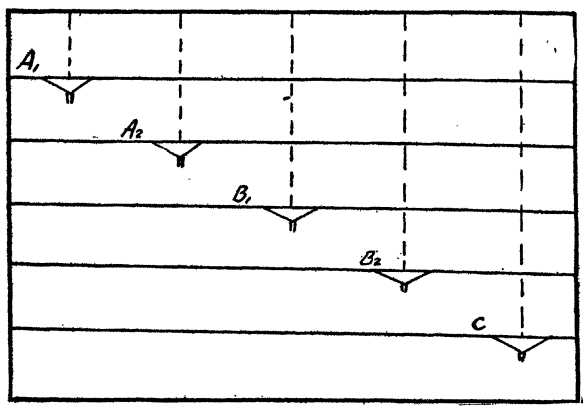
The drainage leachings of each soil horizon offer the means of studying the movement and translocation of these ingredients. More than that: such leachings would show how and where the various plant food ingredients added in the form of fertilizers or those which accumulate naturally in the surface horizon—especially in the virgin soils—are fixed and lost in the soil body.

The only rational method of studying the drainage of each horizon is to install a series of lysimeters at the depths of the respective horizons without disturbing the natural position of the soil profile. Such a system of lysimeters has been installed at the New Jersey Experiment Station on a virgin soil.

The lysimeters consist of flat funnels made of block tin 30 cm in diameter, 4 to 5 cm deep, with nine to ten 2-mm perforations in the center. A pit is dug 120 cm wide, 180 cm deep—the depth depends on the profile depth of the soil studied—and 360 cm long. Under each horizon a tunnel is made in the shape of the funnel. The funnel is filled with quartz pebbles and its sharp edge—3 to 4 mm—rests against the roof of the tunnel. The depth of the tunnel is about 50 cm, so that the distance from the funnel to the wall of the pit is about 20 cm. The funnel is wedged upward and the open space between it and the wall of the pit is filled with soil. After all the funnels have been placed under the respective horizons—100 cm apart on a horizontal line—a board wall is made 8 to 10 cm away from the soil wall and the space is filled in with soil.

Each funnel is connected by means of a coupling with a block tin tube 6 mm internal diameter. The tube leads to a copper receptacle. The accompanying diagram gives the front view of the wall with the



lysimeter funnels in place under the respective horizons.

The pit is covered with a shed roof extending just a few centimeters above the ground. A gutter leads the water off to a distance away from the area where the lysimeters are located.

The cost of a system of ten lysimeter funnels including the material and labor is about $175.00. It is well to remember that such an outfit may be installed anywhere and if the data obtained were either unsatisfactory or incomplete for any particular purpose, the lysimeter funnels might easily be dug out and placed elsewhere.

No data as yet may be offered, as the lysimeters have just been installed.

The model for this type of lysimeter equipment has been taken by the author from the Moscow Regional Agricultural Experiment Station, Moscow, Russia. As far as the author is aware this is the only place where such lysimeter equipment is functioning.

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THE GARGOYLE AS A SCIENTIFIC INSTRUMENT

MY little boy was sent one of these instruments for a birthday present. It proved a rather fascinating study that gives promise of having a certain use in connection with experiments in physiology. The operation of the instrument depends on one bulb being kept cooler than the other by evaporation of water whereupon the liquid occupying the full cross-sectional area of the tube is pushed from the warmer bulb uphill into the cooler. From the upper bulb it flows back in a stream to the lower bulb. Collecting there, it seals the tube and is pushed or drawn into the upper bulb again. The speed of operation depends upon the difference in temperature between the two bulbs and varies with the relative humidity of the air and with the amount of movement in the air. The variations are produced very quickly and it is from that standpoint, if calibrated, that it can be a useful instrument. In the following paragraph, I am giving a sample of the data expressed in readings of the number of passages of liquid during one-minute intervals.

