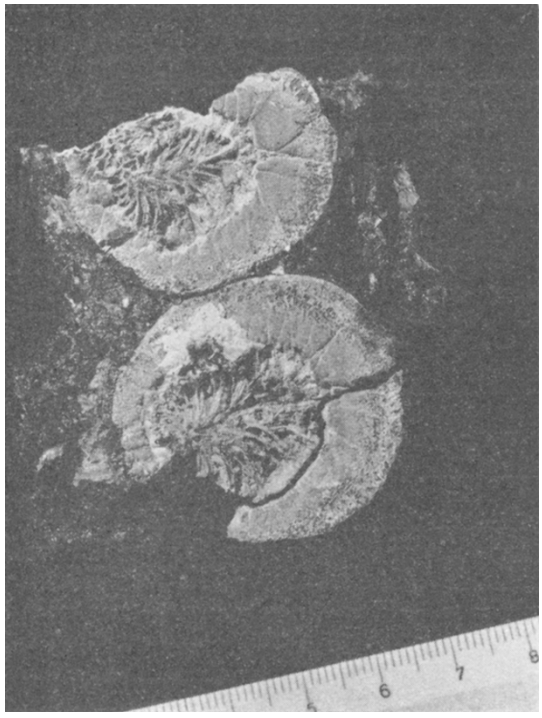

Fig. 1

and not affect the coal, the only thin section has been cut from the fractured outer portion which can be seen on the right-hand side. The whole section was yellowish in colour, remnants of cell structure could be seen and several interesting features such as the presence in one area of what appear to be small fibres and in another of oil glands. These are preliminary announcements but are submitted in support of the probable organic origin of the specimens.

Photographs have been sent to the Royal Botanic Gardens, Kew, for investigation and more details will be published later.

If these are indeed fructifications as they appear to be, their relationship is difficult to imagine. They bear no resemblance to any of the seven 'types' of fructification of Glossopteridae which have been found in South Africa[1], and which are now regarded by a number of plant morphologists as the precursors and possibly the direct ancestors of angiosperms[2,3].

Among much later fossil fruits they are somewhat reminiscent of a silicified multilocular fruit from the Deccan Intertrappean Series of India, which was described by Sahni[4] as *Enigmocarpon* but is now believed to be related to the Lythraceae.

It is possible that the mineralization might have occurred before the specimens were deposited in the swamp. This is suggested not only because no other mineralization has been seen anywhere in the seam but also because coal balls are so far unknown in South African coal deposits. This has been attributed to the complete absence of associated marine sediments from which calcium carbonate might have been derived. After many years of investigation I have found only two apparent coal balls and both proved to be boulders of silicified wood, probably introduced from an older formation.

I have for some time speculated on the higher stage of development and the degree of versatility which are apparent in the Upper Palæozoic fossil plants of the southern hemisphere and have considered the possibility that they might have provided a direct line of descent for angiosperms. The present discovery may provide further evidence.

EDNA P. PLUMPSTEAD

Department of Geology,
University of the Witwatersrand,
Johannesburg.

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Respiration-rates of Bacteria, Bean Roots, and Bean Root Mitochondria as a Function of Oxygen Concentration

IT has been found that the frequencies of X-ray-induced chromosomal aberrations in the root-tips of *Vicia faba* at low oxygen tensions is much higher in the presence than in the absence of respiratory inhibitors[1,2]. The inhibitors were effective only in the presence of oxygen, and their effect appeared to consist essentially of causing the oxygen effect[3] to appear at much lower oxygen concentrations than it does in untreated roots. It was suggested that the chemicals in question enhance the X-ray sensitivity by eliminating an oxygen gradient, which is thought to exist in the roots at low oxygen tensions[2].

A possible way of demonstrating the existence of such an oxygen gradient in bean roots would be to determine the relation between oxygen consumption and oxygen concentration for excised root tips and for mitochondria isolated from the roots. The decrease of the oxygen consumption of plant roots, which is obtained when the oxygen concentration is lowered below that in air, is commonly believed to be due to the fact that the diffusion of oxygen into the roots is prevented by the oxygen consumption of the outer cell layers[4–6]. As a result, fewer and fewer of the root-tip cells are taking part in the oxygen consumption as the oxygen concentration in the surrounding solution decreases. In agreement with this explanation, no decrease of the oxygen consumption with oxygen concentration is observed in the case of unicellular organisms, such as bacteria and yeast, at oxygen concentrations higher than 0·3 per cent[7,8].

