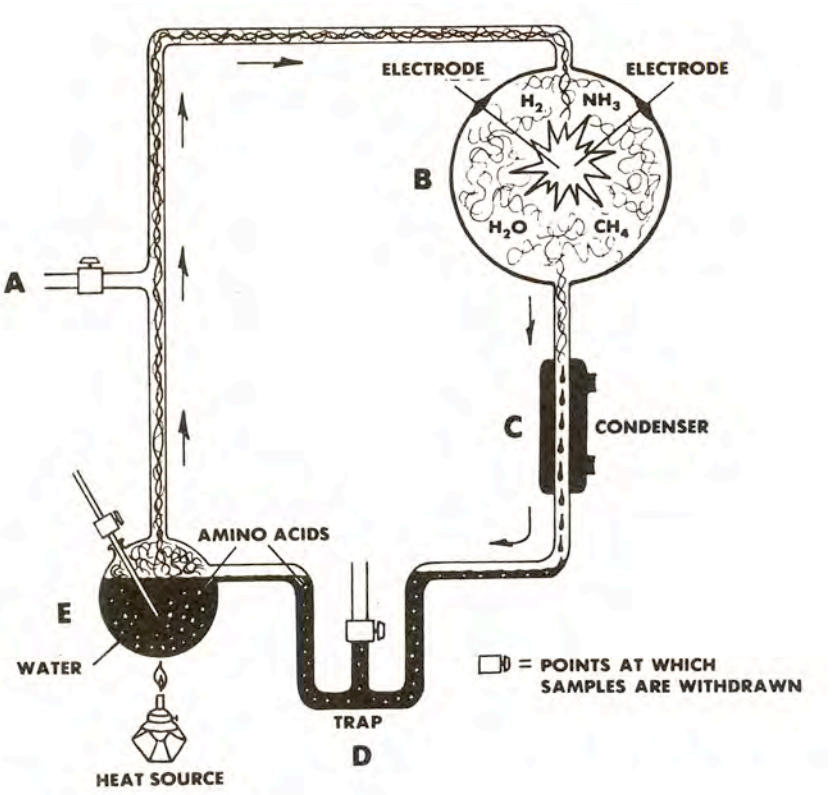

FIGURE 6.10.

The Miller-Urey apparatus for synthesizing organic compounds. Various mixtures of gases thought to have been present in the Earth's primordial atmosphere are introduced at point A. They are subjected to a spark discharge at point B to stimulate the energy input of lightning. A heat source at point E boils water to force a continuous circulation of gas through the system. Amino acids and other organic compounds collect primarily at point D. The final formation of amino acids is the result of a series of consecutive intermediate reactions typically requiring about a week's time. Further, after amino acids are formed they must be isolated from the energy source or it will cause them to disassociate.

These experiments have since been repeated by Miller and others using a variety of gases and also substituting ultraviolet radiation for the spark discharges. Many common forms of amino acids found in proteins have been produced.

It should be noted that recent work performed by Joel Levine of NASA's Langley Research Center suggests that the laboratory experiments of the past thirty years have been conducted using the wrong mixture of atmospheric gases.^2 Levine's computer model simulations suggest that the primary components of the primordial atmosphere were water vapor, carbon dioxide, and nitrogen with a small amount of oxygen also present. The methane and ammonia used by Miller and others is thought to have been chemically unstable and therefore very short-lived, if indeed these compounds existed at all. While the yields are less using Levine's carbon dioxide, water vapor, and nitrogen mixture, some complex organic molecules essential for the formation of life have been produced in laboratory experiments.