Science of Synthesis

Science of Synthesis is the authoritative and comprehensive reference work for the entire field of organic and organometallic synthesis.

Science of Synthesis presents the important synthetic methods for all classes of compounds and includes:

– Methods critically evaluated by leading scientists
– Background information and detailed experimental procedures
– Schemes and tables which illustrate the reaction scope
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Category 3

Compounds with Four and Three Carbon–Heteroatom Bonds

Three Carbon–Heteroatom Bonds: Amides and Derivatives; Peptides; Lactams

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Preface

As our understanding of the natural world increases, we begin to understand complex phenomena at molecular levels. This level of understanding allows for the design of molecular entities for functions ranging from material science to biology. Such design requires synthesis and, as the structures increase in complexity as a necessity for specificity, puts increasing demands on the level of sophistication of the synthetic methods. Such needs stimulate the improvement of existing methods and, more importantly, the development of new methods. As scientists confront the synthetic problems posed by the molecular targets, they require access to a source of reliable synthetic information. Thus, the need for a new, comprehensive, and critical treatment of synthetic chemistry has become apparent. To meet this challenge, an entirely new edition of the esteemed reference work *Houben–Weyl Methods of Organic Chemistry* will be published starting in the year 2000.

To reflect the new broader need and focus, this new edition has a new title, *Science of Synthesis, Houben–Weyl Methods of Molecular Transformations*. *Science of Synthesis* will benefit from more than 90 years of experience and will continue the tradition of excellence in publishing synthetic chemistry reference works. *Science of Synthesis* will be a balanced and critical reference work produced by the collaborative efforts of chemists, from both industry and academia, selected by the editorial board. All published results from journals, books, and patent literature from the early 1800s until the year of publication will be considered by our authors, who are among the leading experts in their field. The 48 volumes of *Science of Synthesis* will provide chemists with the most reliable methods to solve their synthesis problems. *Science of Synthesis* will be updated periodically and will become a prime source of information for chemists in the 21st century.

*Science of Synthesis* will be organized in a logical hierarchical system based on the target molecule to be synthesized. The critical coverage of methods will be supported by information intended to help the user choose the most suitable method for their application, thus providing a strong foundation from which to develop a successful synthetic route. Within each category of product, illuminating background information such as history, nomenclature, structure, stability, reactivity, properties, safety, and environmental aspects will be discussed along with a detailed selection of reliable methods. Each method and variation will be accompanied by reaction schemes, tables of examples, experimental procedures, and a background discussion of the scope and limitations of the reaction described.

The policy of the editorial board is to make *Science of Synthesis* the ultimate tool for the synthetic chemist in the 21st century.

We would like to thank all of our authors for submitting contributions of such outstanding quality, and, also for the dedication and commitment they have shown throughout the entire editorial process.

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October 2000
Volume Editor’s Preface

This volume is one of seven of *Science of Synthesis* dealing with compounds with four and three carbon—heteroatom bonds (Category 3). The volume falls in the latter subcategory, and covers the synthesis of compounds possessing an amide bond, incorporating lactams and peptides. A chapter on acyl phosphorus compounds has also been included. However, it should be noted that amide polymers have not been included, even though they constitute an important class of amido compounds. This omission is primarily due to the fact that these macromolecules are not traditional targets for chemists working in the area of organic synthesis, and a treatment of polymers would not be of value to the vast majority of readers of *Science of Synthesis*.

The volume follows the same organization as the other Category 3 volumes of *Science of Synthesis*. The material has been organized into methods of synthesis of the particular product class, usually with a brief discussion of the scope of the method, followed by specific examples and representative experimental procedures. In general, the product classes are ordered using the usual *Science of Synthesis* pattern.

I would like to thank the many diligent authors who sifted through large amounts of material and selected important information for inclusion in their chapters. Syntheses of amido compounds of various types have previously been reviewed in considerable depth in several volumes of *Houben–Weyl*. For example, Volume E 5 (Parts 1 and 2) which were published in 1985 covered the synthesis of amides. In addition, Volume XIV (Parts 1 and 2) published in 1974 and Volume E22 (in four parts) which appeared in 2001–2 discussed the synthesis of peptides and peptidomimetics, along with protecting group strategies. However, the *Science of Synthesis* organization and degree of coverage is quite different from *Houben–Weyl*, and the new format required the authors to do considerably more than simply paraphrase and/or revise these older reviews. I am indebted to Dr. Joe Richmond for his help and guidance in planning and organizing this volume. I also thank the members of my research group at Penn State University who proofread various chapters prior to publication. Finally, it was a pleasure to once again work with Dr. M. Fiona Shortt de Hernandez and her group of capable editors at Thieme.

Volume Editor

Steven M. Weinreb

University Park, June 2005
Volume 22:
Three Carbon–Heteroatom Bonds:
Amides and Derivatives; Peptides; Lactams

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