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Editorial

Scientists Discover Molecular Patterns that Could Aid in Identifying Extra-terrestrial Life

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EDITORIAL

Extra-terrestrial life may be modestly or radically different from Earth-life, and approaches predicated on detecting specific compounds as biosignatures may not apply to life with a distinct evolutionary history. A recent study has created a machine learning system that uses mass spectrometry to consistently categorize complicated chemical mixtures as biological or abiological. How can we detect life if we have no understanding of what life is in the first place and if that life is fundamentally different from life as we know it? Humankind has been searching for extra-terrestrial life in the Solar System since NASA's Viking 2 mission to Mars in 1976, and the subject of "Are we alone?" has captivated humanity's interest for decades as a question about living entities in the Universe.

MS has the advantage of being able to measure a large number of compounds in a sample at the same time, providing a fingerprint of the sample's composition. However, many similar but slightly different copies of the exact chemicals terrestrial life utilize are frequently discovered in simulations of the primordial processes that scientists believe may have contributed to life's origins on Earth. Because there is still no known sample of alien life, scientists are left with a philosophical conundrum: did Earth-life make some arbitrary choices early in evolution that became locked in, allowing life to be constructed differently, or should we expect all life everywhere to be constrained to be exactly the same way it is on Earth? How can we know if the signals identified in ancient terrestrial samples are from the original living organisms preserved in the samples or whether they are a result of contamination by species that still exist on our planet? This is a problem that has plagued scientists attempting to detect the earliest evidence for life on Earth.

Rather than using the accuracy of MS measurements to precisely associate each peak with a specific molecule in a complex organic mixture, the researchers aggregated their data and examined the overall statistics and signal distribution. Living processes must duplicate themselves, whereas abiological systems have no inherent mechanism to do so." While characterizing every peak in a complicated chemical combination is difficult, if not impossible, the broad distribution of components can reveal patterns and correlations that reveal information about the process by which the combination was created or developed. This form of relational analysis could be useful in the hunt for life elsewhere in the Solar System, as well as in laboratory studies attempting to recreate the origins of life.

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