

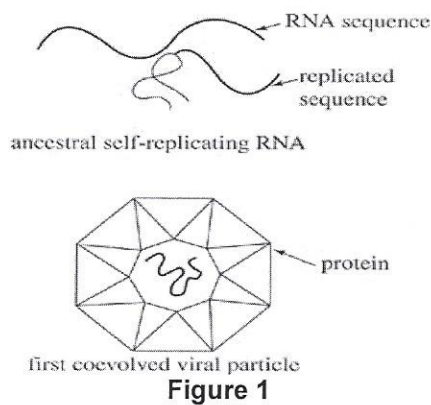
**Directions:** Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Accepted classification systems of life do not include *viruses*. Although viruses possess certain features of cellular organisms, including genetic material that codes for making new viral particles, they cannot *replicate* (make copies of) themselves without first infecting a living cell. Biologists agree that viruses originated from genetic material called *nucleic acid*, but it is difficult to prove any single theory regarding how this occurred. Three hypotheses of viral origin are presented here.

*Coevolution Hypothesis*

Some biologists argue that viruses evolved alongside other organisms over billions of years. They suggest that simple molecules of *ribonucleic acid* (RNA), a *nucleotide* that forms the genetic code for proteins, joined to form more complex sequences. These RNA sequences developed enzyme-like abilities including the ability to self-replicate and insert themselves into other nucleotide sequences. While some RNA sequences became incorporated into membrane-bound cells, others were packaged inside proteins as the first viral particles that could replicate after infecting cellular organisms (see Figure 1).



**Figure 1**

*Cellular Origin Hypothesis*

Some biologists claim that nucleotide sequences within *prokaryotic* (non-nucleated) and *eukaryotic* (nucleated) cellular organisms incorporated into a protein coating and escaped from the cell as a viral particle. Initially, DNA or RNA nucleotide sequences gained the code required for other cells to replicate them. Next, these sequences associated with proteins to form an outer *capsid*. Finally, the *virion* (viral particle) became capable of passing through the cell membrane and infecting other cells where it could be replicated. After the initial escape, viruses evolved independently from their initial host and ultimately could infect either prokaryotic or eukaryotic cells.

*Regressive Evolution Hypothesis*

An alternative explanation of viral origin is that viruses evolved from cellular organisms. Some cellular organisms, particularly certain bacteria, are *obligate intracellular parasites* because they must infect a host cell in order to reproduce. Regressive evolution suggests that some bacterial parasites gradually lost the structures required for survival outside of a cell. The result was a virus particle containing only nucleotides, a capsid (protein coating), and at times an outer membrane or envelope. This would account readily for viruses that contain complex *deoxyribonucleic acid* (DNA) similar to that found in bacteria and other cellular organisms (see Figure 2).

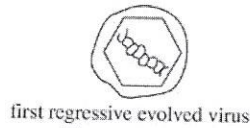
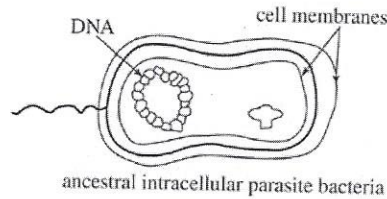


Figure 2

1. The development of which of the following is addressed in the passage by the Coevolution Hypothesis, but NOT by the Regressive Evolution Hypothesis?
- F. Self-replication
  - G. Capsid
  - H. Deoxyribonucleic acid
  - J. Cell membrane transit
2. Supporters of all of the theories presented in the passage would agree with the conclusion that the first viruses:
- A. evolved from bacteria.
  - B. could self-replicate outside a cell.
  - C. were enclosed within a membrane.
  - D. contained nucleic acid.
3. The Coevolution Hypothesis does NOT provide an explanation for the earliest virus particles possessing:
- F. protein.
  - G. enzyme-like activity.
  - H. nucleotides.
  - J. DNA.
4. If the Cellular Origin Hypothesis is correct, which of the following conclusions can be made about modern T4 DNA viruses, which infect *Escherichia coli* bacteria, and modern PP7 RNA viruses, which infect *Pseudomonas aeruginosa* bacteria?
- A. T4 and PP7 are more closely related to each other than to bacteria genetically.
  - B. T4 and PP7 are only distantly related genetically through a cellular organism.
  - C. T4 and PP7 both evolved from prokaryotic organisms.
  - D. T4 and PP7 both evolved from eukaryotic organisms.