MICROBIOLOGICAL ASPECTS
OF SOIL STRUCTURE

I. RELATIONSHIPS BETWEEN ORGANIC AMENDMENTS,
MICROBIAL COLONIZATION,
AND CHANGES IN AGGREGATE STABILITY

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INTRODUCTION

It is well known that addition of organic materials to soil generally produces an increase in the proportion of water-stable aggregates. The organic materials themselves frequently have no immediate effect but during and following their decomposition by micro-organisms changes occur which lead to increased aggregation. The relationship between microbial activity and aggregate formation is widely appreciated but the nature of the relationship has not been fully elucidated 16. That microbial products are of primary importance, however, now seems well established and recent work strongly suggests an important role for certain types of polysaccharide 1 4 7 22. Clearly micro-organisms capable of producing these, or indeed any compounds which significantly affect aggregation, are of major importance in the soil. Their exploitation, however, depends on a detailed understanding of their ecology and particularly of the complex relationships which must exist between substrate, organisms, and product within the soil environment.

In order to gain some insight into the nature of this aspect of the problem an attempt has been made to develop an experimental model system in which changes, both in microbial flora and structure, may be examined under defined conditions.
MATERIALS AND METHODS

Soils

Two soil samples were used; one a poorly structured arable soil from Lincolnshire, the other a relatively well-structured soil from the Department's Experimental Garden at Aberystwyth. The principal characteristics of these two soils are summarized in Table 1, below.

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<th>Characteristics of soils used</th>
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<td>Lincolnshire arable</td>
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<td>Dept. Exptl. Garden</td>
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* Expressed as the mean number of water drops required to disintegrate 2-mm aggregates. For method see below.

Artificial aggregates

Preparation. Soil samples, air dried at room temperature (18–20°), were ground in a mortar and passed through a 52-mesh B.S. sieve. The following materials, ground in the dry condition, were likewise passed through a 52-mesh sieve: (1) cellulose (ball-milled Whatman filter paper); (2) glucose; (3) chitin (B.D.H., lobster shell); (4) grass (leaves of Lolium perenne dried at 100°); (5) fungal mycelium: the following fungi (originally isolated from decomposing leaves of Lolium perenne in soil) were cultured in Roux bottles each containing 100 ml 'Oxoid' Czapek Dox medium: *Phoma* sp., *Penicillium* sp., *Trichoderma koningi* Oudem, *Humicola* sp. After 2 weeks incubation at 20° the mycelial 'mats' were removed from the bottles, washed free of any culture medium and autoclaved at 15 lb for 10 minutes. The 'mats' were finally freeze dried over P₂O₅.

With the exception of glucose (which was added in solution) the materials were mixed with the soil in the dry condition. The amended soils were moistened to 'sticky point' with sterile deionised water and thoroughly mixed. The soil paste was forced into approximately 15-cm lengths (2-mm diam.) from a hypodermic syringe (needle detached) on to a white tile. The lengths of soil paste were allowed to dry out slightly at room temperature before being cut into 2-mm portions, which were further dried at room temperature for 24 hours before use.