Viewpoint: How social justice ideology is infecting the nascent field of astrobiology

I remember attending a symposium on space science in Washington, DC, sometime in the 1990s, at which the head of NASA at the time, Dan Goldin, gave a keynote address. He marched up to the podium in his trademark cowboy boots, looked out at the assembled astronomers and physicists in the audience, and asked: “How many biologists are here today?” No hands went up. He then said, “The next time I address this audience, I expect it to be full of biologists!”

While NASA had launched an exobiology program in 1960, and the Viking program had searched for signs of life on Mars, in my mind, Goldin’s speech marked the official christening of the field of astrobiology.

In many ways, that was a high point.

I realize that may seem like a strange thing to say. Technology has revolutionized the potential for discovering life outside of Earth, and biology has progressed in leaps and bounds, bringing us ever closer to possibly understanding the origin of life on Earth (a subject I enjoyed bringing myself up to date on when writing my new book). The seminal exoplanet discoveries of Mayor, Queloz, Marcy, and Butler, which have been followed by the discovery of thousands of exoplanets, including many around nearby star systems, have raised hopes for the existence of habitable planets. Prebiotic molecules have been detected on comets and asteroids. We have learned a great deal and are continuing to learn more, with the James Webb Space Telescope (JWST), Kepler, Transiting Exoplanet Survey Satellite (TESS), robots on Mars, and other space missions, and in laboratories on Earth. And there are books and whole journals devoted to astrobiology, and new undergraduate and graduate programs in astrobiology are cropping up at institutions around the world.

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So why on Earth, or, rather, why in the Milky Way would I cast any aspersions on this emerging field of science? The problem is that it *is* an emerging field, and that implies three important things: (1) the development and use of rigorous scientific standards characteristic of more mature fields has not yet been universally established; (2) unfounded claims are too often made, and they gain support in the popular press; and (3) small groups of ideologically driven researchers can have, and have had, an inordinately large impact, hindering progress and potentially pushing the field backwards.

The first major public event for astrobiology after Goldin’s admonition to the scientific community occurred at the White House on August 7th, 1996. At a press conference on the South Lawn, President Clinton described a NASA announcement that a Martian meteorite found in Antarctica showed what appeared to be evidence for fossilized microbial life-forms:

> It is well worth contemplating how we reached this moment of discovery. More than four billion years ago this piece of rock was formed as a part of the original crust of Mars. After billions of years, it broke from the surface and began a 16 million year journey through space that would

> end here on Earth. It arrived in a meteor shower 13,000 years ago. And in 1984 an American scientist on an annual US government mission to search for meteors on Antarctica picked it up and took it to be studied. Appropriately, it was the first rock to be picked up that year—rock number 84001.
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> Today, rock 84001 speaks to us across all those billions of years and millions of miles. It speaks of the possibility of life. If this discovery is confirmed, it will surely be one of the most stunning insights into our universe that science has ever uncovered. Its implications are as far-reaching and awe-inspiring as can be imagined. Even as it promises answers to some of our oldest questions, it poses still others even more fundamental.

Grand words and poetic images. Unfortunately, the NASA announcement was premature. While a group of scientists had produced microscopic images from thin slices of the meteorite of tiny objects that resembled fossils of the earliest microbial life on Earth, subsequent analysis suggested a non-biological origin, and the scientific community ultimately discounted the original claim. (Nevertheless, the fact that the Martian meteorite was found in Antarctica, combined with the fact that growing evidence of the ability of microbial life on Earth to survive in extreme environments such as the interior of rocks did raise publicly the interesting possibility that early life on one planet might reach another planet, dropping “seeds” for the future evolution of life there. So, as was suggested at the time, if you want to know what Martians look like, perhaps you need only to look in the mirror…)

This would not be the last time that NASA would host high-profile press conferences describing results that would later be falsified. Perhaps the most well-known of these involved the claimed discovery of a new genesis of life on Earth. In the days preceding the press release, NASA had indicated they would be announcing a new result relevant to the discovery of life. Rumors ran rampant about a possible discovery of evidence of life on Mars or elsewhere. I was privy to some of the details in advance because my colleague at the time, Paul Davies, had some involvement.

He had long argued that a “shadow biosphere” might exist on Earth. If there had been a second genesis of life on Earth, and if it hadn’t involved standard components like DNA with its four known base pairs, then scientists probing for life in exotic places on Earth might not detect it. As he had repeatedly put it, “a second genesis of life might be literally lying right under our noses.” He and other colleagues, including a student who had become a fellow in the nascent NASA astrobiology program, proposed that perhaps arsenic could substitute for phosphorus in DNA and other biomolecules in such novel life-forms.

At a high-profile hour-long press conference on December 2nd, 2010, the NASA team reported that in arsenic-rich Mono Lake in California, an organism had indeed been found that incorporated arsenic as a substitute for some phosphorus in its DNA. This supposed evidence for a new type of life-form was reported to fuel “wild speculations on the internet about extraterrestrial life.”

