



THE BEST
AMERICAN
SCIENCE
WRITING

2006

EDITOR **ATUL GAWANDE**

AUTHOR OF THE NATIONAL BOOK AWARD—NOMINATED

COMPLICATIONS: A SURGEON'S NOTES ON AN IMPERFECT SCIENCE

SERIES EDITOR **JESSE COHEN**

PAUL BLOOM

KENNETH CHANG

MICHAEL CHOROST

FRANS B. M. DE WAAL

W. WAYT GIBBS

GARDINER HARRIS

JACK HITT

ELIZABETH KOLBERT

CHARLES C. MANN

D. T. MAX

TOM MUELLER

ANAHAD O'CONNOR

H. ALLEN ORR

DENNIS OVERBYE

RICHARD PRESTON

ROBERT R. PROVINE

DAVID QUAMMEN

MICHAEL SPECTER

NEIL SWIDEY

JONATHAN WEINER

ALAN WEISMAN

KAREN WRIGHT

The Best American

SCIENCE WRITING

EDITOR: ATUL GAWANDE

Series Editor: Jesse Cohen

AN **ecco** BOOK

HARPER  PERENNIAL

NEW YORK • LONDON • TORONTO • SYDNEY

HARPER  PERENNIAL

Permissions appear following page 362.

THE BEST AMERICAN SCIENCE WRITING 2006. Compilation copyright © 2006 by HarperCollins Publishers. Introduction copyright © 2006 by Atul Gawande. All rights reserved. Printed in the United States of America. No part of this book may be used or reproduced in any manner whatsoever without written permission except in the case of brief quotations embodied in critical articles and reviews. For information address HarperCollins Publishers, 10 East 53rd Street, New York, NY 10022.

HarperCollins books may be purchased for educational, business, or sales promotional use. For information please write: Special Markets Department, HarperCollins Publishers, 10 East 53rd Street, New York, NY 10022.

FIRST EDITION

Designed by Cassandra J. Pappas

Library of Congress Cataloging-in-Publication Data is available upon request.

ISBN-10: 0-06-072644-X

ISBN-13: 978-0-06-072644-7

06 07 08 09 BVG/RRD 10 9 8 7 6 5 4 3 2 1

The Best American Science Writing

2006

THE BEST AMERICAN SCIENCE WRITING

EDITORS

2000: *James Gleick*

2001: *Timothy Ferris*

2002: *Matt Ridley*

2003: *Oliver Sacks*

2004: *Dava Sobel*

2005: *Alan Lightman*

Introduction by Atul Gawande

THE STATE OF KANSAS, until its creationist board of education stepped in last year to muddy the pond, had a rather useful definition of what science is. “Science,” the official definition said, “is the human activity of seeking natural explanations for what we observe in the world around us.” There is still some disagreement among scientists about what that human activity must be like to qualify as science. But for the most part, if you search for natural explanations of reality systematically, using theories of causation that can be tested through observation and experimentation, everyone will agree: you’re doing science.

But when are you doing science writing? The answers get pretty squishy. My own definition would be this: Science writing is writing about the scientific investigation of the world, about the knowledge acquired, or about what happens to that knowledge when it is thrown back into the world. I think that about covers all the bases.

So then what would the definition of the best science writing be? The clearest, most completely objective answer is: the best science writing is science writing that is cool. Even better, this particular year the best science writing is science writing that *I* think is cool. And there are all kinds of science writing that I think is cool.

I like science writing to be clear and to be interesting to scientists and nonscientists alike. I like it to be smart. I like it, every once in a while, to be funny. I like science writing to have a beginning, middle, and end—to tell a story whenever possible.

Among the essays that series editor Jesse Cohen had carefully culled for my consideration, there were three that I loved simply for the story they told. I have no inherent interest in chess programs, or how the brain processes music differently from speech, or the occurrence of progressive supranuclear palsy in Guam. But damn if the writers on these obscurities didn't manage to tell a thrilling story anyway. Tom Mueller's "Your Move" unfolds the story of Chrilly Donninger, an obsessive Austrian who was hired by an Arab sheikh to create the best chess program in the world and in the process produced a program so advanced that it is creating chess strategies human beings have never seen before. In "My Bionic Quest for *Boléro*," Michael Chorost, who went completely deaf at age thirty-seven, describes his methodical effort to reengineer the software in his cochlear implant so that he might hear Ravel's masterpiece again. Jonathan Weiner, in his scientific detective story "The Tangle," follows an ethnobotanist (whatever that is) as he investigates an epidemic of a strange neurologic disease and finds answers that might explain Lou Gehrig's disease. The stories have characters and twists. Most of all, though, the writers show a feel not just for the drama of the human tale but also for the drama in the ideas themselves.

