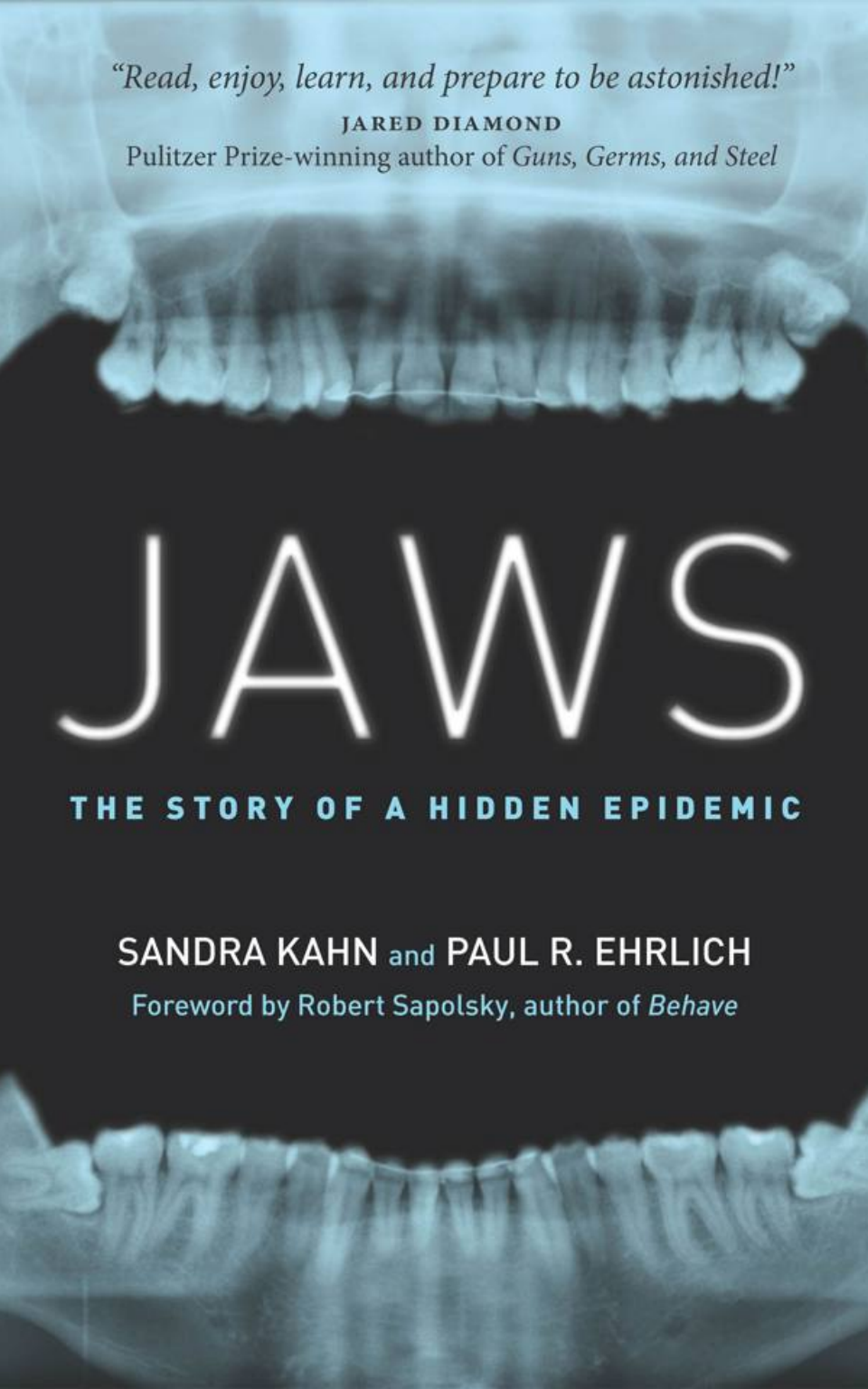
"Read, enjoy, learn, and prepare to be astonished!"
JARED DIAMOND
Pulitzer Prize-winning author of Guns, Germs, and Steel
JAWS
THE STORY OF A HIDDEN EPIDEMIC
SANDRA KAHN and PAUL R. EHRLICH
Foreword by Robert Sapolsky, author of Behave

