Scientists ponder plant life on extrasolar Earthlike planets

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Plants on extrasolar planets resembling Earth could be as black as these eggplants. Scientists who speculate on plant life and what might constitute photosynthesis "out there" say that plant color depends on the size and light intensity that the planet feeds off from its star, or sun, as well as the extrasolar planet's atmospheric chemistry.

When we think of extrasolar Earth-like planets, the first tendency is to imagine weird creatures like Jar Jar Binks, Chewbacca, and, if those are not bizarre enough, maybe even the pointy-eared Vulcan, Spock, of Star Trek fame.

But scientists seeking clues to life on extrasolar planets are studying

various biosignatures found in the light spectrum leaking out to Earth to speculate on something more basic and essential than the musical expertise of Droopy McCool. They are speculating on what kind of photosynthesis might occur on such planets and what the extrasolar plants might look like.

Paint it black

It could be the plants are black, says Robert Blankenship, Ph.D., Lucille P. Markey Distinguished Professor in Arts & Sciences at Washington University in St. Louis. But it all depends on what size and light intensity of star — or sun — the planet feeds off, and the extrasolar planet's atmospheric chemistry.

Plants on Earth are green because of chlorophyll, which harnesses the energy of the sun to make sugars for metabolism. But our plants aren't completely efficient — they waste a little bit of light.

"Ideally, what you want is a black molecule that absorbs all of the light," Blankenship said. "There could be another system developed on an extrasolar planet where plants are completely black if the spectrum of light that's available to organisms is different from the light available to organisms on Earth.

"Then, for sure, the plants will have different types of pigments tuned to absorb those wavelengths of light available on the other world."

Blankenship is co-author of two papers recently published in the journal *Astrobiology*. The papers detail the kinds of clues that researchers are looking for and explore theories of what these other worlds might be like.

Blankenship is part of a NASA working group based at the Jet

Propulsion Laboratory called the Virtual Plant Laboratory. He and his colleagues are studying light that comes from stars and extrasolar planets to infer their composition. They can see clues that suggest the presence of water vapor, oxygen or carbon dioxide, for instance. One key biosignature is the existence of disequilibrium — the simultaneous presence of things that should not coexist on a dead world. The presence of methane and oxygen together on an extrasolar planet, for instance, would be a strong smoking gun for the possible existence of life.

Life on the edge

They also are looking into the "red edge" effect. Seen at 700 nanometers out, beyond the limit of normal human vision, this reflectance spectrum is a signature of the fact that there is very intense chlorophyll absorption going on.

A third way to find extrasolar planets is to look for wobbly stars. As a planet — especially a massive planet — goes around the star it causes the star to wobble a bit. The Hubble Space Telescope has found wobbly stars.

NASA has two missions in the works designed to find possible evidence for life on extrasolar planets. One features a space-based instrument that will make measurements in the near infrared region; the other measures longer wavelengths to get good biosignatures for things like methane and oxygen.

Blankenship said that speculation about the natural world of extrasolar planets is at this point speculative, but that it is important to get a handle on what the possibilities are, how things might look, what measurements to make and what experiments to do to conclude whether there is life on another world.

"I think that everyone thinks that there are Earth-like ones out there, but very few have been detected so far," he said. "One of the things that I've learned is that you have to free your mind from the constraints of thinking that life elsewhere has to be like life here."

Energy on any world is critical, he said, and there has to be some system on an extrasolar planet that involves light capture and storage.

"When you consider another world you've got to find that life there depends on photosynthesis in the broad sense, but it's probably not identical to the way that photosynthesis works here," Blankenship said. "You'll need molecules that absorb light that are highly colored, but whether they have the same green colors we know on Earth is unlikely."

Similarly, on Earth life depends on DNA and proteins. But out there?

"I don't think that there is anything magical about DNA in that it has to be the same out there as here," he said. "But there has to be some sort of information-carrying molecule — again, highly unlikely the same as our DNA — that has information coded in a way that allows the ability to transfer information. We've got proteins that do all of the dirty work in the cell in terms of chemistry. You can imagine a different sort of molecule that would do that sort of chemistry. Maybe it would have the same protein backbone with peptide bonds and so forth. But there's no reason to think it would be comprised of the same 20 amino acids that we have on Earth. It's intriguing to speculate, and I think we'll know more when we get more clues."

Source: WUSTL, By Tony Fitzpatrick