# HL Paper 1

What does a nucleosome consist of ?

A. DNA and histones
B. DNA and chromatin
C. Chromatin and nucleotides
D. Mature RNA and histones

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How does DNA replicate?

A. The deoxyribose of a free nucleotide is linked to the phosphate of the last nucleotide in the chain.
B. The phosphate of a free nucleotide is linked to the deoxyribose of the last nucleotide in the chain.
C. Nucleotides are linked in a 3′ to 5′ direction and the new strands are anti-parallel to the template strands.
D. Nucleotides are linked in a 5′ to 3′ direction and the new strands are parallel to the template strands.

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The sequence of nucleotides in a section of RNA is: GCCAUACGAUCG

What is the base sequence of the DNA sense strand?

A. CGGUAUGCUAGC
B. GCCATACGATCG
C. CGGTATGCTAGC
D. GCCAUACGAUCG

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Which of the following forms the nucleosome?

A. DNA and histone molecules
B. DNA only
C. RNA and histone molecules
D. Histone molecules only

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The antisense strand on the DNA molecule coding for three codons of a gene is

TATCGCACG

What are the anticodons of the three tRNA molecules that correspond to this sequence?

A. UAU, CGC and ACG
B. ATA, GCG and TGC
C. AUA, GCG and UGC
D. TAT, CGC and ACG

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Some regions of DNA do not code for the production of proteins. What are these regions of DNA used as?

A. They have no known function and are recycled to provide nucleotides

B. Gene regulation and coding for production of enzymes used in translation

C. Telomeres and coding for production of tRNA

D. Introns and coding for production of structural proteins

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Variations in the types of antibodies are produced by mRNA splicing. What is an advantage of this process?

A. Reduces the size of mRNA required for the translation of antibodies
B. Increases the number of different antibodies that can be synthesized
C. Ensures that one gene codes for one antibody
D. Speeds up transcription of antibodies

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Which types of interactions are found in a part of a protein with secondary but not tertiary structure?

I. Hydrogen bonds

II. Disulphide bridges

III. Ionic bonds

A. I only

B. I and II only

C. II and III only

D. I, II and III

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Which cell component synthesizes actin and myosin?

A. Free ribosomes

B. Rough endoplasmic reticulum

C. Smooth endoplasmic reticulum

D. Nuclear membrane

What is a nucleosome?

A. A region in a prokaryotic cell where DNA is found
B. A DNA molecule wrapped around histone proteins
C. A ribosome of a prokaryotic cell
D. A molecule consisting of a sugar, a base and a phosphate

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What does post-transcriptional modification of eukaryotic mRNA include?

I. Introns are removed from mRNA.
II. Exons are joined together to form mature mRNA.
III. A 5' cap and 3' poly-A tail are added to mRNA.

A. I only
B. I and III only
C. II and III only
D. I, II and III

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Which best describes the tertiary structure of a protein?

A. The interaction of polypeptide subunits and prosthetic groups
B. Interactions forming hydrogen bonds between the amino acids
C. The sequence of amino acids in the polypeptide chain
D. The structure formed from interactions between the amino acid side groups

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Which of the following chemicals is a component of eukaryotic chromosomes?

A. Protein
B. Triglyceride
C. Fatty acid
D. RNA

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After which process are introns removed?

A. Replication
B. Transcription
C. Translation
D. Translocation

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What makes up eukaryotic RNA immediately after transcription?

A. Exons, introns and primers

B. Exons and introns

C. Introns only

D. Exons only

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What are Okazaki fragments?

A. Short lengths of RNA primase attached to the DNA during replication
B. Short sections of DNA formed during DNA replication
C. Nucleotides added by DNA polymerase I in the same direction as the replication fork
D. Sections of RNA removed by DNA polymerase III and replaced with DNA

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What is the distinction between highly repetitive DNA sequences and single-copy genes?