JAWS

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JAWS

THE STORY OF A HIDDEN EPIDEMIC

SANDRA KAHN and PAUL R. EHRLICH

Foreword by ROBERT SAPOLSKY

AN **ENVIRONMENTAL HEALTH SCIENCES** BOOK
STANFORD UNIVERSITY PRESS • STANFORD, CALIFORNIA

Stanford University Press
Stanford, California

Illustrations by Susan Szecsi

An Environmental Health Sciences Book

Printed in the United States of America on acid-free, archival-quality paper

Library of Congress Cataloging-in-Publication Data

Names: Kahn, Sandra, Dr., author. | Ehrlich, Paul R., author.
Title: Jaws : the story of a hidden epidemic / Sandra Kahn and Paul R. Ehrlich.
Description: Stanford, California : Stanford University Press, 2018. |
Includes bibliographical references and index.
Identifiers: LCCN 2017058481 (print) | LCCN 2017058937 (ebook) |
ISBN 9781503606463 (e-book) | ISBN 9781503604131 (cloth : alk. paper)
Subjects: LCSH: Jaws—Health aspects. | Jaws—Abnormalities. | Malocclusion.
Classification: LCC QM105 (ebook) | LCC QM105 .K34 2018 (print) |
DDC 611/.92—dc23
LC record available at https://lccn.loc.gov/2017058481

Cover design: Rob Ehle
Cover image: Dr. María José Muñoz

To John and Mike Mew
in recognition of their great service to humanity,
and to David, Ilan, Ariela, and Anne
for their patience and support.

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FOREWORD

The Surrealist painters were fond of an epigram penned by an obscure 19th century French poet. "Beauty," they would say, is the "chance meeting on a dissecting table of a sewing machine and an umbrella." This was a celebration of the Surrealist's love of random, capricious events; of absurd, dislocating juxtapositions. The book that you are holding generates a different sort of epigram—"intensely interesting," it suggests, can be the outcome of the "chance meeting over a dinner table of an orthodontic scholar and an eminent evolutionist."

Human cultural evolution has been one long string of examples of the law of unexpected consequences. We invent agriculture, which leads to food surpluses, which leads to job specialization, and before you know it, we've invented socioeconomic status, the most crushing way of subordinating the low ranking that primates have ever seen. We invent sedentary dwelling and permanent structures, and soon we're dealing with the public health consequences of something no self-respecting primate would ever do—living in high-density populations in close proximity to its feces. We domesticate wolves into being companions, and soon we're dressing up our dogs in Halloween costumes and buying Pet Rocks. The emergence of modern humans has generated some surprising twists and turns.

Kahn and Ehrlich explore one of these unexpected consequences of human culture, sitting at the intersection of the expertise of this unlikely pairing of authors. Who would ever have predicted that the Agricultural Revolution, the Industrial Revolution, and the Westernization of nursing patterns would have led to a distinctive orthodontic profile (in both the metaphorical and literal sense of "profile")? And who would have predicted that this orthodontic profile winds up being relevant to an array of aspects

of child development, health, and disease? Most of all, who would have predicted that such a capricious combination of authors could have produced a book both extremely interesting and extremely important? If you have kids, like kids, were ever a kid, or have a jaw, it's well worth your while to read.

Robert Sapolsky
Neuroscientist and author,
Why Zebras Don't Get Ulcers, and *A Primate's Memoir*
Stanford University

ACKNOWLEDGMENTS

David Leventhal and Anne Ehrlich suffered more with this book than we can ever tell. The only person who suffered more was Paul's (and now Sandra's) good friend and frequent editor, Jonathan Cobb. His work on the manuscript transformed *Jaws*, making it orders of magnitude better. An anonymous reviewer at Stanford Press made many helpful suggestions.

Ellyn Bush, Richard Klein, John Mew, Mike Mew, and Simon Wong were very helpful answering questions along the way. A bunch of other friends and colleagues took time from their busy lives to read and comment on the entire manuscript or critical parts of it. For their enormous help we are indebted to Andy Beattie, Keira Beattie, Margaret Bergen, Corey Bradshaw, Greg Bratman, Kate Brauman, Marie Cohen, Gretchen Daily, Lisa Daniel, Joan Diamond, Jared Diamond, Nadia Diamond-Smith, Anne Ehrlich, Jeremy Feldman, Marc Feldman, Daniel Friedman, John Harte, Mel Harte, Craig Heller, Jill Holdren, David Leventhal, Simon Levin, Karen Levy, Jess Marden, Chase Mendenhall, John Morris, Pete Myers, Graham Pyke, Barry Raphael, Robert Sapolsky, John Schroeder, Susan Thomas, Chris Turnbull, and Kenneth Weiss.

Alan Harvey and his colleagues at Stanford University Press aided us in many ways, as did our agent, Jim Levine. Margaret Pinette did a magnificent job of copy-editing. It's a great pleasure to work with real professionals.

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INTRODUCTION

This is a story about a vast and serious epidemic afflicting the developed world increasingly over the last few centuries, one that has gone virtually unrecognized. *Jaws* is about its origins, how it was discovered, and what we can do about it. The epidemic's roots lie in cultural shifts in important daily actions we seldom think about; we just do them automatically. We don't think about chewing, breathing, growing, or sleeping, or even the position of our jaws when we're not eating or talking. Most of these actions we don't acquire as habits, that is, by doing them repeatedly; they are inborn. A newborn exposed to air starts to breathe and cry. A baby presented with a nipple opens her mouth, starts to suckle, and after a bit may reward you with a grin. In the evening, after driving you nuts with screaming, your baby sleeps like a log, no training required.

