

GNAR COUNTRY

GROWING OLD, STAYING RAD

STEVEN KOTLER



HARPER WAVE

An Imprint of HarperCollins Publishers

GNAR COUNTRY. Copyright © 2023 by Steven Kotler. 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, 195 Broadway, New York, NY 10007.

HarperCollins books may be purchased for educational, business, or sales promotional use. For information, please email the Special Markets Department at SPsales@harpercollins.com.

All art provided by author with the exception of page iv: Michal Durinik/Shutterstock, Inc.

FIRST EDITION

Library of Congress Cataloging-in-Publication Data has been applied for.

ISBN 978-0-06-327290-3

ScoutAutomatedPrintCode

Acknowledgments

You cannot go on a Gnar Country adventure without a solid team. Mine was the absolute best. This book would never have been possible without my wife, Joy Nicholson, who handled so much heavy lifting while I was off skiing; Ryan Wickes, who kept me safe, sane, and making steady progress while skiing; and Michael Wharton, who figured out that my peak-performance journal contained the seeds of a book and then helped turn it into this one. Love you all. Also, a shout-out to the Wickes posse—Angela, Kai, Cruz, and Kingston—who backed Ryan and me on the adventure. Wu-Tang is for the children.

On the science front, K. Anders Ericsson got me thinking along these lines. Ongoing conversations with a bunch of neuroscientists, psychologists, and peak-performance experts kept these fires burning. Thanks for the benefit of your brains: Michael Mannino, Mihaly Csikszentmihalyi, Sarah Sarkis, David Eagleman, Adam Gazzaley, Rebecca Rusch, Conor Murphy, Paula Rosales, Laird Hamilton, Gabby Reece, Lynsey Dyer, Andrew Huberman, Chris Malloy, Susi Mai, Rian Doris, Andrew Newberg, Kristen Ulmer, Paul Zak, Clare Sarah, Rich

ACKNOWLEDGMENTS

Diviney, Fred McDaniel, Kele McDaniel, Mark Twight, and Scott Barry Kaufman. Finally, the astounding team at the Flow Research Collective—that’s everyone I am lucky enough to work with and everyone we’ve been lucky enough to train—my deepest gratitude. You are all steady in the sick gnar!

On the ski hill, much gratitude and many more powder days to Keoki Flagg, Robert Suarez, Sofia Mileti, Tom Day, Eric Arnold, Gordon Fields, Will Kleidon, and Michael Wickes—all of whom made this ride a whole lot more fun. Dirk Collins, Jon Klaczekiewicz, and Jimmy Chin, thanks for that day at Jackson—you know the one. Glen Plake for Hood and for being Glen Plake. John and Dan Egan and Rob and Eric Deslauriers for that Chamonix trip. The OG posse from the Santa Fe Ski Area, especially Dave Stanton, TJ Miller, and Marc Braverman. Everyone involved with Team Geezer, Gnar Country Division. Finally, a loud SICKBIRD to Michael Jaquet, Micah Abrams, the Jerk, Brad Holmes, and the rest of the *Freeze* crew.

On the general inspiration front, a huge debt is owed to everyone at SLVSH.com, especially Joss Christensen and Matt Walker for getting this ball rolling. On the skiing inspiration front, a great many thanks to the entire freestyle community, with an especially deep bow to the folks at Armada, Faction, Moment, ON3P, the Bunch, New Schoolers, Bella Bacon, Alex Hall, Adam Delorme, Eileen Gu, Tom Wallisch, Jake Carney, Henrik Harlaut, Tanner Hall, Alex Hackel, Antti Ollila, Daniel Hanka, Candide Thovex, Phil Casabon, Magnus Graner, Jake Mageau, Jespar Trajer, the crew at the Kimbo Sessions, the killers at the AUDI Nines, the New Canadian Air Force, Wayne Wong, SteepSteep, and everyone else I’m forgetting. Without your shoulders to stand on, we’d all be a lot shorter.

I also want to thank a bunch of other people who helped a bunch along the way. Two old friends—both Paul Bresnick, my agent, and Karen Rinaldi, my publisher at Harper Wave—for believing that *Gnar* was more than a “ski book” and helping make sure it delivered on that

ACKNOWLEDGMENTS

promise. Anne Valentino for juggling chain saws. Cynde Christie, Chip Hopper, Vika Viktoria, Sarah Sarkis, and Krista Stryker all read drafts of this book and gave me fantastic notes. The photos were taken by Ryan Wickes and Keoki Flagg—great work, gentlemen, and many thanks. Also, Chris McCann helped tune up images for publication. Alex “Shugz” Dorszynski and Ben Arnst were amazing at coaching our study subjects and filming the results. Everyone at Northstar and Palisades Tahoe who believed in the Gnar Country experiment. All the tireless firefighters who struggled (and struggle) against long odds to keep our forests healthy and mountains safe.

Lastly, to Mom and Dad, for all those rides to the ski hill.

Notes

Preface

- xi According to Wikipedia, “punk rock”: https://en.wikipedia.org/wiki/Punk_rock.
- xi Punk embraces a DIY ethic: Rebekah Cordova, *DIY Punk as Education* (Charlotte, NC: Information Age Publishing, 2016). Also see: Kristine Villanueva, “Defining the DIY Scene,” Medium, September 25, 2017. For an overall look at the early punk scene: Legs McNeil and Gillian McCain, *Please Kill Me* (New York: Grove Press, 1996).

