



Origin of Life



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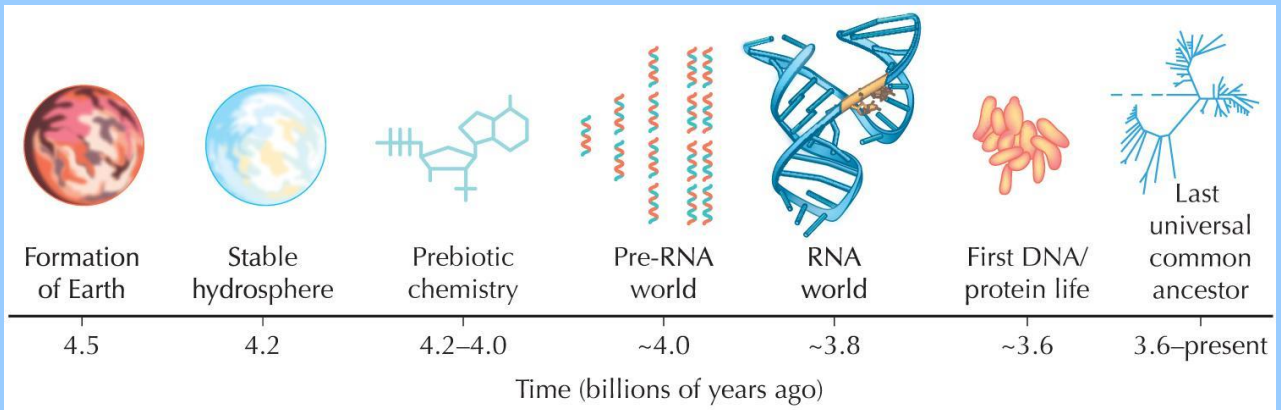


FIGURE 4.4. Steps in the origin of life.

4.4, modified from Joyce G.F., *Nature* **418**: 214–221, © 2002 Macmillan, www.nature.com

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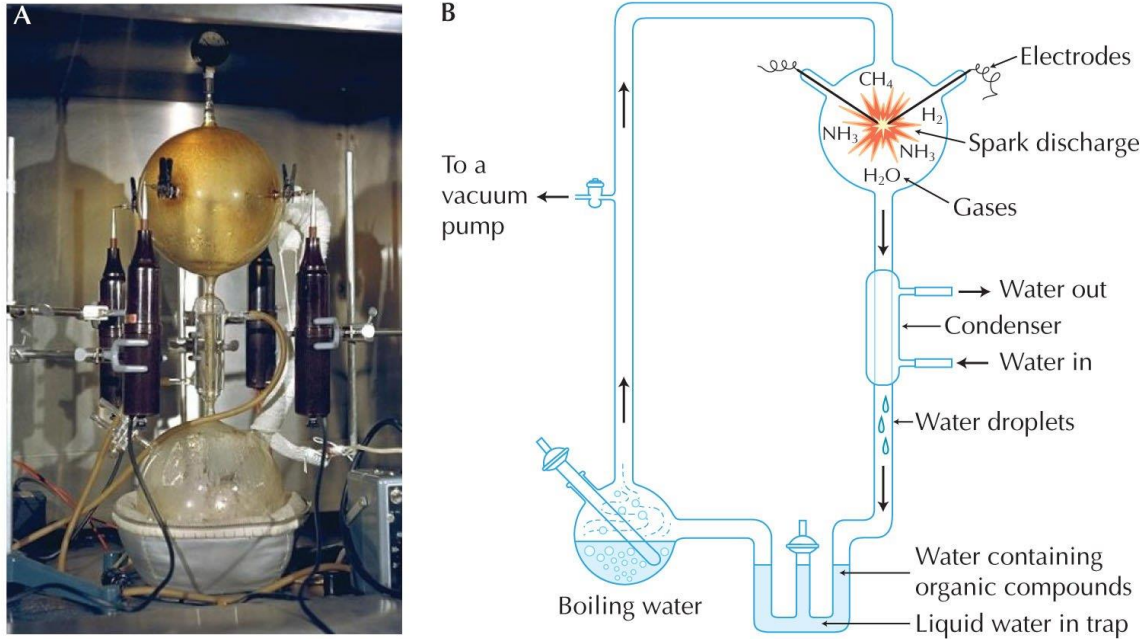


FIGURE 4.6. The apparatus used in the Miller–Urey experiments. (A) Recreation of the original apparatus. (B) Diagram of the apparatus.

