Water in the Atmosphere

Clouds and Storms. The Behavior and Effect of Water in the Atmosphere. F. H. LUDLAM. Pennsylvania State University Press, University Park, 1980. xviii, 406 pp., illus., + plates. $57.50.

Prior to the end of World War II cloud physics was a sluggish enterprise remote from the mainstream of meteorological research. A few investigators were exploring the subject, and indeed in 1933 Tor Bergeron had laid the ground for what was to come with his analysis of the processes by which precipitation is formed and his conclusion that the nucleation of ice crystals in supercooled clouds of liquid drops was the only way in which significant rainfall or snow is initiated. With the discovery by Vincent Schaefer in 1946 that introducing Dry Ice into a supercooled cloud results in formation of ice crystals that grow rapidly and fall out as precipitation, the subject received a great stimulus. Motivated by the possibility of economically valuable increases in rainfall and dissipation of fog, basic research into the processes by which cloud drops grow and develop into raindrops or snowflakes was greatly expanded, in addition to widespread operational cloud-seeding activities. The structure of thunderstorms was already the subject of a large research project, and the possibility of preventing destructive winds, crop-damaging hail, and fire-initiating lightning stimulated continuing investigation of the dynamics of severe local storms.

In addition to its role in fog, precipitating clouds, and thunderstorms, water enters the physics of the atmosphere in other ways. Thus water vapor is a principal absorber in the transfer of radiation through the atmosphere, and the presence or absence of clouds is a major factor in controlling the amount of solar radiation absorbed in the atmosphere and at the earth's surface, as well as the amount of terrestrial radiation emitted to space. Latent heat of condensation and evaporation plays a major role in the exchange of energy between earth and atmosphere and between low and high latitudes. The motions of the atmosphere on all scales are influenced by the effects of water vapor and its changes in phase. Optical and electrical phenomena in the atmosphere are almost entirely the consequence of the presence of water.

These manifold aspects of the role of water are the subject of *Clouds and Storms*. The subtitle of the book is the more appropriate indication of its nature, for in it is brought together a compendium of the influences of water in its various phases on the energy budget, the motions, and the visual phenomena of the atmosphere.

The first part of the book presents conventional background material, though the presentation is in some places quite unconventional. It is in the last three chapters, entitled "Cumulus convection," "Cumulonimbus convection," and "Large-scale slope convection," that Ludlam deals with topics on which he himself has done research. While many of the results of his own work that are given here have been published in journals, some of them appear for the first time and some are presented in more detail than in the journal papers. Also, the presentation of his work in relation to that of others in a coherent, organized fashion adds to its interest.

The special value of the book lies in the synthesis it provides. Ludlam was unusually well suited to carry out this type of synthesis. A keen observer of cloud and storm development, he participated in several projects measuring various aspects of them and was responsible for much of the clarification of the structure of thunderstorms that has taken place. The book was written while he was suffering from a progressive illness that claimed his life in June 1977, and as a consequence it does not include late developments (the latest of the hundreds of references are dated 1974). It is doubtful, however, that the insights Ludlam provides into the relationship between physical theories and observed phenomena would have been improved if these developments had been available to him.

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"A wave cloud with a smooth texture and regular outlines in the lee of the Matterhorn (which reaches nearly 4.5 km). Later the flow over and near the Matterhorn and neighboring mountains became unsteady, and the associated clouds more extensive and irregular." [From *Clouds and Storms*; photograph by G. J. Jefferson]

Complex Carbohydrates

The Biochemistry of Glycoproteins and Proteoglycans. WILLIAM J. LENNARZ, Ed. Plenum, New York, 1980. xiv, 382 pp., illus. $35.

The past ten years have witnessed notable advances in our understanding of the metabolism and function of complex carbohydrates. The synthesis and processing of oligosaccharide residues in glycoproteins and the observation of cell surface carbohydrate-recognition proteins are just two examples of such advances. Complex carbohydrate biochemistry has caught the attention of a broad spectrum of investigators, since these recent studies offer new insights into subjects as diverse as the processing of intracellular proteins and the social behavior of cells. *The Biochemistry of*

Glycoproteins and Proteoglycans is therefore a timely addition to the literature. Although most of the papers in the book are of excellent quality, much of the material they cover has appeared in review articles elsewhere. The book's main strength lies in its compilation of seven good reviews on topics that have not until now appeared together in one volume.

In the opening chapter, on the structure of glycoproteins and their oligosaccharide units, Kornfeld and Kornfeld give an overview of the biochemical techniques and protocols that have elucidated these structures. In chapter 2, Struck and Lennarz describe the synthesis and processing of lipid intermediates in glycoprotein synthesis. They evaluate the use of specific and nonspecific inhibitors of glycosylation, which have been instrumental in the discernment of the role of oligosaccharide moieties of glycoproteins. Our current understanding of protein glycosylation is brought together in a generalized model that serves to orient the reader for subsequent chapters.