Introduction

- xiii *The Liftie Report*: <https://theliftiereport.epicmountainrentals.com/tlr/the-10-steepest-ski-runs-in-california/>.
- xiv Thacher Stone: Thacher Stone, “Q&A: You’ve Seen the Shenanigans, Now Meet the Man Behind @JerryOfTheDay,” Freeskier.com, April 27, 2015, <https://freeskier.com/stories/youve-seen-the-shenanigans-now-meet-the-man-behind-jerryoftheday>. Also see: @jerryoftheday.
- xv At most ski areas: There is an ongoing disagreement about terrain signs and slope angles. There are also American, European, and Japanese interpretations. See: Signs of the Mountain, “What Do the Symbols on Ski Trail Signs Mean?,” [Signsofthemountain.com](https://signsofthemountain.com), <https://signsofthemountain.com/blogs/news/what-do-the-symbols-on-ski-trail-signs-mean>.
- xv steep skiing pioneers: While European skiers invented the “hop-pedal turn” to handle the steeps, most Americans learned the “hop-and-drop” technique,

- which is sometimes called a “hop turn,” from the late Doug Coombs. See Jason Blevins, “Daring Fate,” *Denver Post*, April 10, 2006.
- xvi Ryan Wickes: All of the Ryan Wickes quotes in this book came from author interviews.
 - xvi When your brain makes a suggestion: For a lengthy discussion about flow and intuition, see: Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2014), 43–58. Also see: L. Järvillehto, “Intuition and Flow,” *Flow Experience* (Dordrecht: Springer, 2016), 95–104; A. Bolte et al., “Emotion and Intuition,” *Psychological Science* 14, no. 5 (2003): 416–21.
 - xvii The day the season officially died: Jason Blevins, “The Day Skiing Died: Inside the Historic Day Coronavirus Forced Colorado’s Ski Industry to Shut-ter,” *Colorado Sun*, April 15, 2020.
 - xvii SLVSH videos: SLVSH has its own website at www.slvsh.com, but its YouTube channel is where to find all the games: <https://www.youtube.com/c/SLVSH/videos>.

Chapter 1

- 1 According to traditional learning theories: Gene D. Cohen, *The Creative Age* (New York: Avon Books, 2000), 1–7. Also, much of the credit for ageism in traditional learning theories goes to Sigmund Freud who believed that therapy was useless in anyone over the age of fifty. See: David Smollar, “Freud’s Ageism Disputes; Therapy Aids Older People,” *Los Angeles Times*, January 26, 1986.
- 1 Recent discoveries in embodied cognition: Markus Kiefer and Natalie Trump, “Embodiment Theory and Education,” *Trends in Neuroscience and Education* (2020): 15–20; and Lawrence Shapiro and Steven Stolz, “Embodied Cognition and Its Significance for Education,” *Theory and Research in Education* 17, no. 1 (2019): 19–39. For a general overview of embodied cognition, see: Alva Noe, *Action in Perception* (Cambridge: MIT Press, 2006), 1–35; Andy Clark, *Supersizing the Mind* (Oxford: Oxford University Press, 2011); Margaret Wilson, “Six Views of Embodied Cognition,” *Psychonomic Bulletin & Review* 19, no. 4 (2002): 625–36. For a review of the new field of applied embodied cognition, see: Nuwan Leitan and Lucian Chaffey, “Embodied Cognition and Its Applications: A Brief Review,” *Sensoria* 10, no. 1 (2014): 3–10. For a look at how exercise helps the aging brain: Yi-Ping Chao et al., “Cognitive Load of Exercise Influences Cognition and Neuroplasticity of Healthy Elderly,” *Journal of Medical and Biological Engineering* 40 (2020): 391–99, and Lavinia Teixeira-Machado et al., “Dance for Neuroplasticity,” *Neuroscience & Biobehavioral Reviews* 96 (January 2019): 232–40. Also, the roots of the embodied cognitive approach to learning are often traced to W. Timothy Gallwey, *The Inner Game of Tennis* (New York: Random House, 1974). Finally, for the benefits of both mental and physical training for the brain, see: Clemence Joubert and Hanna Chainay, “Aging Brain: The Effect of Combined Cognitive and Physical Training on Cognition as Compared to Cognitive and Physical Training Alone—A Systematic Review,” *Clinical Interventions in Aging* 13 (2018): 1267–301.

