Dear Editor,

The 24 July 2020 Science carries a book review by Matthew Schindell of The Sirens of Mars. The review claims the book's author, Sarah Johnson, is thoroughly familiar with the exploration of Mars, "putting her at the center of many of the major discoveries." Yet no mention is made of the 1976 Viking Mission to Mars, and the book, itself, concludes Mars is a dead planet. Omitting mention that Vikings' twin spacecraft found strong evidence for extant microbial life, subsequently supported by copious new findings, needs to be stated by Science, perhaps along with a review of the recent book, To Mars with Love, written by my Viking Labeled Release Co-Experimenter, Dr. Patricia Ann Straat. This book gives a lay account of the Viking Mission Labeled Release experiment (LR). Because this topic is so important, I have assembled the following evidence supporting life on Mars. Each item has been published in a peer-reviewed journal or released directly by NASA. (The references are cited on my web page <gilbertlevin.com>, tab "Mars Research, see especially "Levin and Straat, 2016.")

1. Amino acids and many other organics have been found all over the reachable cosmos.
2. Biological fossils have been reported in meteorites by many scientists.
3. Liquid water, biologically complex organic compounds, all key elements of life, including CHNOPS, have been found on Mars.
4. Terrestrial microorganisms have been grown under Martian environmental conditions, and even harsher, even in naked space, surviving 1.5 years of exposure.
5. Microbes on Earth could be impelled to Mars in bolides launched by meteoric impact, and land in viable form (all the parameters have been verified).
6. The Viking 1 Mission LR test and a series of increasingly decisive controls exceeded NASA's pre-mission requirements for the detection of extant life.
7. Then, as dictated by the scientific method, the Viking 1 LR repeated the test and imposed even more restrictive controls.
This duplication verified the first test and its controls, thereby establishing the grounds for scientific proof.
8. In a separate mission, Viking 2 replicated the LR experiment and also duplicated it. All its results confirmed the presence of extant microbes.
9. Viking 2 detected greenish patches on some rocks. Analyzed with the six-channel Viking Imaging System, the spectra of the patches completely matched those of terrestrial lichen when analyzed in the same system.
10. Precise replicate images of the patches on the rocks taken at yearly intervals for three Martian years showed the shapes had changed, with no changes in the surrounding field, thereby eliminating wind and dust as an explanation.
11. Chlorophyll was reported by spectral analysis of the Martian surface and on newly-appearing material on the lander deck. Although the respected scientist who made this claim withdrew the published peer-reviewed publication, inducement is suspected.
12. Ultraviolet (UV) activation of the Martian surface material did not, cause the LR reaction, as was initially proposed by some: a sample taken from under a UV-shielding rock was as LR-active as surface samples.
13. Among complex organics reported on Mars by Curiosity's scientists, kerogen, which is only of biological origin, was mentioned as a possibility.
14. Phoenix and Curiosity concluded that the ancient Martian environment was habitable. They did not conclude that it was not still so.
15. The excess of carbon-13 over carbon-12 in the Martian atmosphere is strongly indicative of biological activity, which preferentially incorporates the latter.

16. The presence of O2 in the Martian atmosphere is also indicative of a disequilibrium, requiring constant replacement. This may be regarded as an indication of photosynthetic life as is the source of O2 on Earth.
17. The seasonal cycle of O2 recorded in the Martian atmosphere requires a rapid sink, beyond any available chemically, but which could be supplied by microorganisms.
18. Methane has been measured in the Martian atmosphere both cyclically and locally; microbial methanogens could be the source.
19. The rapid disappearance of methane from the Martian atmosphere requires a sink, possibly supplied by methanotrophs that could co-exist with methanogens on the Martian surface.
20. Ghost-like moving lights, resembling will-O'-the-wisps on Earth that are formed by spontaneous ignition of methane, have been video-recorded on the Martian surface.
21. Formaldehyde and ammonia, each possibly indicative of biology, are claimed to be in the Martian atmosphere.
22. An independent complexity analysis of the positive LR signal identified it as biological.
23. A worm-like feature was in an image taken by Curiosity.
24. Large structures resembling terrestrial stromatolites (formed only by microorganisms) were found by Curiosity; a statistical analysis of their complex features showed the probability was less than 0.004 that the similarity could be attributed to chance alone.
25. Images sent by Curiosity bear strong resemblances to metazoans (multiple-celled organisms) as assessed by experts.
26. Images sent by Curiosity also bear features resembling mushrooms as assessed by experts. The "mushrooms" are seen to expand, and new ones pop up out of the ground in images taken several days apart.
27. Nothing inimical to life, even as we know it on Earth, has been found on Mars.

In summary, we have: positive results from a test (the LR) adapted from a standard test used by public health departments daily to test for microbial contamination of drinking water for billions of people in cities around the world; those tests were confirmed by strong and varied controls; duplication of the LR results at each of the two Viking sites; replication of the experiment at the two Viking sites; with the above copious additional hard and circumstantial evidence for life on Mars - and the failure for over 44 years of any experiment or theory to provide a scientifically supportable non-biological explanation of the Viking LR results. Over the years, the evidence for life has become greater than "extraordinary," and the claim for life has decreased to ordinary. Indeed, it would be extraordinary if Mars were sterile.

Now, what is the cumulative evidence against the possibility of life on Mars? The astonishing fact is that there is NONE.

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