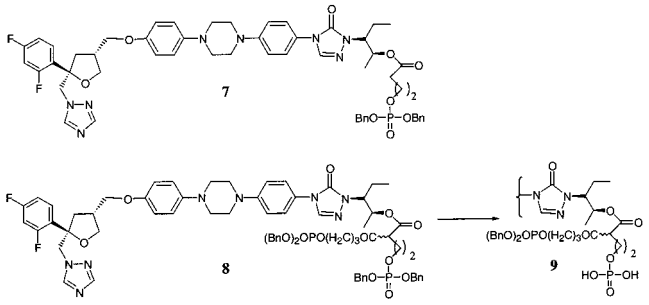
Organic Process Research & Development **2002**, *6*, 86–88

Additions & Corrections

Synthesis of Injectable Antifungal Sch 59884.

Gary M. Lee, Jefferey Eckert, Dinesh Gala,*
Martin Schwartz, Paul Renton, Edward Pergamen,
Michael Whittington, Doris Schumacher,
Larry Heimark, and Petia Shipkova
(*Org. Process Res. Dev.* **2001**, *5*, 622–629).

The names for Jefferey Eckert and Michael Whittington have been corrected as shown. Structures **7**, **8**, and **9** are revised as shown below:



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Book Reviews *

Industrial Biotransformations. By A. Liese, K. Seelbach, and C. Wandrey. Wiley-VCH: 2001. DM 198 (102 Eu). 425 pp. ISBN: 3-527-30094-5.

The aim of the authors of this excellent compendium is to gather information on all (or all that they know of) biotransformations carried out in industry on-scale. For each biotransformation process, a schematic diagram of the chemistry, reaction conditions, scale, plant flow diagrams, and process parameters are given along with relevant literature which may be patent literature. The name of the company or companies operating the process and, where possible, the annual tonnage produced, start up date, specification of the product, product application, and other relevant information is given.

The arrangement of the book is in enzyme class order, not chemistry. Indexes of product, starting material, enzyme name, strain, and company operating the process are given, making it easy to find what you want.

There are three introductory chapters; the first gives a concise history of biotransformations in industry from the "flower of vinegar" to recombinant organisms for enzyme and microbial systems and illustrates the advantages of biotransformations over classical chemistry; the second chapter covers enzyme classification, and the third, the basics of bioreaction engineering. This includes topics such as biocatalyst immobilisation, productivity, cloning, screening, kinetics and reactor types—it is a good introduction to the topic for organic chemists.

In view of the increased interest in industrial biotransformations, the appearance of this volume is timely. The authors recognise that they may not be aware of industrial processes that have operated at low tonnage and which have not been published, and request that readers let them know of any omissions, presumably for updating a second edition in a few years time.

In conclusion this is an outstanding compilation which should be in every industrial chemistry library, and in many academic libraries too.

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*Unsigned book reviews are by the Editor.

 10.1021/op010238n CCC: $22.00

Green Chemical Syntheses and Processes. Edited by P. T. Anastas, L. G. Heine, and T. C. Williamson. ACS Symposium Series 767. American Chemical Society: Washington, DC. 2000. 364 pp. ISBN 0-8412-3678-X.

This volume comprises lectures presented at the Green Chemistry and Engineering Conference held at the National Academy of Sciences, Washington, DC, in 2000 and encompasses all aspects of Green Chemistry. Chapters which are of interest to process chemists include the following:

- There are two chapters relating to reactions in water by Chao-Jun Li (Tulane University, New Orleans) in which he features organometallic processes. He cites examples in the synthesis of polyhydroxylated natural products such as carbohydrates.
- The use of dimethyl carbonate as a green reagent for methylation is described by the group of Tundo (Venice, Italy). Methylation of carbanions is effective at high temperature (150−200 °C) with excess dimethyl carbonate and does not lead to dimethylation—a mechanistic rationale for this is provided.
- The use of biocatalysis and biosynthesis in fine chemical manufacture has a whole section devoted to it. A chapter on the production of 5-cyanovaleramide from adiponitrile (DuPont)—an intermediate in the manufacturing process for a crop-protection chemical—describes scale up issues in such a biotransformation. Fifty-eight consecutive 1500-L batches were run to produce 13.6 tons of product with very little waste products.
- Bioconversion of toluene to *p*-hydroxybenzoic acid is described by a group from North Carolina. This process, using *Pseudomonas putida*, competes with the traditional Kolbe−Schmidt carboxylation of phenol, which is low-yielding and nonspecific. The bioprocess, which proceeds via *p*-cresol and *p*-hydroxybenzaldehyde, has been demonstrated to proof-of-concept stage but, at present throughput and conversion, does not look economic at present; however, further improvements may change this.
- The section on environmentally benign catalysis includes chapters on fluorous biphasic catalysis, polymer-facilitated biphasic catalysis, and novel heterogeneous catalysts. In the latter example, from Eastman, hydrotalcite (HTC) supported noble metal catalysts are used in a microreactor to convert acetone to MIBK in a one-step reduction process. The HTC catalyses the self-condensation of acetone to mesityl oxide and the noble metal (e.g., Pd) catalyses the reduction to MIBK. This process is more efficient and generates less waste than the conventional homogeneous catalyst three-step process.
- In the section on "green" solvent systems, linear volatile methyl siloxanes are suggested (in a paper from Dow) as mild, low-toxicity solvents as replacements for chlorofluorocarbons in cleaning/coating applications, but no use in chemistry is given. Supercritical fluids are, as expected, touted as solvent replacements in organic synthesis by a combined chemistry/chemical engineering group from MIT. This is a good survey of current state of the art, looking at physical chemistry effects as well as synthetic (e.g., selectivity) issues.
- Of course one way to solve solvent issues is to perform reactions without solvents under microwave conditions. In this chapter (Varma, EPA, Cincinnati) these methodologies are reviewed, and a wide range of chemistry is discussed. In all the papers presented on this area of research, the subject of heat evolution from exothermic reactions is hardly mentioned. Solvents are great moderaters of exotherms, and on large scale, selectivity may be related to dilution, so that solventless reactions may not be so attractive in large-batch reactors; continuous processes, using microreactor systems for example, may be feasible.