4.6A, photo courtesy of NASA

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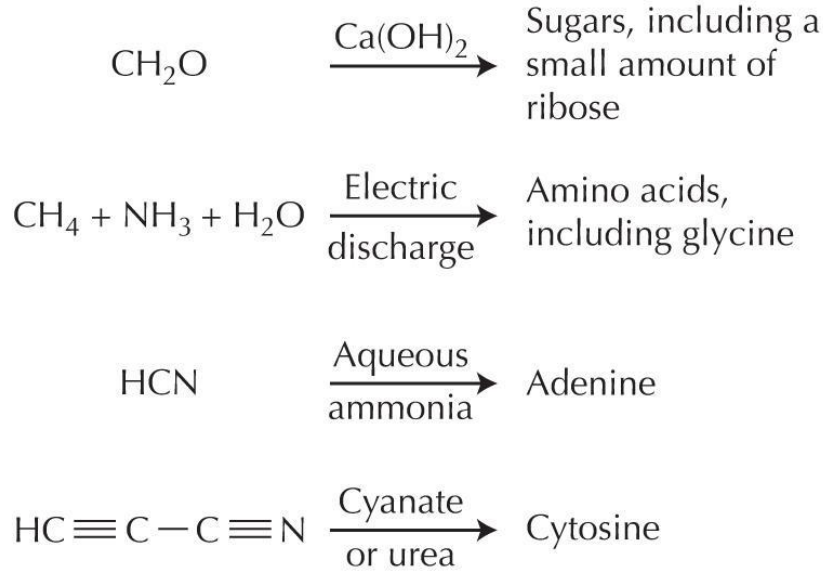


FIGURE 4.8. Schematic diagram of pathways for the synthesis of some key molecules required for the origin of life. Formaldehyde (CH_2O) can polymerize to produce various sugars (i.e., the formose reaction; Fig. 4.7). This polymerization is aided by the availability of reactive groups like Ca(OH)_2 . Methane (CH_4), ammonia (NH_3), and water (H_2O) if mixed in the presence of electrical discharges (in Miller–Urey-like settings) can lead to the production of amino acids (and other compounds). Hydrogen cyanide (HCN) when in the presence of aqueous ammonia can produce adenine. Finally cytosine can be produced from cyanoacetylene when mixed with urea.

4.8, redrawn from Orgel L.E., *Trends Biochem. Sci.* **23**: 491–495, © 1998 Elsevier

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TABLE 4.3. Examples of modern RNA roles

Function	Type of RNA	Role of RNA
Translation	mRNA	Product of DNA transcription
	tRNA	Involved in translation of the genetic code
	rRNA	Serves as part of a ribosomal subunit
DNA replication	RNA primers	Replication of the lagging DNA strand initiates with an RNA primer
	Telomerase RNA	Needed at the ends of linear chromosomes
Splicing and RNA processing	Small nuclear RNA (snRNA)	Involved in splicing
	Small nucleolar RNA (snoRNA)	Required for posttranscriptional processing of rRNA
	RNase P	Essential for tRNA processing
Translation quality control	tmRNA	Targeting aberrant protein products for degradation in bacteria
Protein translocation	Signal recognition particle (srpRNA)	A component of the signal recognition particle (SRP)
RNA interference (RNAi)	Many types	Involved in regulating RNA stability and translation in eukaryotes
Transcription regulation	6S	Regulates the function of bacterial RNA polymerase