- 1 flow science: For a detailed investigation of all the flow science covered in this book, see: Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 211–68. For flow as neuroprotective against cognitive decline and ability to accelerate improvement after injury or in the face of illness, see: Thomas Sather et al., “Optimizing the Experience of Flow for Adults with Aphasia,” *Topics in Language Disorders* 37, no. 1 (January/March 2017): 25–37; Ji-Hoon Kim, “Influence of Upper Extremity Function, Activities of Daily Living, Therapeutic Flow and Quality of Life in Stroke Patients,” *Journal of Digital Convergence* 16, no. 12, 417–26; Kazuki Yoshida et al., “Flow Experience Enhances the Effectiveness of Attentional Training: A Randomized Controlled Trial of Patients with Attention Deficits after Traumatic Brain Injury,” *NeuroRehabilitation* 43, no. 2 (2018): 183–93.
- 1 network neuroscience: For an overview of the major network neuroscience covered in this book, including the “superpowers of aging” ideas, see: Gene D. Cohen, *The Mature Mind* (New York: Basic Books, 2005), 1–49. For the early intersection of network neuroscience and embodied cognitions, there is no better book than J. A. Scott Kelso’s *Dynamic Patterns* (Cambridge: Bradford Books, 1997). For some of the studies that changed our thinking about the neurobiological possibilities for older adults, see: J. A. Anguera et al., “Video Game Training Enhances Cognitive Control in Older Adults,” *Nature*, September 4, 2013; Denise Park and Gerard Bischof, “The Aging Mind: Neuroplasticity in Response to Cognitive Training,” *Dialogues in Clinical Neuroscience* 15, no. 1 (2013): 109–19; Gwenn Smith, “Aging and Neuroplasticity,” *Dialogues in Clinical Neuroscience* 15, no. 1 (2013); J. R. Krebs and S. D. Healy, “A Larger Hippocampus Is Associated with Longer-Lasting Special Memory,” *PNAS* 98, no. 12 (2001): 6941–44; S. A. Langenecker and K. A. Nielson, “Frontal Recruitment During Response Inhibition in Older Adults Replicated with MRI,” *Neuroimage* 20, no. 2 (2003); S. J. Colcombe et al., “Cardiovascular Fitness, Cortical Plasticity, and Aging,” *PNAS* 101, no. 9 (2004): 3316–21; A. Alvarez-Buylla and J. M. Gracia-Verdugo, “Neurogenesis in Adult Subventricular Zone,” *Journal of Neuroscience* 22, no. 3 (2002): 619–23; J. Verghese et al., “Leisure Activities and the Risk of Dementia in the Elderly,” *New England Journal of Medicine* 348, no. 25 (2003): 2508–16; and F. Nottebohm, “Why Are Some Neurons Replaced in Adult Brains?,” *Journal of Neuroscience* 22, no. 3 (2002): 639–43. Also for an additional superpowers of aging, see: Kaoru Nashiro et al., “Age-Related Difference in Brain Activity During Emotion Processing,” *Gerontology* 58, no. 2 (February 2012): 156–63.
- 2 Michael Wharton: Michael Wharton, author interview, 2019.
- 4 Blue Zones: Dan Buettner, *The Blue Zones* (Washington: National Geographic Partners, 2008). Also see: Thais Abud et al., “Determinants of Healthy Aging: A Systematic Review of Contemporary Literature,” *Aging Clinical and Experimental Research*, February 8, 2022; and Francisco Mora, “Successful Brain Aging,” *Dialogues in Clinical Neuroscience*, April 1, 2022, 45–52. For an extra look at the serious benefits of intrinsic motivator in the elderly, see: Michiko Sakaki et al., “Curiosity in Old Age: A Possible Key to

- Achieving Adaptive Aging,” *Neuroscience & Biobehavioral Reviews* 88 (May 2018): 106–16.
- 4 longevity science: For a general overview of the field of longevity science, see: Steven Kotler and Peter Diamandis, *The Future Is Faster Than You Think* (New York: Simon & Schuster, 2020), 169–79. For a much more detailed examination, see: David Sinclair, *Lifespan* (New York: Atria Books, 2019).
- 4 five hours of life expectancy: It was CNN anchor Fareed Zakaria who first tracked down the fact that we gain five hours of life expectancy a day. He first mentioned it to me at an event we cohosted in 2015, but he also said it during a speech for the Harvard Alumni Association, see: “Text of Zakaria’s Commencement Address,” *Harvard Gazette*, May 24, 2012.
- 5 physical skills begin to decline: Bergita Ganse, Urs Ganse, Julian Dahl, Hans Degens, “Linear Decrease in Athletic Performance During the Human Life Span,” *Frontiers in Physiology* (August 21, 2018), Zoran Milanovic et al., “Age-Related Decrease in Physical Activity and Functional Fitness Among Elderly Men and Women,” *Clinical Interventions Aging* 8 (May 21, 2018): 549–56.
- 5 a series of gateways: George Vaillant, *Aging Well* (Boston: Little Brown and Company, 2002), 40–82. Also see: Dilip Jeste and Ellen Lee, “Emerging Empirical Science of Wisdom,” *Harvard Review of Psychiatry* 27, no. 3 (May–June 2019): 127–40.
- 7 Flow Research Collective: www.flowresearchcollective.com.
- 8 As body position is tightly linked to embodied cognition: Sandra Blakeslee and Matthew Blakeslee, *The Body Has a Mind of Its Own* (New York: Random House, 2008), 1–15. Also, when it comes to learning new physical skills, the most crucial tie between body position and embodied cognition is memory, see: Lidia Garcia Perez, “Can Body Posture Influence Autobiographical Memory?,” *Neuron*, May 12, 2021. Also even though Amy Cuddy’s now-famous body posture study has received some criticism, its foundational principles have held up in meta analysis, see: D. R. Carney et al., “Power Posing,” *Psychological Science* 21, no. 10 (2010): 1363–68.
- 9 Adam Delorme: For an introduction to Adam Delorme, see: <https://unofficialnetworks.com/2020/04/07/im-thinking-adam-delorme-might-have-the-best-style-in-skiing/>.
- 11 prone to vertigo: For the relationship between Lyme disease, vertigo, and its impact on balance, see: Magdalena Jozefowicz-Korczynska et al., “Vertigo and Severe Balance Instability as Symptoms of Lyme Disease—Literature Review and Case Report,” *Frontiers in Neurology* (November 12, 2019).
- 12 Klingon: There are a number of different Klingon translators around; see: <https://www.translator.eu/english/klingon/translation/>.
- 13 older athletes take a lot longer to heal: For a good review of recent findings about recovery times in older athletes, see: MastersAthlete.com.au, “We’ve Proved It—Older Athletes Do Take Longer to Recover,” March 8, 2017. For a look at more current ideas on recovery, essentially the “use it or lose it” notions outlined in this book, see: James Fell and Dafydd Williams, “The Effect of Aging on Skeletal-Muscle Recovery from Exercise: Possible Implications

