ANSWERS

(Clues to) Copying the Code: examining the evidence

3. Possible clues to Copying the Code (DNA replication and transcription/translation)

Clues	Evidence supporting replication	Evidence supporting transcription /translation	Not evidence for replication or transcription /translation
1. When DNA from a virus is injected into a bacterium, the bacterium produces viral (phage) protein.		X	
2. Protein synthesis occurs in the cytoplasm of cells.		X	
3. When a gene is destroyed through exposure to radiation, its capacity to produce an enzyme stops.		X	
4. Bacteria grow for many hours in a heavy nitrogen medium.			X
5. If you understand the structure of RNA then you will know how proteins are made.			X
6. RNA is a nucleic acid found in both the nucleus and the cytoplasm.		X	
7. Uracil hydrogen bonds with adenine in place of thymine during RNA synthesis.			X
8. Bacteria with heavy nitrogen in their DNA, when transferred to a culture tube with lighter nitrogen, formed DNA molecules that were made of half heavy and half light nitrogen.	X		
9. When DNA is removed from a cell and placed in a test tube containing the enzyme DNA polymerase and nucleotides, new copies of the original DNA are formed.	X		
10. Since there is greater variety in the protein molecules than in the DNA molecules of an organism, protein must contain the genetic code.			X

4. Write an explanation detailing why this clue (8 or 9) represents solid data and is not an opinion or an inference.

   When the raw materials are present, such as nucleotides and the enzyme DNA polymerase, new copies of the original DNA are made. If DNA could not replicate, this would not happen. The new DNA molecules would not be assembled.

5. (a) Why is it sometimes difficult to tell the difference between an observation and an inference?

   It is often difficult to be objective. Ideas about what is happening or should happen often bias conclusions and deductions.

   (b) Which of the clues included in the table is an inference? Explain why.

   Clue #10. A preconceived notion was that DNA is too simple a molecule to code for the large amount of variation observed in living things since it is composed of only four different nucleotides. The inference was that since there is a great variety of proteins and proteins are found in all living things, they would be the logical choice to contain the genetic code.

   (c) Which of the clues included in the table is an opinion? Explain why.

   Clue # 5. If you understand the structure of RNA then you will know how proteins are made. There is no factual basis for this statement. It seems like a good idea . . . but that is it.

6. At the time the Central Dogma was first stated, it was an inference based on observations. Explain why.

   Crick and Watson had developed a model for DNA and knew that it must contain the genetic code. How that code was translated into protein was still a mystery. RNA was known to be in both the nucleus and the cytoplasm of a cell. Like DNA, it was composed of nucleotides. It seemed reasonable to "infer" that it must carry the DNA code to the cytoplasm and direct protein synthesis. How it did it could not be directly observed because they could not isolate the RNA.

7. From the information provided in the ***Copying the Code*** module, state one example of a preconceived idea that biased scientific thinking and slowed finding the answer to how DNA is a copying mechanism for hereditary material.

   One possible answer is that Crick thought that RNA had something to do with cell viscosity. Since he wasn't thinking that it was directly involved in the synthesis of protein and the genetic code, it slowed progress.