Preface

Carotenoids are a family of yellow to orange-red terpenoid pigments synthesized by photosynthetic organisms and by many bacteria and fungi. They have beneficial health effects, protecting against oxidative damage, and may be responsible for the colors associated with plants and animals. Carotenoids are also desirable commercial products used as colorants, feed supplements, and nutraceuticals in the food, medical, and cosmetic industries. Only a few of the more than 600 identified carotenoids are produced industrially, with β-carotene (a popular additive for butter, ice cream, orange juice, candies, etc.) being the most prominent.

Commercial production of natural carotenoids from microorganisms is a new approach more eco-friendly than synthetic manufacture by chemical procedures. Despite the availability of a variety of natural and synthetic carotenoids, there is currently renewed interest in microbial sources. Due to its increasing importance, industrial biotechnological methods of carotenoids production have been developed with the algae *Dunaliella salina* and *Haematococcus pluvialis*, the fungus *Blakeslea trispora*, and the heterobasidiomycetous yeast *Xanthophyllomyces dendrorhous.*

This book is intended to provide practical experimental laboratory procedures for a wide range of carotenoids producing microorganisms. Although not an exhaustive treatise, it provides a detailed "step-by-step" description of the most recent developments in applied biotechnological processes useful for screening and selection of carotenoids producing fungi, and construction of new carotenoid biosynthetic pathways. The detailed protocols are cross-referenced in the Notes section, providing special details, little problems, troubleshooting, and safety comments that may not normally appear in journal articles and can be particularly useful for those not familiar with specific techniques.

The two lead chapters of this volume represent overviews on the advancement of biotechnology and on microbial carotenoids. The subsequent chapters show comprehensive experimental methods for the manipulation and metabolic engineering of the β-carotene producing fungi *Blakeslea trispora* and *Mucor circinelloides.* Furthermore, methods for lycopene production with the yeast *Yarrowia lipolytica*, and peroxisome targeting of lycopene pathway enzymes in *Pichia pastoris* are shown. This book also comprises several chapters on the manipulation of the heterobasidiomycetous yeast *X. dendrorhous*, which produces astaxanthin, a red xanthophyll with large importance in the aquaculture, pharmaceutical, and food industries. Additionally, the book includes a DNA assembler method for construction of zeaxanthin-producing strains of *Saccharomyces cerevisiae*, production of neurosporaxanthin by *Neurospora* and *Fusarium*, and production of torularhodin, torulene, and β-carotene by *Rhodotorula* yeasts.

This book has been written by outstanding experts in this field and provides a reference source for laboratory and industrial professionals, as well as for graduate students in a number of biological disciplines (biotechnology, microbiology, genetics, molecular biology, etc.).

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