It didn’t take long before the claim was debunked. Two papers published in 2012 demonstrated that the analysis was flawed, but even before that, many scientists had discounted the claim. The institute I ran at my university held a scientific workshop on the subject, and I recall a well-known chemist stating that had

the original paper been submitted to a chemistry journal instead of *Science*, it would never have passed the refereeing stage, as arsenic-based DNA would be unstable and would dissolve in water.

This began to set off concerns that with an agenda to search for and, hopefully, discover signs of life elsewhere in the universe, the enthusiasm of the astrobiologists might, in certain cases, have led them to bypass some more conservative scientific standards. Or, at the very least, concerns that scientific standards in the community might be wildly varying, meaning that not just scientists but also the public at large should probably be advised to take future claims with at least a few grains of salt.

Alas, in the intervening years, many new claims have provided fodder for media speculation about possible discoveries of life elsewhere in the universe, only to have later been shown to have been premature at best.

In 2020, it was announced with great fanfare that phosphine molecules had been observed high up in the thick cloud layer covering Venus, at an altitude where the cloud density and temperature were not that different from that of Earth's atmosphere. Phosphine is a biomolecule formed on Earth by decaying organic matter in bogs, swamps, and marshes, and it is also detected in gas giant planets. But the claim was made that no non-biological synthesis mechanism could be operating on Venus; therefore, there might exist life-forms floating in the Venusian clouds. Once again, many in the scientific community were dubious, and two years later, observations by the Stratospheric Observatory for Infrared Astronomy (SOFIA) satellite, as well as other telescopes, have found no evidence of phosphine in the Venusian atmosphere at levels anywhere near the previous claim.

One of the great successes of the Kepler satellite and the observatories that have followed it has been the discovery of literally thousands of extrasolar planets around nearby and distant stars. Public announcements are now made on a regular basis regarding the discoveries of new rocky planets in the so-called "Goldilocks" or "Habitable" zones of their host stars, where liquid water might exist. Since water has been a prerequisite for the evolution of life on Earth, hopes have risen that these planets may harbor life.

One should recognize that "habitable" means "potentially habitable" and, furthermore, that "potentially habitable" means that there is potentially water and an atmosphere on the planet. Neither is guaranteed, and there are many arguments that suggest that neither may be the case. Most "habitable" candidates orbiting closely enough to their stars to possibly have liquid water on their surfaces are orbiting stars much smaller than our Sun. Since these stars are significantly less luminous than the Sun, these planets are therefore on orbits much closer to their stars than Mercury's is to the Sun. These stars are also notoriously unstable, sending off solar flares that could strip the water and/or the atmosphere from a planet. Alternatively, such a planet could be tidally locked in its orbit around its star—as the Moon is to Earth—meaning that only one side faces the star at all times, resulting in one side being boiling hot and the other freezing cold, thus compromising habitability on most of the planet.

Finally, even if a planet with an atmosphere orbits in the habitable zone, that does not guarantee the presence of liquid water. Whether this is possible depends crucially on the existence of continents, for example. On Earth, about 600 million years ago, when Earth's continents were clustered near the equator and reflected a great deal of sunlight, Earth's ocean surface froze, in a scenario that has since been dubbed "Snowball Earth." The models that have been used to estimate whether the habitable life candidates have liquid water are very rudimentary, without any modeling of possible irregular continental structures on their surface.

Indeed, even with liquid water, there is no guarantee that other conditions that may be necessary for the origin of life—at least life like that on Earth—are present. These include not just the presence of surface land, but also a magnetic field to shield the planet from radiation from the host star, and plate tectonics to provide restorative cycling of molecules.

All of these arguments should give one pause, and a recent result from the JWST adds more reasons for concern. The JWST is able, in certain cases where an exoplanet is transiting in front of its host star during its orbit, to probe the light that has passed the edges of the planet to search for the telltale spectrographic signature indicating the presence of an atmosphere and to search for possible biomarkers.

The first such effort, focused on a nearby star, turned out to be a failure. An Earth-sized planet orbiting the star LHS 475 b, 41 light years away, was observed by the JWST, with the goal of detecting its atmosphere and chemical composition. No spectroscopic evidence of an atmosphere was found. While the simplest conclusion one might have drawn from this was that there was indeed no atmosphere, the astrobiology community, and most of the media reporting that relies on it for information, presented the negative result in a different light. Without much more motivation than sheer optimism, it was suggested that the planet probably had dense clouds that shielded an atmosphere underneath, or a dense carbon dioxide atmosphere that might not be detectable.

Astrobiology is, of course, still in its nascent stages, so it is not unexpected that the learning curve is still at a low point and many tentative results can subsequently be proved incorrect. Over time, that ratio should decrease as we learn more. Unfortunately, however, the standards of the field can only improve if the scientists involved allow them to. There is now growing evidence that ideological issues may impede that progress.

