This expanded third edition examines why each of these chemical building blocks — ethylene, propylene, C4 olefins (butenes and butadiene), benzene, toluene, the xylenes, and methane — is preferred over another in various manufacturing or environmental contexts, and delves into their individual chemistry, derivatives, method of manufacture, uses, and economic significance.

The new edition was prompted in part by the shifts in the world’s chemistry industry away from the U.S., Western Europe, and Japan, and the emergence of the Middle East and Asia-Pacific regions as major players. The book details the impact of globalization on the worldwide transportation of chemicals, the technological advances in polymerization and catalysis, chemicals for electronics, and the implications of the recent boom in shale gas and shale oil — which has altered long-term predictions of resource depletion in the U.S. and other countries. The book also covers recent commercial and market factors that have affected the chemicals industry.

The book presents its information with concepts of sustainability and climate change in mind, covering green chemistry and renewables, including research into processes (such as electricity generation) that produce less or no carbon dioxide.

The authors also offer perspective on how the industry has evolved, along with the technological, societal, and economic changes that have brought it to its present position.

This book should be valuable to engineers, biochemists, and students who seek to understand the science and practice of engineering biocatalysts for industrial microbial strains.

Setting forth strategies for engineering biocatalysts ranging from E. coli and Streptomyces to yeast and microalgae, this book explains the latest developments in engineering industrial microbes for the production of bulk chemicals and biofuels from renewable biomass, while incorporating green technologies. The authors — pioneers and international experts in the field — first guide readers through the tools and technologies available for engineering and characterizing a complex phenotype in an industrial strain. The book then applies these techniques in case studies that show readers how to engineer the complex traits and phenotypes needed for several biocatalysts and bioprocesses. Examples include a clavulanic acid strain improvement program; metabolic engineering of recombinant E. coli for the production of 3-hydroxypropionate; complex systems engineering for an unsequenced microalga; and meiotic recombination-based genome shuffling of Saccharomyces cerevisiae and Scheffersomyces stipitis for increased inhibitor tolerance to lignocellulosic substrate toxicity. These case studies emphasize the many disciplines (metabolic engineering, screening, fermentation, etc.) that underlie the engineering of biocatalysts.

This book should be valuable to engineers, biochemists, and students who seek to understand the science and practice of engineering biocatalysts for industrial applications.