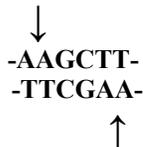


Directions: Pick the **BEST** choice form among the answer choices given. [Mallery #'s 1 to 5 and Glaser #'s 6 to 49]

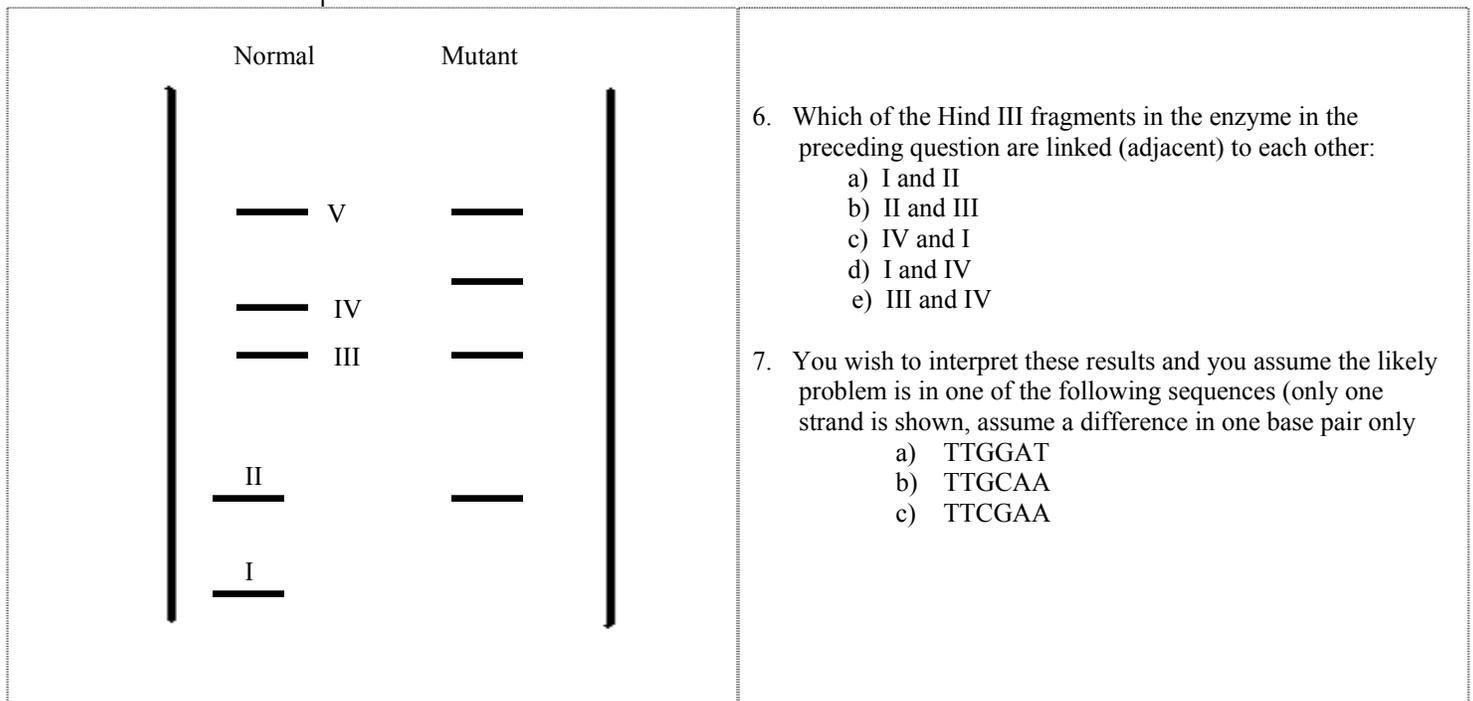
- The production of ATP and NADPH during green plant photosynthesis occurs?
 - only in cyclic electron flow
 - in non-cyclic electron flow
 - only in photorespiration
 - only in CAM plants
 - none of these is correct
- A researcher describes four pairs of mitochondrial redox couples from an unidentified new species and shows each redox couple to have the following E_o' :
 - Glaserchrome = $-0.22v$,
 - Miami-CoQ = $-0.05v$,
 - Mallerchrome = $+0.12v$,
 - Ibis-iron = $-0.58v$.
 What is the most likely correct sequence for the passage of e's between these new electron couples?
 - $a \rightarrow b \rightarrow c \rightarrow d$
 - $d \rightarrow c \rightarrow b \rightarrow a$
 - $d \rightarrow a \rightarrow b \rightarrow c$
 - $c \rightarrow b \rightarrow a \rightarrow d$
 - none of these
- Which of the following is correct concerning ATP synthase?
 - passage of protons through the c protein of the F_0 subunit results in rotation of the F_1 unit through 3 different conformations
 - H^+ ions move through the beta protein of the F_1 subunit
 - the ATP synthase subunit that is intrinsic and membrane bound is the F_1 subunit
 - the c protein of the F_0 subunit spontaneously forms ATP in the O (open) conformation
 - choose this answer if all of these are correct
- A key allosteric regulatory enzyme of aerobic glucose metabolism is?
 - hexokinase
 - phosphofructokinase
 - ATP synthase
 - lactic acid dehydrogenase
 - none of these
- The enzyme of carbon dioxide reduction that is present in both C3 and C4 plants is?
 - RuBP carboxylase
 - PEP carboxylase
 - both of these are present in both C3 and C4 plants

