CO_2 under normal conditions. During photosynthesis there is absorbed about 1,500 cc CO_2 by these leaves per hour. For some time it has appeared to us that the first step in photosynthesis is not a simple splitting of carbonic acid under the influence of light, but that the CO_2 undergoes a primary change through absorption by certain constituents of the leaf.

It has been known that vegetable tissue is capable of absorbing CO_2 in quantities considerably above that accounted for by the solubility of the gas in the water of the tissues.[2] Willstaetter and Stoll demonstrated that this phenomenon is shown not only by living leaves but also by the dried leaf material to which water has again been added.

In order to establish more directly the nature of the absorbing substances in the leaves under conditions similar to those employed in our investigations of photosynthesis we have studied the absorptive capacity of dried leaves. For a number of reasons it was desirable to employ concentrations of CO_2 as near to normal as possible. The experimental difficulties are increased by the fact that the post-mortal respiration of the leaf material is relatively high. The absorptive effects are augmented and the accuracy of the determinations increased by using air enriched in CO_2. Accurate results could be obtained only by the complete avoidance of rubber stoppers and connections in the absorptive flasks. The investigations have been unavoidably interrupted, so that a brief report of the findings to date seems desirable.

(1) Dried and ground leaf material to which the same amount of water has been added as originally contained in the leaves, absorbed CO_2 from the air in the dark. In order to increase the accuracy of the analyses the air was enriched to 1.3 per cent. CO_2.

(2) The manner of drying the leaves greatly affects the absorptive capacity; 55–60° in a rapid stream of dry air seems to be best.

(3) Dried and powdered *Helianthus* leaves, to which the same amount of water was added as originally in the leaves and which had been freed of CO_2 by passing a stream of CO_2 — free air over them, absorbed at 25° 4.95 mg CO_2 per gram, more than ten times the amount dissolved in the water present.

(4) Leaf material exhibiting high absorptive capacity also had a high rate of post-mortal respiration and *vice versa*. The post-mortal respiration coefficient (CO_2/O_2) averaged about 1.5.

(5) Extraction of the dried leaves with cold water reduced somewhat the absorptive capacity of the leaf material. Extraction with cold absolute alcohol greatly reduced the absorptive capacity. The material extracted by the cold alcohol absorbed only exceedingly small amounts of CO_2. Similarly, heat tends to destroy the absorptive capacity of the leaf material. Extraction with acetone, thus removing most of the pigments, did not affect the absorptive capacity. Extraction with water saturated with ether at 20° (Chibnall-Schryver method for protein extraction) reduced the absorptive capacity 90 per cent. The residue obtained from evaporating the water-ether extract at reduced pressure and 50° absorbed as much CO_2 as the original leaf material.

(6) We are of the opinion that our experiments support the theory that the leaf absorbs CO_2 from the atmosphere by a mechanism similar to that by which the blood of mammals serves in freeing the tissues of this gas. According to our experiments 100 grams of dry leaf material, when moistened, can absorb at 25° and 1.3 per cent. CO_2, 495 mg CO_2 or 272 cc at standard conditions. The dry material constitutes about 15 per cent. of the leaf in its original condition, so that 100 grams of fresh leaf material would on this basis be able to absorb about 41 cc of CO_2. 100 cc of venous blood contains about 50 cc CO_2; of this amount not more than 20 per cent. is dissolved in the water of the blood, the rest being held by the blood plasma and the inorganic constituents.

In the leaf probably the major portion of the CO_2 is absorbed by the proteins on the basis of the carbamino reaction. The effect of this is to increase the concentration of the CO_2 in the cells and to alter the form in which the CO_2 is present. It remains to be determined whether these carbamino compounds can act as photochemical acceptors in the primary photochemical reaction. Our experiments on the action of ultra-violet light on the simpler carbamino acids have, however, led to the same negative results as to the formation of the formaldehyde as those with carbonic acid. The primary union of CO_2 with the proteins of the leaf as the first chemical step in photosynthesis may be of considerable importance in determining the cause for the asymmetric nature of the synthesis of the carbohydrates in the chlorophyllous plant.

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[2] de Saussure, Ostwald's Klassiker, No. 15, p. 43, Boehm, *Ann. Chem.*, *185*, 248 (1876); Willstaetter and Stoll, "Untersuchungen ueber die Assimilation der Kohlensauere," pp. 172–225, Berlin, 1918; Carey, Physiological Researches, *2*, 407 (1923).