If the oxygen gradient hypothesis is correct, it would be expected that mitochondria isolated from roots should behave as unicellular organisms so far as the relation between rate of respiration and oxygen concentration is concerned. That this actually is the case is shown in Fig. 1, where the relation between oxygen consumption and oxygen concentration is illustrated for a bacterium (*Escherichia coli B*, methionine-less), for root tips of the broad bean, *Vicia faba*, and for mitochondria isolated from bean roots. It is evident from the figure that for the oxygen concentrations studied, that is, 0·1–1·8 per cent in the gas phase or 1·3–25·0 μM in solution, the oxygen uptake by *E. coli* and by bean root mitochondria is little affected by the oxygen concentration, whereas that of the root tips decreases strongly with the oxygen concentration. The small decrease of oxygen uptake in the case of mitochondria may be due to diffusion of co-factors from the mitochondria. No

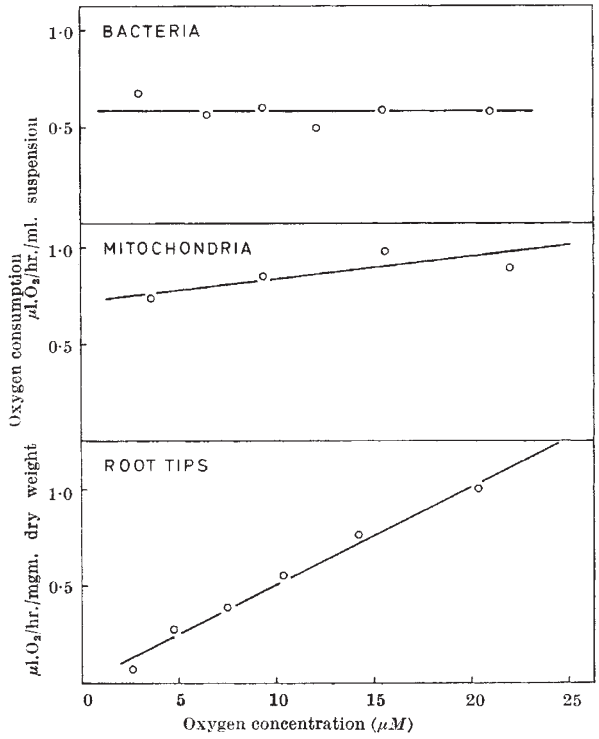

Fig. 1

such decrease in activity was found in a Warburg experiment, which was run parallel with the Hersch cell experiment in order to check the mitochondrial activity during the experimental period. The discrepancy may be explained by the fact that in the Hersch cell experiment the mitochondrial suspension was 80 times more diluted than in the Warburg experiment. This resulted in a much steeper diffusion gradient in the former.

Oxygen consumptions were determined by a method originally developed by Dewey and Gray[9]. Uptake of oxygen took place at 20° C. in a 10-ml. syringe. The syringe was completely filled (no gas phase) with the reaction medium, in which the experimental material was suspended. The composition of the medium was: (1) for *E. coli*: KH_2PO_4, 0·022 *M*; $MgSO_4$, 0·008 *M*; NaCl, 0·085 *M*; NH_4Cl, 0·187 *M*; Na_2HPO_4, 0·042 *M*; glucose, 0·022 *M*; (2) for mitochondria: phosphate buffer, 0·02 *M*, *p*H 7·1; sodium succinate, 0·03 *M*; sucrose, 0·4 *M*; $MgSO_4$, 0·001 *M*; EDTA, 0·1 m*M*: (3) for bean roots: phosphate buffer, 0·017 *M*, *p*H 7·1; glucose, 0·5 per cent.

At the beginning of the experiments the oxygen concentration of the media was adjusted to approximately 27 μ*M*. At 7–15 min. intervals a 0·8-ml. sample of the medium was introduced into a Hersch cell[10] for determination of the oxygen concentration. The oxygen uptake was calculated from the difference between the successive measurements.

In the root experiment, 25 lateral root tips, 3 mm. long, were used.

Mitochondria from roots grown under sterile conditions were prepared essentially according to the method described by Millerd[11] but with the use of ethylenediamine tetraacetic acid[12].

The number of bacteria in the mitochondrial preparation was determined by plating after the end of the experiments. It was found to be approximately 2×10^5 per ml. of reaction medium, which is 40 times less than the number which would give the measured oxygen uptake under the experimental conditions.

In the experiment with *Escherichia coli*, a methionine-requiring mutant was used in order to prevent multiplication during the experimental period.

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G. Odmark
B. A. Kihlman

Institute of Physiological Botany,
University of Uppsala.

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Culture and Sex Modification of Male Cucumber Buds *in vitro*

Sex expression in plants has been the subject of many investigations, which have been thoroughly reviewed by Heslop-Harrison[1]. In recent years attention has been mainly directed to the use of growth substances in the experimental modification of sex expression. Much of this work was done with cucumber (*Cucumis sativus* L.). Laibach and Kribben[2] found that application of auxins such as indolyl-3-acetic acid (IAA) and 1-naphthalene acetic acid may cause earlier occurrence of pistillate (female) flowers in cucumber plants. Application of gibberellins was found to affect their sex expression in the opposite direction[3].

In the earlier work the growth substances were applied to the intact plant. The present work was planned with a more direct approach. An attempt was made to culture very young floral buds, at a stage when they are morphologically and physiologically still bisexual[4], and to apply the growth substances directly to the floral buds. By following their morphogenetic changes induced by IAA, gibberellic acid (GA_3), or a combination of the two, it could be learned whether these growth substances exert their effect only when given to the plant, that is, in some indirect manner, or whether they can act directly on the buds, without the obligatory interference of leaves and other plant organs. Results given here tend to confirm the last possibility, at least in respect to IAA.

Plants of a pure, monœcious line of cucumber were grown in the Earhart and Campbell Plant Research Laboratories at constant conditions (23° day and 19° night temperature and 18 hr. light). Under such