

scientist as of the science . . .". Palaeoanthropology is an eminently suitable field in which to pursue this idea, a field guaranteed to give Feyerabend a good time. Many of its foremost practitioners include people of strong personality and persuasive ability, often well equipped with preconceived notions. Also, like a number of sciences with an historical element, the constraints upon conjecture are relatively slight, for the material evidence for any particular theory is rare, and even more rarely unequivocal. "Controversial" simply means that other people do not believe what you say, and this condition is not new in palaeoanthropology. Each scientist's beliefs can often be justified scientifically, depending for example upon his opinion about time, extent of variation, sexual dimorphism, or the weight given to various anatomical characters. Reader traces these kinds of influences over the past hundred years or so with considerable

insight, consideration and knowledge. He does not ridicule people or their beliefs and attitudes, merely suggests that this is the way the science has advanced; and advanced it has despite these strong personal elements in its methodology.

It would be a great pity if *Missing Links* fell into the shadow of other books by perhaps better known or better publicized authors, for it deserves a wide readership. Not only is it an entertaining and informative book for the general public, but it should not be ignored as an anthropology textbook, providing a thoroughly documented history from a viewpoint that more palaeoanthropologists would do well to share. They might remember the girl with kaleidoscope eyes — just shake the evidence and it falls into another pattern, often equally attractive as the one before.

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Plastid development

F. R. Whatley

Chloroplasts. Results and Problems in Cell Differentiation, 10. Edited by J. Reinert. Pp.240. ISBN 3-540-10082-2. (Springer-Verlag: 1980.) DM 78, \$46.10.

THIS book can be read in sequence from cover to cover and represents a beautifully balanced treatment of plastid development and differentiation. All the articles are pitched at the same level and it is easy to cross-refer from one to the other.

In the opening contribution, Schnepf lays down the framework for the rest of the book in describing the development and interconversions of plastids; using evidence from electron micrographs, he provides a classification of all known types. Butterfass next discusses evidence for the continuity of plastids, and also the coordination of the plastid population, both in terms of the origin of the organelles by division and the evolution of patterns of plastid maintenance.

At a more biochemical level, R. G. Herrmann and Possingham give an account of plastid DNA, its amount and arrangement in the circular chromosome; Wollgiehn and Parthier put a similar emphasis on biochemistry in their discussion of RNA in plastids and aspects of protein synthesis. The important chlorophyll-protein complexes associated with light harvesting are then treated in some detail by F. H. Herrmann *et al.* in the chapter on thylakoid biosynthesis, which also includes a discussion of the sites of synthesis of particular components under the control of nuclear and plastid DNA.

Fraction I protein (ribulosebiphosphate carboxylase) is discussed by Bottomley, who considers the composition and origin of the component sub-units, and Sundqvist *et al.* rehearse the influence of the main external factors on chloroplast differentiation, especially the effects of light, hormones, minerals and water stress. Finally, the experimental evidence that chloroplasts can be cultured outside the cell is drawn together by Leech, who points out the possibilities of experiments which can be done with surviving plastids.

Regrettably, many of the articles end with a note, added in proof, that the literature for this review was completed in 1976. Since the book was published some four years later the editors must have experienced serious delays in receiving some of the manuscripts. In spite of this, all concerned are to be congratulated on the impressively balanced treatment, which covers structural, physiological and biochemical considerations. As well as being of great help to research workers, advanced undergraduates should also benefit from the book. □

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Understanding the facts of IR spectroscopy

Richard C. Lord

Advances in Infrared Group Frequencies. The Infrared Spectra of Complex Molecules, Vol.2, 2nd Edn. By L.J. Bellamy. Pp.299. ISBN 0-412-221350-3. (Chapman & Hall: 1981.) £15, \$35.

In the past ten years or so there has been a relative decline in the use of infrared spectroscopy for the solution of problems in structural organic chemistry, primarily because of the widening scope of nuclear magnetic resonance and other techniques. For lack of practitioners among recent graduates, skilful interpretation of the infrared spectrum of a complex molecule is becoming something of a lost art. In the preface to this book, the author puts the reason for this in a nutshell: "One cannot interpret an infrared spectrum without a good knowledge of the experimental facts, but too rigid an interpretation without any understanding of how these facts originate can lead to gross errors". Happily, he has provided us with an admirable summary of the experimental facts in successive editions of *The Infrared Spectra of Complex Molecules*. Now, with the second edition of Vol.2 of this work, he gives an up-to-date and comprehensive basis for an "understanding of how these facts originate".

The book is quite compact. The eight chapters cover less than 300 pages and treat successively the alkanes, carbon-carbon double bonds, triple bonds and cumulative double bonds, X-H stretching frequencies, carbonyl frequencies, other double-bond vibrations, the stretching frequencies of XO₂ groups and the effects of hydrogen bonding on the infrared

spectrum. Each chapter provides a thorough discussion of mechanical, geometrical and electronic factors that affect the group frequencies under consideration. There are up-to-date references (to 1979) at the end of each chapter, totalling about 1,500 in all.

To me, the chapters on olefinic double-bond frequencies, carbonyl vibrations and hydrogen bonding seem particularly useful. That on carbonyl frequencies is rightly the most extensive; a band due to a carbonyl group is often the most intense in the spectrum of an organic molecule and its precise frequency is a measure of the net effect of a multitude of factors. These include the masses of adjacent atoms, their geometry, interaction with neighbouring vibrations or with overtones (Fermi resonance), conjugation with double bonds and other electronic effects, and intermolecular forces. After detailed discussion of these factors, they are summarized by a table of some 500 carbonyl frequencies in suitably illustrative organic molecules.

This volume gives a thorough account of the various origins of group frequencies in organic molecules. It is a valuable work of reference for those who wish to improve their talents in the interpretation of the infrared spectra of such molecules. Taken with the companion Vol.1, it gives a comprehensive survey of the state of our understanding of the infrared spectra of complex molecules. □

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