

Critical Thinking Answers:

Chapter 1:

1. Viruses are noncellular, parasitic, protein-coated genetic elements that rely upon a host cell to complete their life cycle. Although they are not considered living organisms they are still included in the study of microbiology since they are microscopic and impact both microbes and human health.
2. Ubiquitous is a term meaning “everywhere”, which is fitting since microbes occupy diverse habitats in the environment and within living organisms.
3. This is an incorrect use of the term “theory.” The proper term would be “hypothesis”, as Dr. Miller is testing his educated guess that was made to explain an observation. Remember that a hypothesis may become a theory only after it has been supported through rigorous testing.
4. The evolution of oxygenic photosynthesis in bacteria and archaea appears to be largely responsible for the oxygenation of the earth’s atmosphere. This ultimately spurred on the development of oxygen-utilizing microorganisms as well as aerobic eukaryotic cells.
5. Humans use microorganisms and their products in many ways today including: the use of yeast for beer and bread making; the use of genetically engineered microorganisms to produce pharmaceutical grade drugs; and the use of microorganisms to clean up toxic pollutants.
6. While the Whittaker system divides all living organisms into five major kingdoms (Monera, Protista, Fungi, Plantae, Animalia), the Woese-Fox system further distinguishes among the monerans by creating a three domain system of life: Bacteria, Archaea, Eukarya. This system reflects the three major cell lineages that evolved from the first living cells, and was only brought to life so to speak when genetic analysis of seemingly typical monerans showed that they were actually very diverse from these microorganisms and required their own domain of life: Archaea.
7. An emerging disease is a new disease that has never been seen before within a population. Examples of recent emerging diseases are West Nile disease, SARS, and the newly identified SARS-like disease called MERS-CoV (Middle East respiratory syndrome coronavirus). A reemerging disease is an older disease that experiences a resurgence in the number of identified cases within a population over time. Examples of recent reemerging diseases are tuberculosis and dengue fever, and it should be noted that many reemerging diseases are often resistant to drug treatment.
8. In the mid-1800s, Louis Pasteur tested the hypothesis that air and dust were sources of microbes. These historic experiments supported this hypothesis, and surely influenced Joseph Lister to develop the practice of disinfecting the air within operating rooms prior to surgery.
9. The Centers for Disease Control and Prevention’s Division of Global Migration and Quarantine serves to avoid illness and death within the US by eliminating or reducing the entry or spread of infectious agents within the country. Individuals working in this division monitor populations; regulate the transport of humans, animals, and food; and create policies that can be acted upon rapidly in the case of disease outbreak. These policies do include current recommendations for the use of isolation and quarantine. Please see www.cdc.gov/ncezid for more information.

10. A sound hypothesis to explain this observation would be that the damp summer created the perfect environment for breeding mosquito populations. With a high number of biological vectors present, the virus would have a greater chance of spreading among the human population. A way to test this hypothesis would be to work with entomologists (insect scientists) to study the local mosquito populations through trapping and testing for the West Nile virus. You could then collect data to determine if the numbers of mosquitoes actually increased that summer and if a significant number of them were infected with the virus.

The 5 I's are Used in a Food Poisoning Outbreak Wrap-Up

In instances where the number of bacteria in a sample is expected to be especially large, as would be the case with a fecal sample, many types of specialized media may be used to narrow the possibilities. Selective media contain inhibitory substances that allow only a single type of microbe to grow, while differential media allow most organisms to grow but produce visible differences among the various microbes. In this case, samples of the casserole the prisoners had eaten were analyzed using both selective and differential media and found to contain 43,000 colony-forming units (CFU) of *C. perfringens* per gram of casserole.

Investigators learned that the company distributing meals to the jail routinely froze food that was not served and held it for up to 72 hours before using it to prepare dishes for later consumption. In this case, the ground beef and macaroni had been cooked the previous day, and several other food items were near their expiration dates. Also, proper documentation of cooling temperatures for both the ground beef and the macaroni was unavailable. Investigators concluded that improper handling of food in the kitchen was responsible for the prisoners' illness.