LOWELL OBSERVATORY
FLAGSTAFF, ARIZONA

April 25, 1959

Dr. Joshua Lederberg
Department of Genetics
School of Medicine
Stanford University
Stanford, California

Dear Dr. Lederberg:

Here is the analysis of the feasibility of detecting organic matter on Mars from a probe.

First the detection from a probe of NH bending and C=O stretching bands at 5 - 6 μ is considered. Most of the energy from Mars at these wavelengths will be thermal emission. I find that for an emissivity of 0.5 the energy received per cm^2 from the whole of Mars at 100,000 miles within a 0.1 μ band is 5×10^{-9} watts. Since lead selenide detectors at liquid nitrogen temperatures can detect 10^{-9} watts or less, from a detection standpoint the test seems feasible. Telescope apertures of the order of 100 cm^2 would seem to yield adequate signal-to-noise ratios. The bands will appear in emission since, as mentioned, the majority of the energy is thermal emission. Some amount of surface discrimination may be possible, particularly is larger telescope apertures can be used. Observation of these bands from the ground is prohibited poor atmospheric transmission and the small amount of energy. From a balloon this latter difficulty will be conciderably enhanced by restricted apertures available.

Another possibility I have considered is detection of N-H and O-H stretching bands at 3 μ. This region is again messed up at ground level by a water band. In a balloon this difficulty is eliminated. One expects about 2×10^{-11} watts/0.1 μ from the whole of Mars in a 12-inch aperture. This would be detectable by uding a cooled lead sulfide cell. To obtain resolution on the sueface a considerably larger aperture or a probe is required.

I have learned, partly to my chagrin, that carbonates have prominent bands right at 3.4 microns. However, the presence of carbonates on Mars is eliminated by the fact that their bands are not like the observed in that there is no appreciable absorption at 3.67 μ. It is still further eliminated in that carbonates have a very strong absorption at 3.9 μ which is not observed on Mars. However, I feel that, from the observations alone, one can not be sure that the observed absopptions are produced by organic molecules.

I have enclosed the travel vouchers and my tickets.

Sincerely,

Bill

William M. Sinton

SINTON, W.M.