range 10–300 microns. Such a structure is entirely compatible with petroleum coke[15].

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Comment by Prof. G. Mueller*

THE great cosmic abundance of carbon, hydrogen, oxygen and nitrogen leads us to the conclusion that the crust of the Earth must have contained an original non-biogenic carbonaceous phase. What was its composition, and to what extent is it at present preserved, remain open questions.

It should be stressed that all the known deposits of petroleum and related substances, including the asphalt lakes of Trinidad and Venezuela, are within sediments in general and shallow sea deposits in particular. A considerably greater volume of metamorphic and igneous rocks have proved so far to be barren of oil, etc., although the layers of ashes within the older, often folded, volcanics would serve as quite ideal reservoirs covered by the highly impermeable lava-flow traps. On the other hand, the few reliably abiogenic organic mineraloids found in pegmatite veins (tucholites, etc.) have a quite uniquely high oxygen/hydrogen ratio of around 1·0 as against the range of from 0·0 to 0·25 of petroleums and asphalts. It is unlikely that the former substances would yield much of the liquid low oxygen/hydrogen substances on cracking. Indeed, it seems that the main role of life was to differentiate this original high oxygen/hydrogen phase into carbon dioxide and the correspondingly lower oxygen/hydrogen ratio organisms, the partially biochemical decomposition of which yielding still lower oxygen/hydrogen products.

It appears more likely, therefore, that our petroleums would be essentially distillates, etc., of biogenic substances, which in turn picked up small quantities of abiogenic residues.

It appears from our scanty experience that the most probably abiogenic organic substances from the meteorites are also high oxygen/hydrogen complexes, which yield on distillation relatively little hydrocarbons per carbon, and mostly organic acids on extraction. It seems, therefore, that the supposed parent asteroid of the meteorites contained a similar essentially 'acid' carbonaceous phase, as are our terrestrial tucholites. It would be unlikely that such types of substances could freely flow and form the extensive maria. However, it should be stressed that our knowledge of the terrestrial and extraterrestrial abiogenic carbonaceous phases is based on too few specimens or up-to-date investigations. Ultimately, only the actual exploration of the lunar surface could give us the reply as to the validity of the most interesting observations and their interpretation given by Dr. A. T. Wilson.

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STABILITY OF VIRUSES ON *DISCOVERER* FLIGHTS *XXIX* AND *XXX*

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THE imminence of space travel suggests the need for an increased effort in determining effects of physical and physiological stresses on host–parasite interrelationships. Synthesis of known and speculative conditions encountered during space exploration and the possible influence of infectious disease processes have recently been reviewed[1]. Included among those stress factors are: radiation, hypoxia, temperature, endocrine, nutrition, weightlessness and various combinations. It was of interest, therefore, to ascertain whether or not viruses could be safely orbited and returned to the laboratory, prior to any attempt at experimentally simulating these conditions. The purpose of this report is to give results demonstrating the successful flight and recovery of two animal viruses.

The viruses included in this work were laboratory stock strains of influenza (*PR* 8) and *ECHO* 1. These viruses were selected because of their known inability to produce disease in man or laboratory animals. Furthermore, they differ in their response to deleterious conditions from an unstable virus (influenza) to a relatively stable virus (*ECHO* 1). Influenza stock virus was obtained by inoculation of 9-day-old chick embryos and *ECHO* 1 stock virus from monolayers of monkey kidney cells. Both viruses were collected at the time of maximal replication. Each virus was pooled, lightly centrifuged, and sealed in glass ampoules which were maintained at −70° C. Titrations at various intervals were performed for EID_{50} and $TCID_{50}$ using standard laboratory procedures[2].

A number of successful *Discoverer* flights containing biopacks have been reported[3,4]. Briefly, these biopacks are small air-tight metal canisters, which ride 'piggy-back' on the *Discoverer* rockets. The various biological specimens are tightly fitted into different compartments of the biopacks at the laboratory prior to shipment. In addition to these viruses, other biological specimens included: various tissue and organ cultures, bacteria, algae, insect larvæ, serum and radiation dosimeters.

In general, flights *XXIX* and *XXX* are similar regarding their flight profiles. Table 1 lists an approximation of these data indicating the essential information on both flights. It is obvious, however, that these flights are not critical tests of space conditions inasmuch as the van Allen belt was not