A. The highly repetitive sequences have greater amounts of guanine.
B. The highly repetitive sequences have greater amounts of cytosine.
C. The highly repetitive sequences are not transcribed.
D. The highly repetitive sequences are not replicated.

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The antisense strand of a DNA molecule has the sequence TACCCGATC. What would be the resulting mRNA strand sequence?

A. TACCCGATC
B. ATGGGCTAG
C. UACCCGAUC
D. AUGGGCUAG

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What is the reason for Okazaki fragments being formed during DNA replication?

A. To enable replication of the 3′ → 5′ (lagging) strand
B. To form the template for the RNA primers
C. To initiate replication on the 5′ → 3′ (leading) strand
D. To help the DNA helicase unwinding the DNA helix 27

Which statement applies to transcription in eukaryotic cells but not to prokaryotic cells?

A. RNA polymerase transcribes the antisense strand of DNA to produce a strand of RNA.
B. During transcription, uracil replaces thymine in RNA.
C. Transcription takes place in the cell nucleus.
D. Initiation of transcription requires a promoter sequence of DNA.

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What happens during transcription in eukaryotes?

A. Polysomes move.

B. Nucleosomes are phosphorylated.

C. RNA polymerase separates DNA strands.

D. Okazaki fragments are produced.

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What are introns?

A. Sequences of nucleotides that are removed to form mature RNA in eukaryotes
B. Sequences of nucleotides that are removed to form mature RNA in prokaryotes
C. Sequences that remain in mature RNA after exons have been removed
D. Small pieces of circular DNA that are found in prokaryotes

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What is a feature of transcription?

A. Both strands of a DNA molecule act as a template for mRNA.

B. Nucleoside triphosphates become nucleotides by losing three phosphates.

C. RNA polymerase binds to the promoter region.

D. The sense strand acts as a template for mRNA.

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What happens during the formation of Okazaki fragments?

A. DNA polymerase III adds nucleotides in the 3′→ 5′ direction.
B. DNA polymerase III adds nucleotides in the 5′→ 3′ direction.
C. DNA polymerase I adds nucleotides in the 5′→ 3′ direction.

D. RNA polymerase adds nucleotides in the 3′→ 5′ direction.

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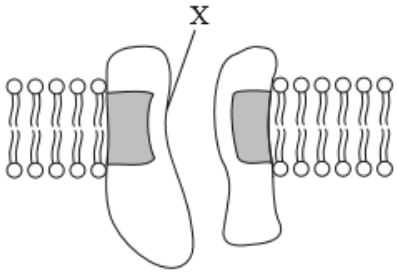
The diagram shows the cross section of a plasma membrane.




What is found in area X?

A. Glycolipid
B. Glycoprotein
C. Polar amino acid
D. Non-polar amino acid

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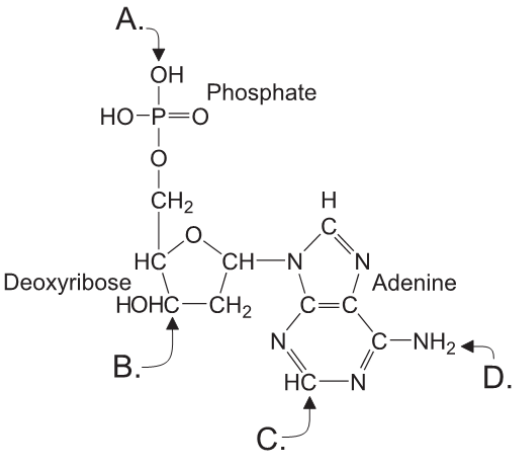
Which letter (A–D) indicates where a new nucleotide would attach?

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What are the fundamental packaging units of eukaryotic chromosomes?

A. Nucleosomes
B. Centromeres
C. Histones
D. Nucleoids

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In which process(es) do nucleosomes play a role in eukaryotes?

I. tRNA activation

II. Transcription regulation

III. DNA supercoiling

A. I only

B. II only

C. II and III only

D. I, II and III

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What is removed during the formation of mature RNA in eukaryotes?

