## Applications of Transition Metal Catalysis in Drug Discovery and Development

Homogeneous catalysis utilizing transition-metal complexes has made huge advances in the past three decades, especially in the areas of asymmetric hydrogenation, coupling reactions, and metathesis. Currently, there are hundreds of groups around the world working to develop new catalysts and transformations to expand the scope further. However, many academic groups are focused on testing reactions on a limited number of standard substrates. "Real" target molecules that are required by the pharmaceutical industry are polyfunctional, and the task of developing an efficient catalytic process that acts on only one site of the molecule can be significantly more challenging. A book such as this one, which shows the power of such transformations when applied to the development of processes for synthesizing actual molecules of interest to the pharmaceutical industry, has long been awaited.

After an introduction, each of the following seven chapters deals with a particular type of transformation, and includes a comprehensive list of references covering the literature up to 2009/2010. The largest part of the book (approximately two-thirds), is concerned with coupling reactions, which is the area that includes the most common applications. The later chapters complete the picture by covering other metal-catalyzed transformations. The chapters are written by chemists working in major pharmaceutical companies, and the logical structure makes it easy to navigate through the wide variety of material presented. We found only a small amount of overlap between chapters, and the writing style is of a high standard.

Chapter 1 serves as a general introduction, with examples taken from a single pharmaceutical company and covering all the transformations discussed later in the book. Chapter 2 gives a comprehensive overview of carbon–carbon cross-coupling reactions, and is sub-divided into the various named transformations, such as Suzuki, Heck, and Sonogashira couplings. Recent concepts such as C–H activation and α-arylation are briefly mentioned, as they are only now being applied in industrially relevant cases. The chapter concludes with a short section on the use of new technologies in the whole area. In Chapter 3 the focus switches to carbon–heteroatom coupling reactions. Here again, there is a logical separation according to the type of bond being formed (C–N, C–O, C–S, or C–B) and the metal catalyst used (Pd or Cu). The section on coupling reactions is completed by a discussion of asymmetric reactions in Chapter 4. These are mainly additions to alkenes, imines, or aldehydes/ketones, and allylic substitution reactions.

The remaining chapters cover other key transformations. In Chapter 5, metathesis reactions are classified into the ring-closing of small, medium, and large rings, together with a short section on cross-metathesis. Chapter 6 deals with heterocycle synthesis, and describes how a wide variety of methods are used to form carbon–carbon and carbon–heteroatom bonds to create five- and six-membered heterocycles. Chapter 7 on oxidation reactions covers epoxidation and dihydroxylation of alkenes, as well as oxidation of alcohols and allylic oxidation (although oxidation of heteroatoms such as sulfur is not included). Asymmetric hydrogenation (Chapter 8) completes the book. This is an interesting and well-written chapter, but differs from the earlier ones in being focused on process chemistry, with a small number of detailed case-studies, rather than giving an overview of where the technology has been applied and the range of transformations that are possible. In most other chapters, "drug discovery" and "process chemistry" reactions are mixed together throughout the chapter, the exception being Chapter 3, where a separation is made.

Overall, this is a very well written monograph, and the editors and authors should be congratulated on bringing together such a large quantity of information in one place. Due to the sheer number of examples included, sometimes only limited details are provided, with no information on why a particular catalyst was chosen or was successful. However, more details can always be found in the original publications cited.

In conclusion, this is a superb and highly recommended book that serves to illustrate the power of transition-metal catalysis in an industrial environment. Not only does it provide an excellent overview, it is also a valuable source of references for those wanting to explore the area further. The examples given would also be an ideal starting point for a course on catalysis in the pharmaceutical industry. It will suit people who have some experience in homogeneous catalysis and want to discover where such catalysts are used in industry, as well as experienced professionals.

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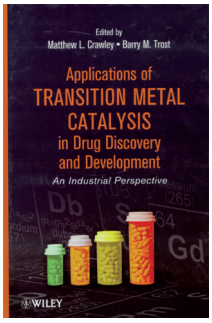


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