

Introduction and Preface

Chemical Biology may be defined broadly as the application of chemistry 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 which 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 biological 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 similarly to 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 being 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 and 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 of and the interplay between these sciences and the corresponding experimental techniques in chemical biology.

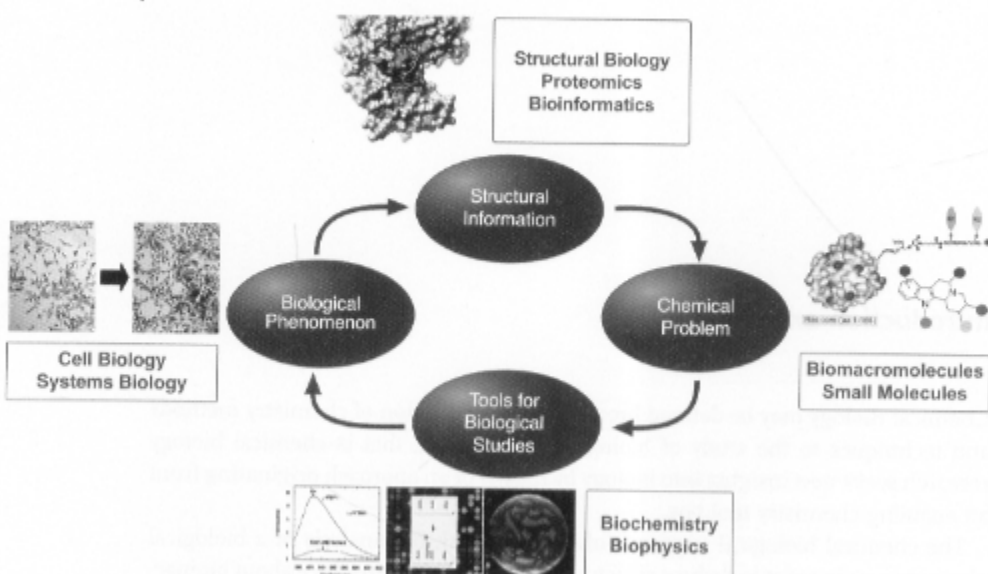


Figure 1 Circle of chemical biology research.

With this goal in mind the book “Chemical Biology—Learning through Case Studies” was planned and prepared. By concentrating on a series of individual successful cases of chemical biology research, it highlights 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.

In order to facilitate understanding of the chemical biology approach nearly every case study follows the same logic: first, the biological questions of interest are introduced, followed by a description of the chemical approach and, finally, a discussion of the resulting chemical biology research. The topics addressed span a wide range of investigations originally carried out by several of the leading chemical biology research groups worldwide. Each single case study should be regarded as an example of the research in a dedicated field and after reading a chapter an advanced student should be able to acquire further background with the help of the cited literature. For a better understanding of single terms and often used techniques short definitions and explanations are given in boxes integrated into the text. These boxes should help students to search for the correct keywords to get a deeper insight into a given topic or technique; but they do not give comprehensive descriptions.

We hope that this book will be used by lecturers to guide seminar series and lecture courses for advanced students in chemistry, biology and chemical biology courses and by students for an introduction to the broad area of chemical biology. It complements the book “Chemical Biology—A Practical Course” [1] which was created with the same motivation yet focuses on experimental training of students.

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Reference

- 1 Waldmann, H. and Janning, P. (Eds.), *Chemical Biology—A Practical Course*, Wiley-VCH, Weinheim, 2004.

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