

ARENE CHEMISTRY

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Reaction Mechanisms and Methods for Aromatic Compounds

Edited by

JACQUES MORTIER

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LIST OF CONTRIBUTORS

Igor V. Alabugin Department of Chemistry & Biochemistry, Florida State University, Tallahassee, FL, USA

Marco Bandini Dipartimento di Chimica “G. Ciamician”, Alma Mater Studiorum, Università di Bologna, Bologna, Italy

Gonzalo Blay Departament de Química Orgànica, Facultat de Química, Universitat de València, Burjassot (València), Spain

Sergio M. Bonesi CIHIDECAR CONICET, Departamento de Química Orgánica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina

Anne Boussonnière Institut des Molécules et Matériaux du Mans, Faculté des Sciences et Techniques, UMR CNRS 6283, Université du Maine and CNRS, Le Mans Cedex, France

Tore Brinck Applied Physical Chemistry, KTH Royal Institute of Technology, Stockholm, Sweden

María E. Budén INFIQC, Departamento de Química Orgánica, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentina

Paola R. Campodónico Centro de Química Médica, Facultad de Medicina, Clínica Alemana Universidad del Desarrollo, Santiago, Chile

Anne-Sophie Castanet Institut des Molécules et Matériaux du Mans, Faculté des Sciences et Techniques, UMR CNRS 6283, Université du Maine and CNRS, Le Mans Cedex, France

Floris Chevallier Chimie et Photonique Moléculaires, UMR 6226 CNRS-Université de Rennes 1, Rennes, France

Renato Contreras Departamento de Química, Facultad de Ciencias, Universidad de Chile, Chile

Michael R. Crampton Department of Chemistry, University of Durham, Durham, UK

- Charles B. de Koning** School of Chemistry, University of the Witwatersrand, Johannesburg, South Africa
- Marion H. Emmert** Department of Chemistry and Biochemistry, Worcester Polytechnic Institute, Worcester, MA, USA
- Maurizio Fagnoni** PhotoGreen Lab, Department of Chemistry, University of Pavia, Pavia, Italy
- Francisco Foubelo** Departamento de Química Orgánica, Facultad de Ciencias, Universidad de Alicante, Alicante, Spain
- Francisco Galindo** Departamento de Química Inorgánica y Orgánica, Universitat Jaume I de Castellón, Castellón de la Plana, Spain
- Javier F. Guastavino** INFIQC, Departamento de Química Orgánica, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentina
- Norbert Hoffmann** Institut de Chimie Moléculaire de Reims, UMR 6229 CNRS et Université de Reims Champagne-Ardenne, UFR Sciences, Reims, France
- M. Consuelo Jiménez** Departamento de Química/Instituto de Tecnología Química UPV-CSIC, Universitat Politècnica de València, València, Spain
- Anny Jutand** Ecole Normale Supérieure-PSL Research University, Département de Chimie, Sorbonne Universités, UPMC Univ Paris 06, CNRS UMR 8640 PASTEUR, Paris, France
- Dipannita Kalyani** St. Olaf College, Northfield, MN, USA
- Masanam Kannan** Department of Chemistry, Indian Institute of Technology Guwahati, Guwahati, India
- Kemal Kaya** Department of Chemistry & Biochemistry, Florida State University, Tallahassee, FL, USA
- Oxana A. Kholdeeva** Borekov Institute of Catalysis, Novosibirsk State University, Novosibirsk, Russia
- Douglas A. Klumpp** Department of Chemistry and Biochemistry, Northern Illinois University, DeKalb, IL, USA
- Guillaume Lefèvre** CEA–Saclay, IRAMIS Institute, SIS2M/LCCEF, Gif-sur-Yvette, Cedex, France
- Christopher J. Legacy** Department of Chemistry and Biochemistry, Worcester Polytechnic Institute, Worcester, MA, USA
- Frédéric R. Leroux** Laboratoire de Chimie Moléculaire, CNRS and University of Strasbourg, UMR CNRS 7509, ECPM, Strasbourg Cedex 2, France
- Simon E. Lewis** Department of Chemistry, University of Bath, Bath, UK
- Magnus Liljenberg** Applied Physical Chemistry, KTH Royal Institute of Technology, Stockholm, Sweden
- Raimondo Maggi** “Clean Synthetic Methodology Group”, Dipartimento di Chimica dell’Università, Università degli Studi di Parma, Parma, Italy
- Mieczysław Małozza** Institute of Organic Chemistry, Polish Academy of Sciences, Warsaw, Poland

