

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

The Genetic Inferno

Inside the Seven Deadly Sins

What makes us react or feel the way we do? If you have ever asked yourself this question, then let gifted writer John Medina take you on a tour of the fascinations and frustrations involved in the quest to understand the biological basis of human behavior.

By describing the gap that exists between a human behavior and a human gene, this fascinating book seeks both to clarify and debunk ideas about the genetic roots of behavior, from the genes of divorce to the tendency to eat chocolate. Using Dante's *The Divine Comedy* as an organizing framework, *The Genetic Inferno* explains each of the Seven Deadly Sins, but in terms of modern understanding of genes and brains. Written by a practising research scientist, this book is not for biologists, but for literature majors, business people, parents, and anyone interested in how our genes work to make us behave the way we do.

JOHN MEDINA is a molecular biologist formerly on the faculty of the Department of Bioengineering at the University of Washington School of Medicine and now Founding Director of the Center for Mind, Brain and Learning. He is also a consultant and regular columnist for an American psychiatric organization on the genetics and neurobiology of human behavior. In the course of his research career, which includes the isolation and characterization of genes involved in cardiovascular development, Dr Medina became concerned with the public communication of biological sciences to both lay and professional medical audiences. He was recently recognized as the Merrill Dow/Continuing Medical Education Teacher of the Year.

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)



*Bosch's Seven Deadly Sins © The Prado National Museum, Madrid, Spain.
(Reproduced in full here, and in sections for each chapter opening page.)*

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

The Genetic Inferno

Inside the Seven Deadly Sins

Written and illustrated by John J. Medina
University of Washington School of Medicine, Seattle



Cambridge University Press
978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins
John J. Medina
Frontmatter
[More information](#)

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK
40 West 20th Street, New York, NY 10011-4211, USA
10 Stamford Road, Oakleigh, VIC 3166, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa
<http://www.cambridge.org>

© John Medina 2000

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

First published 2000

Printed in the United Kingdom at the University Press, Cambridge

Typeface Hollander 9/13pt System QuarkXPress® [w21]

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data

Medina, John, 1956-

The genetic inferno : inside the seven deadly sins / written and illustrated
by John J. Medina.

p. cm.

Includes bibliographical references.

ISBN 0 521 64064 4 (hardcover)

1. Genetic psychology. 2. Behavior genetics. 3. Deadly sins. I. Title.

BF711 .M43 2000

155.7-dc21 99-086430

ISBN 0 521 64064 4 hardback

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

Contents

<i>Introduction</i>	vii
Chapter 1. The Power of Physics Envy	1
Chapter 2. Lust	22
Chapter 3. Gluttony	69
Chapter 4. Avarice	108
Chapter 5. Sloth	151
Chapter 6. Wrath	190
Chapter 7. Envy	230
Chapter 8. Pride	273
Conclusion	324
<i>Index</i>	339

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

Introduction



*“Yours am I, sacred Muses! To you I pray.
Here let dead poetry rise once more to life,
and here let sweet Calliope rise and play*

*some far accompaniment in that high strain
whose power the wretched Pierides once felt
so terribly they dared not hope again.”*

-Canto I, The Purgatorio

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

The first time I ever heard my newborn son cry, I also heard my deceased mother's voice. Here was this little pickle of a baby, all wrinkly and salty and crying, kind of like my wife and I at that moment – and here was this memory of a middle-aged woman exclaiming to me, “You are *just* like your dad!” So common to new fathers in any century, the birth was a confusing, delirious, exhilarating moment to be alive.

Though I smiled pleasantly remembering my mother's voice, her genetic comments were actually founded in anger. I was five years old when she said those words, spoken just after my grade-school chum Scottie and I had seen our first big-city aquarium. I remember being very excited. After school, I immediately dashed over to Scottie's house and decided right there to simulate some of the interesting stuff we had experienced that day. We even discussed a starting premise, taken from a sudden revelation Scottie had about some trout in his parents' freezer. Specifically, he postulated that frozen fish were the biological equivalent of sleeping fish. If we could find a way to wake them up, we'd have our own big-city aquarium! In this spirit of excited behavioral inquiry, he took four frozen trout from the freezer and plopped them into his family's tropical fish aquarium. Then we pressed our noses against the tank, looking eagerly as the quartet of German Browns sank like rocks to the bottom. We were sorely disappointed of course; the only activity was a passing and somewhat bewildered angelfish, who picked at the fins of the frozen invaders. These actions were not what my mother's anger was about, however, though she was referencing my father's similar penchant for tinkering with the way things worked. This tinkering tendency must have rubbed off, because I am now a research geneticist (a developmental molecular biologist, often called in the popular press a “genetic engineer”) just as interested in the way biological things work, still rejecting and accepting hypotheses about physical phenomena. I suppose that same spirit has always been with me, certainly by the time I was five, gazing at the failure of the cold fish experiment in the aquarium.

