

The search for life off of our own planet is at best an inexact science. The only place where we can comfortably claim the existence of life is on our own planet. However, recent studies of microbial life on Earth have altered our views of the potential existence of life elsewhere. Life is tougher and more tenacious than we might have imagined 20 years ago. It is now known to be distributed throughout the crust of our planet in ways that challenge the imagination and widen our anticipation of similar life forms in previously unthought-of niches on other planets. This, coupled with the emergence of many new planets around far-off stars, has put in motion a feeding frenzy of would-be discoverers of alien life. But how do we rationally handle such a problem? Biologists know how to detect life; we have exquisite methods capable of detecting life and its indicator molecules that biologists have developed and routinely use. However, we can not assume that life will be like our Earthly life, and so the tools that we depend on to detect Earthly life must be used with caution, modified, or even discarded. We must define life in its most general features, and develop methods for measuring these features, taking care that they be as non-Earth-centric as is possible. Such an exercise reduces the search for life to basic physics, chemistry, geology, and statistics, rather than biology. However, having the Earth for a laboratory, we can test our non-Earth-centric methods in extreme environments on our own planet, using our tried and true Earth-centric methods to ground-truth the new approaches as they are developed.