

Living Systems and Ultraviolet Radiation

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Abstract

Before being born on our planet, the living systems had to learn how to cope with solar ultraviolet radiation (UV). The chemical evolution (i.e. the built up of the first macromolecules) that took place 4 billion years ago and brought about the origin of life on Earth began thanks to the extremely energetic solar ultraviolet photons. However, the transition from a chemical system to the first cell took place in the sea because water absorbs ultraviolet radiation. As soon as living beings (probably anaerobic photosynthesizing cyanobacteria) began to operate, they had to expose themselves to the solar radiation to get light and heat and, in the same time, to avoid damages arising from UV.

In the course of their long evolution, the living systems were (and still are) able to deal with molecular oxygen in air and water and to take advantage of the presence of the ozone layer in the upper atmosphere. They were (and still are) also able to repair molecular alterations caused from UV photon absorption (say: pyrimidine dimers), to protect cells by suitable cell walls and pigments (say: melanin), to contrast the action of deleterious photoproducts (say: with carotenoid pigments), to cover their bodies with coats, furs, scales, etc. and finally to develop behavioral strategies in order to minimize ultraviolet damages.

Today, the world is facing a thinning of the stratospheric ozone layer and an increase of UV radiation on the sea surface. These two connected phenomena are potentially able to damage terrestrial and marine ecosystems on a large scale: i.e. both biosphere and primary production of Earth are at risk. In this situation, it is of great importance to deepen the biological mechanisms that permit living systems (cells, individuals, populations, communities) to survive in a more dangerous ultraviolet environment. It is even more important to spread the knowledge on these mechanisms among a big audience. The increasing UV will hit neighboring countries in a similar way, though their capability to protect themselves will be probably different. The environmental and social UV damages will also depend on scientific and technical understanding of people.