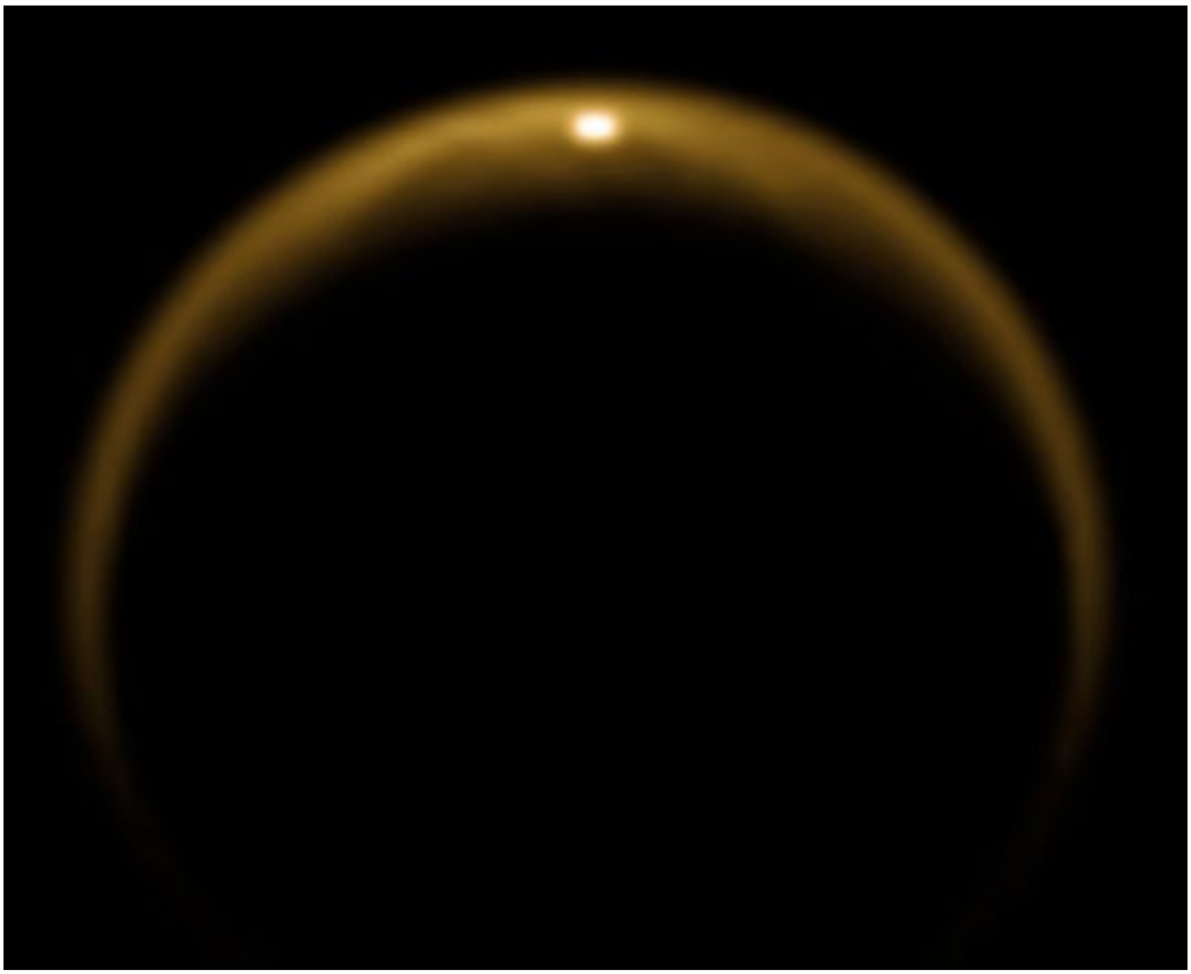
NATIONAL GEOGRAPHIC Daily News

# Saturn's Largest Moon Has Ingredients for Life?

Titan finding suggests new origin for life on Earth?



Sunlight glints off Kraken Mare, a lake on northern Titan's northern hemisphere, in a July 2009 picture.

***Picture courtesy NASA/JPL/University of Arizona/DLR***

**Victoria Jaggard in Pasadena, California**
National Geographic News

**Published October 8, 2010**

# The chemical "letters" used to write the basic code for life on Earth might exist on Saturn's largest moon, according to new research presented Thursday.

The findings suggest the building blocks of life on Earth may have originated in the air, not only in primordial "soup" on land.