- for Aging Athletes,” *Journal of Aging and Physical Activity* 1 (January 16, 2006): 97–115.
- 13 fine-motor performance: Natasa Miljkovic, Jae-Yong Lim, Iva Miljkovic, Walter Frontera, “Aging of Skeletal Muscle Fibers,” *Annals of Rehabilitative Medicine* 39, no. 2 (April 24, 2015): 155–62. For a look at recent research that overturns these ideas, see: Rachael Seidler, “Older Adults Can Learn New Motor Skills,” *Behavioral Brain Research* 183, no. 1 (October 1, 2007): 118–22; Claudia Voelcker-Rehage, “Motor-Skill Learning in Older Adults—A Review of Studies on Age-Related Differences,” *European Review of Aging and Physical Activity* 5 (January 24, 2008): 5–16. Also see: Sandra Hunter, Hugo Pereira, Kevin Keenan, “The Aging Neuromuscular System and Motor Performance,” *Journal of Applied Physiology* 121, no. 4 (October 1, 2016): 982–95; Jonas Leversen, Monika Haga, Hermundur Sigmundsson, “From Children to Adults: Motor Performance Across the Life-Span,” *PLoS One* 7, no. 6 (2012). Also, for really early childhood motor skills development, see: Mijna Hadders-Algra, “Early Human Motor Development: From Variation to the Ability to Vary and Adapt,” *Neuroscience & Biobehavioral Reviews* 90 (July 2018): 411–27.
- 19 a use it or lose it situation: Bryant Stamford, “Use Your Muscles or You’ll Lose Them,” *Courier Journal*, April 3, 2014. Also see: Bergita Ganse, Urs Ganse, Julian Dahl, Hans Degens, “Linear Decrease in Athletic Performance During the Human Life Span,” *Frontiers in Physiology* (August 21, 2018); and Pantelis Theodoros Nikolaidis and Beat Knechtle, “Age of Peak Performance in 50-KM Ultramarathoners—Is It Older than in Marathoners?,” *Open Access Journal of Sports Medicine* 9 (2018): 37–45.
- 19 physiologist John Faulkner: John Faulkner, Carol Davis, Christopher Mendias, Susan Brooks, “The Aging of Elite Male Athletes: Age-Related Changes in Performance and Skeletal Muscle Structure and Function,” *Clinical Journal of Sports Medicine* 18, no. 6 (November 2008): 501–7.
- 20 her name was Lola: This is a reference to the song “Copacabana,” by Barry Manilow, see: [https://en.wikipedia.org/wiki/Copacabana_\(song\)](https://en.wikipedia.org/wiki/Copacabana_(song)).

Chapter 2

- 25 mind wandering as a measure of fitness: Mind wandering is a property of the default-mode network. There are not a lot of studies about the link between DFN deactivation and exercise, but here’s one of the more profound ones. Rakib Rayhan et. al., “Exercise Challenge Alters Default Mode Network Dynamics in Gulf War Illness,” *BMC Neuroscience* 20, no. 7 (February 21, 2019).
- 26 flow is the fastest path: For an examination of flow and learning, see: Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021). Also: Mihaly Csikszentmihalyi, *Applications of Flow in Human Development and Education* (Dordrecht: Springer, 2014). Also see: Severine Erhel and Eric Jamet, “Improving Instructions in Educational Computer Games: Exploring the Relationship Between Goal Specificity, Flow Experience and Learning Outcomes,” *Computers in Human Behavior* 91 (February 2019): 106–14; Lindsay Borovay et al.,