The next two questions are related:

You have discovered a new gene, coding for a protein involved in the development of the α cells of the pancreas. You discover this protein as a result of your studies of the cause for the failure to develop these cells in some newborns. You clone the gene from normal and affected children in a plasmid in *E. coli*. You now have enough DNA to do chemistry and you cleave the isolated genes with the restriction enzyme Hind III whose specificity is:



And obtain the following fragment after electrophoresis on agarose gel:



8. You isolate a gene for a novel protein with partial sequence in the non coding strand i.e. the sequence of the possible mRNA:

T-T-A-T-G-C-C-G-A -C-G-A-C-G-A- C-G-A-C-G-A-C-G-A-G-T-T-T-A-A

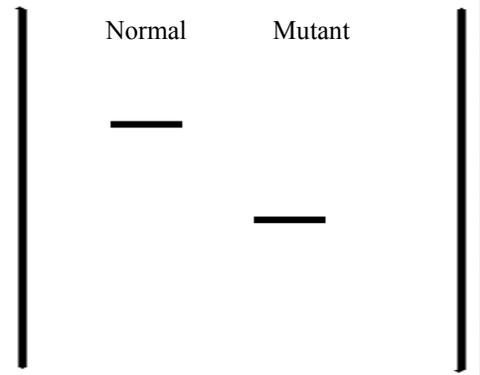
The protein has a region with sequence (Ala)₆, based on the observation what is the amino acid and sequence coded by this stretch of DNA (Think carefully)

- a) Gly- Ser- (Ala)₆-Leu-Val-Glu-Ser b) Leu-Cys-(Ala)₆-Val -Ala -Asn-Stop c) Leu- Cys- (Ala)₆-Val-Stop

9. You prepare a cDNA of both genes and measure their size on electrophoresis:

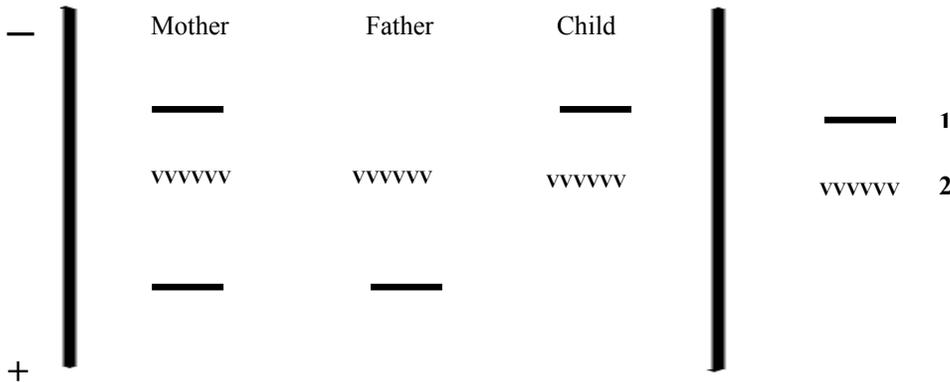
Your most likely explanation of this is:

- a. The mutant makes a larger cDNA
- b. The mutant makes a smaller cDNA
- c. The mutation results differential splicing
- d. a and c apply
- e. b and c apply



