Technikzukünfte, Wissenschaft und Gesellschaft / Futures of Technology, Science and Society

Edited by

A. Grunwald, Karlsruhe, Germany

R. Heil, Karlsruhe, Germany

C. Coenen, Heidelberg, Germany

Diese interdisziplinäre Buchreihe ist Technikzukünften in ihren wissenschaftlichen und gesellschaftlichen Kontexten gewidmet. Der Plural „Zukünfte“ ist dabei Programm. Denn erstens wird ein breites Spektrum wissenschaftlich-technischer Entwicklungen beleuchtet, und zweitens sind Debatten zu Technowissenschaften wie u.a. den Bio-, Informations-, Nano- und Neurotechnologien oder der Robotik durch eine Vielzahl von Perspektiven und Interessen bestimmt. Diese Zukünfte beeinflussen einerseits den Verlauf des Fortschritts, seine Ergebnisse und Folgen, z.B. durch Ausgestaltung der wissenschaftlichen Agenda. Andererseits sind wissenschaftlich-technische Neuerungen Anlass, neue Zukünfte mit anderen gesellschaftlichen Implikationen auszudenken. Diese Wechselseitigkeit reflektierend, befasst sich die Reihe vorrangig mit der sozialen und kulturellen Prägung von Naturwissenschaft und Technik, der verantwortlichen Gestaltung ihrer Ergebnisse in der Gesellschaft sowie mit den Auswirkungen auf unsere Bilder vom Menschen.

This interdisciplinary series of books is devoted to technology futures in their scientific and societal contexts. The use of the plural "futures" is by no means accidental: firstly, light is to be shed on a broad spectrum of developments in science and technology; secondly, debates on technoscientific fields such as biotechnology, information technology, nanotechnology, neurotechnology and robotics are influenced by a multitude of viewpoints and interests. On the one hand, these futures have an impact on the way advances are made, as well as on their results and consequences, for example by shaping the scientific agenda. On the other hand, scientific and technological innovations offer an opportunity to conceive of new futures with different implications for society. Reflecting this reciprocity, the series concentrates primarily on the way in which science and technology are influenced social and culturally, on how their results can be shaped in a responsible manner in society, and on the way they affect our images of humankind.

Prof. Dr. Armin Grunwald, Physiker, Mathematiker und Philosoph, lehrt Technikphilosophie und Technikethik am Karlsruher Institut für Technologie (KIT), ist Leiter des Instituts für Technikfolgenabschätzung und Systemanalyse (ITAS) in Karlsruhe und Leiter des Büros für Technikfolgen-Abschätzung beim Deutschen Bundestag (TAB) in Berlin. / Professor Armin Grunwald, physicist, mathematician and philosopher, teaches the philosophy and ethics of technology at the Karlsruhe Institute of Technology (KIT), and is the director of the Institute for Technology Assessment and Systems Analysis (ITAS) in Karlsruhe and of the Office of Technology Assessment at the German Bundestag (TAB) in Berlin.

Reinhard Heil, Philosoph, ist wissenschaftlicher Mitarbeiter am KIT-ITAS. / Reinhard Heil, philosopher, is a researcher at KIT-ITAS.

Christopher Coenen, Politikwissenschaftler, ist wissenschaftlicher Mitarbeiter am KIT-ITAS und Herausgeber der Zeitschrift 'NanoEthics: Studies of New and Emerging Technologies'. / Christopher Coenen, political scientist, is a researcher at KIT-ITAS and the editor-in-chief of the journal 'NanoEthics: Studies of New and Emerging Technologies'.

Joachim Boldt (Ed.)

