



**Simposio Internacional:** Evolución por cooperación. La obra de Lynn Margulis (1938-2011)

**International Symposium:** *Evolution by cooperation. The work of Lynn Margulis (1938-2011)*

Madrid, 12 y 13 de noviembre de 2012

Madrid, November 12-13, 2012

## **Life in extreme Earth, and beyond**

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One of the fundamental questions in biology is to know the limits of life. The exploration of extreme environments has allowed the discovery of habitats that were considered non habitable only a few years ago. As a consequence, the interest in deciphering the diversity and microbial ecology of extreme environments has grown exponentially, not only to gain information on these peculiar ecosystems but also to explore the potential applications of the microorganisms developing on them. Extremophiles have also a fundamental role in the development of Astrobiology. According to the NASA Astrobiology Institute road map (<http://astrobiology.arc.nasa.gov>), one of the main objectives of this area of transdisciplinary research is the characterization of extreme environments, the microorganisms that thrive on them and the mechanisms that allow them to develop in these conditions. The study of extremophiles has expanded the possibility to find life elsewhere in the Universe. Of the different extreme environments, special attention should be given to the extreme acidic environments associated to mining activities. In this case we are not dealing with adaptations to extreme geophysical conditions (such as temperature, radiation, low water activity, and pressure) but to the extreme acidic conditions generated by the chemolithotrophic metabolism of microorganisms capable to obtain energy from metallic sulfides, mainly pyrite. The exploration of the subsurface geomicrobiology of the Iberian Pyrite Belt has allowed a better understanding of the dynamics of these chemolithotrophic systems, which are independent of the radiation and responsible for the generation of natural acidic conditions of astrobiological interest. This is the case of Río Tinto, one of the best known Mars geochemical terrestrial analogues. Subsurface microbial life needs, for its successful development, efficient symbiotic relationships between the different microbial components of the systems.

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