- “Flow, Achievement Level, and Inquiry-Based Learning,” *Journal of Advanced Academics* 30, no. 1 (2019): 74–106; Sabine Schweder and Diana Raufelder, “Interest, Flow and Learning Strategies: How the Learning Context Affects the Moderating Function of Flow,” *Journal of Educational Research* 114, no. 2 (2001): 196–209; Manuel Nianaus et al., “Acceptance of Game-Based Learning and Intrinsic Motivation as Predictors for Learning Success and Flow Experience,” *International Journal of Serious Games* 4, no. 30 (September 2017). For a larger cultural perspective: Alanda Maria Ferro Pereira, “Flow Theory and Learning in the Brazilian Context,” *Educacao e Pesquisa* 48 (2022).
- 28 Aduro Sport: <https://www.adurosport.com>.
- 29 Lynsey Dyer: Lynsey Dyer, author interview, June 2020. Also see: <https://www.lynseydyer.com>.
- 29 women are often better: Aida Grabauskaite et al., “Interoception and Gender,” *Consciousness and Cognition* 48 (February 2017): 129–37.
- 30 Dopamine enhances: For a full breakdown of dopamine and flow triggers, see Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 233–56. Also, for dopamine and risk, see: Richard Celsi et al., “An Exploration of High-Risk Leisure Consumption Through Skydiving,” *Journal of Consumer Research* 20, no. 1 (2013): 1–23. For novelty and uncertainty: C. Teng, “Who Are Likely to Experience Flow?,” *Personality and Individual Differences* 50, no. 6 (2011): 863–68.
- 30 safe, incremental progress: Meysam Beik and Davoud Fazeli, “The Effect of Learner-Adapted Practice Schedule and Task Similarity on Motivation and Motor Learning in Older Adults,” *Psychology of Sport and Exercise* 54 (May 2021); Laura Milena Rueda-Delgado et al., “Age-Related Differences in Neural Spectral Power during Motor Learning,” *Neurobiology of Aging* 77 (May 2019): 44–57. One interesting detail here, while older and younger brains can learn at the same rate, skill consolidation takes longer in older people, which is another reason older adults need to go slow to go fast. See: K. M. M. Berghuis et al., “Age-Related Changes in Brain Deactivation but Not Activation for Motor Learning,” *NeuroImage* 186, no. 1 (February 1, 2019): 358–68. For a look at the idea that older adults have greater unconscious fear loads, see: Lewina Lee and Bob Knight, “Attentional Bias for Threat in Older Adults,” *Psychology of Aging* 24, no. 3 (September 2009): 741–47.
- 31 Unfortunately, these chemicals: For a look at how anxiety can block flow: Amy Rakei et al., “Flow in Contemporary Musicians,” *PLoS One* (March 25, 2022). Also see: Jacqueline Rano, Cecilia Friden, Frida Eek, “Effects of Acute Psychological Stress on Athletic Performance in Elite Male Swimmers,” *Journal of Sports Medicine and Physical Fitness* 59, no. 6 (June 2019); Susanne Vogel and Lars Schwabe, “Learning and Memory Under Stress,” *NPJ Science of Learning* 1 (June 29, 2006). For the relationship between stress and flow, see the literature on the challenge-skills balance, which is often described as flow’s most important trigger. Steven Kotler, *The Art of Impossible* (New York, Harper Wave, 2021). Also see: Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2016), 75–90; and Mihaly Csikszentmihalyi, *Flow*

- and the Foundations of Positive Psychology (Dordrecht: Springer, 2014), 232.
- 31 Henrick Harlaut: @hharlaut; also see: <http://www.xgames.com/athletes/3015422/henrik-harlaut>.
- 32 ski goals could ruin my season: Joannis Zalachoras et al., "Opposite Effects of Stress on Effortful Motivation in High and Low Anxiety Are Mediated by CRHRI in the VTA," *Science Advances* 8, no. 12 (March 23, 2022).
- 33 Edwin Locke and Gary Lathan: Edwin Locke and Gary Lathan, *Goal Setting* (New Jersey: Prentice Hall, 1984), 10–26. Also, Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 55–64.
- 33 brain's primary filters on reality: Maurizio Corbetta, "Control of Goal-Directed and Stimulus-Driven Attention in the Brain," *Nature Neuroscience News* 3 (March 1, 2002): 201–15. Also see: Yuhong Jiang, "Habitual Versus Goal-Driven Attention," *Cortex* 102 (May 2018): 107–20. For fear: Eleonora Vagnoni et al., "Threat Modulates Perception of Looming Visual Stimuli," *Current Biology* 22, no. 19 (October 9, 2012): 826–27; and J. Zaman et al., "Probing the Role of Perception in Fear Generalization," *Scientific Reports*, July 11, 2019.
- 35 trick list: For a breakdown of freeskiing and freeskiing tricks, check out the "Introduction to Freestyle" video at www.gnarcountry.com.
- 35 slopestyle: Slopestyle, according to the Olympics: <https://olympics.com/en/news/all-you-need-to-know-about-freestyle-skiing>.
- 39 50–50: For a how-to description of the 50–50 and all other tricks in this book, see: <https://skiaddiction.com>.
- 42 Freeze magazine: For a look at the now defunct *Freeze* magazine, see its Facebook page: <https://www.facebook.com/freezemagazine/>.
- 43 punk rock zines: https://en.wikipedia.org/wiki/Punk_zine.
- 43 mainstream populace hated: For the dislike of punk by the mainstream music industry, also see: Ira Robbins, "Left of the Dial," *Redbull Music Academy Daily*, April 11, 2015. For the transition from punk to new wave, see: <https://indie-mag.com/2019/05/new-wave-history/>.
- 43 rebrand the softer: Theodore Cateforis, *Are We Not New Wave* (Ann Arbor: University of Michigan Press, 2011).
- 44 "Squallywood": Robb Gaffney, *Squallywood* (Sacramento: West Bridge Publishing, 2003).
- 44 KT-22: <https://theliftiereport.epicmountainrentals.com/tlr/the-10-steepest-ski-runs-in-california/>. Also see: Stu Campbell, "The Devil's Half-Dozen," *Ski Resort Life*, February 2, 2004.
- 48 my unnatural direction: Why do we have an unnatural direction? Because humans are side dominant. See: "Science Buddies, Side-Dominant Science," *Scientific American*, February 7, 2013.
- 49 *Blizzard of Ahhhs*: Greg Stump, *Blizzard of Ahhhs*, Greg Stump Productions, 1988. For a great Q&A with all the core cast members, see: <https://www.youtube.com/watch?v=c2rInB8ydO4>.
- 50 Plake wasn't a jock: Rob Hodgetts, "Blizzard of Ahhhs: Punk Antiheroes Launched Skiing's Extreme Generation," *CNN*, December 17, 2018.