Simple and normal actions, yes. But, we argue, if repeatedly done in certain ways, early in life especially, over time they can undermine your health and alter your appearance in some surprising ways. If you keep your jaws apart and breathe through your mouth rather than through your nose for a few days, bite your tongue once in a while, or have insomnia for a few nights, you are going to be just fine. On the other hand, if you from an early age develop the habits of perpetually mouth breathing, eating mostly soft foods that require little chewing, and sleeping restlessly, snoring and squirming through every night, that could lead to distorted

Image 1. From an early age, babies can get into the habits of mouth breathing.

development of your jaws, face, and airway (the passage through which air enters and leaves the lungs) and to serious health problems later on—even to an early death. You would be a victim of a growing epidemic.

Modern industrialized societies are plagued by small jaws and crowded, ill-aligned teeth, a condition that the dental profession refers to as "malocclusion" (literally "bad bite"). Malocclusion is often accompanied by mouth breathing. Together, not to mention their negative effects on appearance, the two tend to reduce our quality of life and make us more susceptible to disease. And they are increasingly common. William Proffit, author of the most widely used textbook in orthodontics, the part of dentistry focused on straightening crooked teeth, pointed out the scale of the epidemic in the United States in 1998: "Survey data reveals that about a fifth of the population has significant malocclusion, and irregularity in the incisors (crowding of the front teeth) is severe enough in 15% that both social acceptability and function could be affected. Well over half have at least some degree of orthodontic treatment need."[1] A study of people in Sweden in 2007 showed that about a third of the population was in "real need" of orthodontic treatment and almost two-thirds has real or "borderline" need.[2] Orthodontist and clinical director of the London School of Facial Orthotropics, Dr. Michael Mew, asserts that 95 percent of modern humans have deviations in dental alignment; 30+ percent are recommended to have orthodontic treatment (half have extractions); and 50 percent have wisdom teeth removed.[3] If industrialized societies are plagued by jaw problems, might it not be smart to consider what changes might be made in those societies to ameliorate the problems?

Image 2. Proper facial structure and posture. This young man has had a very active life with minimal processed foods. He currently has all his teeth, including wisdom teeth, and did not need orthodontic treatment. (Photo by Steven Green.)

The focus of almost all orthodontic practitioners today is crooked teeth, the straightening of which is the bread and butter of the orthodontic trade. But it may be that most orthodontists are concerned with the least of the jaw-related problems. Crooked teeth, other than their impact on appearance, are virtually harmless. Crooked teeth are, however, a signal of a more basic problem, poor development of the jaws. And distorted jaws influence more vital functions. For example, more than 10 percent of children may now have jaw-related potentially dangerous interrupted breathing at night;[4] in one study in an urban area of Brazil, 55 percent of 23,596 children aged 3 to 9 years were mouth breathers.[5] Although there has not been a coordinated effort to systematically gather data on the frequency of malocclusion, mouth breathing, sleep disturbance and the like, wherever they *are* examined they turn out to be common. Consider: if just 10 percent of the people in the United States were in bed with the flu, all the mass media would be focused on the "flu epidemic."

