The most significant recommendations of this report are contained in the following paragraphs quoted from this statement:

1. That the International Research Council should be continued.

2. That the statutes of the International Research Council should be entirely rewritten rather than merely amended in certain respects.

3. That in rewriting these statutes the committee on revision of the statutes shall call into conference for advisory purposes representative scientists of countries not now adhering to the International Research Council.

4. That it would be desirable that the new organization be known not as the International Research Council but as the International Federation of Scientific Unions.

R. A. MILLIKAN,
Foreign Secretary of the
APRIL, 1929 *National Academy of Sciences*

SCIENTIFIC APPARATUS AND LABORATORY METHODS

APPARATUS FOR THE DETERMINATION OF CARBON DIOXIDE IN THE RESPIRATION OF APPLES

A REVIEW of the various methods adopted for the determination of the rate of respiration in apples as measured by carbon dioxide evolution discloses the fact that most investigations involve rather small quantities of the product used. When the amount of fruit used is not over three to four kilograms (twenty to thirty apples) it is almost impossible to avoid high experimental error, due largely to the variation in maturity of individual fruits. Recent investigations by Kidd and West[1, 2] show a wide variation in respiratory activity of single apples taken from the same sample. By the use of the pickle-bottle respiration chamber[3] in which eight to nine kilograms of fruit (sixty-five to seventy apples) of approximately one half of a standard apple box in size were used, a method of carbon dioxide determination was devised which was efficient and sufficiently unique in its adaptation to warrant a brief description.

DETAILS OF THE APPARATUS

The apparatus used for the determination of carbon dioxide as a measure of respiration is shown in Plate 1. Air was drawn through two wash-bottles, 1 and 2, containing 50 per cent. potassium hydroxide. It was then bubbled through Ba $(OH)_2$, 3, as a check for small amounts of carbon dioxide. Connections with the respiration chamber, 4, were made with copper tubing in such a way as to draw the carbon dioxide-laden air from the bottom of the bottle. At the points B and C, "Y" tubes were placed in order that the air-stream might be directed either through the absorption tower for the measurement of carbon dioxide or directly to the flow-meter in case continuous aspiration was desired without measuring the carbon dioxide. A simple manipulation of the steel clamps permitted the air to pass through either system.

This system was further desirable because it made possible the removal of carbon dioxide which might have accumulated in the respiration chamber previous to a determination. By this means it was also possible to make connections with the absorption tower with only a momentary stoppage of the air-stream. Where total carbon dioxide was desired, two absorption towers were used, and at the end of one determination the air current was directed through the second tower, through connections previously made. By this method, continuous aspiration was practically

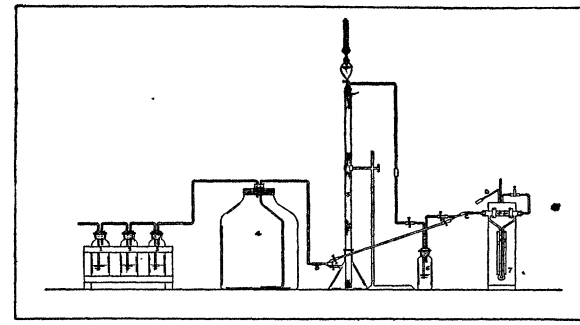

Plate I. Apparatus for the determination of CO_2 as a measure of respiration.

accomplished with no loss and very little accumulation of carbon dioxide in the respiration chamber.

Carbon dioxide was absorbed in a Truog Absorption Tower,[4] 5. Bottle No. 6 contained barium hydroxide and served to indicate whether carbon dioxide was passing off unabsorbed. A flow-meter, 7, was

[1] Franklin Kidd and Cyril West, "The Storage Life of Apples in Relation to Respiratory Activity and Chemical Composition," Report Food Investigation Board, pp. 37–57, 1925–1926.

[2] Franklin Kidd and Cyril West, "Fruit and Vegetables," Report Food Investigation Board, Section B, pp. 23–27, 1927.