Others of the essays here stood out because they reveal something unexpected about a province of our world that we thought we understood. W. Wayt Gibbs's essay on obesity calmly and lucidly demolishes our received wisdom that obesity kills hundreds of thousands of Americans a year. (This is particularly galling for me, since I'm one of those who have blindly quoted as fact the statistics he eviscerates.) Kenneth Chang, in "Ten Planets? Why Not Eleven?" romps with almost evil delight through the confusion over whether the recent discovery of an orbiting ice ball larger than Pluto marks the discovery of a tenth planet or the demotion of Pluto to an asteroid. Paul

Bloom's "Is God an Accident?" ponders whether the ideas of a soul, the afterlife, and God himself could arise from our inherent but mistaken tendency to believe that the mind and the body are separable entities. Both Robert Provine and Dennis Overbye examine things that are similarly everyday and ordinary—yawning in Provine's case, and time in Overbye's—and carry us along enthralled as they show the fascinating possibilities inside. Science writing can show the complexity in the most seemingly simple of phenomena.

There are other essays here, however—some of the most important—that manage to do almost the opposite. They examine areas of science in which there is great public bewilderment and discord—sometimes dangerous discord—and pierce that confusion with shining clarity. H. Allen Orr's "Devolution" was the first magazine piece to comprehensively dissect the claims of intelligent design theorists. Elizabeth Kolbert's epic three-part series in *The New Yorker*, "The Climate of Man," from which "The Curse of Akkad" was selected, examines everything from climate modeling to glacier and ocean temperature measurements to data from archaeological finds to consider the arguments for taking global warming seriously. Gardiner Harris and Anahad O'Connor's disturbing article on whether vaccines containing mercury cause autism or not sounds a serious alarm for scientists about the depth of public mistrust in our authority and explanations. Neil Swidey's careful piece on "What Makes People Gay?" takes us through a political minefield of scientific studies never forgetting that human beings are the subject of his investigation. This is science writing as public service.

Another class of science writing might be called "nuts and bolts stories," stories that reveal the scientific process itself in all its uncertainty and human complexity. Jonathan Weiner's "The Tangle" would also fall in this category, and so would Michael Specter's timely, masterly, and sobering piece, "Nature's Bioterrorist," on avian influenza and exactly how scientists are going about trying to stop a deadly pandemic. In "The Day Everything Died," Karen Wright brings us along to see the work of Luann Becker, a young geologist with a

controversial theory, and gives us a gripping inside look at the scientific battle over what caused the Permian extinction 250 million years ago, which wiped out more than 90 percent of marine species. Jack Hitt's "Mighty White of You," about the battle to determine who the first Americans were, gets us so close to the science of archaeology, so far inside the massive ambiguities in the data, we begin to wonder whether archaeology is a science at all.

Some pieces here accomplish an altogether different task. They show us how science might illuminate areas of life that we don't commonly bring science to help with. The most obvious example is D. T. Max's "Literary Darwinists," an essay in which Max takes us through the sometimes successful—and sometimes less than successful—fledgling efforts of theorists to understand literature using evolutionary psychology. "The Coming Death Shortage" by Charles Mann is a scientific polemic—and a depressingly compelling one at that—on the now fragile structure of human society. It marshals evidence from science to illuminate the larger question of what science has wrought upon society by doubling our millennia-established longevity in the past several decades. In "Earth Without People," Alan Weisman performs a fascinating thought experiment, considering what would happen to our planet if people suddenly disappeared. Frans B. M. de Waal's brilliant concluding essay, "We're All Machiavellians," asks why science has had so little to say about the nature and importance of the drive for power in human beings. One would have thought scientific investigation and explanation had already penetrated all possible corners of the natural world. But with great creativity, these authors show it is hardly the case.