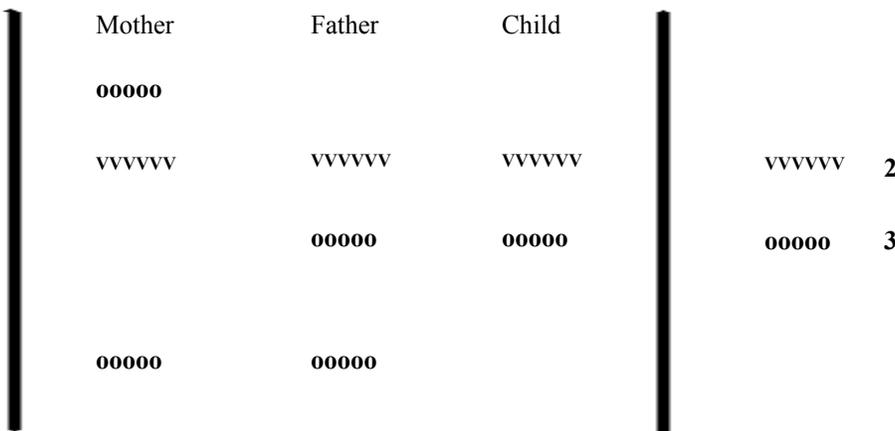
The next two questions are related.

10. As a young MD you are working at Jackson Memorial Hospital and are concerned that given the large number of babies born in Jackson, somebody may make a mistake and the parents might take home the wrong child. You therefore start a program to do DNA fingerprinting of the prospective parents and when the child is born of the infant. The first test with two polymorphisms gives the following results:



- a) You assure the parents that this is their child b) You initiate an emergency search for their real child

11. While you carried out the test another graduate of BIL 255 independently did the same test using polymorphism 2 and 3. The results are:



This test according to your friend is proof that the child belongs to these parents. Looking at both tests:

- a) You agree they have the right child b) You initiate an emergency search for the real child

12. In eukaryotic cells all RNA molecules are? a) Made by the same RNA polymerase b) Made by different RNA polymerases
13. In all cases when a transposon appears at a new site in the genome, a copy remains in the original site:
a) True b) False
14. Which of the following are required components for the Sanger dideoxy-method for obtaining DNA sequence?
a) DNA helicase, Primase b) 4 dideoxynucleoside triphosphates and 4 deoxynucleosides triphosphates
c) a primer d) a and b apply e) b and c apply
15. The immediate source of energy for transport of proteins in and out of the nucleus is: a) ATP b) GTP
16. For import into the nucleus: (nuclear location sequence)
a) Proteins have a NLS signal b) They bind to importin
c) Import requires a complex of Transported protein/importin/Ran GTP
d) Import requires a complex of Transported protein/importin/Ran GDP e) a and d apply
17. Consider the following components that control gene transcription in a cell. Two leucine zipper molecules which bind as a pair as well as another DNA binding protein which can enhance (increase the affinity) of leucine zipper A for DNA when bound to its site. Thus this protein will allow leucine zipper to bind to sites for which it has a very low intensive affinity.
How many different regulatory events can you expect as a result of these three molecules?
a) 3 b) 2 c) 4 d) 6 e) 5
18. In an in vitro system you use the polymer (UGA)_n as an artificial mRNA. Select from the list below the polymer(s) you expect to find?
a) (Aspartic)_n b) (Methionine)_n c) (Valine)_n d) a and b apply e) a, b and c apply
19. You discover a segment of a chromosome with high concentration of methyl cytosine. You conclude:
a) This is an actively transcribed segment of DNA b) This is initiation site for RNA polymerase
c) This is a “non transcribed” heterochromatic region of DNA
20. Peptide bond synthesis is a function of Peptidyl synthetase? a) a ribosomal RNA b) a ribosomal protein
21. You chemically reduce cysteine (labeled with ¹⁴C) linked to its tRNA, to generate (¹⁴C) labeled alanine still linked to the same tRNA. You use this as a substrate in an in vitro protein synthesis including all normal aminoacyl tRNA's ribosomes etc. You use an artificial message of sequence
AUG GCA GGA AGC UGC ACA GCC
1 2 3 4 5 6 7
You expect to find (¹⁴C) alanine in the resulting polypeptide in?
a) Position 2 b) Position 7 c) Position 5 d) a and b apply
22. When you examine the DNA strand which is transcribed into mRNA in a chromosome?
a) All transcription is from the same strand
b) Each gene is transcribed from one strand, but different genes are transcribed from different strands gene
c) Genes are not overlapping d) a and c apply e) b and c apply
23. In eukaryotes mRNAs at their 5' end are identified by ribosomes because? (think carefully)
a) They contain a TATA box b) Have a methyl guanine cap c) Have a poly A tail d) All apply
24. Restriction enzymes cleave DNA?
a) At random sites b) At unique sequences c) The sequence at the site is often a palindrome d) a & c apply e) b & c apply
25. The cytoplasmic membrane of eukaryotic cells contains glycoproteins and glycolipids. You expect the carbohydrate portion of these molecules to be primarily?
a) Facing the inside of the cell b) Facing the outside of the cell c) Both
26. Flipases are proteins that "flip" lipids between the two leaflets of the bilayers. Do you believe that in the case of the cytoplasmic membrane this results in?
a) Equal distribution of lipid classes between the two leaflets
b) A non-random distribution of lipid classes between the two leaflets c) Require ATP d) a & c apply e) b & c apply
27. The minimal DNA sequences required for a functional chromosome in eukaryotic cells is?
a) Two centromeres, one telomere, one origin of replication
b) Two telomeres, one centromere and one origin of replication
c) Two telomeres, multiple origins of replication and one centromere

