LABORATORY MANUAL OF BIOLOGICAL CHEMISTRY WITH SUPPLEMENT

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BY

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PREFACE

This manual of biological chemistry for medical students in Harvard Medical School has been revised annually for the past seven years, and it is believed now to meet our needs sufficiently well to warrant publication.

For many years I have been interested in the development of analytical methods applicable to metabolism investigations. The most serviceable of my older methods and some of the newer methods have been taught to our medical students; these are described in the main body of the manual. Others not heretofore included have been incorporated in the supplement, so that nearly all the newer methods devised in the department are now described in this manual.

In connection with the revisions referred to above I am indebted for valuable help to W. R. Bloor, W. Denis, C. J. Farmer, L. J. Morris, F. B. Kingsbury, F. S. Hammett, R. D. Bell, and C. H. Fiske, as well as to my older friend, P. A. Shaffer.

OTTO FOLIN.

BOSTON.

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PART I

ACIDIMETRY, ALKALIMETRY, NITROGEN DETERMINATION

Equivalent and Normal Solutions.—Since the molecular weight of sodium hydroxid (NaOH) is 40 and that of hydrochloric acid (HCl) is 36.46, it follows that 40 g. of the former contain the same number of molecules as 36.46 g. of the latter. If 40 g. of sodium hydroxid and 36.46 g. of hydrochloric acid are each dissolved in pure water sufficient to make one liter of solution, each liter will contain the same number of dissolved molecules.

It will take a little less than one liter of water to make a liter of solution because the dissolved substance takes up some space. A normal sodium hydroxid solution contains four per cent. of sodium hydroxid. By per cent. in the case of solutions is usually meant the amount of substance present in 100 c.c. of solution.

Mixing equal volumes of two such solutions is therefore the same as bringing together practically the same number of the two kinds of molecules, and the result is the instantaneous and essentially complete transformation into sodium chlorid (and water).

$$X\ NaOH + X\ HCl = X\ NaCl + X\ H_2O$$

If either or both of the solutions should first be diluted with a considerable bulk of pure water, the result on mixing the two would be the same, for the extra amount of water present takes no part in the reaction (except to the extent of absorbing a part of the heat set free).

The two solutions are equivalent. They also happen to be normal solutions. The hydrochloric acid is normal because it contains 1 g. of active or replaceable hydrogen per liter of solution,