sembled for publication over their authors' signatures. Conciseness is essential and, as stated in a former notice in these columns,[1] "the committee reserves the right to condense and combine" where necessary.

Any one who has developed or improved methods of culturing invertebrate animals and wishes to assist in making this volume as complete as possible is cordially invited to communicate with the committee's secretary, Miss Mary E. Davis, Comstock Hall, Ithaca, N. Y., or with any member of the committee.

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CHEMICAL COMPOSITION OF LARGE AQUATIC PLANTS

The general investigations relating to the productivity of Wisconsin lakes have included studies of the chemical composition of the larger aquatic plants. Since these plants serve as a source of food, not only for strictly aquatic forms such as oligochetes, mollusks, insect larvae and fish but also for such animals as ducks and deer, their food value was regarded as an important item in these chemical studies.

Four papers dealing with the organic as well as the inorganic content of some of the larger aquatics were published by Schuette[1] between 1921 and 1929, which indicated the general food value of the forms that were analyzed. It is interesting to note that the chemical results published by Gortner[2] in a recent number of Science for the large aquatics of Minnesota lakes are in reasonably close agreement with those obtained by Schuette. The greatest difference is found in the Potamogetons, where the Wisconsin material yielded a somewhat smaller percentage of crude protein and a larger percentage of nitrogen-free extract than that from the Minnesota lakes. Birge and Juday[3] found that the percentage of crude protein varied with the stage of maturity of these plants, while Harper and Daniel[4] noted that the percentage of nitrogen varied with the character of the soil on which they grew; thus these two factors are probably responsible for the more marked differences noted in the Potamogetons.

With respect to the annual yield of large aquatic plants, Rickett[5] estimated the crop in Lake Mendota at 2,000 kilograms per hectare (1,800 pounds per acre), dry weight, in the zone occupied by them and 1,780 kilograms per hectare (1,580 pounds per acre) in Green Lake. Similar studies have been made on a dozen lakes in northern Wisconsin; while a report on this work has not been completed, the data indicate that the crop of large aquatics in them is much smaller, especially in those with soft water.

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CONCERNING THE TASTE OF HEAVY WATER

In discussing the recent press reports of the drinking of heavy water by Professor Hansen, of Oslo, the present writers could not account for the "dry burning sensation" said to have been experienced by Professor Hansen—assuming that it had been due to the water. Accordingly, it was decided to make a personal test.

In order to make the experiment as objective as possible, a third person in a different room prepared the samples to be tasted. Each of us was then given two identical watch glasses, one containing one cubic centimeter of ordinary distilled water, and the other the same amount of pure heavy water, especially prepared for biological experiments. One of us kept each sample in his mouth for a short time to make sure of its taste, and then spat it out. The other repeated the same procedure, but swallowed the water. Neither of us could detect the slightest difference between the taste of ordinary distilled water and the taste of pure heavy water. It might be mentioned in this connection that one cubic centimeter of water is not too small an amount to taste properly, since both of us could detect plainly the characteristic "flat" taste of distilled water in both cases. It may be concluded, therefore, that pure deuterium oxide has the same taste as ordinary distilled water.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CHOICE OF KILLING FLUIDS APPROPRIATE FOR CYTOLOGICAL RESEARCH

The increasing use of cytological investigations by workers in the fields of physiology and pathology indicates that we have reached a point in biology where we are ready to use cytomorphological methods as an important adjunct to the study of function.

One of the writers pointed out a quarter of a cen-

1 Science, 77: 427–428, 1933.

1 *Trans. Wis. Acad. Sci.*, 20: 529–531, 1921; 23: 249–254, 1927; 24: 135–139 and 141–145, 1929.

2 Science, 80: 531–533, 1934.

3 *Wis. Geol. & Nat. Hist. Sur. Bull.*, 64: 215, 1922.

4 *Bot. Gaz.*, 96: 186–189, 1934.