[3] T. J. Maney, P. L. Harding and H. H. Plagge, "A New Type of Respiration Chamber," SCIENCE, 70, p. 44, 1929.

[4] E. Truog, *Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 12, p. 1045. Dec., 1915.

adapted to this apparatus in order to keep the rate of aspiration uniform and of a known velocity. The flow-meter was connected with the aspirator at the point "D."

Reagents Used

Standard Hydrochloric Acid Solution..... 0.2 N.
Standard Barium Hydroxide Solution..... 0.2 N.
Phenolphthalein as Indicator.

In order to give an idea of the suitability of this apparatus for respiration studies the following data, which were obtained as the result of five consecutive determinations, each of one hour duration, are presented.

Type of sample	Determination	No. of apples	Wt. of sample	Storage temp.	Mg. CO_2 per kilo. hour
Grimes Golden apples	1	70	8659 gm.	30° F.	3.31
"	2	"	"	"	3.65
"	3	"	"	"	3.62
"	4	"	"	"	3.62
"	5	"	"	"	3.62

SUMMARY

A respiration chamber of low original cost was used, which because of its large size was adapted to handling samples of considerable bulk or quantity. The most important feature of the chamber was its wide mouth, which permitted easy insertion and removal of samples.

With the double system of connections, either total or intermittent determinations were made with only momentary stoppage of the air-stream.

The flow-meter proved very satisfactory in maintaining a known and uniform rate of aeration.

The apparatus described was admirably adapted to the determination of carbon dioxide as a measure of respiration on apples, tomatoes and cut flowers.

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APPLE RUST ON HOST TISSUE IN CULTURE DISHES

YOUNG York Imperial apple leaves were removed from the tree, washed, treated with 1–1,000 bichloride of mercury for about two minutes, rinsed in sterile water and inoculated with sporidia of *Gymnosporangium juniperi virginianae*. Inoculation was accomplished by placing a large culture dish containing several leaves under a bell-jar in which was suspended a rust gall discharging sporidia. The leaves were allowed to remain there for about one to two minutes and were then placed in culture dishes containing modified Pfeffer's solution plus .5 per cent. glucose. The cultures were placed in a well-lighted room. Such inoculated leaves developed visible rust spots and pycnia in approximately the same period of time which would have been required if infection had taken place in leaves on the tree. The leaves were frequently transferred to fresh nutrient solution. Cutting away large portions of the leaf did not interfere with development of the disease in the remaining portions. Some specimens were maintained in culture for nearly five months without evidence of deterioration. Pycnospores were produced in great abundance, and one apparently normal aecium was formed, but it was accidentally destroyed without being examined to determine if spores were present. A special type of culture dish has been devised which should enable us to carry the cultures free from contamination for a longer period of time.

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SPECIAL ARTICLES

NORMAL MUSHROOMS FROM ARTIFICIAL MANURE

DURING the past fifteen years there has been in the United States a remarkable expansion of the business of growing mushrooms. According to the present practice, the growers must rely entirely on composted horse manure for making their beds. The industry consumes at least 150,000 tons of horse manure annually, and is still developing rapidly, while the horse is little more than holding his own. In view of these conditions, it is evident that the mushroom growers in the near future must have a substitute or supplement for horse manure. Several growers have succeeded in supplementing their manure to a certain extent by adding straw to the compost heaps, and a few have been experimenting with artificial compost. But it is apparent that there is a need for a further systematic search for material other than horse manure which is suitable for mushroom culture. To the writer, a straw compost made according to the principles laid down by Hutchinson and Richards[1] seemed to be a good starting-point. Therefore, in the summer and fall of 1928, several compost heaps were made

[1] This is now a patented process. It was originally published as follows: H. B. Hutchinson and E. H. Richards, "Artificial Farmyard Manure," *Journ. Minn. Agr. Great Britain*, 28: 398–411. 1921–1923.