- Elodie E. Marlier** St. Olaf College, Northfield, MN, USA
- Miguel Angel Miranda** Departamento de Química/Instituto de Tecnología Química UPV-CSIC, Universitat Politècnica de València, València, Spain
- Rana K. Mohamed** Department of Chemistry & Biochemistry, Florida State University, Tallahassee, FL, USA
- Florence Mongin** Chimie et Photonique Moléculaires, UMR 6226 CNRS-Université de Rennes 1, Rennes, France
- Marc Montesinos-Magraner** Departament de Química Orgànica, Facultat de Química, Universitat de València, Burjassot (València), Spain
- Jacques Mortier** Institut des Molécules et Matériaux du Mans, Faculté des Sciences et Techniques, UMR CNRS 6283, Université du Maine and CNRS, Le Mans Cedex, France
- Rodrigo Ormazábal-Toledo** Departamento de Física, Facultad de Ciencias, Universidad de Chile, Chile
- Armen Panossian** Laboratoire de Chimie Moléculaire, CNRS and University of Strasbourg, UMR CNRS 7509, ECPM, Strasbourg Cedex 2, France
- José R. Pedro** Departament de Química Orgànica, Facultat de Química, Universitat de València, Burjassot (València), Spain
- F. Christopher Pigge** Department of Chemistry, University of Iowa, Iowa City, IA, USA
- Amalia Isabel Poblador-Bahamonde** Department of Organic Chemistry, University of Geneva, Geneva, Switzerland
- Tharmalingam Punniyamurthy** Department of Chemistry, Indian Institute of Technology Guwahati, Guwahati, India
- Emmanuel Riguet** Institut de Chimie Moléculaire de Reims, UMR 6229 CNRS et Université de Reims Champagne-Ardenne, UFR Sciences, Reims, France
- Roberto A. Rossi** INFIQC, Departamento de Química Orgánica, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentina
- Sethuraman Sankararaman** Department of Chemistry, Indian Institute of Technology Madras, Chennai, India
- Veronica Santacroce** “Clean Synthetic Methodology Group”, Dipartimento di Chimica dell’Università, Università degli Studi di Parma, Parma, Italy
- Roberto Sanz** Área de Química Orgánica, Facultad de Ciencias, Universidad de Burgos, Burgos, Spain
- Giovanni Sartori** “Clean Synthetic Methodology Group”, Dipartimento di Chimica dell’Università, Università degli Studi di Parma, Parma, Italy
- Mani Sengoden** Department of Chemistry, Indian Institute of Technology Guwahati, Guwahati, India
- Timothy J. Snape** School of Pharmacy and Biomedical Sciences, University of Central Lancashire, Preston, UK
- Anisley Suárez** Área de Química Orgánica, Facultad de Ciencias, Universidad de Burgos, Burgos, Spain

Ryo Takita RIKEN Center for Sustainable Resource Science, Wako-shi, Saitama, Japan and Graduate School of Pharmaceutical Sciences, The University of Tokyo, Bunkyo-ku, Tokyo, Japan

Ken Tanaka Department of Applied Chemistry, Graduate School of Science and Engineering, Tokyo Institute of Technology, Meguro-ku, Tokyo, Japan

Masanobu Uchiyama RIKEN Center for Sustainable Resource Science, Wako-shi, Saitama, Japan and Graduate School of Pharmaceutical Sciences, The University of Tokyo, Bunkyo-ku, Tokyo, Japan

Willem A. L. van Otterlo Department of Chemistry and Polymer Science, Stellenbosch University, Matieland, South Africa

Miguel Yus Departamento de Química Orgánica, Facultad de Ciencias, Universidad de Alicante, Alicante, Spain

PREFACE

Benzenoid aromatic compounds or arenes have tremendous importance in academic and industrial chemical applications. Of the circa 10 million compounds that are known today, about three millions are arenes. Reactions involving arenes represent key steps in fundamental synthesis, especially in the pharma, agrochemical, and polymer fields. Arene compounds are also widely used as starting materials to obtain dyes, perfumes, explosives, preservatives, etc. New applications include sectors such as functional materials, organic electronics, and molecular machines.

The success of these industries is, in large part, due to the towering achievements of arene chemistry, a mature discipline that emerged well over 150 years ago. Without a doubt, arene chemistry research is now in its golden age, and its knowledge is indispensable for any synthetic chemists. Despite these extraordinary academic and commercial implications, there are, as yet, no books focusing on mechanisms and strategies in this continuing developing field, with a comprehensive coverage of classical and more recent reactions.

To date, the commonly accepted books on arene chemistry are either out of date or only deal with specific reaction types. For instance, *Modern Arene Chemistry* by Astruc (Wiley-VCH, Weinheim, 2002) is overly involved in the materials science end of the chemistry covered, while *Aromatic Chemistry* by Hepworth, Waring, and Waring (Royal Society Cambridge, 2002), which is intended specifically for basic-level chemistry students, is only 168 pages, of which the last 20 are answers to problems.