5 Science, 52: 641–642, 1920; *Trans. Wis. Acad. Sci.*, 20: 521–527, 1921; 21: 381–414, 1924.

tury ago that the essential living parts of the cell preserve their fundamental structure so long as the cell survives. The character which does change readily, either due to chromosomic constitution or to the agency of external factors, is the way the cell synthesizes or accumulates non-living constituents. Under favorable conditions a cell provided with the proper genes actively uses up the heterogeneous materials absorbed from the environment to build up homogeneous materials, which appear under the microscope as "optically empty" cytoplasm, mitochondria and "vacuolar sap." Under unfavorable conditions the homogenizing process is inhibited, resulting in the accumulation of unmetabolized products in the form of amino-acids, glucids or phenolic compounds in solution in the vacuolar sap, or as inclusions such as protids or lipids. In other cases, unused glucids accumulate as starch within the plastids.

Starch storage (which is concomitant with the differentiation of more mitochondria into amyloplasts) is correlated with inhibition of respiratory activity and a retarded rate of growth.

The results of modern cytological studies have shown that a living cell is not necessarily a physiological unit. On the contrary, metabolic processes utilizing the energy afforded by respiration probably take place mainly along the interphase between cytoplasm and vacuolar solution, and each of the "respiratory surfaces" within the cell may be differently affected by external stimuli, thereby producing a definite polarization within the living cell.

The total respiratory activity on an organism is the sum of the respiration on which depends the upkeep of the cell activity—maintenance—and of the respiration which provides energy for the syntheses within the growing cell. The former—the maintenance respiration—may proceed, although the latter—the growth-providing respiration—is inhibited by various agencies.

It is almost axiomatic that one who studies cytology should attempt to preserve the actual cell structure as well as possible. When studying cell morphology one should rely on the results of killing and staining methods only when he can check them through the observation of the living cell.

The killing fluid employed should, therefore, preserve as well as possible all constituents that can be seen in the living cell. It is especially important to preserve as much as possible of the apparent homogeneity of the cytoplasm, the clear-cut appearance of mitochondria and plastids, the outlines of the vacuoles and, above all, the products of cell metabolism. These results can be obtained only when the killing fluid penetrates the living tissues rapidly. Meves' fluid, which is admirable for some purposes, penetrates slowly. Tissues should be kept in Meves' for a week. It stains lipid inclusions dark brown and precipitates phenolic compounds as black bodies in the vacuoles, but may produce artifacts of a deceptive nature.

Nemec's killing fluid penetrates quickly, due to its formaldehyde content, and preserves the morphological integrity of the cell.[1] For the best results it requires a subsequent treatment in 3 per cent. potassium bichromate of at least 8 days to mordant the mitochondria and other constituents. Nemec's fluid precipitates phenolic materials as yellow flocculi, the consistency of which depends somewhat upon the concentration of potassium bichromate employed.

If principles like these were followed, investigators would soon cease to discuss the "good" or "poor" killing obtained through the use of mixtures containing acetic acid or alcohol, since they would realize that such mixtures so wreck the cell structure as to make any inferences drawn from the subsequent staining reactions void of significance.

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ON THE MAPPING OF THE VELOCITY-POTENTIAL AND STREAM FUNCTIONS OF AN IDEAL FLUID

THE methods of Hele Shaw[1] and of Osborne Reynolds[2] in showing the form of the stream-lines about an obstacle are well known. Other methods have been developed by Relf[3] for ideal fluids and by Taylor and Sharman[4] for compressible fluids. Both of the two latter methods require rather elaborate set-ups of a more or less permanent nature, involving considerable apparatus. A modification of these methods, used by the writer in 1932–1933 in connection with some aerodynamic testing, proved quite helpful.

Acting upon the suggestion by Grillet[5] that sheets of conducting paper might be used to plot mathematically orthogonal functions, the writer has obtained satisfactory results, using in place of the usual liquid electrolyte an inexpensive black silhouette paper. The experimental procedure was, of course, identically the same as in the laboratory experiment showing equi-

1 H. S. Reed and J. Dufrenoy, *Amer. Jour. Bot.* In press.

1 Trans. Inst. Naval Architects, p. 27, 1898; *Comptes Rendus*, 132: 1306–1312, 1901.

2 *Phil. Trans. Roy. Soc.*, 1883.

3 *Phil. Mag.*, 48: 535, 1924.

4 *Proc. Roy. Soc.*, London, A 121: 194–217, 1928.

5 *Comptes Rendus*, 194: 1464–1465, 1932.