THE ILLINOIS STATE ACADEMY OF SCIENCE

THE Illinois State Academy of Science held a very successful meeting in Elgin, on May 1, 2 and 3, with an attendance of nearly 200 members, besides many friends. The convention opened on May 1, with a

general meeting in the evening, at which the retiring President, Dr. W. G. Waterman, of Northwestern University, gave the address. Friday morning and evening were also devoted to general meetings, at which invitation addresses were given. On Friday afternoon the following sections met for the presentation of papers and discussions: Biology and Agriculture; Chemistry and Physics; Geography and Geology; Medicine and Public Health; Psychology and Education; High-school Science, and Mathematics.

There were 73 papers on the program for all the meetings, and most of these will be published in the annual *Transactions*.

On Saturday, May 3, there were three excursions: One to the Elgin Watch Factory and Astronomical Observatory; another, a field trip, to regions of interesting glacial deposits about Elgin. This excursion was led by Dr. M. M. Leighton and Dr. Paul MacClintock. The third excursion was a botanical field trip, and was led by Dr. H. C. Cowles. The White Cedar Swamp, a relic of the glacial age, was studied, and the famous Evergreen Nurseries at Dundee were visited.

At noon on Saturday all three excursion groups met at Trout Park, Elgin, and enjoyed the complimentary luncheon furnished by the Illinois Nature Study Society. Mr. Carl Gronemann, chairman of the local committee of arrangements, ably assisted by many local organizations, did much toward making the convention a pronounced success.

The following officers were elected for 1924–25:

President: W. G. Bain, M.D., Springfield.
Vice-president: C. H. Smith, Chicago.
Secretary: C. Frank Phipps, DeKalb.
Treasurer: W. B. McDougall, Urbana.
Librarian: A. R. Crook, Springfield.

There were 34 candidates elected to membership, making the total membership of the academy about 550.

C. FRANK PHIPPS,
Secretary

THE VIRGINIA ACADEMY OF SCIENCE

THE second annual meeting of the Virginia Academy of Science was held at Washington and Lee University, Lexington, Virginia, on May 2 and 3. The Virginia Section of the American Chemical Society met with the academy.

The presidential address "The church and science" was delivered by the retiring president, Professor Ivey F. Lewis, of the University of Virginia. Dr. C. S. Lind, of the Bureau of Mines, Washington, D. C., gave an address on "Radioactivity."

The following officers were elected for 1924–25:

President: James L. Howe, Washington and Lee University.
Secretary-Treasurer: E. C. L. Miller, Medical College of Virginia.
Member of the Council: Ivey F. Lewis, University of Virginia.

The following scientific program was presented:

A simple and yet fairly accurate method of measuring directly quantities of fluid of the order of one cubic millimeter without resorting to pipettes and dilutions: E. C. L. MILLER.

Corn pith as a substitute for cork in the entomological laboratory: J. B. UNDERHILL.

The effects of various inorganic salts on paramecia: E. V. GRAY.

A comparative study of Bacillus carotovorus Jones and B. aroideae Townsend: A. B. MASSIE.

Plant diseases; their occurrence and importance in Virginia: F. D. FROMME.

Effects of endocrine glands upon frog larvae: C. C. SPEIDEL.

Pollination in Plantago decipiens: LENA B. HENDERSON.

Modern man as related to pre-historic man: R. B. BEAN.

The evolutionary history of the spleen in its relation to blood formation: H. E. JORDAN.

Internal motions in the spiral nebulae and their bearing on cosmogony: H. L. ALDEN.

An unusual migration date for the chimney swallow: I. F. LEWIS.

Digestive enzymes of the coelenterates—Hydra viridis and H. fusca: M. C. YODER.

Ciliogenesis in the oesophagus of the frog tadpole: J. E. KINDRED.

Inheritance of flower color in the garden balsam: D. W. DAVIS and RACHEL TARRAL.

Social and economic status of college students: WM. M. BROWN.

A bacteriological study of the water of Lexington and the swimming pool: W. D. HOYT and D. C. T. TSENG.

Vapor pressure measurements: SIDNEY S. NEGUS.

Perchloric acid as an analytical reagent: JOHN H. YOE.

Examination of a turbine petroleum sludge: ALBERT SALATHE.

A discussion of chemical education was introduced as follows:

The correlation of high-school and college chemistry from the standpoint of the college: GARNETT RYLAND.

The correlation of high-school and college chemistry from the standpoint of the secondary school: LEROY L. SUTHERLAND.

The correlation of college and medical school chemistry: E. C. L. MILLER.

E. C. L. MILLER,
Secretary

THE AMERICAN MATHEMATICAL SOCIETY

THE twenty-first regular western meeting of the American Mathematical Society was held at the Uni-