Prebiotic chemistry and the origins of life:

a reassessment of the Miller experiment

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The heterotrophic origin of life proposed by Oparin and Haldane in the 1920’s was part of a Darwinian framework that assumed that living organisms were the historical outcome of a gradual transformation of lifeless matter. This idea was strongly opposed by the geneticist H. J. Muller, who argued that single genes or DNA molecules represented primordial living systems. The debates that followed represent not only contrasting views of the nature of life itself, but also major ideological discussions that reached a surprising intensity after the 1953 Miller experiment, which demonstrated the ease with which organic compounds could be synthesized under putative primitive reducing conditions. During the years following the Miller experiment attempts to understand the origin of life were shaped, in socio-political terms, by the atmosphere created by Cold War tensions, and scientifically, by space exploration and by the development of molecular biology. During the past decades models of the primitive terrestrial environment have questioned the assumption that the prebiotic atmosphere was highly reducing, leading once more to opposing views on the first appearance of life. Experimental results demonstrating that biochemical monomers can be synthesized under neutral conditions, together with the recognition that exogenous and endogenous sources of organic compounds in the primitive Earth, can lead to a more eclectic picture of the conditions that led to the origin of life on our planet.