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The Viking Labeled Release experiment (LR): One of the first panel of biological experiments ever conducted on another world, the Viking LR got a positive response, and therefore remains relevant as we contemplate another attempt at detecting alien life in our solar system. A particularly pertinent lesson from the early mission is that sterilization, which is widely accepted as a control for false positives under laboratory conditions, is not always adequate in natural planetary environments. Specifically, deserts soils can contain photochemical oxidants such as superoxides, which mimic heterotrophic activity in oxidizing heterotrophic medium and being sensitive to heat sterilization. Hence, the Viking LR, while meeting pre-mission criteria for life detection, is interpreted by many as having detected a false positive.

Chiral Life Detection: We recently tested and validated an improved life detection concept that can differentiate between biological activity and chemical reactivity. The new concept calls for soil of interest to be incubated in a racemic sugar or amino acid solution containing both L and D-enantiomers, while the consumption of each enantiomer is monitored. If microorganisms were present, one enantiomer, either L or D, would be consumed. If, on the other hand, the soil were chemically reactive, both enantiomers would be oxidized. Thus, a chirality-resolved experiment would be free of false positives. It is also non-Earth centric and can inform as to whether the detected life uses D- or L-amino acids. We suggest that this approach be considered in future astrobiology missions to Mars and other biologically interesting worlds such as Enceladus.