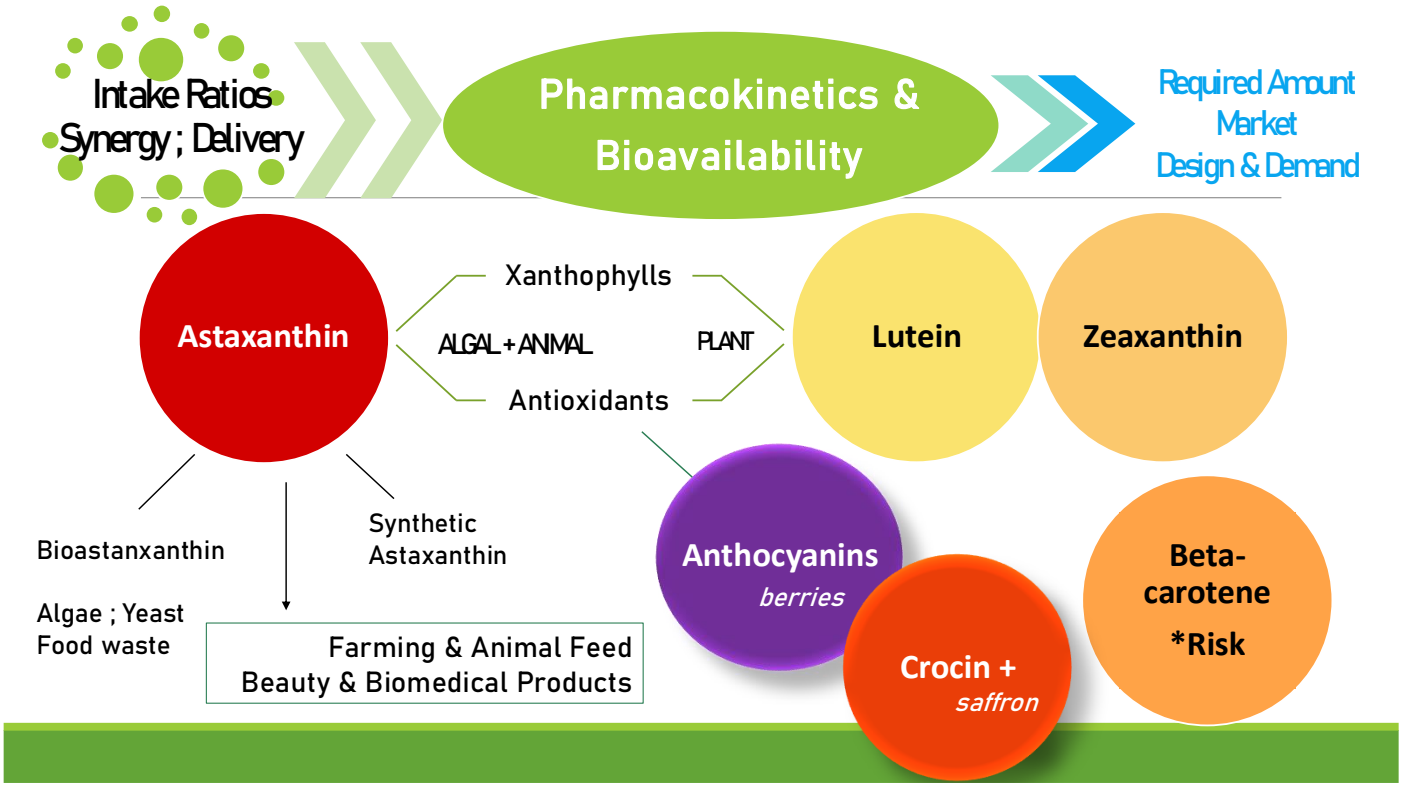
I & Vision Research Centre

Paint it, Pink: Astaxanthin



By IVRC: Summary Diagram

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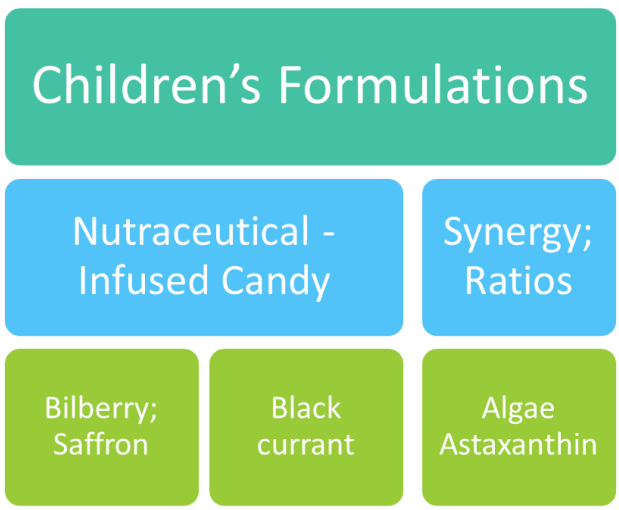
A lot is happening in the market for ocular health supplements and we thought we would feature one in particular: Astaxanthin.