The first inkling of the emerging emphasis of ideology over science in astrobiology came from the support by so many members of that community for the protests against the construction of the Thirty Meter Telescope (TMT) on Mauna Kea in Hawaii. In 2000, the National Academies of Science had identified the project as a top priority for the US astronomy community, and they recommended that it be built withinthe decade. Almost immediately, after the dormant volcano Mauna Kea had been selected as theproposed site, local protests began. In spite of the fact that Mauna Kea is the most sacred mountain inHawaiian religion and culture and was known to Native Hawaiians as the home of Wakea, the sky god,numerous large telescopes had already previously been built on the mountain. Conflict between thepriorities of the scientific community and Indigenous religious myths, which had erupted from time to timein the past in Hawaii, escalated after the construction of TMT was set to begin.

While the conflict between science and religious myth is ubiquitous, as witnessed most recently by efforts in New Zealand to teach “Indigenous Knowledge” on the same level as science in high schools, one might have expected the scientific community to support the TMT project more or less unanimously. However, a new generation of young astronomy activists has begun online efforts using the hashtag #ScientistsforMaunaKea, and they consider protecting the sacred nature of the mountain to be more important than the possible scientific benefits of this trailblazing project.

This has helped delay and may even stop the TMT, which was originally slated for completion in 2024, at the same time as the scheduled completion of the competing European project, the Extremely Large Telescope (ELT), in the Southern Hemisphere.

The support of some of the astronomy community for the TMT protests began to demonstrate the growing impact of broader social justice concerns on the field. However, as far as the future progress of the field, these protests paled in comparison to more recent efforts within the astrobiology community to put the brakes on the fundamental science that the field was meant to uncover.

I have written earlier about the emerging effort by young astrobiologists to “decolonize” the search for extraterrestrial life. The once-great science magazine, *Scientific American*, which has degenerated in recent years as social justice concerns have taken priority over science, published an article entitled “Cultural Bias Distorts the Search for Alien Life” (“‘Decolonizing’ the search for extraterrestrial intelligence (SETI) could boost its chances of success, says science historian Rebecca Charbonneau”). Therein she made the argument that the search for extraterrestrial intelligence might be “undermined by biases they only dimly perceive—biases that could, for instance, be related to the misunderstanding and mistreatment of Indigenous peoples and other marginalized groups that occurred during the development of modern astronomy and many other scientific fields.”

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The fundamental science associated with searching for extraterrestrial life involves the technical development of tools to detect and probe possible exoplanet atmospheres, or, if one is searching for signs of intelligent life, to search for patterns of radio or optical pulses and signs of technological civilization impacting on the atmospheres of distant planets. Concerns about how this scientific research might reflect underlying racial biases seem misplaced at best. But Charbonneau suggests simply stopping developing the technology while we consider the issue. Instead of listening for signs of alien intelligence, we should first be listening to Indigenous people here on Earth, or, as she put it, taking into account “marginalized and historically excluded perspectives.”

Dr Charbonneau is a Jansky Fellow at the US National Radio Astronomy Observatory. These prestigious

fellowships are meant to assist the most promising researchers in radio astronomy. That she espouses such a cause suggests how deeply embedded this ideology has become in the community. Speaking at a large SETI meeting in Pennsylvania last year, she reiterated her claims that racism might underlie much of the current SETI mission. Charbonneau was not alone. Another observer at the meeting reported that many of the “scientific talks” were about forbidding the language of “colonization” and discussing “indigenous” issues, non-binary sexuality, and transphobia. Ultimately, the meeting resolved that it was appropriate to forbid the use of the word “intelligence” in the name “Search for Extraterrestrial Intelligence” as it is a “white construct.”

Numerous SETI scientists reported last year that in the face of these claims, it was becoming harder and harder to carry out SETI research. They had good reason. Not to be outdone by last year’s nonsense, the organizers of this year’s Penn State meeting, which will take place in June, just announced a code of conduct related to unacceptable behavior. The behavior that might lead to exclusion from these conferences now is not confined to mere actions but also to promoting or even citing the work of any scientist the organizing group deems as being unworthy! The code of conduct includes the following explanation:

> II. Unacceptable behaviour
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> […]**Promote the work of those who have violated Professional Codes of Ethics (e.g., the AAS Code of Ethics).** Promotion of an author’s work includes any verbal or visual presentation including that person’s name or likeness. In cases where the participant’s work is sufficiently scientifically-independent from that of the person who has violated the professional code, the work may be presented so long as the presenter is not engaging in promotion. Citations are not violations of this policy, though all participants should weigh the necessity of presenting that citation with the harm that it could perpetuate.

That last phrase is particularly telling. In almost all fields of scholarship, not citing the previous work of other authors on which one’s own work is based is referred to as plagiarism. In astrobiology, citing such work can also now be considered harmful.

The notion that citing past scientific results in scientific papers can “perpetuate harm” may not signal the beginning of the end, but it doesn’t bode well for a field that needs to work hard to ensure the highest level of scientific standards if it is to mature as it attempts to address some of the most significant questions we can ask about our place in the universe.

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