A. Exons
B. Introns
C. Codons
D. Nucleosomes

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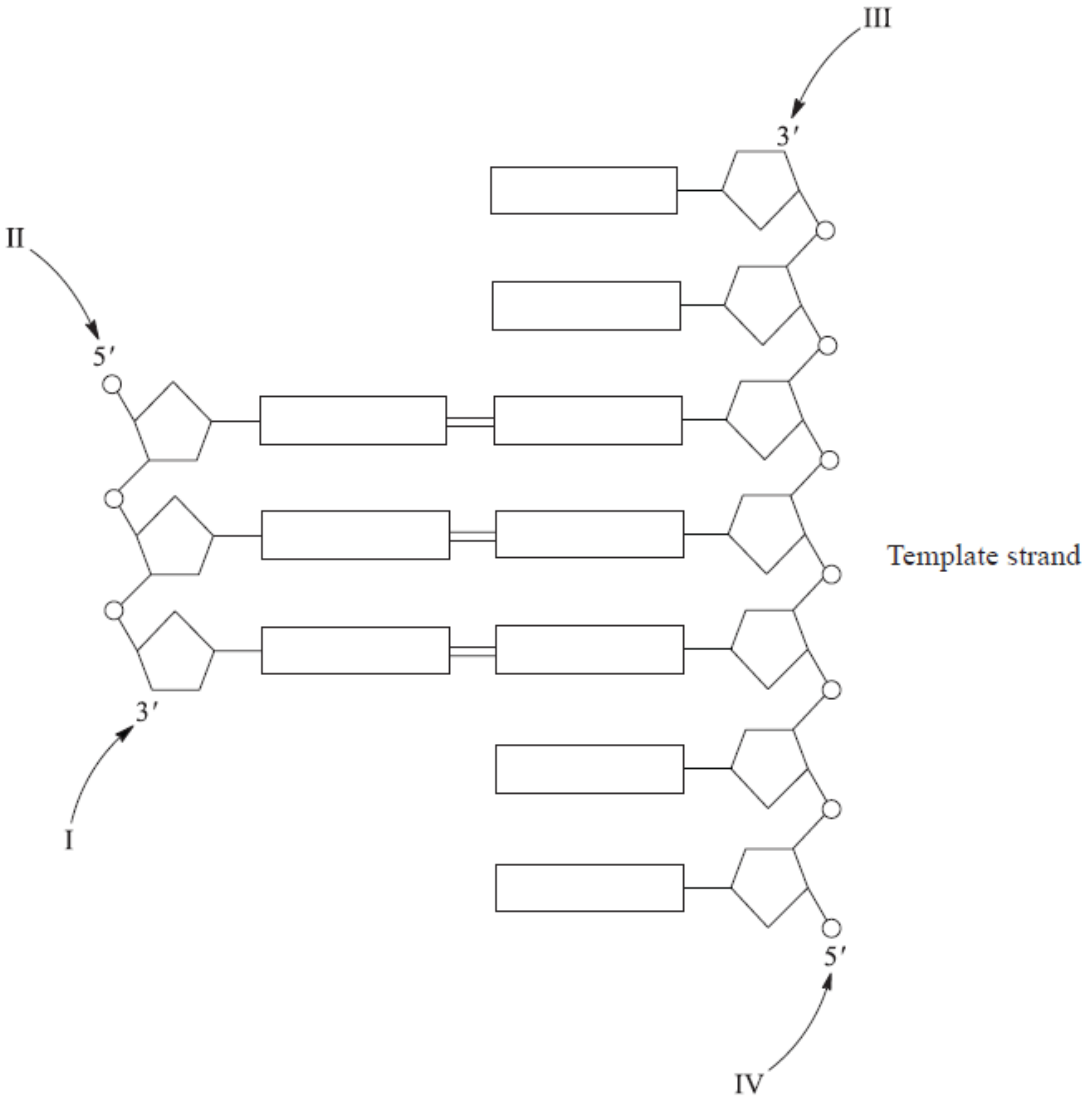
The diagram below shows part of a DNA molecule that is being replicated.




