atmospheric oxygen.[1] The increase amounted to 2.2 ppm for the oxygen tested from a certain commercial cylinder. At the same time that the measurements which demonstrated this difference were being made, Klar and Krauss[2] announced the discovery that the oxygen escaping with the nitrogen at the top of a column for fractionating liquid air is lighter than atmospheric oxygen and that the last portion of oxygen left after the fractionation of a charge of liquid air is heavier than normal. Their discovery has accordingly been confirmed, and in addition the magnitude of the difference to be expected in commercial oxygen from liquefied air has been established.

In a recent article in this journal,[3] it was reported that the water obtained from the sap of a young willow tree was heavier than normal by 2.9 ppm, and the water obtained by burning the dry wood in a current of dry oxygen was heavier than normal by 5.4 ppm. No explanation of the difference of 2.6 ppm between these values was offered at the time, but it is now clear that this increase was contributed by the commercial oxygen used in the combustion. It was also reported that the density difference of 5.4 was reduced to 3.1 ppm by repeated saturation and desaturation with dry gaseous ammonia. It is now clear that no further reduction in density difference was possible by this method because the remaining difference was contributed by the commercial oxygen. This additional information, however, does not change but rather serves to clarify the results and conclusions of the previous article.

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ISOTOPIC CO_2 AND O_2 IN PLANTS?

WASHBURN and Smith report that the sap and combined H_2 in the wooden part of a growing willow tree yield heavy water. There appears to be a preferential selection of heavy H_2 isotopes in the process of synthesis of organic compounds.

Barnes observed the inactivation "in vivo" of certain enzymes in dilute heavy water. Barnes, Richards and Meyer conclude that high concentration heavy water has a lethal effect on plants while dilute heavy water shows a stimulating action.

It appears from such work that the water absorbed by plants for their physiological processes probably differs isotopically from the water lost during such processes.

This would suggest that CO_2 absorbed during the photosynthetic process and the O_2 absorbed during the respiratory process differ isotopically from the O_2 rejected during the photosynthetic process and the CO_2 rejected during the respiratory process.

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1 E. R. Smith, *J. Chem. Physics*, 2: 298, 1934.
2 R. Klar and A. Krauss, *Naturwissenschaften*, 22: 119, 1934.
3 E. W. Washburn and E. R. Smith, SCIENCE, 79: 188, 1934.

THE CONTROVERSY CONCERNING THE PHYSIOLOGICAL EFFECT OF TRIHYDROL IN LIQUID WATER

A NOTE by Ellis and Sorge[1] reported that recently condensed water and water from freshly prepared ice showed similar infra-red absorption curves. The experiments were intended to throw light on the biological effects of ice water and steam water, but no mention is made of similar tests both positive and negative. There is no doubt concerning the physiological importance of trihydrol as an equilibrium constituent of water. As Duclaux[2] points out (from analogy with H_2S, etc.), water should boil about 100° below zero if it were not composed of aggregates. Properties which render water suitable as a life medium are due to its content of liquid ice, *i.e.*, the high specific heat is the heat of dissociation of trihydrol.

The estimates of the equilibrium concentration of hydrols are remarkably similar (*cf.* Whiting,[3] Sutherland,[4] Richards and Chadwell,[5] Rao[6]). Ice water has a favorable effect on the longevity of *Spirogyra* and stimulates cell division in *Euglena*,[7] and Harvey[8] has recently shown that the addition of ice water to sea water stimulates the growth of *Nitzschia*. It is possible that the equilibrium concentration of hydrols in ice water is not instantaneous, for experiments of Howard T. Barnes[9] indicate a lag in the polymer equilibrium during the exhaustion of the ice-forming power of water. In a typical experiment in a large water tank (−10° C.) the first hour yielded 8 pounds of ice, the second hour six pounds, the third hour five pounds, the fourth hour four and one half pounds, etc., until the ice-forming power of the water was practically exhausted. Other experiments[10] have shown that water from ice consisting of large crystals, warmed to 10° C. and placed in Dewar flasks at −5° C., will freeze more rapidly than recently condensed water under the same conditions. According to the colloidal theory, ice water freezes more rapidly

1 Ellis and Sorge, SCIENCE, 79: 370, 1934.
2 Duclaux, *Rev. gen. Sci.*, 23: 881, 1912.
3 Whiting, "A New Theory of Cohesion Applied to the Thermodynamics of Liquids and Solids," Cambridge, Mass., 1884.
4 Sutherland, *Phil. Mag.*, 50: 460.
5 Richards and Chadwell, *Jour. Am. Chem. Soc.*, 47: 2283, 1925.
6 Rao, *Nature*, 132: 480, 1933.
7 Barnes and Jahn, *Proc. Nat. Acad. Sci.*, 19: 638, 1933.
8 Harvey, *Jour. Mar. Biol. Assoc.*, 19: 253, 1933.
9 H. T. Barnes, *Sci. Monthly*, 29: 289, 1929.
10 Barnes and Jahn, *ibid.*