Scottie and I ignored the negative data, a trait I now know to be common among scientists, kept faith in our hypothesis, and decided to do another experiment. Was the aquarium too small to wake up the sleeping trout? If the fish were given a larger venue, perhaps then they would be roused. The largest encloseable area we could think of was the station wagon (owned by Scottie's parents) sitting out in the driveway. And then Scottie suddenly laughed, exclaiming, “I have a *great* idea!” and grabbed the fish out of the aquarium. He ran as fast as he could to the family car, and threw the now-thawing burdens into the front seat. Scottie then rolled up

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

all the windows except one, left open just a crack to accommodate the next technological step of the experiment.

It was this step that got us into trouble, powerfully reminding my mother of her youngest son's paternity. With my help, Scottie ran back to the house and grabbed the garden hose. We unraveled it together, Scottie dragging it over to the car, inserting it into the almost-shut window. He instructed me to turn the water on full blast, which I did enthusiastically. . . .

For awhile, the experiment actually seemed to work. As the car flooded with water, we could see the fish appearing to float a little. It wasn't quite like the giant commercial aquarium – and the fish weren't really floating – but it was satisfying indeed for a couple of curious five year olds. Proud of his accomplishment, Scottie rushed back into his house to tell his dad what had happened, and I waited by the faucet with a triumphant smile on my face.

I can only relate that in the next minute my grin left me and my ears began to ache, the pain foreshadowing what would soon be felt by my rear-end. An ex-marine, Scottie's father let out a scream that could have awakened the dead, rushed out of the house, and yanked the hose out of his mostly ruined car. I then heard the retired military man make two further genetic references, first about the sexual history of Scottie's mother, then about my mother's, with me now paralyzed in fear against the side of the house. It was after Scottie's father dumped my trembling body on the doorstep of my own home that I heard my mother's declaration about my paternally derived tendencies for mischief. Mom said it was the biggest spanking she ever gave me.

That was many years ago, of course, with the hot terror of the moment cooled to a warm, funny memory. As I sat there reminiscing about my first real scientific adventure, I was suddenly brought back to the birthing room by more soft cries – even a yawn! – of our newborn. I began to wonder aloud how many of my own cars would be ruined before my new son heard the cries of *his* child. I felt my mother's voice fade to the background as I heard my wife laugh, and I gave the baby to her, teary, trying unsuccessfully not to think about the wonder of it all.

The purpose of this book

I don't think any amount of research experience prepares you for the birth of your own child. I have been cloning human genes for many years now,

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

virtually since it was possible. Yet in the delivery room, viewing the combined results of the greatest genetic engineering project possible, I mostly just blubbered and cried. So many colliding feelings. So little time to sort them all. How could such a little guy, a near eight-pounder named Joshua, produce such an incredible weight of – what? – joy? pride? fear? all of the above? The feelings were almost too intense to form questions. What kind of mistakes would his mother and I make raising him? What kind of magnifying glass does Joshua have that could so powerfully focus all his Daddy's emotion into one tiny, wiggly little space? I am reminded of a verse from *The Purgatorio*, one of sections that comprise Dante Alighieri's *The Divine Comedy*:

*Thus, you may understand that love alone
Is the true seed of every merit in you,
And of all acts for which you must atone.*

The birth of a child is powerful not for just the emotions that the experience elicits. Tucked in the back of your mind, like a collection of ticking bombs, are all the worries, excitements and anticipations about what the child will be like. In recalling my mother's words, I wondered if this newborn would have his Daddy's curiously mischievous streak, taken from grandfather's genetic armory. I wondered if he would have my wife's gift for music, or her kindness, or her beauty. What types of things are heritable anyway? Would his disposition turn out to be just as genetic as his currently cobalt blue eyes?

In an indirect way, the book you have in your hand attempts to address the worries every new mother and father face as they contemplate the nature of their newborn child. It is a tour, really, through some of the most captivating and frustrating biological research that exists: the quest to understand the biological basis of human behaviors. Specifically, I want to talk about seven different human behaviors, all except one falling under the category of "emotion". I want to talk about them at the most intimate level possible, starting at the level of the brain, and moving to the level of the gene.

Don't let the words *biological basis* scare you away. Though this book is about research science, it is not written for research professionals, nor is it meant to be a formal discussion of the broad topic of human behavior. Rather, it is written for literature majors, political science types, business people, anyone who has an interest in human beings but who is not a working biochemist. Moreover, these pages are not meant to be

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

exhaustive, but to provide simply a glimpse into the mysterious bridge between genes and human behaviors. To underscore this fact, I use as an organizing principle behaviors not extracted from a biological point of view, but from a literary perspective. Specifically, I exploit chapters from *The Divine Comedy*, written by the Dante from whom I just quoted, focusing on the biology of the so-called Seven Deadly Sins. You are probably familiar with these sins, and not just because you have read about them; a powerful organizing feature of human behavior in medieval times, The Seven Deadly Sins still resonate with the people of the twenty-first century. There are chapters on lust and sloth and wrath and gluttony, for example, though these days we are more likely to say words like sexual arousal and circadian rhythms and fight-or-flight responses and appetite control.