In summary, this volume contains a useful collection of chapters which should be of interest to the process chemist. However, as with all conference proceedings, much of the work will already have been published elsewhere. The problem with much of the material not highlighted above is that it is too academic, with little relevance to industrial processes—the green chemical community needs to encourage more industrial—particular process—chemists to be invited to these conferences, where a healthy dose of realism can be injected into the proceedings.

OP010086W

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The Chemical Process Industries Infrastructure: Function and Economics. By T. R. Couper, O. T. Beasley, and W. R. Penney. Marcel Dekker: New York. 2001. 640 pp. $195 ISBN: 0-8247-0435-5.

The book has been developed from an earlier work, *The Structure of the Chemical Process Industries*, by Wei, Russell, and Schwarzlander (McGraw Hill, 1979). It is clearly aimed at chemical engineers and provides course material for an introductory university programme on the chemical industry, focusing on economic issues. The definition of the chemical process industry (CPI) is essentially bulk chemicals with little reference to fine chemicals. This may explain a table in the Introduction where the distribution of chemical engineers and chemists by job function is listed. 20% of chemical engineers are listed as process engineers, but no chemists are listed as process chemists! An interesting table, also in the Introduction, lists the education of top executives in 20 chemical and pharmaceutical corporations—only two were chemists, but there were eight engineers (four chemical engineers) with the rest lawyers, MBAs, and other business degrees.

After an introduction, the first chapters are on economics, accounting, and financial statements and input−output analysis. In Chapter 5, products and companies in the CPI are introduced, with the emphasis on commodity chemicals and tonnage produced, rather than profitability. The emphasis is also on United States—surely in the commodity chemicals industry a more international view is appropriate. Chapter 6

discusses specific chemical products (e.g., methanol, propylene) and in Chapter 7, specific companies (e.g., Air Products, Dow, DuPont, Exxon, Merck, Mobil, Monsanto, Procter and Gamble, Union Carbide). The book was written before the merger of Dow and Union Carbide.

A discussion on general characteristics of the CPI (i.e., U.S. CPI) includes marketing, manufacturing, employment, finance, and is followed by chapters on international aspects of the CIP, future prospects—threats and opportunities. Appendices of 150 pages include Standard Industry Classification codes (i.e., U.S. Industry), and Input−Output Tables (for 1987!)

The book will be of interest to those working in the commodity chemical industry and contains lots of tables of data on economic factors (too much of it irrelevant, in my view). It only briefly discusses the fine chemicals industry, and important issues such as outsourcing and the importance of time-to-market are hardly mentioned. For readers outside the U.S.A., the emphasis on the U.S. chemicals industry, rather than a global perspective, will be a severe disadvantage (as will the tonnages expressed in pounds rather than tonnes, and the volumes in gallons). Nevertheless, the combination of an industry survey coupled with an economic analysis of the industry is rare, and the volume is valuable. It can be compared to Wittkoff and Reuben's *Industrial Organic Chemicals* (1996) and Reuben and Burstall's *The Chemical Economy* (1973).

OP0100899

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Modern Carbonyl Chemistry. Edited by J. Otera. Wiley-VCH: New York. 2000. 622 pp. £95. ISBN 3-527-29871-1.

The editor has collected together some well-known names to write the 15 chapters in this excellent compilation. These include a short, 20-page review on pinacol coupling (Fu); modern free radical methods for the synthesis of carbonyl compounds (Ryu and Komatsu); engineered asymmetric catalysis (Mikami); two chapters on the aldol reaction, one on methodology and stereochemistry (Carreira), the other on polyketide natural product synthesis (Paterson, Cowden, and Wallace); two chapters on allylation of carbonyls, the first a mammoth 100-page review of methodology and stereochemistry (Denmark and Almstead), the second on applications in natural product synthesis (Chemler and Roush); asymmetric Michael-type addition reactions (Tomioka); stereoselective radical reactions (Sibi and Ternes); activation of carbonyl compounds in aqueous media (Kobayashi, Manabe and Nagayama); and finally, thermo- and photochemical reactions of carbonyl compounds in the solid state (Toda).

These are some of the best reviews you will find anywhere in the literature, focusing on the chemistry of the 1990s with literature coverage up to 1999. The emphasis is on stereoselectivity and synthetic applications, with lots of mechanistic interpretation to help explain the results.

The only limitation of the book is that the coverage of carbonyl chemistry is not comprehensive, and some areas, owing to limitation of space or maybe because they do not fall within the editor's definition of "modern", have had to be left out. The volume is extremely well-produced and has a comprehensive 14-page index.

In conclusion, this volume should be in every organic chemistry library—at £95, it represents excellent value!

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