# Preface

The decision to write a book on the origin (or origins) of life presupposes a fascination with this "great problem" of science; although my first involvement with the subject took place more than 30 years ago, the fascination is still there. Experimental work on protein model substances under simulated conditions, which may perhaps have been present on the primeval Earth, led to one of the first books in German on "Chemical and Molecular Evolution"; Klaus Dose (Mainz) had the idea of writing the book and was my co-author.

In recent years, the huge enlargement and differentiation of this research area has led to the formation of a new, interdisciplinary branch of science, "Exo/Astrobiology", the ambitious goal of which is the study of the phenomenon of "life" in our universe.

The following chapters provide a review of the manifold attempts of scientists to find answers to the question of "where" life comes from. Successes will be reported, but also failures, discussions and sometimes passionate controversies. It will also be made clear that very many open questions and unsolved riddles are still awaiting answers: there are more such questions than is often admitted! The vast amount of relevant scientific publications unfortunately makes it impossible to report in detail on all the components of this interdisciplinary area of natural science.

The description of scientific facts and issues is generally dealt with by two different types of author: either by scientists working on the particular problem under discussion and developing hypotheses and theories, or by "outsiders". In each case there are advantages and disadvantages: the researcher brings all his or her expertise to bear, but there is a danger that his or her own contributions and related theories may to some extent be judged one-sidedly. The "outsider", however, should be able to provide a neutral appraisal and evaluation of the scientific contributions in question. In an article in the "Frankfurter Allgemeine Zeitung" (July 9$^{th}$, 2001) entitled "Warum sich Wissenschaft erklären muß", the neurophysiologist Prof. Singer refers to this problem: "on the other hand, researchers tend to overvalue their own fields, and the intermediary must be able to confront this problem with his own critical ability".

The intermediary is often forced to present complex material in a simple manner, i.e., to carry out a "didactic reduction". Such processes naturally cause problems, resembling a walk on a jagged mountain ridge. On the one side is the abyss of an inordinate simplification of the scientific conclusions (and the resulting condemnation by the experts), on the other that of the complexity of scientific thought, which is only really understood by the specialist.

Presentation of the biogenesis problem is difficult, because there is still not one single detailed theory of the emergence of life which is accepted by all the experts working in this area. There has been important progress in recent years, but the single decisive theory, which unites all the experimental results, has still not emerged. In other words, important pieces in the jigsaw puzzle are still missing, so that the complete picture is not yet visible.

This book is organised as follows: first, a historical introduction, followed by a survey of the origin of the universe, the solar system and the Earth. Planets, meteorites and comets are discussed in the third chapter, while the next deals with experiments and theories on chemical evolution. Proteins, peptides and their possible protoforms are characterized in Chaps. 5 and 6, as well as the "RNA world". Further chapters deal with important hypotheses and theories on biogenesis, for example, inorganic systems, hydrothermal vents and the models proposed by Günter Wächtershäuser, Manfred Eigen, Hans Kuhn, Christian de Duve and Freeman Dyson, as well as the problem of the origin of the genetic code. Chapter 9 provides a discussion of basic theoretical questions and the chirality problem. The search for the first traces of life and the formation of protocells are dealt with in the tenth chapter, while the last covers the question of extraterrestrial life forms, both within and outside our solar system.

Looking back, I must thank my academic teachers, Gerhard Pfleiderer and Theodor Wieland, for introducing me to biochemistry and natural product chemistry, and thus to the phenomenon of "life", the origins of which are still hidden in the darkness of the unknown.

I thank Dr. Gerda Horneck (DLR, Cologne) and my colleagues Clas Blomberg (Royal Institute of Technology, Stockholm), Johannes Feizinger (Ruhr University, Bochum), Niels G. Holm (University of Stockholm), Günter von Kiedrowski (Ruhr University, Bochum), Wolfram Thiemann (University of Bremen) and Roland Winter (University of Dortmund).

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Maj-Lis Berggren (Varberg) provided invaluable help in avoiding all the pitfalls which computers can generate. Special thanks go to my wife, who showed great patience during the time of preparing the manuscript.

Finally, a quote from Georg Christoph Lichtenberg, to whom we owe thanks for so many apposite, polished aphorisms. Lichtenberg (1742–1799) was a scientist, satirist and Anglophile. He was the first professor of experimental physics in Germany. I hope that, with respect to most of his points, Lichtenberg made gigantic mistakes in the following lines!

> Eine seltsamere Ware
> als Bücher gibt es wohl schwerlich
> in der Welt. Von Leuten gedruckt
> die sie nicht verstehen; von Leuten
> verkauft, die sie nicht verstehen;
> gebunden, rezensiert und gelesen,
> von Leuten, die sie nicht verstehen,
> und nun gar geschrieben von
> Leuten, die sie nicht verstehen.

Here is one possible translation:

> There could hardly be
> stranger things in the world than books.
> Printed by people who do not understand them;
> sold by people who do not understand them;
> bound, reviewed and read by people who do not understand them,
> and now even written by
> people who do not understand them.

Varberg, 2004 Horst Rauchfuß

*Author's note*: Some figures in this book are published additionally in colour in order to make them clearer.

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