Admittedly, there is a lot to chew on here. To make this text easier to swallow, I use plenty of metaphors and analogies taken from the pages of *The Divine Comedy*, as well as anecdotes from thirteenth and fourteenth century medieval life. As I was a graphics artist before I was a scientist, I have also included plenty of illustrations to get us through parts of the biology that might seem a bit unfamiliar.

When appropriate, I also mention conversations and lectures from various scholars and academic professionals (they go unnamed to protect their privacy and my sometimes lapse of memory) whose specialties were not the sciences, but the humanities. In fact, each chapter starts with a classroom lecture given by an imaginary medievalist professor. To introduce the subject of a given biological exploration, the medievalist describes what happens to Dante at the appropriate level of the afterlife mentioned in *The Divine Comedy*. I use the word imaginary here because the dialogue represents the mosaic distillation of many academics and numerous lectures I consulted while putting this book together.

At the end of each chapter I include a subject that was truly brought home to me when I heard our newborn cry. As we traverse the genes and biochemicals involved in certain behaviors, you may at some point ask yourself, "Does Medina think we are simply a vast array of sophisticated chemical processes?" If that's what crosses your mind, you are in familiar company. As my wailing Joshua looked up at me with eyes as blank and as full as a deep ocean, I sensed the uneasy truce science has made with issues of human identity. The issues of "who we are" were a part of Dante's time, too, though couched in different, primarily religious, forms. I could not write a book describing human behaviors without giving at least a nod to one part of this issue: the history of what has commonly been called the "mind/brain" dilemma. This is the idea that contemplates whether a mind

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

– and thus a human – is more than the sum of its neurological parts. We will start with Greek notions about a soul, work through Descartes *cogito ergo sum* and end with a controversial idea some neuroscientists are calling emergentism.

Finally, each chapter will conclude with a discussion of how mind/brain ideas impact on the concept of the emotion being considered. As we shall see on p. 8, we are going to use as a working model the idea that an emotion is made of two parts: an embedded neural system interacting at some level with our consciousness. That will take some explaining, for, as you may know, the modern notion of consciousness has roots deeply connected to mind/brain discussions. As we shall also note later, no one really knows what consciousness is, though one can easily list some of the ingredients of which it must be composed. And that's exactly how we'll close each chapter, discussing one of the many ingredients that make up the notion of consciousness, and showing how ingredients may inform the biology of the emotion being considered in the individual chapter. That should put to rest any questions about how well the uneasy truce between science and human identity issues is holding up.

Taken together then, each chapter can be divided into five parts. If it gets confusing, feel free to recheck this outline:

1. A quick word with Dante, describing the section of *The Purgatorio* he is currently visiting.
2. The biology of the emotion under study (starting with cells, moving to genes).
3. A segment of history regarding mind/brain dilemmas.
4. An ingredient of consciousness, and its interface with mind/brain issues.
5. A parting thought about how the ingredient informs the discussion of the emotion in question.

So let's get started

As I stated above, I make no attempt to be thorough in this book. In fact, the point I wish to leave you with is this: in discussing DNA and human motivation, it is not *possible* to be thorough, because there is too much that is unknown. The gap between a gene and a behavior is so vast that the best explanation might invoke not medieval, but cosmological, metaphors. Even when gene functions have been responsibly described, one does not find

Cambridge University Press

978-0-521-64064-0 - The Genetic Inferno: Inside the Seven Deadly Sins

John J. Medina

Frontmatter

[More information](#)

single genes causing identifiable behaviors, but collective efforts of many genes appearing to make certain neurological impressions.

Even if that is all I get across here, demonstrating that there is a distance between a behavior and a gene will be well worth the effort, and for a surprising reason. There is some terrific research going on in the field of human behavioral genetics. Blossoming disciplines such as neurological psychiatry point not only to our increased knowledge of natural processes, but our understanding of what happens when things go wrong. Obscuring these great strides by overinterpretation – or the close sin of oversimplification – denigrates not only the data, but the dedicated individuals who are discovering them.

Before we get into the main body of our discussion, however, we need to describe some important biological background in both neuroscience and molecular biology. Only with that information in mind will we be ready to borrow some fourteenth century text to define the borders of some twenty-first century research. And we will be equipped to put some research ears to the infinitesimal chasm of human behavior, determining if the innocent cries of babies and the exasperated cries of mothers create an echo large enough to cross over from the fourteenth century. Or small enough to be heard in a test tube.