constant use of structural formulas. With such practise the study of two chapters of organic chemistry is not appalling.

A library shelf, easily accessible and especially selected for students of general chemistry, pays goods dividends. Other texts, books on the applications and special advertising pamphlets should fill this shelf. Not all will read but those who do are the ones who take advanced chemistry.

Stress must be placed on equilibrium, early and late, on solutions, on that fascinating chapter about the periodic system, on the hydrocarbons and their derivations and such other topics as appeal strongly to the teacher.

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An informal talk with each student or a written test on entrance will indicate that some who have had high school chemistry will do better in the class with those who had none. Since high schools vary widely in quality of instruction in chemistry (as do colleges also) the mere name of preparatory chemistry should not be accepted without some investigation. Usually the record of the school is sufficient evidence.

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ON THE EXISTENCE OF A HITHERTO UNRECOGNIZED DIETARY FACTOR ESSENTIAL FOR REPRODUCTION[1]

THE fact has been abundantly demonstrated that rats may be reared on a dietary regime consisting of "purified" protein, fat and carbohydrate to which an appropriate salt mixture and adequate doses of the growth vitamines Fat Soluble A and Water Soluble B have been added. We have employed a ration of casein (18), cornstarch (54) and lard (15) to which butterfat (9) and salts (4) are added, the animals receiving separately and daily .4 gram each of dried whole yeast.

Such animals are sterile. They are chiefly so in the first generation and wholly so in the next succeeding one. The sterility of dietary origin yields a highly characteristic picture. Animals suffering from it do not differ so profoundly from normal ones in their ovarian function as they do in placental behavior. Approximately the same number of Graafian follicles mature and rupture per ovulation and the ova are fertilized and implanted. The placentæ are abnormal. They may persist almost throughout gestation but show as early as the second day of their establishment beginning blood extravasations which increase in extent. Resorption invariably overtakes the products of conception.

Natural foodstuffs contain a substance, *X*, which prevents such a sterility or which cures the disorder occasioned by the purified dietary regime. We have thus been able to witness a comparatively sudden restoration of fertility to animals of proven sterility, and whose controls continued sterile, by the administration of fresh green leaves of lettuce. Even the dried leaves of alfalfa appear to possess a similar potency. The proven efficacy of leaves invites inquiry into the certainty of segregation of the new dietary factor from vitamines A and C. As regards A, it is conceivable that amounts of A adequate for normal growth, freedom from eye disease and, indeed, vigorous health might still be inadequate for the reproductive function. Such a conception is apparently strengthened by the reappearance of fertility which we have discovered to take place when the butterfat quota in the above diet is increased so as to constitute 24 per cent. by weight.[2] A sufficient answer to this conception, however, is afforded by our demonstration that in some dietaries reproduction may be unhindered when the A content is lower than in

[1] University of California, aided by the Dairy Division of the Bureau of Animal Industry of the United States Department of Agriculture, the Committee for Research on Sex Problems of the National Research Council and the California Central Creameries. The writers desire also to express their especial thanks to Mr. C. E. Gray, of San Francisco, and Dr. C. W. Larson, of Washington.

[2] Drummond (*Biochem. Jour.*, xiii, 77) has, for instance, reported two generations of animals reared on 20 per cent. butter in this diet.

our ration. Such a diet is furnished by rolled oats (40), gelatin (10), casein (5), dextrin (40.3), butterfat (1), and salts (3.7) (McCollum). It is perhaps also pertinent to point out that we have detected an invariable sign of inadequacy in the A factor of greater delicacy than those hitherto employed and may thus recognize such inadequacy long before growth impairment, for instance. The sign is constituted by a highly characteristic aberration of the œstrous cycle. And we have been able to demonstrate the persistence of fertility with a wheat-milk ration (Sherman) even in the absence of butterfat and when the A deficiency is heralded by the continuous exhibition of the new sign. The beneficial effect of a very high percentage of butterfat, consequently, seems preferably explained by its possession of a definite though low quota of the fertility conferring substance. Furthermore, a sample of cod liver oil tested by us and proven to possess a much superior A content to butterfat is far less efficacious than butter in curing or preventing the impairment of the reproductive function.

The beneficial dietary factor can not be identical with the antiscorbutic vitamine C, for curative effects have been secured when ground whole wheat was added to our purified ration, and the cereals are, of course, notably deficient in C. Moreover, although some favorable influence on growth has been noted, it has been impossible for us to secure with orange juice the fertility effects so evident with lettuce.

Lastly, we may refer to the suggestions either implied or expressed in the publications of some investigators (Osborne and Mendel, Kennedy and Palmer) that yeast contains some toxic substance inimical to the organs of generation and hence causing sterility or that it simply does not contain enough of the water soluble vitamine B. The curative foods could hardly be assumed to detoxify. Nor do we believe our animals suffered from lack of B, for growth was excellent; and as much as 25 per cent. by weight of yeast (which must have given a great surplus of B) did not change the result. Fertility, when wheat germ is used as a source for B, results not from more B but because wheat germ is also rich in X.

We have undertaken a series of experiments designed to trace further in natural foods the distribution of the substance thus shown to be indispensable for the production of healthy young.

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THE RECENT SCIENTIFIC WORK OF ROBERT WHEELER WILLSON

IT must be of interest to the many friends and former students of Professor Robert W. Willson to know that the last months of his life were actively occupied in the successful solution of certain scientific problems.

Professor Willson died at his home in Cambridge, November 1, 1922, in the seventieth year of his age. He was a graduate of Harvard College in the class of 1873, and took his Ph.D. at Würzburg a few years later, after specializing in physics, a subject which, in conjunction with his astronomical experience, gave just the right equipment for his solution of aerial navigation problems at a much later date.

The main facts of his professional career are available in the biographical reference books, while others can speak more fully than I of his devotion to the building up of a department of astronomy in Harvard College. Following his retirement as professor emeritus in 1919, he devoted an increasing amount of time to his own work in Cambridge along the line of air navigation instruments, and this later work is not perhaps so well known.

His development of the air-craft sextant was a notable achievement successfully demonstrated during the war, and widely adopted since. Anti-aircraft defense, trans-Atlantic flight, and ground speed indicators were only a few of the subjects which claimed his keenest attention and in which definite progress had been made. He was fully aware of all the trying obstacles which must be met in the development of instruments for practical airplane use, and not only had a sound, scientific solution in readiness for each case, but was equally alert to suggest the most economical method of construction.