the pancreas is stimulated by _____, and the function of that NaHCO3 is to _____

A.	bile salts	acidify gastric juice
B.	secretin	neutralize duodenum
C.	CCK	neutralize duodenum
D.	secretin	stimulate enzyme secretion
E.	amino acids	stimulate enzyme secretion

37. Which of the following concerning PCR is *false*?
   A. Taq polymerase adds dNTPs to free 3'OH ends of growing DNA.
   B. Taq polymerase operates well at high temperatures .
   C. Taq polymerase does not require primers.
   D. Polymerization occurs in the 5' to 3' direction.
   E. Polymerization occurs *in vitro*.

38. Which of the following concerning a red blood cell is (true)
   A. It carries roughly 1 billion molecules of O_2
   B. It contains nuclei
   C. It is spherical in shape
   D. It does not contain the enzyme carbonic anhydrase
   E. None of the above are true statements

39. The greatest amount of absorption of food products occurs in the
   A. small intestine
   B. pancreas
   C. stomach
   D. large intestine
   E. colon

40. Which of the following concerning the cloning of Dolly is true?
   A. the egg cell nucleus was removed before it was fused with the mammary cell
   B. the nuclear donor also contributed mitochondrial DNA
   C. the nuclear donor and the cytoplasmic donor were the same
   D. all of the above are true
   E. only A and B are true

41. In negative pressure breathing, inhalation results from
   A. hemoglobin binding to oxygen
   B. contraction of the diaphragm
   C. using muscles of the lungs to expand the alveoli
   D. all of the above
   E. only B and C

42. Which of the following concerning homeotic genes is correct?
   A. They act as transcription factors for other genes
   B. They cause misplaced structures when mutated
   C. They determine segment identity
   D. All of the above are true
   E. Only B and C are true

43. The Anaphase Promoting Complex
   A. inhibits cydin ubiquitinization
   B. inhibits proteins holding sister chromatids together
   C. represents the M phase checkpoint
   D. Both A and B are true
   E. Both B and C are true

44. Which of the following is *not* a type of connective tissue?
   A. bone
   B. blood
   C. adipose
   D. cartilage
   (E) cardiac

45. You place a small, impermeable membrane between the anchor cell and the other vulval precursor cells in a *C. elegans* larva. What result do you expect?
   A. multiple vulvas
   B. no vulva formation
   C. normal vulva formation
   D. differentiation of outer vulva only
   (E) differentiation of inner vulva only

46. When you need to expend fuel, your body first breaks down
   A. protein
   B. fat
   (C) liver glycogen
   D. muscle glycogen
   E. cholesterol

47. A cell that can give rise to any type of cell is known as
   A. an adult stem cell
   (B) a totipotent cell
   C. a pluripotent cell
   D. a determined cell
   E. all of the above

48. Which of the following is not involved in fat digestion or absorption
   A. the pancreas
   B. the gall bladder
   C. the liver
   (D) the stomach
   E. lacteals

49. Some diabetic individuals inject insulin to control glucose levels. Injection of insulin would decrease blood sugar levels. Typically these individuals would inject _____ eating a meal. Their cells would have functional insulin receptors.
   A. Increase; several hours; non-functional
   B. Increase; several minutes; non-functional
   C. Decrease; several minutes; non-functional
   (D) Decrease; several minutes; functional
   E. Increase; several hours; functional

50. Which of the following reactions prevails in red blood cells traveling through pulmonary capillaries?
   A. $Hb + 4CO_2 \rightarrow Hb(CO2)_4$
   B. $Hb(O_2)_4 \rightarrow Hb + 4O_2$
   C. $CO_2 + H_2O \rightarrow H_2CO_3$
   D. $H_2CO_3 \rightarrow H^+ + HCO3^-$
   (E) $Hb + 4O_2 \rightarrow Hb(O_2)_4$

Fill in the blanks with the most appropriate word or phrase for the definition or concept. (1 pt each)

1. peptidyl transferase — The name of the enzyme that catalyzes the formation of a peptide bond between the amino acids during translation.
2. sense mutation — A point mutation (substitution) that converts a stop codon into a codon coding for an amino acid.
3. Hfr cell — Name of the type of cell in which an F plasmid has inserted itself into the bacterial chromosome.
4. operator — Control elements in eukaryotic DNA to which transcription factors called activators bind.
5. Hershey & Chase — Name(s) of the investigator(s) who showed in his/her/their experiments with bacteriophages, bacteria, radioactive sulfur and radioactive phosphorus, that DNA was the genetic material .
6. aminoacyl tRNA synthetase — Name of the enzyme involved in attaching an activated amino acid to a tRNA molecule.

