compiled such tables in great variety, differing from each other in the number of decimal places, the intervals between successive arguments, and in their reliability. The two sets of tables before us are in the reviewer's opinion the most useful that have appeared, and ought to be on the shelves of every computer who has to deal with trigonometric formulae. They give all four functions (sine, tangent, cotangent and cosine) for every 10″. Differences and proportionate parts are always given. The arrangement is excellent and the typography is good. Both are practically free from error. They differ from each other only in that one gives six decimals and the other seven. In addition the six-place volume contains the cotangent for every second up to 3° to at least seven significant figures; and also the sine and tangent to seven decimals for every 10″ in the first degree. Similarly, the seven-place tables contain the cotangent to seven decimals (that is, up to thirteen significant figures) for every second up to 6°, and the sine and tangent to seven significant figures for every 10″ in the first degree. Considering the character of these books and the present cost of printing tabular matter, their cost is very moderate.

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The Structure and Composition of Foods. BY ANDREW L. WINTON and KATE BARBER WINTON. Pp. 1–710, figs. 1–274. New York: John Wiley and Sons, Inc. 1932. $8.50.

THE Wintons, both of whom have worked for many years on food structure and food chemistry both in this country and abroad, have just issued the first volume of a series of books dealing with the morphology and chemistry of foods. This first volume deals with cereals, starch, oil seeds, nuts, oils and forage plants. It is, of course, primarily a compilation of information from all sources on the food plants of the world and is the first work of the kind in English. In addition to its thoroughly dependable assembly of references and information from others, it is unique in its very fine illustrations, consisting principally of drawings made to scale by the authors, which will be invaluable as aids in identifying different plant products by their structure. These, with a ruler which will aid in interpreting the scale drawing, all made to the magnification X 160, will be a first-class aid to pharmacognosists and food microscopists as well as to students and investigators in more scientific fields. Their work on starch deals not only with the well-known types such as potato, corn, arrowroot and sago, but gives additional information on the starch of the banana, the yam, the lotus and a great number of plants of less common use. Even the yam bean commonly grown in China in the tropics, *Pachyrhizus erosus,* is given satisfactory and definite treatment. The text is, of course, primarily intended as a reference, but contains such a wealth of information about uses and treatment of the different products that it will be found interesting as well as a school guide, although one would scarcely expect it to be adopted as a school text for any except specialists who expect to spend their lives in this field.

To ultra-moderns, who seek the very latest fashions in science as well as in dress, in one respect the book will prove a disappointment. While it deals in the most comprehensive fashion in the chemistry and detailed analysis of the products treated wherever information is available and gives the results of an immense amount of ordinary research, one looks in vain for any mention of those mysterious regulators of human and animal nutrition, the vitamins. To those familiar with the most recent developments in vitamin research, this will perhaps be more of an advantage than a drawback, for vitamin work is, of course, primarily a study of physiological reactions and not of chemical compositions. Any report made this year on vitamin content of food will need to be revised frequently in the near future to make it of any value. Until we know more of the chemistry of these substances, they will still remain for many years in the realm of the mysterious rather than that of science. Unlike most of our American reference books, this book is of truly world-wide scope. Even among the grains one finds side by side information on the Mexican teosinte and the Oriental Coix or Job's-tears, the latter being a valuable food and drug plant of the Orient, but known in this country only as an ornamental. In dealing with the oil seeds, the authors have given ample information on the principal oil plants, such as cocoanut, peanut, soy-bean, linseed and palm nut and of the common edible nuts more frequently used as desserts. Besides these, they tell us much of the composition of weed seeds. Seeds of the common buttercup are poisonous and objectionable as a mixture in grains, which may seem at first a little surprising, although the objectionable features of larkspur and its poisonous character are widely recognized. One is impressed with the number and diversity of the oil seeds of the mustard family, both of economic importance and among the weeds. Cottonseed naturally gets a large share of attention, because of its importance among oil plants.

The text of the section on forage plants is relatively brief, comprising only thirty-eight pages, but is probably ample when one considers that the economic phases of this important group of food crops are dealt with in detail by agricultural experiment stations and other agricultural research institutions.