28. Stem cells are maintained because when they divide they undergo?
 a) Asymmetrical division b) Daughter cells are subject to environmental asymmetry c) Both apply
29. *E. coli* cells lack telomerase yet, they survive because?
 a) They reproduce rapidly in large numbers and can tolerate multiple mutations b) Their DNA has no end
30. Telomerase is an enzyme that?
 a) Adds random set of bases (nucleotides) to the ends of DNA
 b) The repeated sequences are complementary to an RNA sequence which is part of telomerase
 c) Adds repeated sequences to the end of DNA d) b and c apply
31. One of your friends has made an unusual observation in the laboratory and is looking for a likely explanation. She consults you as a well educated student in BIL 255. She has studied the expression of gene coding for a liver protein which has exons I-V. She has noted that about 4% of the protein coded by this gene only contains the amino acids coded by Exons I-IV (i.e. lack Exon V). Your best explanation from your knowledge of mRNA's is?
 a) Differential splicing b) There must be a weak transcription termination signal at the end of Exon IV
 c) There must be a Poly A addition signal at the end of Exon IV d) a and c apply e) b and c apply
32. The loss of NH₃ (deamination) of cytosine or methylcytosine (Cmet) results in possible mutations in DNA when it is replicated before the mutation is corrected. Which of the changes below could occur? [met = Methylcytosine]
 a) G/C → A/T b) G/Cmet → G/T c) G/Cmet → A/T d) a and c apply e) b and c apply
33. Human females have two X chromosomes, while males have one, therefore they?
 a) Synthesize twice as many gene products coded by the X chromosome
 b) randomly inactivate half the genes on each X chromosome
 c) inactivate a specific set of genes in each X chromosome, so that each chromosome only expresses a different half of the X chromosome genes d) None of the above is correct
34. Embryonic stem cells are derived from? a) The inner cell mass of the blastocyst b) Any tissue in the embryo
35. When the ribosome reaches the end of the coding region of a mRNA?
 a) It releases the polypeptide chain still linked to the last tRNA
 b) It release the free polypeptide c) There is a specific tRNA that binds to the termination codon (s)
 d) a and c apply e) b and c apply
36. Starting at the origin of replication, the replication fork (s) move (s) in? a) One direction b) Two directions
37. DNA polymerase proofreading?
 a) Results in its dissociation from the DNA if a mistake has been made
 b) Removal of the mismatched base and its replacement by the correct base c) Cleavage of the template strand
38. RNA molecules have? a) No secondary structure b) Fold at random c) Can fold into unique structures using base pairing rules
39. Higher organisms often contain multiple proteins which have apparently evolved from a common ancestral gene. The most likely origin of these is? (for example, hemoglobin) a) Unequal crossing over b) Bacterial infections
 c) Insertion of enhancer molecules close to the initiation site of gene transcription
40. You wish to design a plasmid to clone various genes in *E. coli*, to do so, you expect the plasmid minimally to have the following components:
 a) Code for an antibiotic resistant gene b) Have an origin of DNA replication
 c) Have a sequence that can be cleaved by a restriction enzyme d) The sequence in "c" cannot occur in "a" or "b"
 e) All apply
41. To amplify a particular region of DNA, by PCR you need?
 a) Knowledge of the nucleotide sequence at one end of the region you wish to amplify
 b) Knowledge of the nucleotide sequence at both ends of the region you wish to amplify
 c) DNA polymerase which is thermostable and all four deoxynucleoside triphosphate
 d) a and c apply e) b and c apply
42. Messenger RNAs are degraded in cells? (pick the best answer)
 a) All messenger RNAs are degraded at same rate b) Different mRNAs are degraded at different rate
 c) The 3'UTR (untranslated region) influences the rate of mRNA degradation.

