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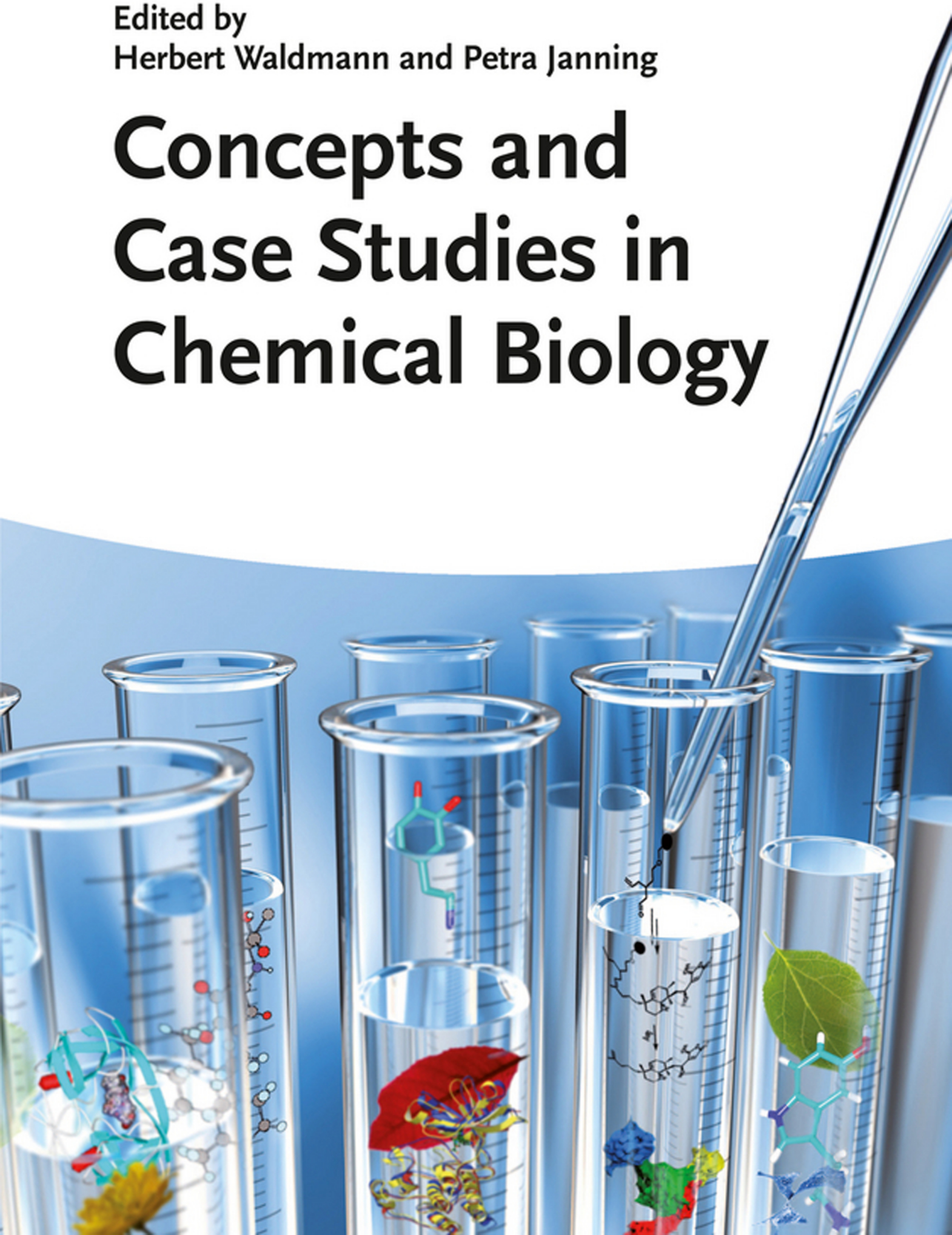
Concepts and Case Studies in Chemical Biology



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Introduction and Preface

"Chemical Biology may be defined as the application of chemical methods and techniques to the study of biological phenomena, that is, chemical biology research seeks new insights into biology by means of an approach originating from an enabling chemistry tool box.

The chemical biological approach often starts with the analysis of a biological phenomenon in order to deduce structural information, for instance, about biomacromolecules or small molecules that interact with them. On the basis of this information, unsolved chemical problems are identified and the ability of the synthetic chemist to design and prepare tailor-made reagents and tool compounds, that is, proteins equipped with reporter groups and tags or potent and selective small molecule modulators of protein function, is employed as key enabling technology for subsequent research. Very frequently, the biochemical and biophysical properties of these reagents need to be determined for the proper design and execution of biological experiments, giving new insights into the originally motivating biological phenomenon. The results gleaned thereby may then lead to a better understanding of biology and fuel additional cycles of chemical biology research following the same logic Figure 1 illustrates the cycle of chemical biology research.

