SUBSTRATE STEREO SELECTIVITY MAY BE USED TO DISTINGUISH BETWEEN CHEMICAL AND BIOLOGICAL REACTIVITY ON MARS. Henry J. Sun, Desert Research Institute, 755 E. Flamingo Road, Las Vegas, NV 89119. henry.sun@dri.edu

In the Viking labeled release experiment, organic compounds added to the Martian soil were rapidly degraded as if the soil contained live microorganisms [1]. But failure to detect native organic carbon raised the possibility of a chemical reactivity as caused by the presence of inorganic oxidants [2, 3]. The debate between pro-life and anti-life views is likely to intensify in light of the results of the Phoenix mission, which could be argued to support both possibilities. Future astrobiology studies of Mars need a simple method to distinguish between chemical and biological reactivity. One idea, as advocated by Dr. Gilert Leven and implemented by the Mars Oxidant experiment, is the use of pure enantiomers of chiral compounds [4]. The idea assumes that biological activity is inherently stereo specific, whereas abiotic redox processes are stereo indiscriminate. In this presentation I present experimental data indicating that this assumption is valid, but not across the board for all chiral substrates. In the case of glucose, the assumption appears to be correct. More than two dozens of species of microorganisms, including bacteria, eukaryotic yeasts and fungi, and archaea, have been studied so far. They all consumed D-glucose. None used L-glucose [5]. Microbial communities in four different soils, too, consumed glucose in a stereo specific manner. In the case of lactate and amino acids, two substrates that were used by the Viking labeled release experiment, the result was mixed. Some organisms utilized only D-lactate and only L-amino acids as has been assumed. Other organisms were stereo indiscriminate and used L-lactate and D-amino acids as well as D-lactate and L-amino acids. For some amino acids a third scenario exists, where both enantiomers were biologically active, but the L form was more so than the D form. The addition of these enantiomers to soils was followed by a lag phase whose duration is enantiomerically dependent. The lag phase was consistently shorter for the natural enantiomer, L for amino acids and D for lactate, than for the rare enantiomers. Once they entered their respective log phase, the two enantiomers were consumed at approximately equal rates. In conclusion, stereo specificity or selectivity could be used to differentiate between chemical and biological reactivity, but such experiments would require a careful selection of substrates and need to take into account reaction kinetics.

1. Levin, G.V. and P.A. Straat. 1976. Viking labeled release biology experiment: Interim results. *Science* **194**:1322-1329.
2. Klein, H.P. 1977. The Viking biological investigation: general aspects. Journal of Geophysical Research **82**:4677-4680.
3. Zent, A.P. and C.P. McKay. 1994. The chemical reactivity of the Martian soil and implications for future missions. *Icarus* **108**:146-157.
4. McKay, C.P., Grunthaner, F.J., Lane, A.L., Herring, M., Bartman, R.K., Ksendzov, A., Manning, C.M., Lamb, J.L., Williams, R.M., Ricco, A.J., Butler, M.A., Murray, B.C., Quinn, R.C., Zent, A.P., Klein, H.P., and Levin, G.V. 1998. The Mars Oxidant experiment (MOx) for Mars '96. *Planetary and Space Science* **46**:769-777.
5. Sun, H.J., Saccomanno, V., Hedlund, B.P., and McKay, C.P. Stereo-specific glucose consumption may be used to distinguish between chemical and biological reactivity on Mars: A preliminary test on Earth. *Astrobiology*, in press.