Journal Writing Response. BI107

Writing Prompt:

1. Thinking about the elements necessary for life vs. those that exist, how would you counter the following argument? "It's paranoid and ignorant to worry about industry or agriculture contaminating the environment with their chemical wastes. After all, this stuff is just made of the same atoms that were already present in our environment."

2. Life as we know it is based on carbon. What other element would give molecules enough structural diversity to base living systems off of? Explain how you came to this conclusion.

Question 1:

The fact that all substances in our environment are made up of a limited group of elements does not diminish the reality that the impact of these elements is dependent on three things: the properties of the substance (which changes as elements are combined); the location of the substance; and the concentration of the substance. A small quantity of HCI in our stomach is good; a large quantity of HCI on our skin is very bad.

Just as our bodies are sensitive to these variables, so is our environment. The complexity and relationship between the many parts of our environment are only beginning to be understood, but industrial agriculture has proceeded in the past several decades without regard for the long-term (and long-distance) effects of chemical waste. For example, synthetic fertilizers may appear to be beneficial in increasing crop production in the factory farms of the American mid-west. This fertilizer is composed of nitrogen and phosphorus, elements that are naturally occurring and are needed for healthy plant growth.

If the benefits are measured only locally, synthetic fertilizer may appear harmless. However, the run-off from these chemicals enters the Mississippi River and over the years has concentrated in the Gulf of Mexico in such quantities that there is a "dead zone" that is the size of New Jersey. The same chemicals that promote growth of our food crops also allow algae to flourish. The decomposition of the excess algae results in water that is toxic to other aquatic life forms. No fish or shellfish can survive in the Gulf dead zone, which is currently over 800 square miles and growing every year. This is just one example of the impact of agricultural chemicals that may be beneficial in one part of the enviroment, but deadly in another.

Question 2:

This is a question for science fiction fans! For decades, science fiction writers have speculated that a silicon-based life form might be possible. Silicon is a relatively small element, is abundant in our universe and, like carbon, has the ability to form four covalent bonds. One of the earliest (maybe THE earliest) reference to a silicon-based life form in literature is the classic short story "A Martian Odyssey" by Stanley Weinbaum, published in 1934. Weinbaum deals with one of the

more difficult issues of silicon¬based life: respiration. Unlike carbon dioxide, which is a gas that can easily pass out of living cells and into the environment, the oxidation of silicon yields a solid: silicon dioxide. Disposing of this substance would be a challenge for an organism, so Weinbaum describes his creature as methodically depositing a "brick" every ten minutes as it grows.

Like carbon, silicon can form long chains (polymers), but silicon atoms have a larger mass than carbon, and therefore they have difficulty forming double or triple covalent bonds, which limits the total number of different molecules they make in combination with other elements. Perhaps this is why Weinbaum proposed that, while meeting the requisite characteristics for life of growth and reproduction, his Martian creature was not intelligent and unlikely to evolve significantly beyond its primitive state. On the lighter side, the original Star Trek series used an intelligent silicon-based life form called the Horta. Although the episode did not address any of the chemical challenges of silicon life, it's worth watching if only for the classic Dr. McCoy line, "I'm a doctor not a bricklayer!"