

WORKBOOK 1

DETECTING THE UNNATURAL: MILLER'S EXPERIMENT 40 YEARS ON

PART 1 ASSIGNMENT Complete and hand in to your instructor before commencing Part 2.

Name: Class Date

We have used coin tossing to identify the results of a natural or spontaneous reaction. Remember the coin had two natural, or spontaneous results which were possible (heads or tails). But throwing the coin many times, eg. every two minutes for one week, produced approximately equal numbers of heads and tails. Amino acids produced spontaneously, result in a 50:50 mix of left and right handed molecules. A pair of dice tossed every two minutes for one week produced approximately equal numbers of 1's, 2's, 3's, 4's, 5's, 6's. **When the properties of substances involved in a reaction make it possible to obtain a number of different results, a natural or spontaneous reaction is one where all possible results are produced by the reaction after sufficient time.**

However, life is full of reactions where many results are possible, but only certain results are ever obtained! Dice again provided useful illustrations.

THINK IT THROUGH

1-1. How would you devise a dice game so the dice always landed showing 6's?

1-2. How many times would you have to toss a pair of dice to get the dice both showing 7?

POSSIBLE SOLUTIONS

Did you succeed in getting straight 6's with the dice? The time (dis)honoured way is with loaded dice? Gambling cheats have used them for thousands of years. A small weight inserted inside the dice ensures it will always land 6 up. Such dice do not produce the natural result of equal numbers of 1, 2, 3, 4, 5, 6's no matter how long you throw them. So, if two or more results are naturally possible and you keep getting only one no matter how long you try, somebody or something is unnaturally interfering. Intelligent design, outside manipulation, or an unknown factor, is involved. The end result is **unnatural**, because it does not result from **natural properties** of the system.

IMPOSSIBLE SOLUTIONS

Throwing dice to obtain a pair of 7's can't be done because 7 is not on the dice! Seven is not a **natural property** of dice so you could throw dice for trillions of years but you will never get 7's. When a required result is not a property of a system, eg. 7's on a dice, energy, time and chance will never produce such a result. Unless you create a new dice with 7 on it - 7's are not a natural or spontaneously possible result.

THINK IT THROUGH

1-3. How might the information above help detect unnatural manipulation or cheating in gambling casinos?

HANDY DISCOVERY

It was Louis Pasteur who, in 1848, first reported to the Academy of Science, the existence of chemicals which occurred as left and right handed varieties. In 1847 he had noticed Tartrate crystals from grape juice seemed to be two slightly different shapes which proved to be mirror images of each other. Using tweezers, Pasteur slowly picked out left handed from right handed crystals and separated them into two different containers. Upon redissolving them in separate solutions, Pasteur showed that polarised light beams travelling through the solutions were bent in opposite directions.

THINK IT THROUGH

1-4. Since Pasteur's day, we have discovered many ways of separating left and right handed chemicals. In every case, it has been achieved only by mechanisms that are not a natural property of the chemical system, eg. intelligent scientists. We have no case in the past 150 years where separation of left and right handed mixtures has occurred by natural or spontaneous means. Does this fact help the hypothesis that life originated by a spontaneous process? Explain your answer.

1-5. It has been observed over the past 150 years that any pure sample of left handed amino acid outside a living body automatically changes to a mixture of 50% left handed and 50% right handed amino acids with time. Does this support the concept life originated by spontaneous generation?

1-6. Because left handed amino acids change to a 50:50 mix at a measurable rate, geologists have tried to use this information to find how long ago a fossil died. The longer an animal has been dead, the closer its amino acids should come to the 50:50 mix. How does this affect the relevance of Miller's experiment? Explain.

1-7. The review of Miller's experiment in the Time Magazine, October 11, 1994 stated"

"In 1953 University of Chicago graduate student Stanley Miller provided the first widely accepted experimental evidence. In a glass jar he created a comic-strip version of primitive earth. Water for the ocean. Methane, ammonia and hydrogen for the atmosphere. Sparks for lightning and other forms of electrical discharge. One week later he found in his jar a sticky goop of organic chemicals, including large quantities of amino acids, Lego blocks for the proteins that make up cells. Case closed, or nearly so, many scientists believed.

Now this textbook picture of how life originated, so familiar to college students just a generation ago, is under serious attack. New insights into planetary formation have made it increasingly doubtful that clouds of methane and ammonia ever dominated the atmosphere of primitive earth. And although Miller's famous experiment produced the components of proteins, more and more researchers believe that a genetic master molecule - probably RNA - arose before proteins did."
(p.71)

"It was", says planetary scientist and White House Fellow, Christopher Chyba, "a beautiful picture." "Unfortunately", he adds, "it is probably wrong." (p.73)

What can be learned from this review about how strongly you should be committed to a scientific theory?

1-8. Some people have suggested if you give a spontaneous situation long enough it must produce the 'right' result at least once. For example, if a monkey hits the keys on a typewriter long enough, it must eventually type a piece of poetry by Shakespeare. Since the poem consists of letters and the monkey is hitting letters, then one possible combination of letters is a Shakespearian poem. Therefore, they argue, given long enough, it must be attained. What do you think of this argument? (Hint: look for the assumption about the natural properties of letters, monkeys and typewriters and remember the dice).

HAND YOUR COMPLETED ASSIGNMENT SHEETS TO YOUR INSTRUCTOR PRIOR TO COMMENCING PART 2.

Instructors Comments and Rating
