highest water occurs a few miles to the right and at about the time of passage of the center and high water is observed from 100 to 200 miles to the right of the storm, while to the left it is hardly observed at all.

An interesting point is the effect upon the height of the water which may be attributed to the decreased atmospheric pressure in the center of the storm. This of course will allow the water to be raised in that vicinity. In the great hurricane of 1900, which passed inland at Galveston the pressure was low enough to have caused a rise of 1.5 feet in the level of the water. There is no danger of confusing such an effect as this, however, with the main storm-tide, because the amplitude of the storm-tide is much greater; indeed, in this case, it was 15 feet.

The apparent simplicity of this method of forecasting hurricanes must not be overestimated, however. The hurricane is a capricious disturbance and difficulties may be introduced by its unusual conduct either with respect to its rate of movement, or point of recurving. An example of this may be made in the hurricane of September 21–22, 1920.[2] This storm, as indicated by the tides after it entered the Gulf, was moving in the direction of the coast between Corpus Christi and Galveston; but it recurved and with unexpected speed swept northward and inland near Morgan City, La. The difficulty was that, owing to the unexpected late recurving and unusual speed, it was impossible to forecast the actual point of entrance. As a consequence, the warnings were displayed first from Corpus Christi to Port Arthur, Texas, and then extended to include the coast as far east as Pensacola. In retrospect, it is seen that the method worked out well enough; but the peculiarities of the storm's movement preclude a satisfactory application of the method. In this case, the method did not give as great precision as might be required; but it must not be inferred that the method is faulty.

[2] *Cf.* Cline, Isaac M., "The Life History of Tropical Storm in Louisiana, September 21 and 22, 1920," *Monthly Weather Review*, September, 1920, pp. 520–524.

Anything that will improve the forecasting of hurricanes is welcomed, and it can not be said that Dr. Cline's paper does not constitute a genuine contribution to this difficult and troublesome question.

C. LeRoy Meisinger
Washington, D. C.

## SPECIAL ARTICLES

### THE COLLECTION OF RADIUM EMANATION FOR THERAPEUTIC USE[1]

The practise of using radium emanation instead of radium salts for therapeutic purposes is now thoroughly established in this country. Its advantages are so patent that all of the hospitals and clinics, where large quantities of radium are employed, have had their radium salts converted to soluble form, and collect emanation from solution.

It is necessary, however, to separate the emanation from hydrogen, oxygen and other gases which accompany it in the collection, in order to reduce its volume to meet the requirements. This can be accomplished by several different methods: (1) The chemical method of purification by heating copper oxide and other chemicals in a tube through which the gases pass before being confined in small volume over mercury; (2) the method of Professor Duane[2] of passing the gases over an electrically heated partially oxidized copper wire; (3) the method of freezing emanation at liquid air temperature and pumping off the residual gases. This method may also be employed in conjunction with either of the first two.

All three methods require a rather complicated apparatus and manipulations which can be carried out only by a specialist. It occurred to the writer that some simplification might be introduced by collecting emanation from the highly heated or fused radium salts, thus avoiding the presence of water and the consequent large volume of hydrogen and oxygen resulting from its decomposition. It

[1] Published with permission of the director of the United States Bureau of Mines.

[2] *Phys. Rev.* (2), 5, 311, 1915.

is probable that the gas collected from the fusion or high-temperature treatment would require no further purification for therapeutic use.

The liberation of small quantities of emanation by high temperatures has already been successfully applied in the quantitative measurement of radium by the emanation method. There is nothing novel in the idea, and its application has already been tested out under somewhat different conditions. The object of the present note is simply to call attemtion to the possibility of applying the same principle to the collection of large quantities of emanation for therapeutic use, and to leave the field open for experimentation by the different laboratories and companies interested.

The procedure might be varied in several ways. Fusion might be employed with or without a flux; possibly temperatures considerably below fusion will be found to liberate emanation from some salts with a satisfactory recovery. The salts come mainly in consideration are: The chloride, bromide, carbonate and sulfate. With the chloride or bromide the corresponding lithium salt might prove to be a good flux. Experiments with other salts of radium might disclose one that would yield its emanation at a still lower temperature.

It should also be investigated whether the state of fusion per se is favorable to the liberation of emanation. It is possible that a viscous fusion just above its melting-point would not liberate emanation so readily as the more porus salt before fusion. The effect of various proportions of barium should also be studied, as well as volatilization losses under various conditions with different salts.

The heating should preferably be electrical, but whether internally or externaly applied is a matter for determination.

The collection after liberation might be by means of mercury displacement or by liquid air condensation.

S. C. LIND

GOLDEN, COLORADO,
November, 1920

## A QUANTITATIVE SURVEY OF THE FLORA OF LAKE MENDOTA

IN the summer of 1919, quantitative determinations were undertaken for the Wisconsin Geological and Natural History Survey, of the submerged vegetation of Lake Mendota, Madison, Wis. The object of the work was to form an estimate of the total amounts of the various species present in the lake, and to obtain such additional data as might be available on their comparative distribution.

The plants were gathered by hand from measured areas of the lake bottom. For this purpose the whole plant zone of the lake was divided into stations according to local differences in physical and floral characteristics. Samples were gathered at different depths in each station. The plant zone is continuous around the lake in water not deeper than 7 m. The samples thus gathered were separated into their component species, and their wet and dry weights determined.

For purposes of calculation the plant zone was divided into three depth-zones, namely, 0 to 1 m., 1 m. to 3 m., 3 m. to 7 m., this arbitrary classification being based on evident differences in the character of the vegetation at different depths. By averaging the weights of the various samples gathered within one depth-zone, and comparing this average with the total area of that zone, as measured on a map, the total weight of each species in each zone was computed, and by addition the total weights for the whole plant zone.

The total amount of plants collected in this way was some 93 kilograms wet, 11 kilograms dry, the average water content being about 88 per cent. This material was obtained in 221 samples taken from 35 stations. The yield of the entire lake, estimated on the basis of these collections, is in round numbers 18,500,000 kilograms wet, 2,100,000 kilograms dry. The total area of the plant zone is 10,040,000 square meters. The yield per unit area is therefore 18,426 kilograms per hectare wet, 2,091 kiligrams per hectare dry (or 16,215 pounds per acre wet, 1,840 pounds per acre dry).