

Norman Harris
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Annotated Bibliography – Plant Respiration

1. Appleman C. 1918. Respiration and Catalase Activity in Sweet Corn. American Journal of Botany [Internet]. [Cited 2015 April 22] 5(4):207-209. Available from: <http://www.jstor.org/stable/2435008>

It is well known that in potato tubers there is directly proportional relationship between the respiratory intensity and catalase activity. Therefore, any increase or decrease in respiratory intensity is a result of an increase or decrease in catalase activity within the tuber. Charles Appleman wanted to show that this relationship remains constant in a different plant structure. For his research he studied the respiratory and catalase activity of sweet corn in the milk stage. By pulling the sweet corn off at the milk stage and introducing it to different temperatures during storage, 30° C and 25° C. The levels of catalase after a 2 and 5 days were recorded as well as the respiratory intensity. The results of Appleman's experiments support previously held assumptions about the respiratory intensity and catalase activity relationship being directly proportional.

2. Haas A. 1916. A Simple and Rapid Method of Studying Respiration by the Detection of Exceedingly Minute Quantities of Carbon Dioxide. Science [Internet]. [Cited 2015 April 19] 44(1125):105-108. Available from: <http://www.jstor.org/stable/1643038>

The study of respiration is an accurate quantitative method for understanding life-processes. In order to study respiration the only reliable method is by measuring the production of CO₂. Therefore, it is necessary to have a method of detecting minute quantities of CO₂. As Haas describes current methods are limited and difficult to perform with high enough accuracy. Haas proposes a method of adding an indicator to a solution that contains the plant sample. He states a few qualities the indicator must have, the most important being its high sensitivity to slight increases in hydrogen ion concentrations due to CO₂ production. Phenolsulphone-phthalein was found to be one of the best indicators due to its sharp color changes over small changes in pH. Haas continues to describe varying methods of sampling different plants; seeds, algae, or aquatic plants can be submerged in the solution while land plants are placed in a chamber and placed in the solution. This simple process allows studying of respiration in successive intervals without disturbing the plant.

3. Haas A. 1917. Anesthesia and Respiration. Science [Internet]. [Cited 2015 April 19] 46(1193):462-464. Available from: <http://www.jstor.org/stable/1643612>

There had been considerable debate over the effects of anesthetics on plant respiration and until simple methods of measuring the respiration of plants became possible, such as the process of using indicators in sea water to observe the change in hydrogen-ion concentration of the solution. To test the respiration changes, the marine alga, *Laminaria*, was selected and fronds were cut up into small two inch long pieces. Respiration had been known to increase following injury so preliminary experiments included smaller, uncut fronds to compare to the cut samples. This was done to show that any change in respiration due to injury was negligible. After numerous tests, setting a baseline for the controls of the experiment samples of the plant were placed in sea water containing the

anesthetic. A variety of different anesthetic agents in different concentrations were used and in all cases the plant showed an increase in respiration compared to control groups. Although, if the concentration is too high, the sample shows increased respiration followed by a decrease below the norm as a result of the reagent being sufficiently toxic and killing the plant.

4. Haas A. 1917. Rapid Respiration after Death. Proceedings of the National Academy of Sciences of the United States of America [Internet]. [Cited 2015 April 19] 3(12):688-691. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1091359/?page=1>

To the author, A. R. C. Haas, it is believed that respiration of some plants continues after death but the speed of respiration does not exceed the normal rate. However, in the case of alga *Laminaria* certain reagents that induce death cause respiration to occur more rapidly after death than during its normal state. The various methods for killing the plant included: sea water containing anesthetics, sea water saturated with ethyl bromide, sea water containing 17.4% acetone, sea water containing 24% ethyl alcohol, and sea water with 3.2% formaldehyde. Other, simpler methods included wounding and drying of the plant. The author determined a plant had died based on the electrical conductivity of its tissue. Normal electrical resistance was considered 100% and when the resistance dropped below 15% the author considered the plant to be dead. Evidence proved that a wide variety of killing agents raise the respiration rate above the normal amount post mortem. Haas believed that previous observers were unable to recognize this as they were not able to accurately determine time of death and simply missed the window of increased respiration.