Where would DNA polymerase link the next nucleotide during replication?
A. I
B. II
C. III
D. IV

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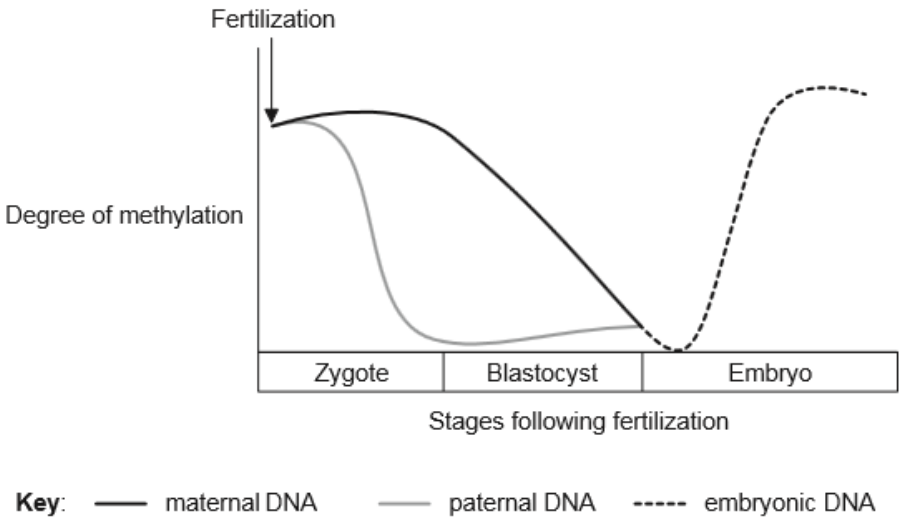
Very soon after fertilization, parental epigenetic methylation is reversed in the DNA.

Later, tissue-specific epigenetic modifications are made to the embryonic DNA. The graph follows the degree of methylation from different sources during embryonic development.




[Source: Sandra Rodriguez-Rodero, "Epigenetic regulation of ageing" *Discovery Medicine* 10 (52), 225–233, September 2010. Reprinted with permission.]

According to the graph, what are the changes in DNA methylation during embryonic development?

A. Only the paternal DNA becomes demethylated.
B. The maternal DNA becomes demethylated first.
C. The methylation patterns of the parents' DNA are erased before fertilization.
D. The methylation patterns of both parents are erased after fertilization.

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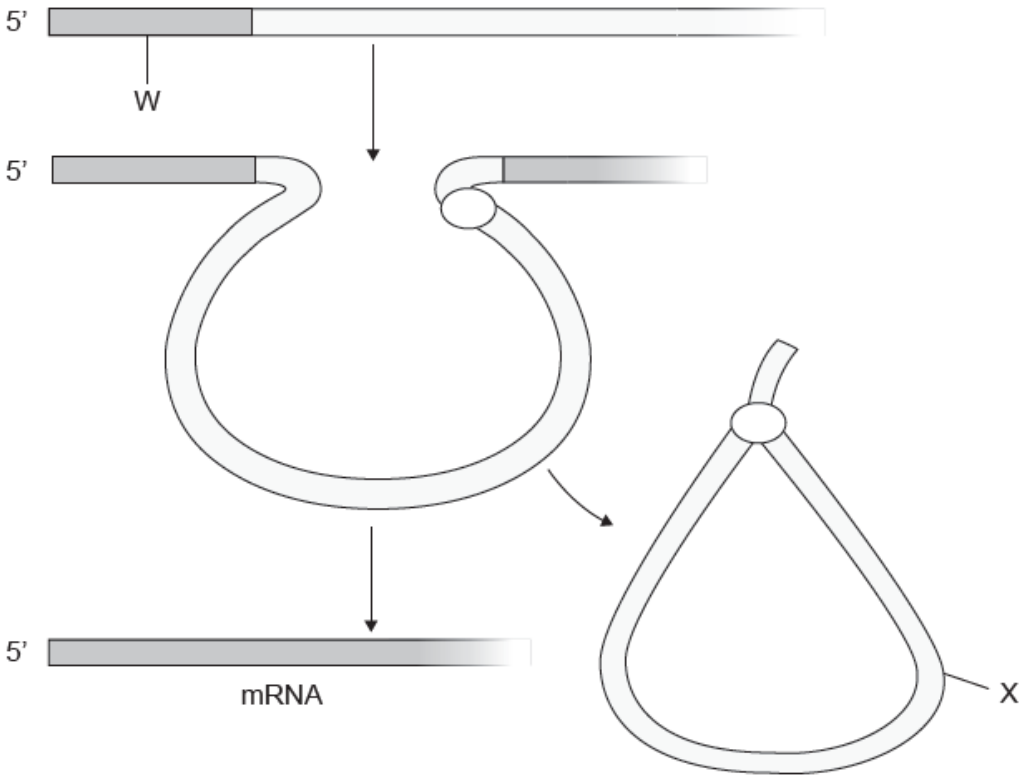
The diagram shows how pre-mRNA is processed into mature mRNA. Which structures are indicated by the letters W and X?



