method. Results for the interionic potentials of many simple metals are given, but a critical discussion is lacking. Chapter 3 gives a simple account of the role the electrons play in shielding the coulomb interaction of the ions. It is a standard textbook kind of discussion. Chapter 6 deals with the phenomenon of melting. Strangely enough, the author discusses an empirical relation by Mukherjee and considers it to provide strong support for dielectric screening theory. He could have easily found in the literature more convincing examples in support of this theory.

Chapter 7 deals with the phenomena of electrical transport in liquid metals. It is a well-written chapter, but better accounts can be found elsewhere. In chapter 8 the author discusses the dynamics of atomic motions in liquids. This chapter is a mere glossary of formulas and does not much help the beginner to understand the field. The theory of electron states in liquid metals is well summarized in the last chapter. I have my doubts, however, whether a reader who is not familiar with Green's function techniques will be able to follow intelligently the discussion in this chapter. There are six useful appendices in the book.

My feeling is that the author has been severely handicapped by trying to condense the vast amount of knowledge that has accumulated during recent years on the physics of liquid metals into a tiny monograph. The result is a book which is useful if and only if it is read in conjunction with other, more detailed texts and review articles.

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## Plants in Beringia

**Flora of Alaska and Neighboring Territories.** ERIC HULTÉN. Stanford University Press, Stanford, Calif., 1968. xxii + 1008 pp., illus. $35.

In this handsome volume, the distinguished Swedish author has crystallized his thoughts and experience of more than half a century as they bear upon the vascular plants of Alaska and their role in circumpolar vegetation. His *Flora of Kamchatka and the Adjacent Islands* (1927–1930), *Outline of the History of Arctic and Boreal Biota during the Quaternary Period* (1937), *Flora of the Aleutian Islands* (1937), *Flora of Alaska and Yukon* (1941–1950), and *The Circumpolar Plants* (1962) are so many giant stepping-stones to this impressive synthesis.

The central emphasis of the book is on the historical importance of Beringia as an intercontinental land bridge and the significant role of Alaska as a great northern biological *refugium* during Pleistocene glaciation. These ideas were first enunciated in Hultén's 1937 thesis: ". . . the present ranges of Alaskan plants seemed to demonstrate that Beringia had been a pathway for the interchange of biota and that its Asian and American remnants lie at the center of many distributional patterns." The successive openings and closings of Bering Strait in response to fluctuation in ocean level caused by glacier formation and melt acted as a spigot to turn periodically off and on the migration and intermingling of plants and animals between Siberia and Alaska from Miocene time until the final interdiction of movement by land some 10,000 years ago.

Because, as the author notes, plants and animals have little respect for political boundaries, Hultén's Alaska is not coincidental with the outlines of our 49th state. For both floristic and cartographic reasons, he includes the Yukon Territory, an interstitial arm of British Columbia, parts of the Northwest Territories, and the Chukchi Peninsula of Siberia. Inclusion of the last "helps to make clear the important overlapping of the floras of the two continents" and certainly makes this the first flora of an American state to deal also with a portion of the Soviet Union! The area involved adds up to a total of nearly 1,000,000 square miles, ranging from Point Barrow at the north to the southern Aleutians, and from Attu Island on the west to the eastern border of the Yukon. Within this vast area ("about four times the size of Texas") the author accounts for more than 1500 species of vascular plants belonging to more than 300 genera. These are distributed in Alaska proper over four major floral regions: the coastal coniferous forest extending southward down the Panhandle, the coniferous forest of the interior, the treeless tundra of the Arctic slope, and the likewise treeless Pacific shores of the various islands and peninsulas. The Aleutian Islands, dominated by Pacific coastal plants, might almost constitute a fifth.

The first botanical collections in Alaska were made by Steller, the German naturalist with Bering's 1841 voyage of discovery, but the first extensive ones were those of Chamisso and Eschsholtz, published in the results of Kotzebue's *Rurik* expedition (1826–1936). The Harriman Alaska Expedition of 1899 led to the preparation by Standley of a manuscript flora, but this remained unpublished. An early and indefatigable collector in interior Alaska was J. P. Anderson, whose *Flora of Alaska and Adjacent Parts of Canada* appeared in 1959. Establishment of the Arctic Research Laboratory at Point Barrow in 1946 opened the northern area to vigorous biological investigation, and the vascular plants were summarized by Wiggins and Thomas in *A Flora of the Alaskan Arctic Slope* in 1962. Both this laboratory and the Arctic Institute of North America sponsored Hultén in four profitable summers of preparatory field work. The author notes that the quantity of research material available to him for writing the present volume was at least three times that available in 1950.

Following the concise introductory material and a master key to families and genera, 937 pages are devoted to taxonomic treatment, providing keys, descriptions, synonymy, habitat and range information, and frequently biological, taxonomic, or ethnobotanical notes. The author's concept of species and other categories is conservative, in line with his strong and conscious emphasis upon intercontinental similarities among circumpolar plants. He finds the subspecific category useful for his purposes and employs it extensively. He allows for extensive hybridization, and groups the numerous apomicts into morphological units that correspond to sexually reproducing species. For each of the more than 1700 taxa there are provided simple but diagnostic line drawings and a pair of distributional maps, one showing occurrence within the area defined, the second indicating the complete circumpolar distribution of the species. As Hultén remarks, "The circumpolar range maps . . . should offer a welcome opportunity to study the geographical affinities of the flora in detail, and to provide a basis for phytogeographical theory and speculation that has not earlier been available. For many purposes they may be found to be the most useful contribution I have made in preparing this flora." A special feature is the inclusion of 49 colored photographs by the author, superb in both quality and reproduction. The volume closes with a glossary of botanic

terms, lists of authors of taxa and persons for whom taxa have been named, a bibliography, and indices to common and botanical names.

