

Review

On the Neuroprotective Role of Astaxanthin: New Perspectives?

Christian Galasso ¹, Ida Orefice ¹, Paola Pellone ¹, Paola Cirino ² , Roberta Miele ¹,
Adrianna Ianora ¹, Christophe Brunet ^{1,*} and Clementina Sansone ^{1,*}

¹ Marine Biotechnology Department, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy; christian.galasso@szn.it (C.G.); ida.orefice@szn.it (I.O.); paola.pellone@gmail.com (P.P.); robertamiele90@libero.it (R.M.); adrianna.ianora@szn.it (A.I.)

² Research Infrastructures for marine biological resources Department, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy; paola.cirino@szn.it

* Correspondence: christophe.brunet@szn.it (C.B.); clementina.sansone@szn.it (C.S.);
Tel.: +39-081-583-3603 (C.B.); +39-081-583-3221 (C.S.)

Received: 11 July 2018; Accepted: 23 July 2018; Published: 24 July 2018



Abstract: Astaxanthin is a carotenoid with powerful antioxidant and anti-inflammatory activity produced by several freshwater and marine microorganisms, including bacteria, yeast, fungi, and microalgae. Due to its deep red-orange color it confers a reddish hue to the flesh of salmon, shrimps, lobsters, and crayfish that feed on astaxanthin-producing organisms, which helps protect their immune system and increase their fertility. From the nutritional point of view, astaxanthin is considered one of the strongest antioxidants in nature, due to its high scavenging potential of free radicals in the human body. Recently, astaxanthin is also receiving attention for its effect on the prevention or co-treatment of neurological pathologies, including Alzheimer and Parkinson diseases. In this review, we focus on the neuroprotective properties of astaxanthin and explore the underlying mechanisms to counteract neurological diseases, mainly based on its capability to cross the blood-brain barrier and its oxidative, anti-inflammatory, and anti-apoptotic properties.

Keywords: astaxanthin; neuroinflammation; neuroprotective effect; neuroactive carotenoids; neurodegenerative diseases

1. Introduction

Carotenoids have gained scientific and commercial interest during the last decades, due to their huge chemical diversity (about 750 carotenoids have been characterized) and their strong beneficial effects on human health and wellbeing. These bioactive compounds exert antioxidant, repairing, antiproliferative, antiaging and anti-inflammatory effects and can be used either as skin photo-protection to inhibit adverse effects of solar UV radiation or as nutraceutical and cosmeceutical ingredients to prevent oxidative stress-related diseases and chronic inflammation [1–3].

Astaxanthin is one of the most successful carotenoids on the market (Figure 1), since many studies in recent years have demonstrated its inhibitory role against oxidative stress and inflammation, dangerous processes at the basis of many chronic diseases. Moreover, astaxanthin exerts a strong protective effect on human brain; its unique chemical structure allows it to readily cross the blood-brain barrier (BBB) [4]. Thus, the brain is considered the most important target organ of astaxanthin.