

Preface

Control of consciousness determines the quality of life.

Mihaly Csikszentmihalyi

The impetus to editing this book stemmed from the overarching needs to fuel the fledgling bioeconomy or circular economy by realizing industrial and environmental sustainability through knowledge-based solutions, innovation, and cleaner production. The heart of this matter is promoting a greater awareness and deployment of environmentally benign biological processes to achieve various bioconversions by using naturally occurring or genetically improved enzymes, whole cells and associated bioprocesses. Whenever possible, renewable bio-based materials should be the feedstock of choice for the supply of chemicals and alternative energy sources to meet human societal needs.

This book, *Quality Living through Chemurgy and Green Chemistry*, is designed to give a deep appreciation of what the future holds, empowered by the synergy of two biomasses—a renewable feedstock and an infinite microbial biomass and its diversity as “game changers” in value addition and creation. Biocatalysis is integral to the 12 principles of green chemistry, an environmental priority and gateway to sustainability. Putting green chemistry to work on renewable feedstocks besides the conventional biomass is an extension of the original definition of chemurgy—applying “chemistry” (chemi) to “work” (ergon—Greek) on agricultural residues or simply on the farm.

I am deeply honored to have Brent Erickson writing a Foreword. He is Executive Vice President of the Industrial and Environmental Section of the Biotechnology Innovation Organization (BIO, formerly Biotechnology Industry Organization), and recently his name made the upper 10 % list of the Biofuels Digest “Top 100 people in the Advanced Bioeconomy,” a premier trade publication for the industrial biotechnology sector. I am equally honored to have Dr. David Constable, Director of the American Chemical Society’s Green Chemistry Institute to contribute a key chapter on Green Chemistry and Sustainability.

This book comprises 13 chapters and they have been written by scientists and engineers who are experts in their own fields. I am most grateful to these authors and colleagues who kindly accepted to undertake the charitable task of writing an informative chapter beyond their call of duty. The contents of the book are organized as follows:

- Chapter 1 serves as an introduction to the concept and practice of green chemistry and outlines the opportunities for applying sustainable (green) chemistry to maximize biobased resource efficiency.
- Chapters 2 and 3 highlight the industrial needs and perspectives in the bio-production of key commodity chemicals, e.g., dicarboxylic acids and omega-3 fatty acids.
- Chapters 4 and 5 are directed toward the development of a potpourri of biocatalysts to meet chemical and pharmaceutical needs, chiral building blocks, in particular; and also specialized enzymes from underexplored feedstock such as macroalgae for the production of biofuels and biochemicals.
- Chapters 6–8 focus on value creation from cellulosic and lignocellulosic materials to produce starch and derivatives thereof, as well as to gain access to a variety of biochemicals and biofuels including hydrogen, methane and butanol. Novel approaches to fermentation, e.g., simultaneous enzymatic biotransformation and microbial fermentation are highlighted. In the latter two chapters, various socioeconomic factors and technical bottlenecks that researchers and industries face in the biorefinery of lignocellulosics are discussed.
- Chapters 9 and 10 are devoted to the depolymerization and valorization of lignins from cleaner production (green approaches) point of view, and an updated review on the wide range of polymeric products that can be derived from this abundant aromatic feedstock. Notably, a great number of patents are cited in Chap. 9.
- Chapter 11 discusses the production of a family of amino sugars, sialic acid and its derivatives, and Chap. 12 presents a value chain in phenolic acids and polymeric production from agricultural feedstocks as well as the development of new enzymes and associated bioprocesses.
- Last but not least, Chap. 13 is considered a lagniappe—baker's dozen. Without an infrastructure and receptors any technology development will be futile. Extrapolations of present day pillars of competitiveness in fossil-based economy to those of chemurgy and green chemistry in the bio- or circular economy are discussed by Dr. Manfred Kircher using a European model.

All in all, this book provides invaluable insights and perspectives in biobased economy and bioproduction from academia, national laboratories, health and environment industries as well as consulting enterprises. Although there is no shortage of books in the general context of biomass and nonbiological green chemistry approaches, *Quality Living through Chemurgy and Green Chemistry* is considered unique while adding knowledge to current advances in the literature. Graduate and undergraduate students in various disciplines, aspiring “sustainability scientists,” practitioners of industrial biotechnology and biobased industry,

researchers and engineers, granting officers and policy makers, etc., are expected to benefit from this book.

Started in the 1930s, a “chemurgic movement” was said to have taken place, formalized by the 1935 “Declaration of Dependence upon the Soil and of the Right of Self-Maintenance” and initiated by Dr. William J. Hale of Dow Chemical Company, among prominent proponents like Henry Ford and George Washington Carver: “When in the course of the life of a Nation, its people become neglectful of the laws of nature..., necessity impels them to turn to the soil in order to recover the right of self-maintenance.” Sustainability in either environmental or industrial setting is the new framework in which we all have a role to play.

I will be remiss if I do not express my gratitude to June Tang of Springer Beijing who first approached me for a project on Sustainable Development but agreed on this alternative title. Support and assistance in contacting the authors, preparing and realizing the final launching of the book came from the unyielding effort and patience on the part of June Tang and her team, Heather Feng, in particular. The interactions and exchanges of information with the Publisher, not forgetting the timely cooperations of the authors, have been a most gratifying experience. Thank you all. I hope readers will enjoy the book. Any suggestions or comments are welcome.

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Peter C.K. Lau

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