

Biotechnological strategies for the improvement of sweet orange fruit quality by altering its carotenoid composition

Author: **Mireia Uranga Ruiz de Eguino**
Directors: **Leandro Peña García** and **Berta Alquézar García**
PhD program in Biotechnology



INTRODUCTION:

What are **carotenoids**?

- C40 isoprenoid pigments synthesized by all higher plants
- Responsible for colourations ranging from yellow to orange and red in many fruit and vegetable crops
- Essential nutrients for humans: antioxidants and precursors of retinoid synthesis (e.g. vitamin A and retinoic acid)
- Related to the prevention of certain types of cancer and other diseases

Why **sweet orange** (*C. sinensis*)?

- Massively consumed fruit tree crop worldwide and source of important phytonutrients
- Peel and pulp colouration in ripe fruit is mainly due to carotenoids
- Limited knowledge on the regulatory mechanisms of carotenoid biosynthesis in citrus (*Figure 1*):
 - **Orange (OR) proteins** are involved in chromoplast differentiation and posttranscriptional activation of PSY
 - Suggested relationship between carotenoid biosynthesis and the development of **storage structures** within the chromoplast

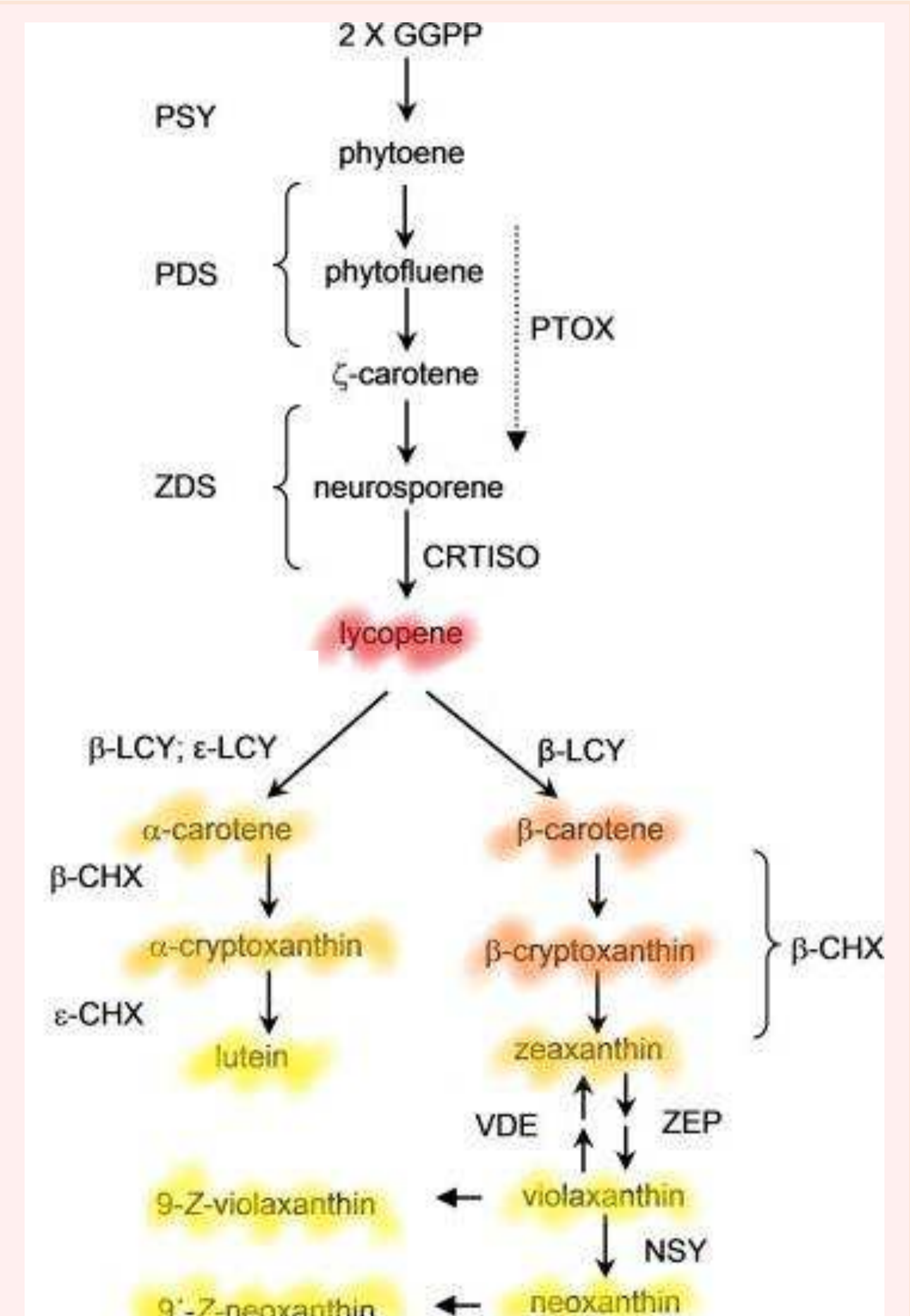


Figure 1. Carotenoid biosynthesis pathway in citrus



OBJECTIVES and RESEARCH PLAN:

Obtain sweet orange varieties enriched in **health-related carotenoids** through metabolic engineering

1. Characterization of lycopene-accumulating sweet orange transgenic lines

- Transgene integration
- Fruit quality analysis
- Carotenoid accumulation
- Gene expression (precursor synthesis and carotenoid biosynthesis pathway)
- Characterisation of chromoplasts
- Antioxidant activity of orange juice

2. Understand the role of Orange (OR) proteins as regulators of carotenoid biosynthesis

- Identification and cloning of putative CsOR genes
- Genetic variability (different citrus genotypes)
- Gene expression
- Protein-protein interactions (e.g. OR and PSY, OR and Clp protease)



EXPECTED RESULTS and APPLICATIONS:

New insights on the regulation of carotenoid biosynthesis

New insights on chromoplast development

Development of novel citrus varieties that accumulate specific carotenoids