Based on lab experiments, scientists concluded it's possible the thick atmospheric haze on Titan contains the five so-called nucleotide bases used in DNA and RNA, as well as some simple amino acids—the building blocks of proteins. (See a quick guide to DNA.)

That's not to say Titan is any more likely to host birds, fish, or even microbes like those on Earth, emphasized study co-author Sarah Hörst, a graduate student at the University of Arizona's Lunar and Planetary Laboratory.

"If there's life on Titan, it probably—for a lot of different reasons—would not use the molecules that life on Earth uses," she told National Geographic News. For starters, Titan is much colder—an average of -290 degrees Fahrenheit (-180 degrees Celsius).

"Also, life on Earth is based on water, and there's no liquid water on Titan's surface available for life." Though Titan has lakes, they're believed to be filled with liquid methane. (Related: "Could Jupiter Moon Harbor Fish-Size Life?")

Instead, Hörst and colleagues think their results might mean that earthly life arose in part from atmospheric components, suggesting the popular idea of a primordial soup on Earth's early surface might be joined by an image of a primordial haze in the sky.

"One of the reasons we think this is exciting is that Titan's atmosphere gives us a window into what kinds of molecules a similar atmosphere is capable of producing," Hörst said.

"With Titan, we can study the process, because it's ongoing right now. But there's lots of evidence now that early Earth might have had a Titan-like haze, and there's probably a lot of exoplanets that have similar chemistry going on."

(See pictures of the three solar system worlds most likely to harbor some form of life.)

### Titan Molecules Replicated in Lab

The new lab results—presented at a meeting of the American Astronomical Society's Division of Planetary Sciences in Pasadena, California—are based on two recent findings from NASA's Cassini spacecraft, which has been studying the Saturnian system since 2004.

(Related: "Fog Seen on Saturn Moon Titan—A First.")

One find is that Titan's haze of nitrogen, methane, and other hydrocarbons is being fed a constant stream of oxygen ions from the nearby ice moon Enceladus, which is spewing material from geysers in its southern hemisphere.

Cassini also found that the top of Titan's atmosphere—around 620 miles (1,000 kilometers) above the surface—contains very heavy molecules, Hörst said.

"This is something nobody would have predicted," she said, "and it's not well understood—no one has any idea why these things are there. But every time Cassini flies by [Titan], we see them over and over again, so we know it's real."

That got Hörst and colleagues interested in figuring out which types of big molecules might form when you pump oxygen into Titan's haze. So in the lab, the team simulated the moon's atmosphere and zapped the molecules with energy similar to what they're known to receive from sunlight.

Hörst then made a list of interesting molecules—including amino acids and DNA bases—that might have formed from the sample, and used a computer program to compare that list to actual data from the experiment.

"I made the list and put it in the computer and hit enter, then went to go do something," Hörst said.

"When I came back, the computer was printing out a long list of all the molecules it had found, and I just stood there for a minute and went ... that's not right. I think any scientist's reaction to seeing something exciting [in the data] is, I've done something wrong. So I went through it again and then went through the data by hand and—no [the molecules are] still there."

**Earthly Life Formed in High Haze?**

Hörst added that the new results don't necessarily mean Titan hosts these molecules: "It's impossible to perfectly replicate Titan's atmosphere in the lab," she said. While Cassini can see the basic components of molecules on Titan, the probe doesn't have the resolution to see exactly how the atoms are arranged.

But if Titan really does form nucleotides and amino acids in its haze, it may be that early Earth's atmosphere also provided a global source of these molecules.

"A lot of standard ideas of the origin of life on Earth is that you get organics in the atmosphere, and they land in liquid water and make exciting things," she said. (Related: "Early Life Fed on Organic Haze, Study Suggests.")

But it takes a lot of energy to break apart otherwise stable nitrogen and hydrocarbons. On the surface, the only thing with enough energy is lightning, because highly energetic radiation from the sun doesn't penetrate that far into the atmosphere.

And if lightning is your only energy source, that means you get the molecules forming on isolated parts of the planet, and "nobody else gets to have any," Hörst said.

Forming the molecules in the atmosphere means sunlight could in fact be an energy source, so the reactions could happen anywhere on the planet—no surface or water required—making the key molecules much more accessible for life to get started.

Ultimately, though, proving the molecules of life exist on Titan will require a new probe with more sensitive instruments, Hörst said—something that may be years from happening.

"The end game would be to have a mission that would be capable of detecting these things," she added. "In the meantime, we can still investigate the chemistry in the lab."

NATIONAL GEOGRAPHIC