- 51 We were hunting dopamine: For the best research on dopamine and exploration, see: Jaak Panksepp, *Affective Neuroscience* (Oxford: Oxford University Press, 1998), 144–63. Also, V. D. Costa et al., “Dopamine Modulates Novelty-Seeking Behavior During Decision Making,” *Behavioral Neuroscience* 128, no. 5 (2014): 556–66.
- 52 dirty shame: While I don’t cover it at length in this book, there appears to be a direct impact of shame on athletic performance; see: Simon Rice et al., “Athlete Experiences of Guilt and Shame,” *Frontiers in Psychology*, April 29, 2021.
- 53 James Jerome Gibson: James Gibson, *The Ecological Approach to Visual Perception* (New Jersey: Lawrence Erlbaum Associates Publishers), 133–35.

Chapter 3

- 60 the beginning of an unhealthy obsession: Odin Hjemdal et al., “The Relationship Between Resilience and Levels of Anxiety, Depression and Obsessive-Compulsive Disorder in Adolescents,” *Clinical Psychology and Psychotherapy* 18, no. 4 (July–August 2011): 314–21.
- 60 Buck Brown: <https://olympicbootworks.com>.
- 61 retail therapy: Nora Schultz, “Thoughts of Mortality Fuel the Desire for Retail Therapy,” *New Scientist* 198, no. 2658 (May 2008): 12.
- 63 What did Nietzsche say?: Friedrich Nietzsche, *Beyond Good and Evil* (New York: Vintage, 1989), 89.
- 65 the size of that challenge-skills sweet spot: Sefan Engeser and Falko Rheinberg, “Flow, Performance and Moderators of Challenge-Skill Balance,” *Motivation and Emotion* 10, no. 1007 (2008). Also see: William Fernando Garcia, et al., “Dispositional Flow and Performance in Brazilian Triathletes,” *Frontiers in Psychology*, September 20, 2019. Finally, further explanation for the shrinkage of the challenge-skills balance can be found in the theory of cognitive reserve; see: Jason Steffener and Yaakov Stern, “Exploring the Neural Basis of Cognitive Reserve in Aging,” *Molecular Basis of Disease* 1822, no. 3 (March 2012): 467–73.
- 65 minimize subconscious fears: Scott Stossel, “The Relationship Between Performance and Anxiety,” *Harvard Business Review*, January 6, 2014; and Clive Fullagar, Patrick Knight, Heather Sovern, “Challenge/Skill Balance, Flow, and Performance Anxiety,” *Applied Psychology: An International Review* 62, no. 2 (2013): 236–59.
- 67 German Volume Training: <https://fitnessvolt.com/german-volume-training/>.
- 67 Mark Twight: <https://www.marktwight.com>.
- 67 Mike Horn: <https://www.mikehorn.com>.

Chapter 4

- 71 Dolores LaChapelle: Dolores LaChapelle, *Deep Powder Snow* (Durango: Kivaki Press, 1993), 32–33.
- 72 Michael Jordan: The highest vertical leap is an ongoing discussion. For