7. **(4 pts)** Below is shown a gene encoding a small polypeptide. The promoter is marked by parentheses and introns are underlined. Write in the space provided the sequence of the **primary transcript (pre-mRNA)** that would be obtained from this gene. Indicate 5' & 3' ends.

5 ' ATGACGTACCGTGACCGTACATGAGTAATACAT (TTTATA) -3 '
3 ' TACTGCATGGCACTGGCATGTACTCATTATGTA (AAATAT) -5 '

• pre-mRNA contains introns

5' AUGACGUACCGUGACCGUACAUGAGUAAUACAU (UUUAUA) 3'

8. (4 pts) A polypeptide, after translation, is modified by the removal of the first two amino acids from the amino end of the polypeptide. After this modification, the polypeptide has the following amino acid sequence (showing the amino end--the complete sequence is not shown):

N terminus --pro-asn-val--. . . .Carboxy terminus

The mRNA molecule used to translate this polypeptide has the following sequence:

5' AAUGAAUUGAAACCAAACGUGCACCGCCGGUAGUUACCAAAUAAAAAA 3'

met Lys pro asn val his arg arg stop

Use the genetic code table and the above information to answer the following questions.

A. Locate and circle the start codon on the mRNA molecule above.

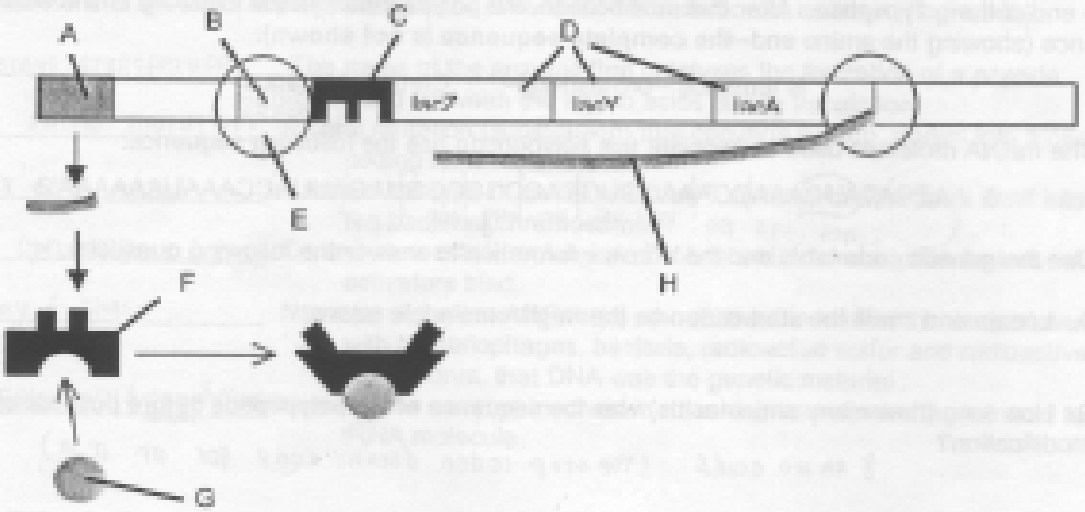
B. How long (how many amino acids) was the sequence of the polypeptide before post-translational modification?

8 amino acids (the stop codon doesn't code for an a.a)

4

2nd base in codon

1st base in codon	U	C	A	G	3rd base in codon
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	STOP	STOP	A
	Leu	Ser	STOP	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G



9. (4 pts) The figure above is a diagram of the lac operon. Identify the required components A through H on the appropriate line below. Some are already indicated.

A. **Repressor gene**

B. promoter

C. operator

D. **Structural genes**

E. **RNA polymerase**

F. Repressor

G. **lactose (analog)**

H. ~~repressed~~ gene

10. (2 pt) Glucose and lactose levels determine if the lab operon is transcribed. Under what set of nutrient conditions would the lac operon (shown above) be ON (be transcribed

Glucose levels = low

Lactose levels = high

11. (2 pts) When listening to the heart one can hear sounds best described as "Lub-dup". Be brief and specific.
What accounts for the "Lub" sound? closing of the AV valves

2

What accounts for the "dup" sound? closing of semilunar valves

12. (2 pts) Why do the atria and ventricles of a human heart NOT contract at the same time? Explain.

0

if they contract at the same time, the blood flow will be mixed between oxygenated and deoxygenated, making it less efficient

13. (2 pts) How is cholesterol delivered to cells and taken up by cells?

1½

LDL receptor sites bind the LDL, which delivers cholesterol to cells and tissues; it is ingested as a complex by endocytosis into cells

14. (2 pts) Some individuals have a genetic basis for hypercholestrolemia. What gene is mutated in these individuals and how does this defect lead to atherosclerosis?