The tabulated information on composition of hay and of legumes, the structural details and particularly the drawings will prove useful additions to the existing literature on this topic. This book will prove a permanent and important addition to the literature of the world on food and food crops. It might also be said to mark the beginning of American activity in furnishing reference books of truly world scope, a function that we have been accustomed to regard as a particular prerogative of the Germans before the war. Let us venture to hope that America with her financial resources and world interest will now take her place in surveying world information.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE "MOLECULAR STILL" AS A TOOL OF BIOCHEMICAL RESEARCH[1]

THE comparatively unstable nature of many compounds often encountered in biochemical work and the frequent occurrence together in preparations of biological origin of substances of widely varying molecular complexity and weight suggest that the so-called "molecular still" should prove useful in biochemical research as a device for the distillation and purification of such compounds and for the partial or complete separation of such mixtures.

The term "molecular still" is applied to any distillation or sublimation device in which the condensing surface is separated from the evaporating surface by a distance less than the mean free path of the molecules of gas at the pressure used. Ordinarily a very high vacuum is used such as is achieved by the use of a diffusion pump in conjunction with a cold trap. Distillation by this method differs from the usual variety in that most of the escaping molecules proceed to the condenser in an unobstructed path by their own kinetic energy, instead of diffusing or being swept along in a current of gas. A suitable temperature differential is maintained between the evaporating and condensing surfaces. For the complete theory of operation and details of the various types of construction, the original papers should be consulted.[2]

The "molecular still" was first used by Brönsted and Hevesy[3] for the partial separation of the isotopes of mercury and later was suggested for the separation of the higher paraffins by Washburn,[4] who also succeeded in distilling sucrose. It since has been used by other investigators for the separation of mixtures and for other purposes.[5]

The complete absence of oxygen and the possibility of the use of low or moderate temperatures should make the molecular still particularly useful in biochemical research where substances sensitive to oxygen and high temperatures are not infrequently encountered. In this laboratory glucose, sorbitol and glycine have been distilled unchanged without difficulty at good rates at temperatures fifty or more degrees below their melting points. Vegetable oils and animal fats have been distilled.[6] Very recently Freudenberg[7] and others have succeeded in preparing methylated cellotetroses in pure form by this means. It should be very easy to separate relatively simple substances from such complex and completely non-volatile materials as proteins and the higher carbohydrates or from inorganic impurities. Where there is a propitious difference in volatility and/or molecular size between the components of a mixture, fractionation can be accomplished. Other applications of this comparatively new tool of research should readily suggest themselves in specific investigations.

On theoretical grounds it is probable that any substance can be distilled unchanged (rates are, however, often extremely slow) if the heat of dissociation of the least stable bond in it is greater than the molecular cohesion. The molecular cohesion of a compound is its molecular heat of evaporation at absolute zero, estimated by extrapolation from data obtained at higher temperatures. This property, which has been studied by Dunkel,[8] appears to be roughly additive, and the approximate value for any compound of known structure can be calculated from a table of values for the various constituent groups. In this connection it is interesting that it has been found possible to distil the normal paraffin $C_{70}H_{142}$ but not $C_{80}H_{162}$.[9] The value for the heat of dissociation of the carbon-carbon bond (ca 75,000 cal.) lies between

1 Communication No. 99 from the Experimental Station of E. I. du Pont de Nemours and Company.

2 Brönsted and Hevesy, *Phil. Mag.*, 43: 31, 1922; Washburn, *Bur. Standards Jour. Research*, 2: 476, 1929; Burch, *Proc. Roy. Soc. (London)*, 123: 271, 1929; Hickman, *Jour. Franklin Inst.*, 213: 119, 1932.

3 Brönsted and Hevesy, *loc. cit.*

4 Washburn, *loc. cit.*

5 Burch, *loc. cit.;* Carothers, Hill, Kirby and Jacobson, *J. Am. Chem. Soc.*, 52: 5279, 1930; Carothers and Hill, *Jour. Am. Chem. Soc.*, 54: 1557, 1559, 1566, 1569, 1932; see also Hickman, *Chem. Ind.* 48: 365, 1929; E. K., *Synthetic Organic Chemicals*, 2: 3, 1929.

6 *Synthetic Organic Chemicals, loc. cit.*

7 Freudenberg, Friederich and Bumann, *Ann.* 494: 57, 1932.

8 Dunkel, *Zeits. physik. Chem.*, 138, 42, 1928; see also Meyer and Mark, "Der Aufbau der hochmolecularen organischen Naturstoffe," Academische Verlagsgesellschaft, 1930, p. 23.

9 Carothers and Hill, Kirby and Jacobson, *Jour. Am. Chem. Soc.*, 52: 5279, 1930.