Preface

The question '*what is the origin of life?*' cannot be approached without considering the prerequisite question '*what is life?*'. While the latter question has always been fundamentally related to philosophical reflections and, accordingly, to historical circumstances, the first question can be probed experimentally.

Life can be considered to be originated from the organization of different organic molecules in an open thermodynamic system, which is far from equilibrium and needs a constant input of energy and material. The system requires energy to escape from equilibrium, allowing spontaneous evolution, and several processes should become irreversible. Many dynamic processes have been assumed as essential for the origin of life, such as catalysis and autocatalysis, compartmentalization, (self)replication and exponential growth, heritable instructions, the capacity for making selection and mutation, for interactions with the environment, and for the achievement of metabolic independency. The importance of these phenomena has been formulated, based on the analysis of the present-day life. The origin of life itself may have been somewhat more simple.

The fully integrated system is indeed very complex, and there is no way to design a single experiment that may explain how one of these processes was '*born*', and how it contributed to the '*origin of life*'. What we do is designing experiments that may support a theory that certain molecules or chemical processes could have been involved in the '*origin of life*'. Therefore, we have carefully selected the subtitle of this volume: 'Chemical *Approach*'.

This 'chemistry' is defined in its broadest sense, as we are still far away from a definitive answer to the most fundamental question in science, and because every theory (such as the *Miller–Urey* experiment, the '*RNA world*' hypothesis, the role of astrobiology, the function of minerals as primitive catalysts, the uniformity of life in the universe, *etc.*) has its supporters and opponents. Given the observation that increase in specialization and complexity mostly parallels a replacement (or loss) of more primitive functions, it will become extremely difficult to reconstruct primitive forms of life before the '*last common ancestor*'. We have to remain open to all kinds of chemical experiments that may contribute to a better understanding of the complexity and (conceivable) emergence of life.

This compilation of reviews and original manuscripts, which originally appeared in the journal *Chemistry & Biodiversity*, gives an overview of the present 'state of the art', written by the eminent 'players' in the field. We realize that several topics are not really covered and would like to apologize for this deficiency. We are hoping, however, that the enthusiasm with which the authors have agreed to contribute to this volume will inspire further pioneers of this creative domain of 'explorative chemistry' to present their ideas and/or experimental data.

We dedicate this volume to the memory of *Leslie E. Orgel* and *Stanley L. Miller*, two great pioneers of this science.

Last but not least, we would like to extend our profound gratitude to all contributors for their support of our effort to bring this fascinating research field to the attention of a broader readership.

January 2008

Piet Herdewijn
M. Volkan Kısakürek