Chapter 1

Editors’ Introduction: A Healthy Debate

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A. Introduction

Interest in carotenoids and human health goes back some 80 years, when the link between β-carotene (3) and vitamin A was first demonstrated and the dietary importance of β-carotene and some other carotenoids as provitamin A was established. This alone is sufficient to ensure that carotenoids will always have an important place and value in human nutrition. But there is more. This is now the era of ‘functional foods’, when a major goal is to identify roles of chemical components of foods as important micronutrients. Dietary intake can be manipulated by adopting a ‘healthy diet’, i.e. one rich in fruit and vegetables. Many supplements are now available to augment supplies when intake is limited or considered to be sub-optimal.

Carotenoids feature high on the list of food components that are of interest in relation to human health. The first great catalyst and stimulus for this was the publication in 1981 of a paper in Nature in which the authors addressed the question ‘Can dietary β-carotene materially reduce human cancer rates?’ [1]. Three years later another key paper [2], revealing that β-carotene could be a new kind of antioxidant, stimulated the imagination of many carotenoid researchers. Antioxidants are now big business and their importance in maintaining health and as major players in the fight against serious and chronic diseases such as cancer is widely accepted. Even after 25 years of intensive study, however, it is still not clear if carotenoids have an important place in the hierarchy of natural antioxidants in vivo.

In recent years, investigations have spread in directions as diverse as whole population studies (epidemiology), detailed investigation of effects on molecular processes and intricate mechanistic studies. The literature is vast and expanding rapidly. This, the final volume of the Carotenoids series, surveys the field of carotenoids in human nutrition and health. In the past 15 years or so, the topic has been covered in several books. Two of these, ‘Carotenoids in

B. Volume 5

1. Strategy

Carotenoids, Volume 5 was planned as a coordinated, integrated treatment providing up-to-date research surveys by leading authorities in the field, and incorporating some background material to help make the chapters accessible to carotenoid researchers who are not specialists on the particular topic. The practical approach that has been a feature of the series is maintained. Not only are experimental findings reported but the methods by which the data were obtained are explained and evaluated.

2. Relation to other volumes

Although Volume 5 may be used as a single stand-alone volume, Volume 4: Natural Functions and Volume 5: Human Nutrition and Health were planned as companion volumes to be used together. To understand the mechanisms of functions and actions of carotenoids requires understanding of the underlying fundamental principles. The treatment of fundamental properties of carotenoids presented in the first part of Volume 4 is intended also as a foundation for understanding how carotenoids may be involved in maintaining human health.

Each carotenoid has a precise three-dimensional shape which is vital for ensuring that the carotenoid fits into cellular, sub-cellular and molecular structures in the correct location and orientation to allow it to function efficiently. Absolute configuration, conformation and geometrical isomeric form are considered in Chapters 2-4 of Volume 4. Geometrical isomeric form (cis/trans or E/Z) may be an important factor in the biological activity of carotenoids, especially in relation to bioavailability, transport and deposition in tissues.

The conjugated double-bond system of carotenoids determines the photochemical properties and chemical reactivity that form the basis of most of their functions. Light absorption is the basis of detection and analysis. Excitation, energy transfer and quenching (Volume 4, Chapter 9) are relevant to protective roles in the eye and skin. The susceptibility of the electron-rich polyene chain to attack and breakdown by electrophilic reagents and oxidizing free radicals is the basis for the behaviour of carotenoids as antioxidants or pro-oxidants (Volume 4, Chapter 7). This instability can have serious consequences for large-scale