**Self-test Quiz for Chapter 12 (From DNA to Protein: Genotype to Phenotype)**

**Question#1: One-Gene, One-Polypeptide**

The figure below shows the results of feeding trials with one auxotroph strain of *Neurospora* grown under four treatments, on minimal medium alone (none) and on media supplemented with various arginine intermediates. Note that the strain can only grow on minimal medium plus arginine. Given these data and the following arginine pathway, which arginine intermediate(s) would you expect to accumulate in the cells of this auxotroph if grown on minimal media?

- A. None
- B. Ornithine
- C. Citrulline
- D. Arginine
- E. Ornithine and citrulline

**Question#2: Features of RNA**

RNA (right) and DNA differ in a number of ways. Which one of the following is **not** a difference?

- A. Chargaff equality of purines and pyrimidines
- B. The type of sugar present
- C. The ability of RNA to base pair within its own sequence
- D. The nitrogenous bases present
- E. RNA is a polynucleotide whereas DNA is not
**Question#3: Central Dogma**
The central dogma is sometimes presented diagrammatically as shown below. Which of the following statements about the central dogma is **false**?

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>A.</strong> The arrow from DNA to RNA represents transcription-DNA-directed RNA synthesis.</td>
<td><strong>B.</strong> Information never moves from RNA to DNA.</td>
</tr>
<tr>
<td><strong>C.</strong> The molecule involved in the flow of information from RNA to protein is transfer RNA.</td>
<td><strong>D.</strong> Information never flows from protein to nucleic acids.</td>
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<td><strong>E.</strong> In eukaryotes, mRNA carries the genetic information from the nucleus to the cytoplasm.</td>
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</tbody>
</table>
Question #4: Initiation of Transcription
Which of the following statements about the initiation of transcription (bottom) is false?

A. A gene promoter is a sequence of DNA where RNA polymerase binds.
B. Promoters are closest to the 5' end of the gene on the complementary strand.
C. All promoters have the exact same DNA sequence.
D. The same DNA strand can be the template strand for one gene, but the complementary strand for another.
E. Promoters differ in their RNA polymerase binding effectiveness.

Question #5: Prokaryotic and Eukaryotic Transcription
Which of the following is not a valid difference between transcription in prokaryotes and eukaryotes?

A. Eukaryotes produce only mRNA through transcription; prokaryotes also produce rRNA and tRNA.
B. Eukaryotic promoters initiate the transcription of a single gene; prokaryotic promoters may initiate the transcription of several, related genes.
C. Prokaryotes have a single RNA polymerase; eukaryotes have three functionally different RNA polymerases.
D. In prokaryotes, translation may begin before transcription ends; in eukaryotes, translation always occurs after transcription is complete.
E. In eukaryotes, there is a spatial separation of translation and transcription; in prokaryotes, there is not.

Question #6: Genetic Code - Features
In the genetic code (below), what amino acid, or start or stop codon, is coded for by the triplet nucleotide sequence GTA on the 3' to-5' template DNA strand (or CAT on the 5' to-3' complementary DNA strand)?
<table>
<thead>
<tr>
<th></th>
<th>A. Valine</th>
<th>B. Histidine</th>
<th>C. Tyrosine</th>
<th>D. Proline</th>
<th>E. Serine</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>First letter</th>
<th>Second letter</th>
<th>Third letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>UUU UUC</td>
<td>UUA UUG</td>
</tr>
<tr>
<td></td>
<td>CUC UCU</td>
<td>CUA CUG</td>
</tr>
<tr>
<td></td>
<td>Leucine</td>
<td>Leucine</td>
</tr>
<tr>
<td>C</td>
<td>UAU UAC</td>
<td>UAA UAG</td>
</tr>
<tr>
<td></td>
<td>AAC CAC</td>
<td>CAA CAG</td>
</tr>
<tr>
<td></td>
<td>Serine</td>
<td>Histidine</td>
</tr>
<tr>
<td>A</td>
<td>UAU UAC</td>
<td>UAA UAG</td>
</tr>
<tr>
<td></td>
<td>AAC CAC</td>
<td>CAA CAG</td>
</tr>
<tr>
<td></td>
<td>Tyrosine</td>
<td>Stop codon</td>
</tr>
<tr>
<td>G</td>
<td>GGU GCC</td>
<td>GUA GUG</td>
</tr>
<tr>
<td></td>
<td>GCA GGC</td>
<td>GAG GGG</td>
</tr>
<tr>
<td></td>
<td>Valine</td>
<td>Aspartic acid</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

**Question#7: Genetic Code-Application**
Which of the following statements does not describe a property of the genetic code (below)?

A. All codons specify different amino acids.
B. All newly-formed proteins have methionine as their N terminus amino acid.
C. The genetic code is not ambiguous.
D. The order of bases in the codon is in the 5’-to-3’ direction relative to mRNA.
E. The genetic code is the same for both prokaryotes and eukaryotes.