To start with, the instrument had been in an ordinary room for two or three hours and in this experiment showed fifty-one "beats" while the operator was sitting within a foot of the instrument and breathing ordinarily upon it. Turning an electric fan on the instruments resulted in 107 beats per minute. Changing the fan from low to medium resulted in 109 beats. Turning off the fan and allowing the instrument to adjust itself, a minute later it made forty-two beats. Placing the instrument in a casserole and putting the top on, without, however, taking any special precautions to have an air-tight seal, after a minute it made thirty beats. The third minute following it made twenty-one beats, the fifth minute it made sixteen and one half beats, and in the eighth, eleventh, four-

teenth, seventeenth and twentieth minutes it made twelve, eight, six and one half, six and one half and five beats respectively. Then pouring in water around the edges to make a water-seal resulted in the beats diminishing to three per minute; after a three-minute interval, one and one half, and after two more minutes the gargoyle became stationary and no further beats were noted as long as it was kept in this saturated air. After awhile the instrument was taken out of the casserole and placed in the current of air from the electric fan and it made 107 beats. The instrument was then taken outdoors where the temperature was 1° C. with scarcely any breeze blowing. The instrument made five beats for each of four different minutes that were counted at irregular intervals. Then brought back into the room it made forty beats.

The use of the atmometer arrangement in greenhouse practice such as was written up by J. D. Wilson in a recent article[1] will no doubt give more exact data of amount of evaporation, but a gargoyle would be a much simpler instrument to utilize under ordinary conditions of greenhouse practice.

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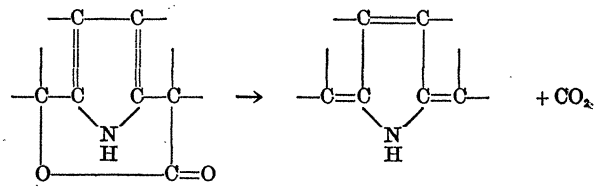
SPECIAL ARTICLES

THE RELATIONSHIP OF CHLOROPHYLL TO THE PORPHYRINS

CHLOROPHYLL a and b and a group of substances obtained from them by the removal of magnesium and the hydrolysis of the ester groups may be transformed by drastic treatment with alkali into porphyrins which are substances characterized by the type of their absorption spectra. Hans Fischer has established by synthesis the general constitution of the porphyrins and very recently has proved in detail the structure of aetioporphyrin,[1] the final decomposition product of the chlorophyll series. The relationship between the porphyrins and chlorophyll is still unknown. We have discovered a few facts which throw some light on this problem.

The magnesium-free chlorophyll derivatives (the phaeophorbides, phytochlorin e and phytorhodin g) have been found to differ from typical porphyrins (from chlorophyll and blood) in the following respects (1) In dilute alkaline solution they are reduced by sodium hydrosulphite and by the action of hydrogen in the presence of palladinized asbestos (about 2 moles of hydrogen are absorbed): neither of these reagents affects porphyrins. (2) Catalytic hydrogenation in glacial acetic acid yields colorless solutions with the absorption of 3 or 4 moles of hydrogen; on exposure to air reoxidation occurs but the product is different from the original material. Under the same conditions the porphyrins absorb about the same amount of hydrogen[2] but the product of oxidation is also a porphyrin. Phaeophorbide a and b and phytochlorin e yield substances that appear to be porphyrins; phytorhodin g is transformed to a substance with an absorption spectrum more like that of the bile pigments. It is clear that the porphyrin structure represents a more stable and less reactive grouping of unsaturated linkages and pyrrole nuclei than are present in the chlorophylls and related substances. It also seems extremely probable that the carbon skeleton characteristic of the porphyrins is already present in the chlorophylls.

We have also found that the phaeophorbides, phytochlorin e and phytorhodin g lose carbon dioxide and water at 150°–250° in diphenyl solution. The formation of carbon dioxide, at least in the case of the non-acidic substance methyl phaeophorbide a, can not be due to a free carboxyl group; the trimethyl ester of phytochlorin e does not lose carbon dioxide, therefore the ester groups are not involved. One of the two crystalline products of the decomposition of phytochlorin e is a porphyrin. We suggest that a lactone linkage is responsible for part of the thermal formation of carbon dioxide, perhaps as follows:



The presence of this same linkage would explain the transformations for which Willstaetter postulated a lactam grouping. The presence of hydroxyl groups was indicated by the recent analyses of Treibs.[3] Our own analytical data point in the same direction. It thus seems probable that the carbon skeleton of the porphyrins is modified in chlorophyll by the presence of one or more hydroxyl and carboxyl groups (or lactone groups) on the atoms connecting the pyrrole nuclei. The work is being continued and the details will be published elsewhere as soon as possible.

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JULY 8, 1929

[1] H. Fischer and A. Treibs, Ann. *466*, 188 (1928).
[2] Compare Kuhn, Ber. *61*, 2509 (1928).

[1] *Ecology*, 9: 412–420. 1928.
[3] Treibs and Wiedemann, Ann. *466*, 264 (1928).