- Michael Jordan's contribution, see: Scott Fujita, "Michael Jordan Vertical Jump," ScottFujita.com, February 8, 2022.
- 72 long jump: https://en.wikipedia.org/wiki/Long_jump.
- 76 terrain is ferocious: Barclay, "The 10 Most Challenging Ski Resorts in the United States," *The Unofficial Network*, August 10, 2015.
- 77 three levels of goals: For a complete breakdown on goal setting, see: Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 55–64.
- 79 LL Cool J: LL Cool J, "The Debt," *NCIS Los Angeles*, 2011.
- 80 played with mirror neurons: For a look at why mimicry enhances learning: Jaclynn Sullivan, "Learning and Embodied Cognition," *Psychology Learning & Teaching* 17, no. 2 (2018): 128–43; Thea Ionescu and Dermina Vasc, "Embodied Cognition: Challenges for Psychology and Education," *Procedia: Science and Behavioral Sciences* 128 (2014): 275–80. For mirror neurons and predictive coding, see: James Kilner, Karl Friston, Chris Frith, "Predictive Coding," *Cognitive Processing* 8 (2007): 159–66; and Angel Lago-Rodriguez et al., "The Role of Mirror Neurons in Observational Motor Learning," *European Journal of Human Movement* 32 (2014): 82–103.
- 81 Hesitation is death: Arne Nieuwenhuys and Raiul Oudejans, "Anxiety and Perceptual Motor Performance," *Psychological Research* 76, no. 6 (2012): 747–59; Simon Van Gaal et al., "Unconscious Activation of the Prefrontal No-Go Network," *Journal of Neuroscience* 30, no. 11 (March 17, 2010): 4143–50.
- 83 know who you are and how you like to learn: Chris Jackson and Michele Lawty-Jones, "Explaining the Overlap Between Personality and Learning Style," *Personality and Individual Differences* 20, no. 3 (1996): 293–300. Also, Jessica Heinström, "Personality Effects on Learning," in N. M. Seel, ed., *Encyclopedia of the Sciences of Learning* (Boston: Springer, 2012). Also see: Sabine Schweder and Diana Raufelder, "Interest, Flow and Learning Strategies: How the Learning Context Affects the Moderating Function of Flow," *Journal of Education Research* 114, no. 2 (March 23, 2020): 196–209.
- 86 in the language of motor learning: Janelle Weaver, "Motor Learning Unfolds Over Different Timescales in Distinct Neural Systems," *PLoS Biology* 13, no. 12 (December 2015). Also, Paul Fitts and Michael Posner, *Human Performance* (Oxford: Brooks/Cole, 1967).
- 87 repetition suppression: Lisa Mayehauser et al., "Neural Repetition Suppression," *Frontiers in Human Psychology*, April 17, 2014.
- 87 the brain reduces the wow: David Eagleman et al., "Predictability Engenders More Efficient Neural Responses," *Nature*, February 3, 2009.
- 90 that roar worked: Pawel Fedurek et al., "The Relationship Between Testosterone and Long-Distance Calling in Wild Chimpanzees," *Behavioral Ecology and Sociobiology* 70, no. 5 (May 2016); and Sari van Anders, Jeffrey Steiger, Katherine Goldey, "Effects of Gendered Behavior on Testosterone in Men and Women," *PNAS* 112, no. 45 (October 26, 2015): 13805–10.
- 92 a "schema": Schema theory has a colorful history inside the field of motor learning, see: Richard Schmidt, "Motor Schema Theory After 27 Years," *Research Quarterly for Exercise and Sport* 74, no. 4 (2003): 366–75.

Chapter 5

- 95 one of the bigger terrain parks in Tahoe: Snowledge Team, “Northstar Top to Bottom: Devan Peeters Greases 25 Features in 3 Minutes,” Snowledge.com, May 26, 2017. See: <https://www.snowledge.co/blog/northstar-terrain-parks/>.
- 98 “the Fingers”: For a look at the Fingers and many other lines mentioned in this book: <https://snowbrains.com/scratching-the-technical-itch-kirkwood/>.
- 102 Little wins produce dopamine: Sefano di Domenico and Richard Ryan, “The Emerging Neuroscience of Intrinsic Motivation,” *Frontiers in Human Neuroscience*, March 24, 2017. Also see: Elliot Berkman, “The Neuroscience of Goals and Behavior Change,” *Consult Psychology Journal* 70, no. 1 (March 2018): 28–44.
- 103 the neurochemicals that underpin: Sutton Harber, “Endorphins and Exercise,” *Sports Medicine* 1, no. 2 (March 1984): 154–71; and Sonja Vuckovic et al., “Cannabinoids and Pain,” *Frontiers in Pharmacology* 9 (2018).
- 103 potent pain relievers: Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2014), 66–67. Also: Johannes Fuss et al., “A Runner’s High Depends on Cannabinoid Receptors in Mice,” *PNAS* 112, no. 42 (October 5, 2015); Arne Dietrich and William McDaniel, “Endocannabinoids and Exercise,” *British Journal of Sports Medicine* 38 (2004): 536–41.
- 106 “deliberate practice”: K. Anders Ericsson, “Deliberate Practice and the Acquisition and Maintenance of Expert Performance in Medicine and Related Domains,” *Academic Medicine* 79, no. 10 (October 2004): 70–81.
- 106 Well, Anders: K. Anders Ericsson, “The Influence of Experience and Deliberate Practice on the Development of Superior Expert Performance,” *The Cambridge Handbook of Expertise and Expert Performance* (Cambridge: Cambridge University Press, 2006) 685–705.
- 109 The day started with *The Art of Impossible*: <https://www.theartofimpossible.com>.
- 113 flow triggers: For a technical examination of the triggers for group flow, see: Jef J. J. van den Hout and Orin Davis, *Team Flow* (New York: Springer, 2019). For a more general overview, see Keith Sawyer, *Group Genius* (New York: Basic Books, 2007); and for all the triggers together, see Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 233–56.
- 116 And what does group flow look like: For a group flow overview, see: Keith Sawyer, *Group Genius* (New York: Basic Books, 2007), and Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2014), 127–49.
- 119 There was a U2: <https://www.u2.com/lyrics/111>.
- 121 Nailing our performance: For a really nice article about the role of dopamine and performance in front of an audience, see: Peachy Essay, “Theater Performance and Media Result of Neurochemistry Changes in the Brain,” Peachyessay.com, January 10, 2021. For a more technical description: Vikram Chib, Roy Adachi, John O’Doherty, “Neural Substrates of Social Fascination Effects on Incentive-Based Performance,” *Social Cognitive and Affective Neuroscience* 13, no. 4 (April 2018): 391–403.

