# Alien Life In Our Solar System

For almost as long as human beings have understood that the points of light circling the dome of the sky were other worlds and suns, we have speculated about life existing beyond the bounds of earth. When our understanding of the cosmos was tentative and fearful, such speculation was considered bizarre, even heretical: Giordano Bruno, one of the first to make a formal claim of a “plurality of worlds”, was burnt at the stake in 1600.

Until the 1950’s, these conjectures were almost entirely fanciful: tales of moon maidens, yarns in pulp science fiction, Percival Lowell mapping nonexistentMartian canals. As we began to realize just how inhospitable conditions were outside the warm oasis of our planet – Venus a sulphuric hellhole, Mars a baked desert – we began to look further afield, into interstellar space.

Much of this period has been focused on the possibility of life beyond our own solar system: with some 300 *billion* stars in the Milky Way alone, and programs like HARPS and Kepler detecting planets around them with increasing frequency, it would seem that no matter how rare and fortuitous the circumstances of our own evolution might be, the odds that we are the *only* sentient species in the universe are vanishingly small. But despite serious attempts to find traces of communication – the electromagnetic “leakage” or directed communications of other civilizations across the vast gulf of space – almost half a century of investigations have so far not yielded any firm data.

Beginning around the 1980’s, astrobiologists brought their eyes considerably closer to home, seriously reconsidering the presence of life outside the bounds of Earth but within our own solar system. Part of this change was due to revelatory explorations of our own planet, and the recognition that our previous definitions of the conditions necessary for life, within accepted ranges of heat, oxygenation, and chemical balance, were wildly contradicted by the discovery of new species. Such “extremophiles” – thriving at crushing pressures, boiling and freezing temperatures, and far away from sunlight – made biologists reconsider the possibility of at least microbial or bacterial life on other planets in the solar system, even moons. At this point in time, the prime contenders as habitats for life are:

Accepted ranges of heat, oxygenation, and chemicals as conditions for life have been wildly contradicted by the discovery of new extremophile species.

## Mars

The source of so much alien life in science fiction, from HG Wells and Edgar Rice Burroughs to Robert Silverberg, Mars could never be home to sentient beings in fact, although it certainly had the conditions to support multicellular support in the distant past.

Tantalizing hints of what *appear* to be fossils have been claimed by some scientists in the digging explorations of the *Opportunity* rover and in samples of Martian meteorites that have fallen to Earth, preserved in Arctic ice. The claim that these tiny features are organic in origin must be viewed with a great deal of skepticism: geological processes can create very complex shapes, which human beings, with our predisposition for pareidolia, are wont to see as significant.

Perhaps the most promising signifier of *existing* primitive life on Mars is the presence of seasonal methane “blooms” in the planet’s atmosphere. While it is possible for the methane to have a geological origin: clathrates sublimating deep underground, or the interaction of volcanic rock rich in olivine with water , the magnitude of the release – 60 parts per billion, lasting for a year in the atmosphere – imply a major production of the gas, far more than can readily be explained by known geological processes. Sadly, these findings have not yet been confirmed on the ground – the *Curiosity* rover has so far failed to find anywhere near that level of methane, at least in its current locale of Gale Crater.

## Enceladus & Europa

The moons of Saturn and Jupiter, more than a billion miles from Earth, would appear to be the least likely home for extraterrestrial life, but Enceladus and Europa are in unique positions: due to their close proximity to their mother planets, the moons are constantly squeezed by gravitational resonance, producing a phenomenon known as tidal heating. It is this constant push and pull, or ongoing radioactive processes in the core of the moons, or a combination of the two, that produces enough heat to produce liquid water, seen in salt-rich jets from the southern poles of the moons.

Frustratingly, Cassini’s mass spectrometer cannot sense the heavy, complex organic compounds that would be a strong sign of life ejected by the cryovolcanoes on Enceladus; neither do we have ground-penetrating radar to see the water we are certain exists underneath the icy crusts of the moons. While more data will be gathered from Enceladus by the probe during its next close flyby in 2015, final summary evidence will have to wait for a specialized mission, which is not yet planned.

## Titan

Third on our list is another moon of Saturn. Titan is far larger than Enceladus and our own moon, and would be a planet under any other circumstance. It is the only natural satellite known to have an atmosphere (of nitrogen) and stable bodies of liquid on its surface (comprised of methane or ethane), with what is thought to be a liquid water layer below. Methane “smog” makes the atmosphere visually impenetrable, but also creates a greenhouse effect that “warms” the surface (to -179**°** C).

Any life on Titan that existed near the surface would have evolved based on a methane substrate, rather than water. Before the Cassini probe reached Titan, astrobiologist Chris McKay suggested that any such life would likely consume both atmospheric hydrogen and surface acetylene, resulting in unbalanced proportions of these chemicals; when the probe arrived, this is exactly what was found. By itself, this does not indicate the presence of life: the odd mixture could also be the result of some hither-to unknown geological or meteorological process.

Ice water geysers emerge from the “tiger stripes” on the south pole of Enceladus.

## Conclusion

Outside our own solar system, it seems increasingly likely that we will detect life through similar methods: not by detecting alien signals or cities, but by analyzing the spectra of the exoplanet’s atmosphere as it passes in front of its star. In a note of supreme irony, the process that concerns us most in our own environment – the high concentration of CO2, methane, and other industrial chemicals in our atmosphere – could well be the fingerprint of intelligent life on planets around other stars.

Poll: When do you think we will discover life outside of Earth?

Within the next decade

Within 25 years

Within the next century

Never