By its very nature, chemical biology is multidisciplinary and needs to bridge the approaches and cultures of the neighboring sciences, chemistry, biology, and physics, within a given research group or in collaborations between groups of complementary expertise (as is very frequently the case).

Thus, education in chemical biology requires training in these disciplines on a more or less advanced level. A chemical biology textbook, planned and organized similar to that of established textbooks of the individual disciplines mentioned, would have to face the challenge of not growing too large to be readable but at the same time be sufficiently comprehensive to cover the individual disciplines in the required scientific depth.

An alternative, and probably more efficient and appropriate, approach to chemical biology education may be to resort to the well-established, proven textbooks of chemistry, biology, and physics for in-depth courses and to complement them by lecture series, seminars, and practical courses that demonstrate the combination

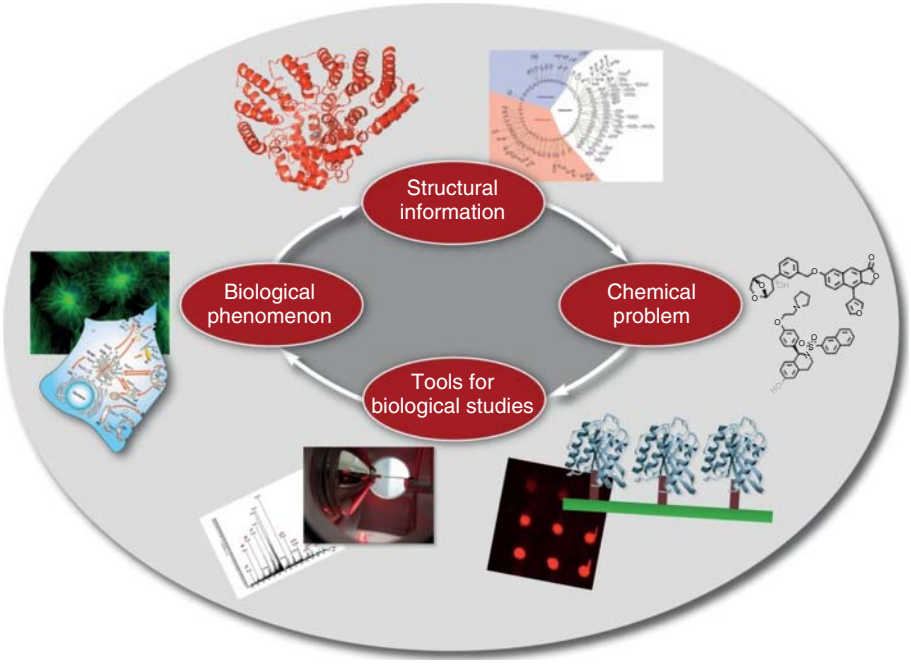

Figure 1 Illustration of the cycle of chemical biology research.

of and the interplay between these sciences and the corresponding experimental techniques in chemical biology." [1]

With this goal in mind, we planned and prepared our previous book *Chemical Biology: Learning through Case Studies* [1] in 2009. By concentrating on a series of individual successful cases of chemical biology research, it highlighted the combination of the different sciences involved in gaining new insights into biological phenomena with approaches originating from chemistry and integrating biophysics, biochemistry, and other disciplines whenever required.

The same concept has been chosen for this new book, entitled *Concepts and Case Studies in Chemical Biology*. It covers 27 new case studies in Chemical Biology, reflecting the rapid growth in this interdisciplinary topic since 2009.

Again, in each chapter, initially a biological problem is presented. To address this problem, a chemical approach is described and both together lead to chemical biology research. Following this line, for several different examples the reader is introduced into thinking and research in Chemical Biology, arriving at important scientific results and techniques and methods used in this field at the same time.

In contrary to the previous *Learning through Case Studies* book, we asked the researchers themselves to write a case study that has the origin in their own lab, rather than writing the chapters based on literature reports only.

We hope the book will be a valuable source of information for advanced students, postdoctoral researchers, and researchers working on the borderline between chemistry, biology, and biochemistry.

We are grateful to all authors of the individual chapters for their excellent work and trust in the concept. We are also grateful to Bernadette Gmeiner and Dr Anne Brennführer from Wiley-VCH for their editorial help and encouragement.

Dortmund, February 2014

Petra Janning
Herbert Waldmann

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