5. Harrington G. 1919. Respiration and Age of Plant Organs. Botanical Gazette [Internet]. [Cited 2015 April 19] 67(2):177-179. Available from: <http://www.jstor.org/stable/2469447>

Harrington discusses a study done by G. Nicolas, comparing the respiration patterns of very young leaves and leaflike structures to corresponding fully developed organs, taken from older parts of the same plants. In this study the collected samples of plants ranged in a variety of species; annuals, biennials, and perennials. For every case, the young organ was found to have a greater respiratory intensity than the corresponding older organ. This led to the conclusion that young organs consume more oxygen than completely developed organs, and use this increased respiration for growth purposes.

6. Kidd F. 1916. The Controlling Influence of Carbon Dioxide. Part III.--The Retarding Effect of Carbon Dioxide on Respiration. Proceedings of the Royal Society of London. Series B, Containing Papers of a Biological Character [Internet]. [Cited 2015 April 22] 89(612):136-156. Available from: <http://www.jstor.org/stable/80744>

7. Morse F. 1908. The Effect of Temperature on the Respiration of Apples. Journal of the American Chemical Society [Internet]. [Cited 2015 April 20] 30(5):876-881. Available from: <http://pubs.acs.org/doi/pdf/10.1021/ja01947a030>

While examining different methods of storage on the chemical composition of apples, it was thought that minute changes in temperature may produce composition changes in the apple at a different ratio to change in temperature. By studying the respiration rates of apples different temperatures; 18°-25° C, 5°-10° C, and at 0° C. By comparing the amount

of CO₂ exhaled (in mg) to the changes in temperature it was found that the differences were not directly proportional to one another. Rather the rate of respiration was accelerating as temperature increased.

8. Osterhout W. 1919. Apparatus for the Study of Photosynthesis and Respiration. Botanical Gazette [Internet]. [Cited 2015 April 19] 68(1):60-62. Available from: <http://www.jstor.org/stable/2469186>

This article describes the a simple method and design for a device to improve the study of photosynthesis in land plants. This device utilizes the bubbling of a gas through a liquid with an indicator present; from here the indicator will change colors depending upon the concentration of CO₂ present and will indicate equilibrium between the chamber containing the plant and the tube. The plant is then exposed to sunlight and the gas is bubbled through once more; any uptake of CO₂ will observed by the change in indicator .This is account for the change in alkalinity, which can help calculate the levels of CO₂ during respiration. The article describes a simple method of studying the photosynthesis and respiration of land plants by placing plants in a gas chamber. Then with the changes in color of the indicator the changes in CO₂ levels can be determined. This simple method described can be easily adapted for classroom demonstrations.

9. Pond R. 1907. Growth and Respiration During Winter. Botanical Gazette [Internet]. [Cited 2015 April 20] 43(1):73-74. Available from: <http://www.jstor.org/stable/2465874>

During the winter plants undergo a period of rest for many different and separate growth functions. While some functions are autogenous, and only rest for a portion of the year other functions are necessitated by external conditions and will be resting for much of the year. Although, if a period arises with the proper conditions these growth functions can resume. As opposed to the different growth functions respiration does not show a period of rest even as much of the plant's growth and energy needs are not being performed. However if satisfactory conditions occur the respiration intensity can increase to an above normal level, close to 25% of its maximum.

10. Shull C. 1917. Respiration in Succulents. Botanical Gazette [Internet]. [Cited 2015 April 23] 63(1):83-85. Available from: <http://www.jstor.org/stable/2469219>

Succulent plants such as cacti have been known to have different respiratory processes; however they have not been closely studied. A point of interest Shull mentions is affect changes in acidity, temperature, and light have to do with altering the respiratory intensity in these plants. In observation of CO₂ production it is noted that CO₂ production parallels rise and falls in temperature, but behind by about an hour. The main interest to Shull, however is that this CO₂ production during the deacidification process could be a source of respiratory energy. This energy could help conserve other biologically significant raw materials for photosynthesis. He continues to discuss possible reasons for this phenomenon and stats further research and observations are needed.