Trends summarised from Straus M. (2023), 'Screen Team' in *Nutritional Outlook*

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Astaxanthin is amongst the most ferocious of the xanthophylls, a sub-category of carotenoids. The molecular structure allows it to span cell membranes, blaze red, and gobble radicals at ten times the rate of its near relations, lutein & the carotenes (See Figure 1 from Rebelo *et al.* 2020). Unlike hundreds of other carotenoids, human dietary sources for astaxanthin and phoenicoxanthin are typically seafood.

You may be familiar with its visible presence in things like flamingo feathers, salmon muscle, and lobster exoskeleton. In aquafeed applications, it gives fish an appetising colour, may stop prawns from turning black after harvest, and according to internet rumour (April Fools?) turn your swans a fabulous pink if you so desire. A substrate for its synthetic production, canthaxanthin, is being used in products to give human skin an orange-brown tan but there are advisories against high intake. Receptivity towards use of synthetic astaxanthin for human consumption is low and antioxidant performance – the criteria of great interest – is very low in comparison. There has even been mounting resistance to synthetic astaxanthin and yeast-based production in animal feed. This has yielded some urgency for discoveries that could boost natural production through plants like ketocarotenoid tomatoes or algae in time for projected demand.

Biomedical studies so far concentrate on astaxanthin's characteristics of UV protection plus antioxidant and anti-inflammatory effects. The range of applications is huge, covering skin appearance and protection, polycystic ovarian syndrome (PCOS) and perhaps fertility, life duration, menopause symptoms, alzheimers, and even amyotrophic lateral sclerosis (ALS). In the performance market, astaxanthin is under investigation paired with factors such as pain, injury and exercise routines, and perhaps soon as an element in synergistic supplements e.g. combined with whey protein. This combination is one of several techniques being evaluated for improving bioaccessibility, another being extracellular vesicles and the simplest option of formula ratio tweaking.

Besides antioxidant effects, the biomedical value of compounds like astaxanthin is linked to supporting endoplasmic reticulum (ER) mechanisms for proper folding and function in protein synthesis. The 'unfolding protein response' associated with ER stress and disease progression is present in PCOS and several ocular pathologies including diabetic retinopathy, glaucoma, neovascularisation and optic neuropathy (Kroeger *et al.* 2019). Astaxanthin dosing could therefore not just be about reducing damage, harmful exposures, and accumulation of biophysiological gunk over the lifespan, but raising baseline cellular function.

Obviously that cannot be confirmed yet and depends on environmental habits, helpers, and harms. It is also impossible to rule out adverse effects at this stage, ranging from allergies and pigmented excretions to cytotoxicity, furthermore dependent on chosen delivery method and target tissues or systems. Delivery method and ability to reach and effect target tissue, particularly the eyes, is an area of exploration in terms of optimals and mechanisms of action within a living system (review in Yang & Wang, 2022).

What do you think? Could there eventually be a child consumer market for nutraceutical colour-coded candies? Perhaps things will shift away from refined sugar to new processing and sweetening strategies from our fruits for other types of dessert, including traditional recipes. If there's already buttered lobster ice cream, why not shrimp-ruby-berry chocolate bars, right? Or a shrimp-shell / ultra-algae astaxanthin ramen broth to improve the nutritional content of a college student's cup noodle.

There are many benefits of a diet with high xanthophyll or antioxidant intake, with relatively fast-occurring and personally observable results for skin quality. As such, the contemporary health-conscious but science-checking and sceptical consumer market is driving a larger amount of professional research interest and boosting support for clinically trialled products with multi-faceted benefits. We're starting off general, but, as blood and genetic testing

technologies evolve, in line with growth in precision medicine, 'precision nutrition' is probably on the horizon and already practiced in certain clinical specialties.

The path is not entirely clear or absent dangers. The carotenoid beta-carotene in the original AREDS study was associated with increased risk of lung cancer, therefore replaced in the AREDS2 formula several years later with the pair of lutein and zeaxanthin. In 2022, an updated formula from Bausch + Lomb has involved the proprietary ratio patented as *OCUsorb*. Synergistic intake of protein in addition to lipids is being eyed a factor beyond vitamin & mineral ratios that may improve the absorption of antioxidants from food or supplements. Translation for improving bioavailability: Your supplements should be supplemented such that they resemble the nutritional profile of a balanced, unprocessed, omnivorous diet. Amazing, right? It is a convenient coincidence that algae, which produces astaxanthin, is a theorised future food source for lipids and protein as well.

It pays to be a little cautious about megadosing and interactive risks of nutraceutical compounds, especially if they are ultra potent like the keto-carotenoids. No concerns have been voiced so far for astaxanthin, although recent reporting on its potential as a youth potion should be taken with many, many, many grains of sea salt. We are neither worms nor putrefying shrimp, ergo results may vary.

In terms of the current research approach, it is noteworthy that several environmental root causes and risk sources of ocular disease are being interpreted as the given condition rather than being aggresively scrutinised and ameliorated accordingly. Sometimes it's easier to manufature a nutrition pill instead of supporting a total rewrite of food availability, diet choices and lifestyle. In a manner similar to cash crops of the past, this will have expansive effects on our food prices, markets, cultivation technologies, and supply decisions.

Disclaimer: *The material presented is for informational and entertainment purposes only, in summary of recent news and events. It neither reflects the views nor constitutes professional advice of the organisation. The major sources used are referenced below.*

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