43. Ubiquitin binding to proteins?
 a) Targets them for degradation in the proteasome b) Targets them for degradation in the lysosome
 c) Requires ATP d) a and c are correct e) b and c are correct
44. For RNA polymerase II to function, some of the enzymes associated with it are?
 a) Primase b) Helicase c) Topoisomerase d) a and c apply e) b and c apply
45. The carboxyl terminal (C-terminal) region of RNA polymerase II is phosphorylated before the enzyme can initiate gene transcription. The phosphorylated sites?
 a) Serve as anchors for mRNA processing enzymes b) Anchor enzymes that acetylate histones
 c) Anchor enzymes that phosphorylate histones d) a and b apply e) a and c apply
46. Receptors for several hormones which can cross the cytoplasmic membranes such as cortisol and thyroxine have similar structures, which of the following statements is (are) true?
 a) Cortisol binds to its receptor in the cytoplasm and the receptor is then translocated into the nucleus
 b) Thyroxine and its receptor function in the same way as cortisol and its receptor
 c) The thyroxine receptor is always bound to DNA & in presence of thyroxine acetylates histones to allow transcription to occur
 d) a and b apply e) a and c apply
47. You have purified the glucose transporter (uniport/ facilitated diffusion) from erythrocytes (A) and from liver cells (B) you insert these equivalent amounts into liposome membranes and equilibrate the liposomes with 5 mM glucose inside and out. You now transfer the liposomes to a solution free of glucose and measure the rate of exit of the glucose from the liposome. Assume the V_{max} for both transporters is the same. You expect? a) $A > B$ b) $B > A$
48. Since you already have these proteins available, you examine their three dimensional structure as they traverse the membrane, you expect? (pick the most complete answer)
 a) The protein traverses the membrane multiple times as an alpha helix
 b) The helices are amphipatic i.e. they contain hydrophilic and hydrophobic residue
 c) Glucose binds to a site created by the hydrophilic area of the helices
 d) a, b and c are correct
 e) The protein traverses the membranes as a set of beta pleated sheets
49. You clone your prize male guinea pig by nuclear transfer and separately also clone his sister the same way. You obtain several cloned animals that appear to be healthy. The unfertilized eggs came from a guinea pig at the local pet shop and the nucleus from a skin cell of your guinea pigs. The pet shop forgot to tell you that the oocyte donor had trouble running and appeared to have a late onset mitochondrial defect. You mate two of your guinea pig clones.
 a) You believe the offspring of your cloned guinea pigs will be ok if they are male
 b) You believe that the offspring of your cloned guinea pig will be ok if they are female
 c) All offspring will be ok d) None of the offspring will be ok
50. In medical terms for the lay person which of the following is correct?
 a) artery - is the study of fine paintings b) bacteria – is the back door to the cafeteria c) coma – is a punctuation mark
 d) nitrate – is lower than day rate e) to receive credit for this question you must bubble in e)

		2nd base in codon				
		U	C	A	G	
1st base in codon	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G
						3rd base in codon

I CONSENT TO HAVE MY GRADE POSTED BY MY I.D. NUMBER ON A CLASS ROSTER.

YES (Darken, if agree)

SIGNATURE _____ DATE _____

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED AID  THIS EXAMINATION.

SIGNATURE 255207 Fm 2 DATE 12

SIDE 1

A B C D E
1 1 3 4 5

A B C D E
2 1 2 4 5

A B C D E
3 2 3 4 5

A B C D E
4 1 3 4 5

A B C D E
5 2 3 4 5

A B C D E
6 1 2 3 5

A B C D E
7 1 2 4 5

A B C D E
8 1 2 7 5

A B C D E
9 1 2 3 4 5

A B C D E
10 2 3 4 5

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11 1 3 4 5

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