**Question#8: Transfer RNA**
Which of the following statements about transfer RNA (tRNA) is true?
A. Each tRNA anticodon is specific for one codon.
B. The 3' end of the tRNA molecule varies depending on the amino acid it will bind.
C. Activating enzymes (aminoacyl-tRNA synthetases) link together a specific amino acid with a specific tRNA.
D. A DNA master codon of TAC (3' to 5') would have an anticodon on a tRNA of CAU.
E. tRNA binds to mRNA (via its anticodon), but not to rRNA.

Question#9: Initiation of Translation
In the following descriptions of steps in the initiation of translation (right), which step would be third?

A. Large ribosomal subunit binds mRNA
B. Anticodon of methionine bearing tRNA base pairs with its anticodon on mRNA
C. Small ribosomal subunit binds mRNA
D. Anticodon of a charged tRNA base pairs with the codon at the A site
E. Peptide linkage forms

Question#10: Polypeptide Elongation
Refer to the figure to the right showing polypeptide elongation and the genetic code table below in answering the following question. What will be the fourth amino acid in the polypeptide?
Question #11: Signal Sequences
In the figure to the right showing movement of a newly formed polypeptide into the ER, what is the structure labeled a?
Question #12: Mutations I
Consider the figure below showing a mutation at position 14 in the DNA that causes valine to substitute for asparagine in the peptide chain. This is an example of a

- A. silent mutation.
- B. Missense mutation.
- C. Nonsense mutation.
- D. frame-shift mutation.
- E. translocation.

```
Mutation at position 14 in DNA: T→A
DNA template strand 4 6
AADCAGGGGCGAAATT 6
Transcription
mRNA 5 6
AUGGCUCCCGGUUAA 6
Translation
Peptide Met Trp Leu Pro Val Stop
Result: Amino acid change at position 5: Asp → Val
```

Question #13: Mutations II
In the mutation shown below, the chromosomes involved are ____ and the lower chromosome would have suffered a ____.

- A. homologous, crossover
- B. homologous, duplication
- C. homologous, reciprocal translocation
- D. nonhomologous, duplication
- E. nonhomologous, reciprocal translocation

```
A B C D E F G
A B E F G
A B C D E F G
```

Question #14: Mutations III
Which of the following statements regarding mutations (shown below) is false?

- A. Mutation is the primary source of evolutionary change in a population.
- B. Mutation occurs frequently in a natural population.
- C. Mutation can be either spontaneous or induced.
- D. Mutations can be beneficial.
- E. Sources of mutation include chemicals and radiation.

```
***ATGCTG***
***TACGAC***
***ATGCTG***
***TACGAC***
Replication is normal
Mutated sequence
```
Self-test Quiz for Chapter 13 (The genetics of Viruses and Prokaryotes)

**Question #15: Genetics of Viruses**
To the right is the tobacco mosaic virus. Which of the following statements about the genetics of viruses is **false**?

- A. A single human cell has about 100,000 times as much DNA as a typical bacterial virus.
- B. Viruses usually have only a single copy of each gene in their genome.
- C. A virion consists of a central core of both DNA and RNA surrounded by a capsid.
- D. All viruses are acellular.
- E. All viruses are obligate intracellular parasites.

**Question #16: DNA Virus Reproduction**
Which of the following statements regarding the reproductive cycle of viruses (right) is **false**?

- A.
- B.
- C.
- D.
- E.
A. Some viruses can be surrounded by membrane derived from the host cell.

B. Naked virions enter cells via endocytosis.

C. Membrane-enclosed viruses (enveloped viruses) cannot be imported into the host cell via endocytosis.

D. Membrane-enclosed viruses may be taken up into the host cell when the membranes of the virus and host cell fuse.

E. Virion assembly occurs only in the cytoplasm of the host cell.

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**Question #17: HIV Retrovirus**

The figure below shows a portion of the reproductive cycle of the HIV retrovirus. What is the next step in this cycle?

A. Integration of the viral nucleic acid into the host chromosome to form a provirus

B. Replication of the viral DNA

C. Formation of complementary DNA (cDNA)

D. Translation of RNA to form viral proteins

E. Transcription of proviral DNA into RNA
**Question #18: Bacterial Reproduction**  
The figure to the right shows two bacteria connected by a structure called a **pilus**. This is an example of ____.

- A. transduction  
- B. Transformation  
- C. conjugation  
- D. transposition  
- E. Mutation

**Question #19: The lac Operon—Function**  
The figure below shows a typical operon and its regulator. The **regulatory** sequences of this DNA segment include

- A. promoter for regulatory gene.  
- B. promoter for regulatory gene + regulatory gene.  
- C. promoter for regulatory gene + regulatory gene + promoter for structural gene.  
- D. promoter for regulatory gene + regulatory gene + promoter for structural gene + operator.  
- E. promoter for structural gene + operator.

**Question #20: Operons with Promoters**  
The figure to the right shows an operon with structural genes encoding enzymes that break down a food source other than glucose. The effect of the CRP-cAMP complex is to ____; the immediate effect of an increase in glucose is to ____.
A. block RNA polymerase, increase cAMP concentration
B. block RNA polymerase, decrease cAMP concentrations
C. increase promoter efficiency, increase cAMP concentration
D. increase promoter efficiency, decrease cAMP concentration
E. increase transcription of the regulator gene, increase cAMP concentration