Finally, the reader will find at least one essay whose selection I can't completely explain. A few years ago in his long profile of the maverick human genome decoder J. Craig Venter, Richard Preston stopped and took a moment to describe what a small aliquot of his own purified DNA tasted like when he dropped the clear sticky goo onto his tongue. It was an indelible description. There was nothing really scientific about it. He had no theory or hypothesis he was testing—no

evident purpose and certainly no objective method of measurement. It was purely subjective. Yet he captured in that moment a deeply scientific impulse. And he does it again in “Climbing the Redwoods,” his essay included here. He describes climbing with a scientist into the dense canopy at the intertwined top of a cluster of giant redwood trees, its own living world three hundred feet off the ground, and his detail is the marvel. He finds lichen growing on the bark “like tiny pumpkin pies,” a fire cave, a crisscrossing of branches so thick there were “fusions, bridges, and spires,” and he could not see the ground.

Is this science writing? Maybe. It certainly is cool.

The Best American Science Writing

2006

Contents

<i>Introduction by Atul Gawande</i>	vii
TOM MUELLER <i>Your Move</i>	1
MICHAEL CHOROST <i>My Bionic Quest for Boléro</i>	16
ALAN WEISMAN <i>Earth Without People</i>	28
ELIZABETH KOLBERT <i>The Curse of Akkad</i>	37
DENNIS OVERBYE <i>Remembrance of Things Future: The Mystery of Time</i>	58
W. WAYT GIBBS <i>Obesity: An Overblown Epidemic?</i>	68
MICHAEL SPECTER <i>Nature's Bioterrorist</i>	79
GARDINER HARRIS AND ANAHAD O'CONNOR <i>On Autism's Cause, It's Parents vs. Research</i>	104

NEIL SWIDEY <i>What Makes People Gay?</i>	113
JONATHAN WEINER <i>The Tangle</i>	129
DAVID QUAMMEN <i>Clone Your Troubles Away</i>	152
CHARLES C. MANN <i>The Coming Death Shortage</i>	177
H. ALLEN ORR <i>Devolution</i>	194
D. T. MAX <i>The Literary Darwinists</i>	208
KAREN WRIGHT <i>The Day Everything Died</i>	223
JACK HITT <i>Mighty White of You</i>	237
PAUL BLOOM <i>Is God an Accident?</i>	272
ROBERT R. PROVINE <i>Yawning</i>	291
KENNETH CHANG <i>Ten Planets? Why Not Eleven?</i>	306
RICHARD PRESTON <i>Climbing the Redwoods</i>	313
FRANS B. M. DE WAAL <i>We're All Machiavellians</i>	344
<i>About the Contributors</i>	349

TOM MUELLER

Your Move

FROM THE NEW YORKER

When the IBM supercomputer Deep Blue defeated chess champion Garry Kasparov in 1997, it was heralded as a major turning point in the continuing struggle between man and machine. Adapting Deep Blue's approach to less powerful PCs, programmers are making up for lack of number-crunching ability with artfulness. As Tom Mueller has discovered, the results have been unexpected, with computers developing strategies grand masters have never thought of.

Chris Donninger prefers to watch from a distance when Hydra, his computer chess program, competes, because he is camera-shy, but also because he rarely understands what Hydra is doing, and the uncertainty makes him nervous. During Hydra's match against the world's seventh-ranked player, Michael Adams, in London last June, Donninger sat with three grand masters at the back of a darkened auditorium, watching a video projection of the competition on the wall behind Adams. Most of the time, Donninger, a forty-nine-year-old Austrian, had little to worry about; Hydra won the match five games to none, with one draw. But in the second game, which ended in the draw, the program made an error that briefly gave its human opponent an advantage.

The game was played at a spotlit table on a low podium. Adams sat in the classic chess player's pose—his elbows resting on the table, his chin cupped in his palms—reaching out now and then with his right hand to move a piece on a large wooden chessboard. Across from him was Hydra—a laptop linked by Internet connection to a thirty-two-processor Linux cluster in Abu Dhabi—and Hydra's human operator, who entered Adams's moves into the computer and recorded the program's replies on the board. On the laptop's screen was a virtual chessboard showing the current position in the game, as well as a pane of swiftly scrolling numbers representing a fraction of the thousands of lines of play that Hydra was analyzing, and a row of colored bars that grew or shrank with each move, according to the program's assessment of who was winning—green bars meant an advantage for white, red bars for black.

