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UV light-driven prebiotic synthesis of iron-sulfur clusters

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Introduction: Iron-sulfur clusters are ancient cofactors that play a fundamental role in metabolism and may have impacted the prebiotic chemistry that led to life.[1] However, it is unclear whether iron-sulfur clusters could have been synthesized on the early Earth. Dissolved iron on prebiotic Earth was predominantly in the reduced ferrous state[2], but ferrous ions alone cannot form iron-sulfur clusters. Similarly, free sulfide may not have been readily available. We have shown that UV light drives the synthesis of [2Fe-2S] and [4Fe-4S] clusters through the photooxidation of ferrous ions and the photolysis of organic thiols. Iron-sulfur clusters coordinate to and are stabilized by a wide range of cysteine containing peptides, and the assembly of iron-sulfur cluster-peptide complexes can take place within model protocells in a process that parallels extant pathways. Our experiments suggest that iron-sulfur clusters may have formed easily on early Earth, facilitating the emergence of an iron-sulfur cluster dependent metabolism.

References:

[1] Eck RV and Dayhoff MO (1996) *Science* 152(3720):363–366.

[2] Anbar AD (2008) *Science* 322(5907):1481–1483.