

reactions in the plant proceed in the direction of their formation and not suggest that they are functioning as the progenitors of other terpenes, a study of the relative abundance of the terpenes should serve as a clue to understand the biogenetic tendencies in the plant regarding the synthesis of the terpenes. A census taken with this idea furnishes the following data:  $\alpha$ -pinene occurring in 375 oils; cineol in 260; limonene or dipentene in 160; phellandrene ( $\alpha$  or  $\beta$ ) in 126; borneol in 110; camphene in 85; camphor in 70;  $\alpha$ -terpineol in 165;  $\beta$ -pinene in 60 and the others are all occurring in smaller number of oils (the aliphatic terpenes being omitted).

From a knowledge of the general reactions of the various terpenes in our "test-tube experiments" and an analysis of their 'molecular architecture', it is suggested (after trying various possibilities) that linalool can satisfactorily be considered to be the precursor of all the abovementioned widely occurring terpenes. Very significant is the suggestion of Ruzicka<sup>1</sup> that the formation of small amounts of camphor and borneol observed by Winogradov<sup>2</sup> when linalool is heated with activated aluminium, takes place through the intermediate methylpinol, the formation of which from linalool by a double ring closure is now considered to be the trigger reaction in the production of the widely distributed bicyclic terpenes.

The scheme given above shows the probable "general direction of the processes" in the formation of the widely distributed terpenes in nature.

Regarding the formation of the widely distributed linalool (which is very closely related to geraniol, citral, citronellol and citronellal) it seems better to defer speculating till the exact (botanical) mechanism of the formation of the terpenes in the plant is understood.

The above scheme accommodates many facts, the detailed discussion of which as also the mechanism of formation of the other terpenes will shortly be published.

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<sup>1</sup> *Ann. Rev. of Biochem.*, 1932, 1, 583.

<sup>2</sup> *Ber.*, 1931, 64, 1991.

### Physiology and Function of the Oesophageal Diverticulum in Blood-sucking Psychodidae.

It has been suggested by the previous workers on this line that the general function of the oesophageal diverticulum is that of a crop or a food reservoir, from which the food material is regurgitated back into the alimentary canal at intervals. The following experiment was done to determine as far as possible the exact function of the diverticulum. Sterile *Phlebotomus argentipes* Ann. and Brun. kept in different cages were allowed to suck the free-fluid from cotton-wool soaked in the following solutions, viz., 5% glucose in distilled water stained with methylene-blue, 5% glucose with a colloidal suspension of Indian ink and N.N.N. culture with flagellates. The midges were picked up after they were fully fed and dissected immediately. It was found in the case of flies fed on glucose-methylene-blue solution that the diverticulum was bloated up considerably with the fluid while in the case of those fed with the fluid with a suspension of Indian ink some of the finer particles reached the diverticulum along with glucose; the coarser particles, on the other hand, being diverted to the mid-gut. The experiment with the N.N.N. medium with flagellates showed the presence of flagellates both in the diverticulum and the mid-gut. Apparently, the mid-gut was reached after the diverticulum was already full. In the control experiment with flies fed on an animal it was found that flies bloated up with a blood-meal seldom showed any trace of blood in

the diverticulum. The author thus opines that in all probability the midges have a selective reflex action, not altogether mechanical, by which they can by closing or opening the valve of the diverticulum, divert a particular ingested fluid to a selected reservoir or reservoirs wherefrom they are regurgitated and absorbed when needed. It is quite likely that this closing of the diverticular valve by a reflex action takes place only at the time of a blood-meal by the actual penetration of the proboscis and the consequent folding in of the labium which is quite distinct from the "licking of free surface fluid" which, as the previous experiments show, diverts most of the ingested fluid to the diverticulum. The author also found that in the case of wild flies collected freshly fed in nature, blood was seldom found in the diverticulum and hence diverticulum, at least in these midges, cannot, in the true sense of the term, be called a food reservoir. On the other hand, there are evidences of the presence of a colourless fluid in the diverticulum of wild-flies apparently, in the process of regurgitation. The author thus concludes that in nature the diverticulum of a blood-sucking *Psychodid* contains a fluid of lesser consistency than the blood traced in the mid-gut of a fly and that this fluid, at times, is regurgitated into the alimentary canal of the midge to restore or alter the physico-chemical properties of a blood-meal for a specific purpose.

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### An Apparatus to Determine the Coefficient of Energy Absorbed by a Leaf.

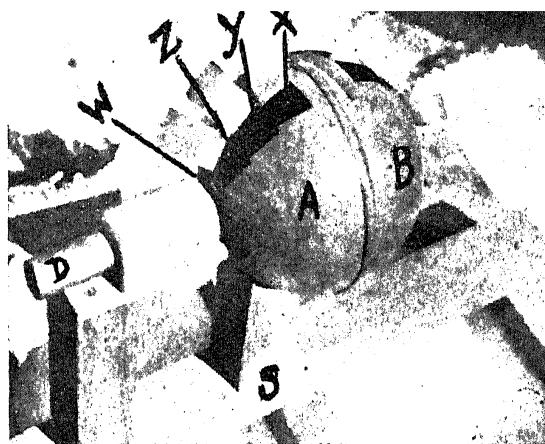
THE problem of energetics of a leaf though very important has been dealt with by comparatively few workers. Brown and Escombe,<sup>1</sup> the premier workers in the field, have tried to establish a relation between the physiological activities of a leaf and the energy absorbed by it. In finding out the energy absorbed by a leaf they took for granted that the loss due to reflection from the surface of a leaf is negligible. Jorgensen and Stiles<sup>2</sup> cast a doubt on this hypothesis

and brought out the fact that even a black cloth reflects one per cent. of the incident energy.

Coblentz,<sup>3</sup> Shull<sup>4</sup> and others have made spectrometric measurements of light incident on, transmitted by and reflected from a leaf. They all agree that the reflected energy is about 10 per cent. of the total incident energy.

In the present state of our knowledge about the problem the author thought it desirable to construct an apparatus which would give an accurate idea of the amount of energy absorbed by a leaf. Fig. 1 gives a vertical section of the apparatus *in situ*, shown in the photograph.

A and B are two hemispheres, A fitting into B as shown in Fig. 1. The hemisphere A has an aperture at its apex to admit a beam of light coming through the tube D. A removable circular plate C is fitted in



A—Hemisphere receiving the light reflected from the surface of the leaf L. B—Hemisphere receiving the light transmitted by the leaf L. D—Tube admitting a beam of light incident on the leaf L. X, Y and Z areas cut on the surface of the hemisphere A on which the photonic cell is placed. W—Surface of the hemisphere, the energy falling on which cannot be measured directly. S—Support.

flush with the edge of the hemisphere A. The plate C has a circular aperture at its centre. This aperture is in line with the tube D and the aperture in the apex of the hemisphere A. The apparatus is supported on a wooden frame S (Fig. 1).