| | W | X |
|---|---|---|
| A. | Exon | Poly-A tail |
| B. | Poly-A tail | Exon |
| C. | Intron | Exon |
| D. | Exon | Intron |

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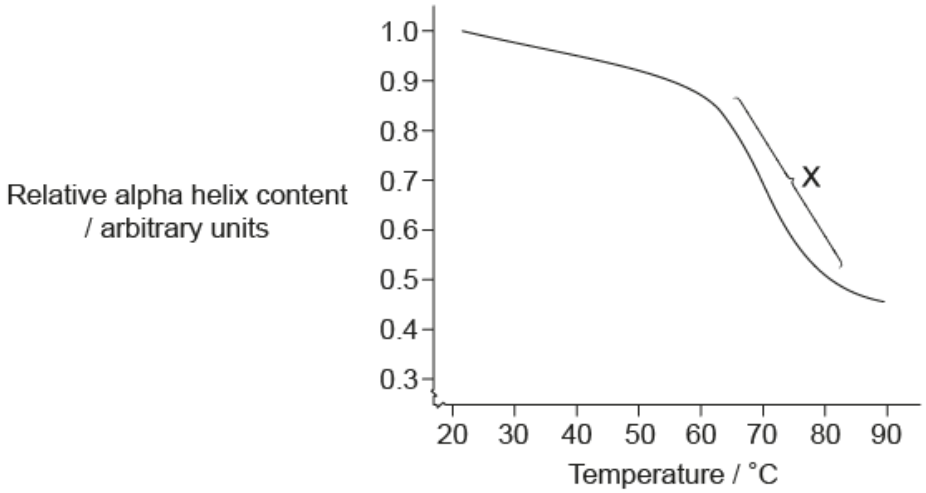
Scientists have heated a solution containing the protein albumin and measured its relative alpha helix content, shown on the graph.




[Source: adapted from R Wetzel, *et al.*, (1980), *European Journal of Biochemistry*, **104** (2), Wiley, page 471]

What does the zone labelled X indicate?