1

it's a gene that normally ~~removes~~ clears cholesterol in the blood it leads to atherosclerosis because cholesterol in excess and it forms a plaque inside the artery walls.

15. (1) Which organ is responsible for the metabolism of cholesterol?

1

liver

16. (3 pts) Fill in the following chart with the appropriate phenotypes. ~~Note that there is a death signal present in each case.~~ Choose from: Cell Death (CD), No Cell Death (NCD) or Not Applicable (N/A)

2

Genotype	Death signal absent	Death signal present
ced-3 (-) / ced-3 (-)	N/A NCD	NCD
ced-9 (-) / ced-9 (-)	CD	N/A CD
ced-3 (-) / ced-3 (-); ced-9 (-) / ced-9 (-)	NCD	NCD

ced 9 → ced 4 → ced 3 → proteasomes, etc

7½

signal absent, ced 9 blocks ced 4, which activates ced 3

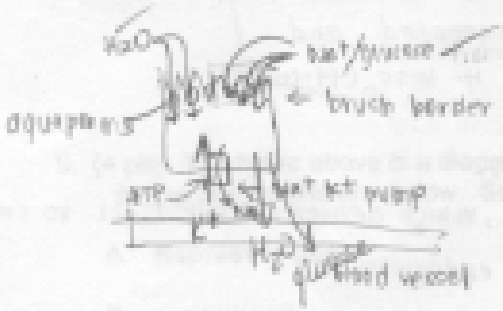
17. (3 pts) Bicoid mutations are recessive. You mate a bicoid (+) / bicoid (+) male fruit fly to a bicoid (-) / bicoid (-) female fruit fly. What is the phenotype of the offspring? Be specific and explain the basis for your answer by discussing bicoid.

how does bicoid work?

2

phenotype is bcd (-) (is valid) because it's a maternal effect gene. Regardless of the offspring's phenotype, if the mother is homozygous for bcd (-), offspring will have bcd (-) phenotype.

18. (4 pts) A patient is suffering from severe diarrhea, and you try to prevent dehydration by orally administering a dilute solution of glucose dissolved in water (a technique known as oral rehydration therapy). **Draw and explain** how glucose and water are absorbed into the bloodstream (include all necessary components)



3

Na+ is pumped out actively (by ATP) using a Na+ K+ pump. Then by conc. gradient, the Na+ and glucose diffuse back in by cotransport; meanwhile, H2O diffuses in through aquaporins

19. (5 pts) You want to use DNA chip technology to study the potential genes involved in breast cancer. The DNA chips are already made and contain a complete library of genes. Design your experiment below (*Note: by convention, normal tissue is fluorescently labeled red and abnormal tissue is fluorescently labeled green)

label all normal tissue DNA with red; spot the chip; label all abnormal tissue green; spot the chip; see which genes are turned on

1/2

Given the following data from your experiment, discuss the specific types of genes they represent:

red spots	yellow spots	bright yellow-green spots
normal tissue only (genes are on) +1	genes on in normal and abnormal tissue +1	genes on in abnormal tissue, some genes on in normal tissue +1/2

3

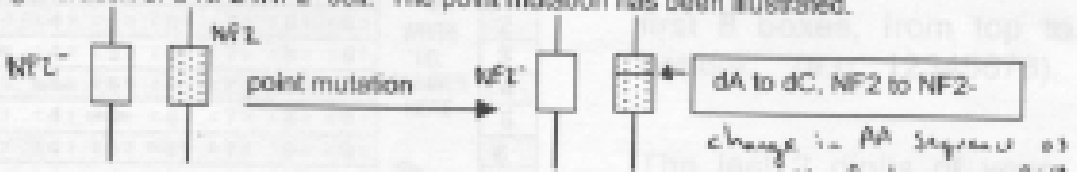
Page 12 of 13

8

20. (3 pts) The disorder Bilateral Acoustic Neurofibromatosis (NF2) leads to benign tumors growing from the cranial nerve, causing hearing loss. NF2 follows the two-hit model. Is the wild type NF2 protein likely to promote or block the cell cycle? Explain briefly:

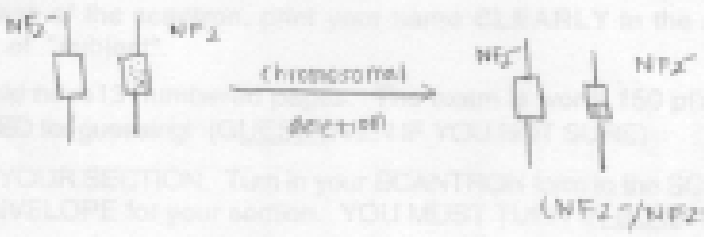
In a 2-hit model, the 1st hit is inherited, the 2nd is by some other mutation (deletion, recombination, pt mutation, nondisjunction) The wild type should block the cell cycle and not let the tumor grow because you need the 2nd mutation to make the tumor grow A is a recessive mutation and (2)