Clearly, no one but Eric Hultén could have written this book, and it is indeed fortunate that he has done so. The flora of Alaska and adjacent regions is viewed from a cosmopolitan and sophisticated point of view and from a wealth of relevant experience. The taxonomy notably avoids the twin pitfalls of provincialism and undue emphasis upon any one or a few criteria. Alaska, as a result, suddenly jumps into the lead as that one of the United States with what is undoubtedly the most attractive and profound treatment of its vascular plants, although its flora is probably the least known. The author is to be congratulated upon a fine achievement, Stanford University Press for its superb execution of its publishing responsibility.

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## Festschrift

**Structural Chemistry and Molecular Biology**. A Volume Dedicated to Linus Pauling. ALEXANDER RICH and NORMAN DAVIDSON, Eds. Freeman, San Francisco, 1968. xii + 907 pp., illus. $10.

This is a remarkable volume of essays, proposed in 1966 when Linus Pauling was 65 years old and written by a number of his students, colleagues, and friends, who dedicate it to him in admiration and appreciation. Thirty years ago, in the preface to the first edition of his book *The Nature of the Chemical Bond,* Pauling wrote:

> For a long time I have been planning to write a book on the structure of molecules and crystals and the nature of the chemical bond. . . . The ideas involved in modern structural chemistry are no more difficult . . . than the familiar concepts of chemistry. Some of them may seem strange at first, but with practice there can be developed an extended chemical intuition which permits the new concepts to be used just as confidently as the older ones of the valence bond, the tetrahedral carbon atom, etc., which form the basis of classical structural chemistry.

The central ideas there, the importance of molecular structure and the nature of the chemical bond, have dominated Pauling's work and because of this work have transformed and defined the emphasis of modern chemistry. As Pauling brought modern structural chemistry to bear on the concerns of biology he defined the idea of molecular biology and provided precise and powerful means of enquiry, a conceptual framework for asking meaningful questions. He devised experimental studies to yield needed quantitative physical-chemical information.

In a short preface the editors, Alexander Rich and Norman Davidson, give a brief outline of Pauling's life and scientific career and suggest the pleasures and stimulation for his students and colleagues of his working style. They underscore the dominant structural emphasis of his approach and the triumphant progress of his work, and give brief but welcome recognition of his nonscientific concerns. There is an account by J. D. Sturdivant of Pauling's scientific work until 1963 and a bibliography of his publications compiled by Gustav Albrecht. The last entry in the book is a reprint of an important 1931 article by Pauling on the nature of the chemical bond.

Contributors were evidently given a broad mandate to write as they chose, and Bernal in his article provides one further direct account of Pauling's work. All the direct accounts sketch the outlines with care, define the elements with precision, and delineate the triumphs with evident pleasure and appreciation. But it remains to the general contributors to reflect the full measure, range, and power of Pauling's achievements. These articles, predominantly reviews, with some original papers and a few more speculative and generalized discussions and reminiscences, do most splendidly round and complete the picture. There are 60 essays grouped in nine sections (entitled The Structure of Proteins; The Chemistry of Proteins; Antibodies; Molecular Biology; Nucleic Acids; Hydrogen Bonding, Water, and Ice; The Chemistry and Structure of Smaller Molecules; Metals and Minerals; and Chemical Theory) which brilliantly reflect the broad areas of Pauling's interest and influence.

Any chemist who misses reading this book has missed much more than the communications at several scientific meetings and at most conferences and symposia. When scientists write as they have written here, staying at home is rewarding pleasure and not deprivation. In "Selected topics in hydrogen bonding" Jerry Donohue discusses with wit and ease some few features of hydrogen bonds: the curious discrepancies between the accepted explanations and the observations they explain, the disappearing bifurcations. It is not simply amusing and elegant; it is fruitful, ordered criticism at its best and most incisive.

The most sophisticated machine and machine inventor are clearly far removed from a good teacher, and light years away from the even rarer teacher who can project the involvement and communication of spoken discourse in the written text. The article by Jürg Waser, "Pauling's electroneutrality principle and the beginner" is immensely satisfying. I enjoyed, too, the article by Hans Kuhn, "On possible ways of assembling simple organized systems of molecules." By avoiding all discussion of experimental techniques it excites an impatient interest in the details of "it has been shown."

Few invented words please; their hybrid origins and dissonance repel. "Emphore," invented in the brief, rewarding article of Arthur B. Pardee, is a useful and appropriate term for "carrier" proteins. It underlines and illuminates, as do all good classifications, the common biological features of their roles.

Linus Pauling has urged us to move imaginatively and to stay firmly in 3D. G. Adam and M. Delbrück explore the rewards of staying resolutely out of 3D in their article, "Reduction of dimensionality in biological diffusion processes." The pleasing reminiscences of Dorothy Crowfoot Hodgkin and Dennis Parker Riley in "Some ancient history of protein x-ray analysis" serve to measure the enormous distances conceptually and experimentally covered since that time in this one area of protein structure by those whose work has been shaped by the Pauling sense of molecular structural identity.

As J. H. Sturdivant in his account, "The scientific work of Linus Pauling," and Edward Hughes in "The past, present, and future of crystal structure determination" both remind us, the decision to initiate a series of x-ray diffraction studies of amino acids and simple peptides was made by Pauling in 1937. The studies were to provide the basic quantitative information not only about intramolecular but also about intermolecular bond lengths, stereochemistry, and packing. The easiest x-ray crystallographic techniques were thus necessarily avoided and the structural problems in consequence were among the most difficult and challenging being studied at that time. These studies are the fundamental source of precise information about protein