Schachter and Roseman author an impressive review of mammalian glycosyltransferases. In the first part of the chapter they discuss the tissue and subcellular distribution, purification protocols, and kinetic requirements of the enzymes responsible for the addition of each monosaccharide moiety found in mammalian oligosaccharides. There is a structural analysis of the A, B, H (O), and Lewis blood group antigens, which gives a welcome physiological and genetical aspect to the chapter. The second part of the chapter contains the only detailed discussion of glycolipids in the book. Recent reports of the occurrence of gangliosides containing glucosamine are discussed, as are the subcellular distribution and metabolism of these compounds. This section contains one of the few discussions in the book of postulated functions for complex carbohydrates. Particular attention is paid to the role of gangliosides in development and differentiation and as receptors for hormones and toxins.

Mutant cell lines resistant to toxic plant lectins are characterized by alterations in their surface complex carbohydrates. In chapter 4, Stanley illustrates the use of such cell lines in elucidating the pathways of oligosaccharide biosynthesis. It was through the use of such cell lines that two independent mannose:*N*-acetylglucosaminyl transferases, each with its own linkage specificity, were identified. A biochemical catalog of cell lines resistant to a variety of lectins serves to emphasize the enormous value of cells such as these.

The pitfalls that have made difficult the analyses of surface carbohydrate alterations accompanying growth and transformation are well documented by Atkinson and Hakimi in chapter 5. The authors carefully criticize the biochemical and cell biological techniques used in these controversial studies. They set out broad categories of specific, surface-carbohydrate alterations that, even if they prove inaccurate, suggest ways in which future experimentation can be more carefully controlled. Although all the chapters touch upon the methods used for structural analysis, Atkinson and Hakimi give considerable attention to the use of endoglycosidases, which have proved invaluable in these studies.

The pioneering work of Ashwell and his colleagues on the hepatic clearance of circulating desialyzed glycoproteins has led to widespread interest in the role of lectin-like cell surface proteins in physiological regulation. The clinical significance of this subject is shown by the work of Neufeld and her colleagues on mucopolysaccharide "storage" diseases, one of which, I cell disease, appears to result in defective recognition of some mucopolysaccharidases by lectin-like membrane receptors. Chapter 6, by Neufeld and Ashwell, beautifully illustrates the historical development of two independent research avenues that eventually came to similar working hypotheses fundamental to cell biology.

The final chapter, by Rodén, is an excellent and exhaustive review of the structure, synthesis, and degradation of the known proteoglycans. The tissue source, purification, substrate specificity, and kinetic requirements of the enzymes responsible for the synthesis and hydrolysis of the 33 individual linkages that make up proteoglycan polysaccharides are discussed. Technical protocols for the isolation of proteoglycan are presented, as are biosynthetic pathways for the synthesis of some specific proteoglycans.

As is often the case with books of this type, this one is already somewhat dated. Since these chapters were compiled, for example, the continued isolation of highly purified glycosyltransferases by Hill and his colleagues and the recent characterizations of glucosidases involved in glycoprotein processing have added to our understanding of complex carbohydrate biosynthesis.

As is evident from the foregoing discussion, the quantity of data (and references) in the book is overwhelming. However, it is unfortunate that glycoproteins of wide abundance and significance such as collagen and fibronectin are scarcely mentioned. Likewise, there is no discussion of the structurally interesting glycoprotein erythroglycan, of glycoproteins on teratocarcinoma cells, or of the basement membrane glycoprotein laminin. On the other hand, authors draw upon clinical correlatives whenever possible, broadening the book's scope. The extensive bibliographies following each chapter add considerably to the book's usefulness.

For the investigator or student who is seeking a broad, comprehensive book on the technical, structural, and enzymological aspects of complex carbohydrate metabolism, this book is strongly recommended.

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Human Nutrition

Nutrition and Growth. DERRICK B. JELLIFFE and E. F. PATRICE JELLIFFE, Eds. Plenum, New York, 1979. xx, 452 pp., illus. $37.50. Human Nutrition, vol. 2.

I found this book an excellent source of information. It is divided into a short preliminary section describing the modification of nutritional requirements and processes by genes and environmental factors, a long middle section on developmental nutrition from fetal to adult life, and a final section on the assessment of nutritional status by anthropometry. The book is the second of a series of four, the first of which is concerned with prenatal and postnatal requirements, the third with adult nutrition, and the fourth with nutrition in disease. Its contents overlap to some extent those of the other volumes; for example, it includes papers on the mother and fetus (Lechtig *et al.*), the adult (Wolanski), and such disorders as obesity (Lloyd) and protein-energy malnutrition (Gurney).

The middle section of the book follows a conventional "conception to coffin" developmental approach except that the first trimester of pregnancy receives scant attention. Parts of some papers are particularly useful; for example, the discussions of the effect of birth interval on maternal nutrition and fetal growth (Lechtig *et al.*), the social and emotional factors in the failure-to-thrive syndrome (Brown), and the etiology of obesity (Lloyd). Despite a feeling of déjà vu