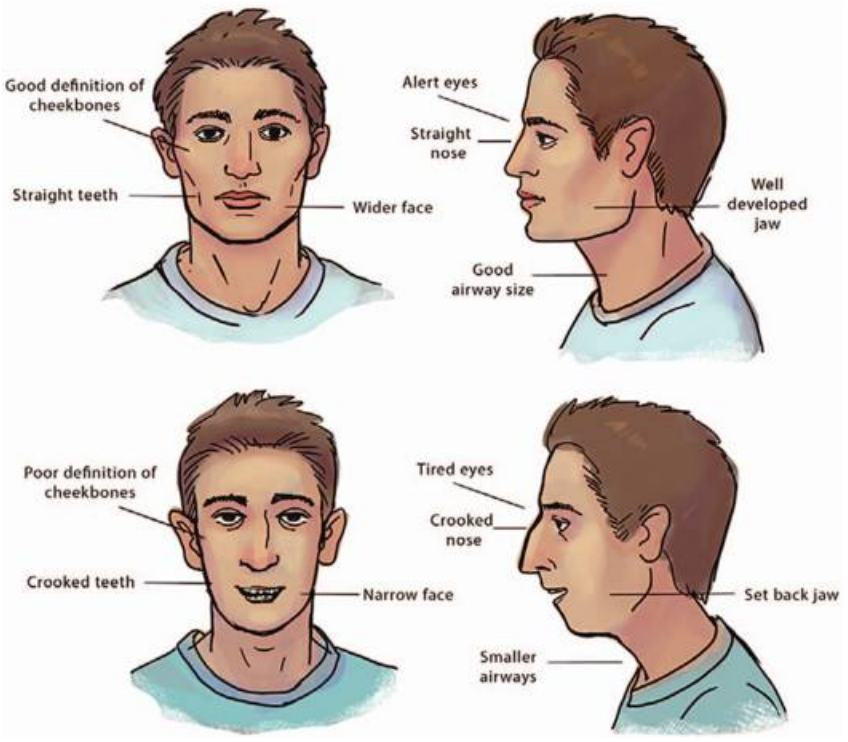

Image 3. Basic differences in facial development of (top) a nose- and (bottom) a mouth-breather.

By now you may be asking yourself, "Who are these people telling me there is a vast public health epidemic that is being ignored? Who is claiming that a long-admired profession may not be paying enough attention to a serious problem in its area of specialization? Who has the chutzpah to proclaim a need to dramatically change some basic aspects of industrial society?" Is this a standard "eat a pound of radishes a day and live a decade longer while enjoying a better sex life" kind of book? Actually, it isn't. It is the result of a collaboration between two concerned scientists with very different backgrounds and experiences—a highly experienced dental practitioner and a world-recognized environmental scientist and expert in human evolution. And we are not selling any product or service.[6]

So how did these two scientists decide to write a book about this unrecognized epidemic? It started as a dinner club; Sandra and Paul and our respective partners, David and Anne, would meet for dinner in Palo Alto at one of several quality establishments every few weeks. The goal was to enjoy some good wine, good food, and good conversation about nature conservation, about how the world was a mess, and to wonder whether it was too far gone to save. It was during these dinners that Sandra started recounting to Paul and Anne a personal journey in her profession as an orthodontist. It was such a striking story, and of so much interest to Paul, that it culminated in his suggesting that they should write a book about it together. Sandra couldn't believe that someone as published as Paul (with more than 50 books and 1,000 articles to his credit) would be interested in her work, but it was exactly her work that he found so interesting, the fact that something so life changing and dangerous was literally right under our noses and we didn't see it. Paul had written a book or two on the same sort of life-changing issues, such as reproduction and racism, but this would be the first one that looked at such an issue from the fresh viewpoint that Sandra brought to the table.

Unlike Paul, who has three grandchildren, Sandra has two young children of her own. And as an orthodontist who had practiced the craft for 22 years, she discovered that she could not treat her own children the same way she was treating her other patients. She realized that, as in so many other professions, dental schools were pumping out students whose practices were "by the book" but were not necessarily best for patients. What she saw in practicing orthodontics the traditional way was that the solution to fixing

smiles was usually to extract teeth, wire up the remaining teeth and use the resulting extra space to create beautiful smiles. And the results were exactly that and only that, beautiful smiles. But the smiles lacked "context." These were smiles that in the process of building up a straight set of perfectly aligned pearly whites, left behind destruction to what could have been a strong jaw line, easy breathing, and a well-constructed face. Faces and health were left behind in the race to create that perfect movie-star smile.

So when Sandra was looking for the right way to treat her eldest child without extracting teeth, she first turned to "myofunctional therapy" as a rising and popular form of treatment. The idea was that how you chew, how you swallow, and how you position your tongue, repeated thousands of times a day for your entire life, would result in changes to your teeth and your smile. Imagine if every time you swallowed you pushed your teeth out a bit; eventually your teeth should move outward. Sandra enrolled her preteen children in myofunctional therapy and marched them through the exercises. At the same time, she kept studying the literature and investigating more intensely, while keeping a close eye on the kids' development.

On a spring day in early 2012, at the recommendation of a colleague in an orthodontic myofunctional study group, she heard that one of the early founders of a practice called orthotropics, Dr. John Mew, would be giving a presentation in nearby Oakland. What she learned from Mew, the father of orthotropics, hit her with the clarity that must have first hit early scientists with the idea that Earth wasn't the center of the universe. Surely it couldn't be true, but so much indicated it *was* utterly true. Orthotropics finally explained to Sandra what she intuitively knew and what led her on her journey to find a better solution for treating her own children. While myofunction dealt with "muscle function," orthotropics dealt with posture. While myofunction was concerned with the powerful movements we did from time to time, orthotropics dealt with what we did all the time. Sandra's focus shifted more to posture, the resting state of the body, and by promoting the right oral posture she could finally address the cause and not the symptoms. So when Sandra started listing all the symptoms, Paul at first couldn't believe that something so simple could cause such an epidemic. How could poor oral posture be a linchpin to so many diseases?

After several weeks of dinner club discussion, the importance of Sandra's work became evident to Paul, as did how it fit into his long-term