COSMIC MICROBIOLOGY

I am deeply concerned over the incipient despoilment of an opportunity for biological exploration unique in our time: the starting point of extra-terrestrial microbiology.

Rockets destined to reach the moon are certain to be launched within the next few months or years. The level of current biological discussion suggests that the event was relegated to science-fiction until recently, and there is still no evidence of the advance planning needed to anticipate the event before irreparable harm is done. However, to ignore its immediacy is to evade the facts of life today. Perhaps the moon has been discounted as a source of biological information on the premise that its surface environment is incompatible with any active form of life. This may be true, but our opportunity to test the premise may be thrown away very soon. In any case it is not the only issue.

Since Arrhenius' biospore theory, men have speculated whether the cosmic dust includes any still viable spores. The status of current opinion of this theory, including my own, is insignificant next to the fact that there has been no opportunity to approximate an experimental test of it. Its bearing on the cosmic distribution and origin or origins of life, and the importance of these issues, need hardly be stressed.

Astronomers suppose that the moon, lacking an atmosphere, has acquired over the ages a layer of cosmic dust. This is our nearest, likely accessible, substantial and uncontaminated source. That is, it will remain uncontaminated until the first rocket perhaps carrying casual dirt, pigment or even a dog is sent to crash spectacularly on the moon's surface. Any useful sampling of such dust may have to be done on a large scale, large enough perhaps to strain our technical ingenuity, and enough that the dejecta of one animal dispersed over the moon's surface would probably confuse or vitiate the search, both for terrestrial and totally new forms[1]. (At the extreme, Arrhenius' theory demanded only one spore per planet, so that the scope of any test should be limited only by our will and ability to carry it out.) It is likely, of course, that the earth is the most likely source of such spores, e.g. via escapes from volcanic catastrophes. This does not lessen the interest and validity of our model test whether spores can achieve as well as survive interplanetary transit by natural agencies. It should be possible to devise feasible precautions against contamination. Large scale contamination of other sorts, e.g. by radioactive isotopes might also be disastrous to the scientific study of the moon from other aspects, but these are less sensitive than the biological.

Unfortunately, our technical ability to contaminate the moon's surface will predate our opportunity to retrieve a sample of it by several years. The temptations to spoil the game meanwhile will be enormous. I earnestly hope that my colleagues will be able to review these problems on their merits and feed their conclusions to the policy-making apparatus in time to save the situation. The tactical and technical problems of starting the biological exploration of the extra-terrestrial universe on the right track are enormously difficult, perhaps matched only by the importance of the scientific issues.

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1 The surface area of the moon $\sim 4 \times 10^{13}$ m^2. Counts of 10^{13} bacteria per kilogram of contaminated material would not be unusual.