Arene chemistry is growing so rapidly that one cannot keep up with progress, and to get information on aromatic reactions, one needs to consult many different books. Although there are already many books on the market about nucleophilic aromatic substitution (including *Modern Nucleophilic Aromatic Substitution*, by Terrier, Wiley-VCH, Weinheim, 2013), aromatic rearrangements, reductions, oxidations, dearomatization reactions, and photochemical and biochemical transformations, it is quite difficult to get an overview of the significant impact of each topic. On the other hand, electrophilic aromatic substitution, aryne chemistry, and directed aromatic metalation have advanced dramatically in understanding over the years but rarely received appropriate attention. Moreover, metal-catalyzed cross-coupling and CH-functionalization reactions, which have known a recent booming development widely covered by an extremely abundant literature, deserve to be summarized and commented to meet the needs of a broader readership.

Arene Chemistry: Reaction Mechanisms and Methods for Aromatic Compounds is the first book of its kind that furnishes a complete overview and a guide and collects in a single opera all the topics related to the field. This compendium connects methodology and reactivity of aromatic compounds with mechanism, at the interface of synthesis and physical organic chemistry. It is organized according to reaction classes, so that someone who would like to run their first aromatic oxidation can flip open to the corresponding chapter to learn the basics quickly. This book also establishes the interesting connectivity between the different subjects. Because the presentation of the material organized according to reaction mechanisms is of central significance to students of organic chemistry, I feel fairly confident that the pedagogical approach followed will render the content readily comprehensible. In addition, the text grouped on reaction mechanism type as opposed to the reaction products should be much more intuitive to aid a deeper understanding of the area.

Considering that arene chemistry is a field that evolves in parallel in laboratories throughout the world, I sought to select younger active colleagues and leading senior experts who were not only authoritative but also as geographically distributed as the field itself. The contributors' expertise allows them to frame the literature contextually for the audience while providing a critical view of the state of the art in terms of potential for growth, future outlook, and limitations. In a rather limited space, each chapter is organized to understand and expand on aromatic reactions covered in foundation courses to the latest understanding and to apply them in a practical context by designing syntheses.

In building the project, 32 topics divided into 10 parts have been identified as deserving a special coverage. There is detailed contents from which I believe it will be possible to track down most points. Each chapter covers basics as well as most recent areas of interest to give a complete picture to both teach and bridge the primary literature. Each chapter should also lead the reader to consult the secondary literature sources cited by the authors including reviews, books, and monographs, in order to understand the subject in a more comprehensive manner. This book is organized with the intention of providing a platform for scientists from different disciplines to generate new ideas and thoughts by inspiring each other.

As aromatic compounds are ubiquitous, this book should be especially relevant to a large audience, which covers advanced undergraduates through postgraduates and right up to academic faculty, and the chemical industry, that is, almost the entire organic chemistry community. The work published on heteroaromatic chemistry is so extensive that it was impractical to attempt to review progress in this area at the same time. If so, this would have doubled or tripled the content. However, synthetic applications described in the different sections can be related to the preparation of carbocyclic aromatic (benzene) rings embedded in a heterocycle. Typical examples of industrial applications of the relevant technologies are appropriately illustrated throughout the text.

To sum up, the coverage presents the most significant results and the underlying principles that are emerging in arene chemistry. Since this book directly addresses arenes and encapsulates most important synthetic applications, it should be an easy choice for people looking for information on aromatic reactions, both from mechanistic and synthetic viewpoints.

At the start of the project about 3 years ago, I was aware of the immensity of the task and the difficulty of covering such a broad area. I hope that this book reflects recent changing trends in research so that it will cater for the maximum possible range of interests. I accept the entire responsibility for any significant omission. I heartily encourage those who read and use this book to contact me directly with comments, errors, and publications that might be appropriate for eventual future editions.

My email address is jacques.mortier@univ-lemans.fr, my blog is <http://jmortier.unblog.fr>

As an editor, it has been a very exciting experience to collaborate with acknowledged experts from all over the world. I wish to express my profound gratitude for the time and effort that they have dedicated to this process. This work would not have been accomplished without the acknowledged experts (over 150) including most of the contributors of this book who agreed to read the chapters and contributed to improving the quality of the book.

I like to extend my warm thanks to all of my students, postdoctoral researchers, and colleagues from the university and the industry for their intellectual contribution and dedication.

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I also think of my mom, Marie-Thérèse Bernier, whom I miss so much. This book is dedicated to her memory.

JACQUES MORTIER