21. (3 pts) A patient suffering from NF2 inherited one bad copy (NF2-) from his father (unshaded chromosome in the diagram). There are multiple mechanisms for the "second hit" in the maternal copy. A point mutation could result in a defective NF2 allele (diagramed). Two other possible mechanisms are listed. Diagram what the chromosomes would look like, or how they would move to illustrate the generation of a NF2-/NF2- cell. The point mutation has been illustrated.



change in AA sequence as a result of change in DNA sequence

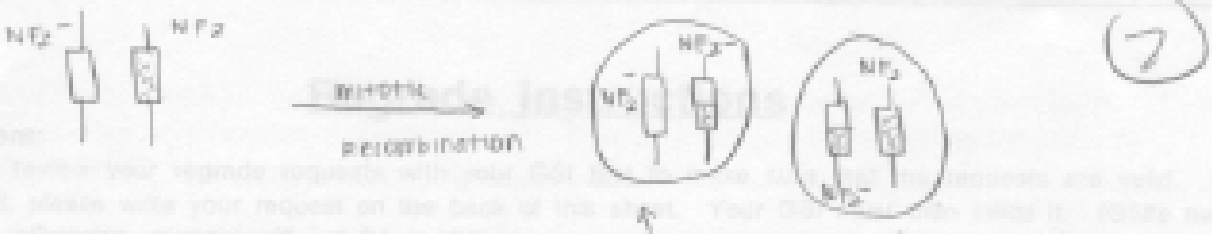
i) chromosomal deletion



(NF2-/NF2-)

part of the chromosome missing, making it NF2 to NF2- (1)

ii) mitotic recombination



both one is NF2-

(NF2-/NF2-) (NF2-/NF2) (2)

15

Name: [redacted]

Section number: 6

Registration number: [redacted]

Question number	Your response	Correct response	Points off
9	D	E	2.00
16	D	A	2.00
31	D	B	2.00
32	E	C	2.00
33	C	D	2.00
38	D	A	2.00
40	D	A	2.00
45	E	B	2.00

Your total score: 84.00 out of 100.00

Answers Exam 2 Bio 1A, Summer 2002

1	E	6	C	11	D	16	A	21	D	26	C	31	E	36	B	41	B	46	C
2	D	7	D	12	C	17	E	22	D	27	E	32	C	37	C	42	D	47	B
3	C	8	B	13	E	18	C	23	A	28	D	33	D	38	A	43	E	48	D
4	E	9	E	14	D	19	C	24	C	29	E	34	A	39	A	44	E	49	D
5	D	10	C	15	A	20	E	25	E	30	C	35	B	40	A	45	B	50	E

Multiple Choice: 7) Offspring would be heterozygous for both alleles. 8) Anti-codon in tRNA. 16) Transduction involved in the transfer of information. 38) 2.5 X 105 molecules of Hb/RBC. 4 O_2 per Hb. 42) Homeotic genes are involved in segment identity. 47) pluripotent = some limitations. 49) Insulin works and therefore there must be functional receptors and signal transduction pathways. 50) Binding of O2 occurs in the lungs, CO2 is given off ($H_2O + CO_2(g) <- H_2CO_3 <- HCO_3 + H^+$

Part II--1) peptidyl transferase 2) sense 3) Hfr 4) enhancers 5) Hershey & Chase 6) aminoacyl tRNA synthetase 7) The bottom strand is the same as the mRNA except replace the T with U. TATAAA is in that strand. 5'-AUGUAUUACUCAUCUACGGUCACGGUACGUCAU - ' 8) 5'-AAAGAAAUG ; 8 Amino acids long 9B) promoter 9C) operator, 9F) repressor, 9H) polycistronic mRNA 10) glucose low or absent, lactose high or present. 11) Lub = closing of AV valves, Dup = closing of semilunar valves, 12) AV node delays the signal so ventricles contract after atria, 12) LDL receptor is mutated. Thus these individuals can not take up cholesterol. High levels of cholesterol in the blood results in atherosclerosis. 15) liver 16) ced 3-/ced 3- = No Cell Death, ced 9- , ced 9- = cell death, ced3-ced3-; ced9-/ced9- = No Cell Death. 17) offspring have 2 tails (no anterior structures), bicoid protein is a transcription factor, bicoid is a cytoplasmic determinant deposited during development of the egg 18) see key 19) see key.