A. Rapid increase in beta pleated sheets

B. Rapid formation of hydrogen bonds

C. Rapid increase in denatured protein molecules

D. Rapid decrease in peptide bonds

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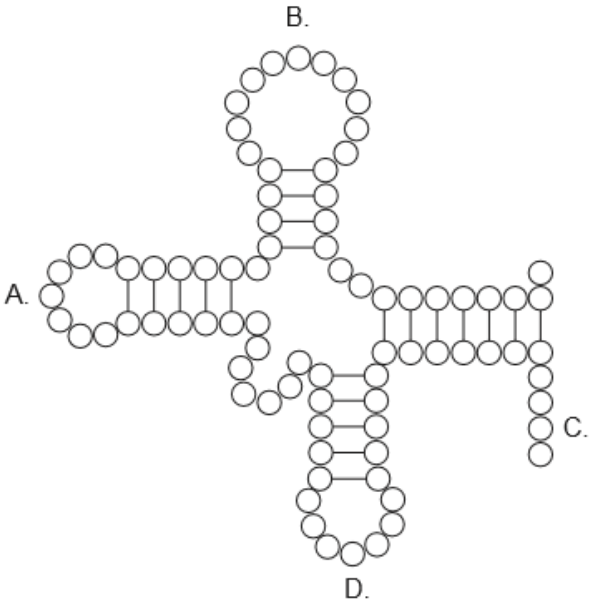
Where does a tRNA-activating enzyme attach the appropriate amino acid to the tRNA molecule?

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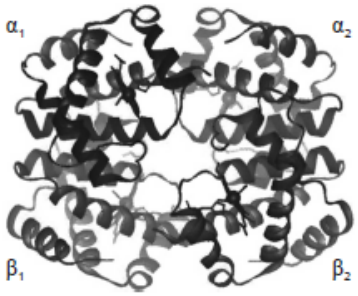
The image shows the structure of hemoglobin.




[Source: adapted from http://upload.wikimedia.org]

What determines the primary structure of hemoglobin?

A. Genetic information

B. Hydrogen bonding

C. Four polypeptide chains

D. Side chain interactions

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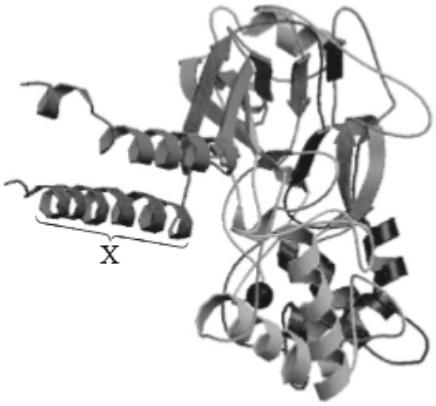
The diagram is a three-dimensional molecular model of a protein.




[Source: Reprinted by permission from Macmillan Publishers Ltd: Nature, Toshimitsu Kawate, Jennifer Carlisle Michel, William T. Birdsong & Eric Gouaux, 'Crystal structure of the ATP-gated P2X4 ion channel in the closed state', 460, pp 592–598, © 2009. www.nature.com.]

Which bonds stabilize the shape of the area labelled X?

A. Covalent bonds between adjacent amino acids
B. Hydrogen bonds between N–H and C=O groups of amino acids
C. Hydrophobic interactions between R groups of amino acids
D. Disulphide bridges between cysteine molecules

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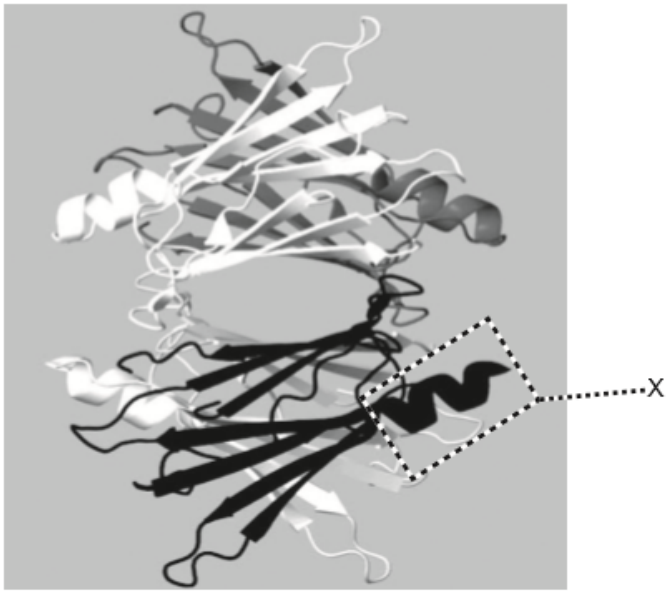
The image represents a model of the protein transthyretin.