Synthetic Biology

Metaphors, Worldviews,
Ethics, and Law

Editor
Joachim Boldt
Albert-Ludwigs-Universität Freiburg
Freiburg, Germany

Technikzukünfte, Wissenschaft und Gesellschaft / Futures of Technology, Science and Society

ISBN 978-3-658-10987-5

ISBN 978-3-658-10988-2 (eBook)

DOI 10.1007/978-3-658-10988-2

Library of Congress Control Number: 2015954947

Springer VS

© Springer Fachmedien Wiesbaden 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use. The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Lektorat: Frank Schindler, Monika Mülhausen

Printed on acid-free paper

Springer VS is a brand of Springer Fachmedien Wiesbaden
Springer Fachmedien Wiesbaden is part of Springer Science+Business Media
(www.springer.com)

Preface

The results, arguments, and theses that are presented in this volume have been developed and discussed within the project *Engineering Life: An interdisciplinary approach to the ethics of synthetic biology*. The project was funded by the German Ministry of Research and Education (grant nr. 01GP1003). The following contributors were part of this project. In the order of appearance: Joachim Boldt, Oliver Müller, Harald Matern, Jens Ried, Matthias Braun, Peter Dabrock, Tobias Eichinger, Jürgen Robiński, Jürgen Simon, Rainer Paslack, Harald König, Daniel Frank, Reinhard Heil, Christopher Coenen.

Jan C. Schmidt, Bernadette Bensaude Vincent, Johannes Achatz, Iñigo de Miguel Beriain, Sacha Loeve, Christoph Then, Bernd Giese, Henning Wigger, Christian Pade, Arnim von Gleich joined us at different occasions, first and foremost our concluding conference at Freiburg University, Germany.

I'd like to thank the all the project partners and contributors for their cooperation. I am grateful to the German Ministry of Research and Education for giving us all the opportunity to engage in philosophical, ethical, legal, and social science research relating to synthetic biology. I'd also like to thank the Centre for Biological Signalling Studies (BIOSS) at Freiburg University for their kind support.

Special thanks to Susan Keller for skillfully adjusting the English language style, grammar and spelling in this volume, and to Sebastian Höpfl for accurately unifying bibliography styles, citations, and layout.

Freiburg, August 28, 2015

Joachim Boldt

Contents

Swiss watches, genetic machines, and ethics. An introduction to synthetic biology's conceptual and ethical challenges 1
Joachim Boldt

I Concepts, Metaphors, Worldviews

Philosophy of Late-Modern Technology. Towards a Clarification and Classification of Synthetic Biology 13
Jan C. Schmidt

Synthetic Biology. On epistemological black boxes, human self-assurance, and the hybridity of practices and values 31
Oliver Müller

Living Machines. On the Genesis and Systematic Implications of a Leading Metaphor of Synthetic Biology 47
Harald Matern, Jens Ried, Matthias Braun and Peter Dabrock

Production biology. Elements and limits of an action paradigm in synthetic biology 61
Tobias Eichinger

Creativity and technology. Humans as co-creators 71
Harald Matern

The moral economy of synthetic biology	87
<i>Bernadette Bensaude Vincent</i>	

Evaluating biological artifacts. Synthetic cells in the philosophy of technology	101
<i>Johannes Achatz</i>	

II Public Good and Private Ownership. Social and Legal Ramifications

Legal Aspects of Synthetic Biology	123
<i>Jürgen Robiński, Jürgen Simon and Rainer Paslack</i>	

Synbio and IP rights: looking for an adequate balance between private ownership and public interest	141
<i>Iñigo de Miguel Beriain</i>	

III Opportunities, Risks, Governance

Beyond unity: Nurturing diversity in synthetic biology and its publics	155
<i>Sacha Loeve</i>	

Synthetic Genome Technologies	185
<i>Christoph Then</i>	

Promising applications of synthetic biology – and how to avoid their potential pitfalls	195
<i>Bernd Giese, Henning Wigger, Christian Pade and Arnim von Gleich</i>	

Synthetic biology's multiple dimensions of benefits and risks: implications for governance and policies	217
<i>Harald König, Daniel Frank, Reinhard Heil and Christopher Coenen</i>	

Contributors	233
--------------------	-----