

Fluorescent microscopy for searching extraterrestrial life

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Fluorescent microscopy is a method to detect localized biosignatures *in situ* and a potentially powerful tool to detect extraterrestrial life. It is highly sensitive and will provide clear evidence for extraterrestrial life as images. Stained objects are observed with an epifluorescence microscope with a resolution of 1 micrometer. Many types of fluorescent dyes are commercially available and used in various biological studies. In this study, fluorescent dyes were selected based on the basic characteristics of life: genetic information, metabolism, and discrimination of self from non-self. Each characteristic was detected using a different type of fluorescent dye that was specific for nucleic acids, enzymes, or cytoplasmic membranes. The range of detectable molecules of the selected dyes was investigated with various samples: cultured bacteria, miniature cells which were deficient in DNA, proteins, protenoids, PAH, and Martian soil simulants. The optimum combination of dyes that had the potential to distinguish biological objects from non-biological compounds and useful to search extraterrestrial life especially on Mars will be discussed.

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