[Source: adapted from http://en.wikipedia.org]

Which level of structure is indicated by X on the image?

A. Primary
B. Secondary
C. Tertiary
D. Quaternary

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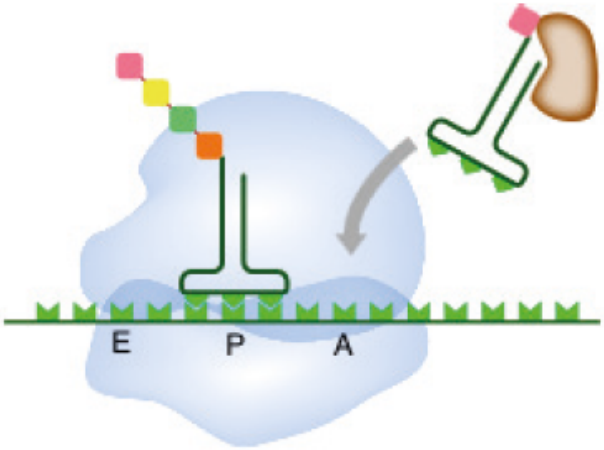
The following diagram shows a ribosome during translation.




[Source: http://upload.wikimedia.org/wikipedia/commons/d/d1/ProteinTranslation.svg]

What describes the specific stage of translation?
A. Initiation
B. Elongation
C. Termination
D. Translocation

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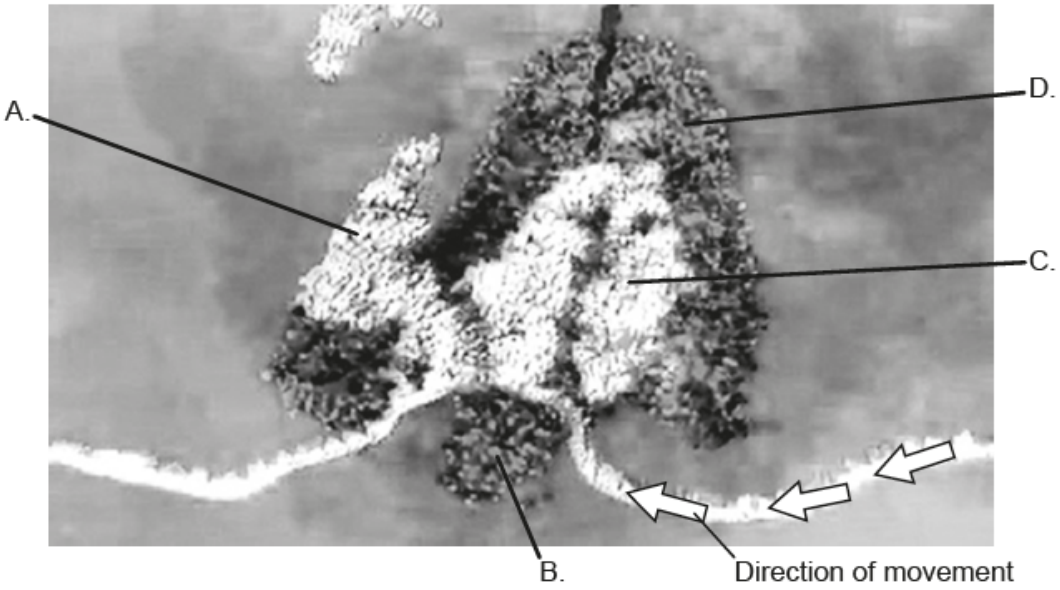
This image is taken from a visualization of a eukaryotic ribosome. The arrows show the direction of movement of mRNA. Which letter represents a tRNA exiting from the E site?




[Source: Adapted from Cold Spring Harbor Laboratory DNA Learning Center (www.dnalc.org)]

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