For much of the match, the bars showed Hydra comfortably in the lead. When Adams made a mistake, they spiked dramatically, but mostly they grew in small increments, recording the tiny advantages that the program was steadily accumulating. Many of these were so subtle that Donninger and the grand masters failed to grasp the logic of Hydra's moves until long after they had been made. But about twenty minutes into the second game, when Hydra advanced its central e-pawn to the fifth rank, there was a small commotion in the group. Yasser Seirawan, an American player formerly ranked in the top ten, who had coached Adams for the match, gave a thumbs-up sign. Christopher Lutz, a German grand master who is Hydra's main chess adviser, groaned. Only Donninger, who programs chess far better than he plays it, was baffled. He turned to Lutz in alarm.

"What was that? What did you see?"

"Now our pawn structure has become inflexible," Lutz replied. "Do we have anything in the program for flexibility?"

"What do you mean by 'flexibility'?"

Lutz frowned. He sensed that Hydra had hemmed itself in, giving Adams the upper hand. Bishop to b7 was the correct move, Lutz

believed—the most natural way for Hydra to preserve its attacking chances and its room to maneuver. But explaining his nebulous insights to a lesser player like Donninger was a challenge.

“This position lacks flexibility,” he repeated, shaking his head.

“When you can define ‘flexibility’ in twelve bits, it’ll go in Hydra,” Donninger told him, twelve bits being the size of the program’s data tables.

Adams locked up Hydra’s center with his next move and managed, several hours later, to eke out a draw. “Hydra didn’t play badly, but ‘not bad’ isn’t good enough against a leading grand master,” Donninger said after the game. His program is widely considered to be the world’s strongest chess player, human or digital, but it still has room for improvement.

LEAN AND RESTLESS, with a scraggly beard and a large Roman nose, Donninger says that he approaches programming less like a scientist than like a craftsman—he compares himself to a *Madonnenschnitzer*, one of the painstaking Baroque and rococo wood-carvers whose Madonna sculptures adorn the churches near Altmelon, the village in northern Austria where he lives and works. He speaks German with a thick Austrian brogue and frequently uses expressions like “*Das ist mir Wurscht!*”—“That’s all sausage to me!” For the past two years, he has led the Hydra project, a multinational team of computer and chess experts, which is funded by the Pal Group, a company based in the United Arab Emirates which makes computer systems, desalinization plants, and cyber cafes. Pal’s owner, Sheikh Tahnoon bin Zayed al-Nahyan, is a member of the country’s royal family and a passionate chess player; he hired Donninger with the goal of creating the world’s best chess program. Pal is also using the same kind of hardware that runs Hydra for fingerprint-matching and DNA-analysis applications, which, like computer chess, require high-speed calculations. The program’s main hardware resides in an air-conditioned room in Abu Dhabi, and Donninger is frequently unable

to access it, because the sheikh and Hydra, playing under the name zor_champ, are on the Internet, taking on all comers.

As a child, Donninger was so attached to puzzles that his mother worried that he was disturbed. At the age of four, he spent months building houses out of four colors of Lego bricks, in which no bricks of the same color ever touched; two decades later, when he was an undergraduate at the University of Vienna, he learned that this was a famous conundrum in topology—the Four-Color Problem. After completing a doctorate in statistics, he worked as a programmer for Siemens, where he earned a reputation as a bug fixer, the computer equivalent of a puzzler. In 1989, he was transferred to the Dutch city of Noordwijk. It was there, during a period of intense loneliness, that Donninger joined a local chess club and started writing his first chess program. “I found my ecological niche,” he says.

He had also found the ultimate puzzle. With about 10^{128} possible unique games—vastly more than there are atoms in the known universe—chess is one of mankind’s most complex activities. In an average arrangement on the board, white has thirty-five possible moves and black has thirty-five possible replies, yielding twelve hundred and twenty-five potential positions after one full turn. With subsequent moves, each of these positions branches out exponentially in further lines of play—1.5 million positions after the second turn, 1.8 billion after the third—forming a gigantic map of potential games that programmers call the “search tree.”

How human beings confront this complexity and seize on a few good moves remains a mystery. Experienced players rely on subconscious faculties known variously as pattern recognition, visualization, and aesthetic sense. All are forms of educated guesswork—aids to making choices when certainty through exhaustive calculation is impossible—and may be summed up in a word: intuition. Even a novice player uses intuition to exclude most moves as pointless, and the more advanced a player becomes the less he needs to calculate. As the eminent Cuban grand master José Raúl Capablanca once told a weaker player, “You figure it out, I know it.”