Astrobiology News December 2019:
On Science Fiction, Astrobiology, and Citizen Science

It's hard to believe that I've been writing monthly astrobiology columns for the CLP e-newsletter for nearly seven years![1] It seems my colleagues in Marketing at the Adler Planetarium like the pieces I've written, since they recently asked me to update my December 2016 column, "On *Star Wars*, Hope and Imagining the Future," for an Adler blog, "Exoplanets: Sci-Fi vs. Fact,"[2] in preparation for *Star Wars: The Rise of Skywalker,* the last installment in the series of three trilogies that began more than 40 years ago. Like *Star Trek*, the *Star Wars* franchise has inspired the imaginations of generations, and will likely continue to do so long after those of us who witnessed the beginnings of these pop-culture phenomena are gone.

In one of my early CLP astrobiology columns (August 2013), I discussed the role Jupiter's satellite, Europa, played in the film based on *2010: Odyssey Two*, Arthur Clarke's 1982 sequel to his 1968 novel *2001: A Space Odyssey*. I also noted that Guy Consolmagno (currently Director of the Vatican Observatory, and fellow science fiction geek) suggested that Europa should have a subsurface liquid ocean in his 1975 Master's thesis at MIT, a prediction that has been supported by spacecraft data over the subsequent years. Just last month, the journal *Nature Astronomy* announced the direct detection of water vapor on Europa.[3]

The possibility of extant life in a subsurface ocean on Europa has motivated NASA and the European Space Agency (ESA) to prioritize missions scheduled for launch to this icy world in the next five years.[4] NASA's Europa Clipper mission will carry nine science instruments to study Europa from orbit to determine the thickness of Europa's icy shell, the depth and salinity of its ocean, and to study the chemical makeup of plumes emanating from Europa's interior. Essentially, this mission will learn as much as possible about Europa's potentially habitable subsurface environment without facing the technological challenges of penetrating the thick, icy surface, or the ethical issues of contaminating a pristine environment.

In parallel, ESA is developing the JUpiter ICy moons Explorer (JUICE) to study the complex relationship between Jupiter and its subsurface-

ocean-bearing satellites, Ganymede, Europa, and Callisto. Together, the Europa Clipper and JUICE will gather critical information that could pave the way for a future Europa Lander,[5] although the latter is only in the concept stage of development, with a timeline yet-to-be-determined. Still, I can't help but wonder whether I'll ever write an astrobiology column announcing evidence for extraterrestrial life, either in our Solar System or beyond!

Finally, in my December 2014 column, I reported that the online citizen-science platform *Zooniverse* passed its one-million volunteers mark. On December 12th, 2019 *Zooniverse* celebrated its 10th birthday (I won't mention which birthday I celebrated that same day.)[6] At 1,949,035 registered volunteers, there's still time to reach two million before the year runs out – and there's a special prize lined up for the two-millionth registrant. So, if you've been considering our appeal to incorporate *Zooniverse* in your 2020 Evolution Weekend activities, this would be a particularly good time to sign up!

Happy Holidays, and Peace & Blessings in 2020,

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[1] http://theclergyletterproject.org/Resources/Astrobiology.html
[2] https://www.adlerplanetarium.org/exoplanets-scifi-vs-fact/
[3] https://www.nature.com/articles/s41550-019-0933-6
[4] See https://astrobiology.nasa.gov/missions/europa-clipper/ and https://sci.esa.int/web/juice
[5] https://www.jpl.nasa.gov/missions/europa-lander/
[6] https://blog.zooniverse.org/2019/12/12/zooniverse-is-10-today/