

## Making Sense of Genes

What are genes? What do genes do? These seemingly simple questions are in fact challenging to answer accurately. As a result, there are widespread misunderstandings and over-simplistic answers, which lead to common conceptions widely portrayed in the media, such as the existence of a gene 'for' a particular characteristic or disease. In reality, the DNA we inherit interacts continuously with the environment and functions differently as we age. What our parents hand down to us is just the beginning of our life story. This comprehensive book analyses and explains the gene concept, combining philosophical, historical, psychological and educational perspectives with current research in genetics and genomics. It summarises what we currently know and do not know about genes and the potential impact of genetics on all our lives. *Making Sense of Genes* is an accessible but rigorous introduction to contemporary genetics concepts for non-experts, undergraduate students, teachers and healthcare professionals.

KOSTAS KAMPOURAKIS is a researcher in science education at University of Geneva, where he also teaches the course Biology and Society to biology undergraduates, and various science education classes to teachers and doctoral students. He is the Editor-in-Chief of the journal *Science and Education*, the co-editor of *Newton's Apple and Other Myths about Science* (with Ronald L. Numbers, 2015), and the editor of *The Philosophy of Biology: A Companion for Educators* (2013). His book *Understanding Evolution* (Cambridge, 2014) was selected as a 2015 *Choice* Outstanding Academic Title.

Cambridge University Press  
978-1-107-12813-2 — Making Sense of Genes  
Kostas Kampourakis  
Frontmatter  
[More Information](#)

---

# Making Sense of Genes

KOSTAS KAMPOURAKIS

University of Geneva



CAMBRIDGE  
UNIVERSITY PRESS

Cambridge University Press  
978-1-107-12813-2 — Making Sense of Genes  
Kostas Kampourakis  
Frontmatter  
[More Information](#)

## CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

4843/24, 2nd Floor, Ansari Road, Daryaganj, Delhi – 110002, India

79 Anson Road, #06-04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781107567498](http://www.cambridge.org/9781107567498)

DOI: 10.1017/9781316422939

© Kostas Kampourakis 2017

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2017

Printed in the United Kingdom by TJ International Ltd. Padstow Cornwall, February 2017

*A catalogue record for this publication is available from the British Library.*

*Library of Congress Cataloging-in-Publication Data*

Names: Kampourakis, Kostas, author.

Title: Making sense of genes / Kostas Kampourakis, University of Geneva.

Description: New York, NY: Cambridge University Press, 2017. |

Includes bibliographical references.

Identifiers: LCCN 2016052788 | ISBN 9781107128132 (hardback) |

ISBN 9781107567498 (pbk.)

Subjects: LCSH: Genes.

Classification: LCC QH447.K36 2017 | DDC 572.8/6–dc23

LC record available at <https://lccn.loc.gov/2016052788>

ISBN 978-1-107-12813-2 Hardback

ISBN 978-1-107-56749-8 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party Internet Web sites referred to in this publication and does not guarantee that any content on such Web sites is, or will remain, accurate or appropriate.

Cambridge University Press  
978-1-107-12813-2 — Making Sense of Genes  
Kostas Kampourakis  
Frontmatter  
[More Information](#)

---

To my brother, Yannis, and our mother, Evaggelia,  
who have always made me think hard about  
“nature” and “nurture”

Cambridge University Press  
978-1-107-12813-2 — Making Sense of Genes  
Kostas Kampourakis  
Frontmatter  
[More Information](#)

---

## Contents

Acknowledgments	<i>page</i> ix
Prolegomena: Genes, Science, and Science Fiction	1
1 Mendel and the Origins of the “Gene” Concept	11
2 The Genes of Classical Genetics	27
3 The Molecularization of Genes	45
4 So, What Are Genes?	67
5 “Genes for” (Almost) Everything	89
6 Are There “Genes for” Characters?	109
7 Are There “Genes for” Diseases?	130
8 So, What Do Genes Do?	154
9 Genes Are Implicated in the Development of Characters	171
10 Genes Account for Variation in Characters	191
11 Genomes Are More than the Sum of Genes	208
12 Limitations in the Study of Genomes	229
Concluding Remarks: How to Think and Talk about Genes?	251
Further Reading	261
References	265
Glossary	295
Index	305

Cambridge University Press  
978-1-107-12813-2 — Making Sense of Genes  
Kostas Kampourakis  
Frontmatter  
[More Information](#)

---



## Acknowledgments

There are many people I would like to thank because they made writing this book possible in various ways.

I am indebted to Bruno J. Strasser, thanks to whom I have been working at the University of Geneva for the past few years, on projects relevant to the teaching and the public understanding of genetics. His support and friendship have made writing this book possible. I am also very grateful to Andreas Müller and Didier Picard who have been supporting my work and research at the University of Geneva. My interest in human genetics goes back in time when as an MSc student I had the opportunity to work at the laboratory of Emmanouil Kanavakis at the University of Athens. I thank him for that opportunity.

While writing this book, I have been very fortunate to benefit from the thoughtful feedback of several scholars: Garland Allen, John Avise, Sheldon Krimsky, Alessandro Minelli, David S. Moore, Staffan Müller-Wille, John Parrington, Giorgos Patrinos, Erik Peterson, Gregory Radick, and Tobias Uller. I thank them all for their valuable comments and suggestions. Writing this book has also benefited from discussions during an older collaboration with Richard Burian. Of course, as is always the case, I am responsible for any remaining problems or errors.

I am also indebted to Katrina Halliday, my editor at Cambridge University Press, who supported the project from the very first moment and all along the way toward the publication of this book. Katrina has been extremely helpful and supportive, and it is a pleasure to have two books, *Understanding Evolution* and the present one, published by Cambridge University Press. Of course, besides Katrina, I am grateful to a number of people at the Press who worked with me until the publication of my book, especially Lindsey Tate, who worked with me during the production of the book and patiently dealt with all my requests. I would also like to thank Tim Oliver for designing the cover and the staff at Newgen for the copy-editing and typesetting.

X ACKNOWLEDGMENTS

Finally, there are always those to whom I owe a lot: my family. I dedicated *Understanding Evolution* to my wife Katerina and our children Mirka and Giorgos. An earlier – edited – book was dedicated to my father, Giorgos, so it is now the turn of my brother and our mother to get their own dedication. This book is most appropriate for this purpose as the striking differences and similarities among us have always made me think hard about “nature” and “nurture.”