

Preface

The fossil fuel era started in the 1890s; it is characterized by the widespread utilization of coal, natural gas, and petroleum. As a result, modern industrial civilization has become highly dependent on petroleum for the manufacture of fuels and chemicals. During the past one hundred years, energy and materials derived from this fossil feedstock have enabled the rapid development of several regions of the world, including sustained economic, industrial, and population growth. However, despite the usefulness of petroleum, its extraction, processing, and the combustion of fuels has resulted in severe negative consequences to the environment. Furthermore, fossil fuels are non-renewable, and their demand is constantly increasing. Therefore, it is clear that alternatives to the use of petroleum are highly desirable.

An ideal replacement for petroleum would be a raw material that is renewable, non-polluting, and does not compete with human food supplies. Most of these characteristics can be found in plant-derived biomass. Lignocellulosic agricultural residues, non-food crops, and by-products, such as glycerol, can be considered partial replacements for petroleum. One approach for generating useful products from these renewable feedstocks involves their chemical transformation by microbes. This is a major challenge since microbes do not have the natural capacities for efficiently utilizing the carbon sources from biomass and transforming them into the many products currently obtained from petroleum. Furthermore, the chemical and thermal treatments usually required to facilitate the utilization of plant-derived biomass also generates by-products that are toxic to the microbes. Therefore, the development of commercially viable processes for the transformation of renewable resources into useful products requires the genetic modification of microbes to improve their production capacity and enable them to resist toxic conditions, among other useful traits.

The objective of this book is to provide reviews on the current knowledge regarding strategies for the generation and improvement of microbial strains designed for the transformation of renewable raw materials into useful products. This book aims to become a source of reference for researchers and students working in this field. Leading experts wrote the chapters and included up-to-date

information as well as the in-depth analysis of current issues and challenges in this field. Key topics in this book include specific approaches for the engineering of thermophilic bacteria, *Saccharomyces cerevisiae*, *Escherichia coli*, and *Zymomonas mobilis*. These microbes possess particular advantages as production strains and are currently employed for the synthesis of biofuels and chemicals. The improvement of sugars and glycerol catabolism, as well as the issue of lignocellulosic hydrolysate toxicity, is addressed in several chapters, where genetic engineering and adaptive laboratory evolution strategies are discussed.

Support from the Universidad Nacional Autónoma de México and the Consejo Nacional de Ciencia y Tecnología is gratefully acknowledged.

Cuernavaca, Mexico
October 2016

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Engineering of Microorganisms for the Production of
Chemicals and Biofuels from Renewable Resources

Gosset, G. (Ed.)

2017, VII, 200 p. 18 illus., 15 illus. in color., Hardcover

ISBN: 978-3-319-51728-5