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## Preface

Synthetic biology is often cited as one of the largest and fastest growing but less defined trends in life science technologies. Nevertheless, driven by open technology platforms, technical standards, and success stories of applied synthetic biology, this young scientific area became more than a grant-friendly hype in the past 10–15 years.

Scientists have been manipulating genes for decades: insertion, deletion, and modification of genes and their expression have become a routine function in thousands of labs. Yet by the beginning of the twenty-first century, our ability to modify the DNA and the genetic code through molecular biology had endowed scientists to use cells as hardware, and the genetic code as the software to design microorganisms for new purposes that stretched beyond the goals that could be reached by so far used recombinant techniques. This includes new strategies for engineering the transcriptional apparatus, creating novel DNA and RNA elements, expansion of the genetic code, as well as pathway engineering and cellular remodelling towards no producer strains, and the chemical synthesis of novel biocompatible polymers. Today, scientists from a growing number of disciplines such as biology, engineering, chemistry, and bioinformatics interact as a self-defined global community in cross-disciplinary approaches applying the principles of engineering to facilitate and accelerate the design, manufacture, and/or modification of genetic materials in living organisms.

Recent advances in technologies, the availability of cheap DNA building blocks, and concerted educational events paved the way to plan efforts *in silico*, to understand life via building, and to engineer biology based on thousands of easily accessible well-defined parts and methods. The implementation of first industrial production processes such as the semisynthetic production of artemisinin after intense biological, chemical, and process engineering demonstrated that synthetic biology is more than useful for research but also to the benefit of human health.

This book was written by international experts in the attempt to provide a contemporary summary of the achievements in these areas as reached today, both for the purpose of updating the beginners and stimulating the development of ideas for those already working in this field.

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