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Book Review

Food The Chemistry of its Components, by T. P. Coultate

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Food The Chemistry of its Components Third Edition, by T. P. Coultate. Royal Society of Chemistry Paperbacks, 1996. ISBN 0 85404 513 9, softcover, x11 + 360 pages. Price 14.50 pounds sterling.

My reading of Food The Chemistry of its Components, written by T. P. Coultate, filled me with delight, curiosity, and wonder. This book, now in its third edition, is extremely well written in a slightly informal style, giving the feeling that the author is discussing these topics with you. He addresses the foods that we frequently eat, so the interest level is kept high as everything relates to us immediately. The chemistry throughout is clear and complete. Several organic mechanisms are given in beautiful figures that show the transformations the molecules undergo. This book has whetted my appetite to search out more in the topics presented to add to my organic chemistry and biochemistry classes.

The introductory chapter deals with the different macronutrients and micronutrients in foods. Many questions are answered concerning where and how much of these nutrients might be found in the foods we commonly eat. Since World War II, food chemists have had to give additional information related to the food-processing industry as new questions have emerged concerning the reactions foods undergo in storage, cooking, and in the mouth. In addition, today's public has a growing interest in the "chemicals" in foods (meaning undesirable materials). This is not a nutritional textbook, but the information in this book can be used to supplement such a course. The book utilizes information from biology, microbiology, and from all branches of chemistry.

There are four chapters dealing with the macronutrients: carbohydrates, lipids, and proteins. These are all very complete and clear with respect to where these nutrients are found and the reactions they undergo.

An extremely good discussion of the monosaccharides is given, including the topic of optical activity. I was pleased with the inclusion of thermodynamic studies on structures of the sugar ring, which correspond to what is taught in organic chemistry with respect to axial and equatorial positions in the chair conformations. Synthetic sugars such as xylitol and sorbitol are also discussed. These taste sweet but are not absorbed by the intestine, so are used as sugar replacements in reduced-calorie foods. Decomposition of sugars gives many flavors, and the organic reactions involved are clearly explained. The structures of the different polysaccharides (starch, pectins, seaweed polysaccharides, cellulose, fiber, and gums) are illustrated. Their differing structures and shapes are useful in various food preparations. Information is given on how the body

processes these molecules.

The protein chapter is phenomenal! Proteins from meat and grains are the focus. The topic of meat is discussed in terms of the butchery, the processing from the slaughterhouse, rigor mortis, and beyond. A very good discussion of fibrous and globular proteins is given, with how cooking affects their structures. The grains used in bread-making and the proteins in these seeds are discussed, as is what happens during the process of dough-making.

The overview of the micronutrients, vitamins and minerals, is comprehensive and clear. Vitamin structures, stabilities, and the organic reactions that can occur upon heating or changing the pH in food preparation are discussed. The explanation and figures showing how cooking affects mechanisms of transamination and the role of vitamin B6 are especially illuminating. The roles of vitamins as cofactors with enzymes are discussed, as are the effects of a deficiency or an overdose of minerals in the diet. The commercial synthesis of vitamin C is also outlined here.

Two chapters deal with the colors and flavors in foods. These are not nutrients, but are important chemicals used widely in our foods, with roles involving palatability and esthetics. Chlorophylls, carotenoids, anthocyanins, betalaines, melanins (with a good deal of enzyme chemistry involved), and "natural" and artificial dyes are well discussed with a focus on how and why (molecularly) we get colors. Although the molecules producing flavors are difficult to study in the laboratory, the structures of some of these are given.

Water is not usually considered a macro- or a micronutrient, but its percentage by weight or volume in foods is often high. In this chapter, hydrogen bonding is used to explain the effects of solubilizing food molecules, and also the folding of proteins and orientation of hydrophobic molecules (or portions of molecules). An illustrative table on the typical water contents of foods and drinks indicates that there is more water in a potato (w/w) than in fruit juice (v/v)!

An excellent chapter covers the preservative techniques of salting, smoking, irradiation, sulfur dioxide treatment, and the use of nitrates, benzoates, and other organic acids. The reactions, such as the formation of possible carcinogens like nitrosamines from the enzyme-catalyzed reactions of amino acids with heat, are very clearly outlined. The aims of different type of radiation treatment are covered, and the effects on carbohydrates, lipids, and vitamins are very well described.

One of the most fascinating chapters deals with the "undesirable" molecules in foods. Covered here are endogenous toxins in both plant and animal foods, mycotoxins, bacterial toxins, allergens, toxic agricultural residues (such as pesticides, and antibiotics and hormones in animal foods), toxic metal residues (from water, soil, fertilizers, and the equipment, containers and utensils used in food processing, cooking, or storage), toxins from heat treatment of foods, and packaging residues from plastics. It was illuminating to read about what makes the deadly nightshade deadly, that there are vasodepressors in chocolate that can cause migraines, and that raw legumes should be avoided as they contain molecules that inhibit the action of trypsin and chymotrypsin, causing digestive problems.

This is a book I will refer to frequently, for coursework and to answer questions about the chemistry occurring in my foods. When a topic is beyond the scope of the book, the author gives sources for further reading. In addition to being an excellent primary source for a food chemistry course, this book would also be good for organic, biochemistry, and nutrition courses as a resource. All of the chemistry is very clear and thorough. I heartily recommend it.