- 121 show-offs like to show off: Marie Banich and Stan Floresco, "Reward Systems, Cognition, and Emotion: Introduction to the Special Issue," *Cognitive, Affective, & Behavioral Neuroscience* (May 23, 2019): 409–14.
- 122 nonverbal lexicon: Walter Cannon, *Bodily Changes in Pain, Hunger, Fear and Rage* (New York: Appleton, Century, Crofts, 1929).
- 123 Exploratory mode: Colin DeYoung, "The Neuromodulator of Exploration: A Unifying Theory of the Role of Dopamine in Personality," *Frontiers of Human Neuroscience*, November 14, 2013.
- 126 Andrew Huberman: Andrew Huberman discusses the relationship between vision and fear all over the web. Two personal favorites are his conversation with *Scientific American* (Jessica Wapner, "Vision and Breathing May Be the Secret to Surviving 2020," *Scientific American*, November 16, 2020) and in conversation with former Navy SEAL commander Rich Diviney and the Flow Research Collective, <https://www.flowresearchcollective.com/radio/6>.
- 127 Alia Crum: Parul Somani, "Mindsets: Q&A with Dr. Alia Crum, Stanford Psychology," ParulSomani.com, December 31, 2019.
- 127 Research dating back to the 1970s: Most of the early research on mindset was conducted by Harvard psychologist Ellen Langer. For a great roundup of this work, including her most famous "counterclockwise study," see: Ellen Langer, *Counterclockwise: Mindful Health and the Power of Possibility* (New York: Random House, 2009).
- 127 Ohio Longitudinal Study: Robert Atchley, "Ohio Longitudinal Study on Aging and Retirement, 1975–1995," <https://doi.org/10.7910/DVN/XL2ZTO>, Harvard Dataverse, V1.
- 128 addictiveness of progress: For a broad introduction to the relationship between dopamine and compulsive behavior, including success, see: David Linden, *The Compass of Pleasure* (New York: Viking, 2011).

Chapter 6

- 131 five major intrinsic motivators: Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 17–97.
- 131 three tiers of goals: Ibid.
- 137 Marijuana decreases inflammation: For a general look at the endocannabinoid system and stress, see: Ryan Wrofsky et al., "Endocannabinoids, Stress Signaling, and the Locus Coeruleus-Norepinephrine System," *Neurobiology of Stress*, November 11, 2019. For an overview of recent research: Emily Earlenbaugh, "New Research Reveals Why Cannabis Helps PTSD Sufferers," *Forbes*, September 17, 2020. For a look at the science: Marcel Bonn-Miller et al., "The Short-Term Impact of Three Smoked Cannabis Preparations Versus Placebo on PTSD Symptoms," *PLoS One*, March 17, 2021; Christine Rabinak et al., "Cannabinoid Facilitation of Fear Extinction Memory Recall in Humans," *Neuropharmacology* 64 (2013): 396–402; Leah Mayo et al., "Targeting the Endocannabinoid System in the Treatment of Post-Traumatic Stress Disorder," *Biological Psychiatry* 91, no. 3 (February 2022): 262–72.
- 139 Sense of meaning: Flow's impact on meaning is well documented. I cover it

- thoroughly in *The Art of Impossible*, but if you want a detailed look at flow on human development, see: Mihaly Csikszentmihalyi, *Applications of Flow in Human Development and Education* (New York: Springer, 2014), 14–18, 31, 83.
- 140 embodied cognition: Jennifer Fugate et al., “The Role of Embodied Cognition in Transforming Learning,” *International Journal of School and Education Psychology*, 2018.
- 140 anger did its job: Grace Giles et al., “When Anger Motivates,” *Frontiers in Psychology*, August 5, 2020.
- 143 Grit is a limited resource: Roy Baumeister, *Willpower* (New York: Penguin, 2012).

Chapter 7

- 145 *deliberate play*: The literature on learning and play is considerable. For a good review: Claire Liu et al., “Neuroscience and Learning Through Play: A Review of the Evidence,” LEGO Foundation, November, 2017. The LEGO Foundation has published an excellent summary of this work and more, *Learning Through Play: A Review of the Evidence*, which is available here: https://cms.learningthroughplay.com/media/0vvjvscx/learningthroughplay_areview_summary.pdf. For a look at the neurobiology of play: Stephen Siviy and Jaak Panksepp, “In Search of the Neurobiological Substrates for Social Playfulness in Mammalian Brains,” *Neuroscience & Biobehavioral Reviews* 35, no. 9 (October 2011): 1821–30. Also see: Rene Proyer, “The Well-Being of Playful Adults,” *European Journal of Humour Research* 1, no. 1 (2013); and Cale Magnuson and Lyn Barnett, “The Playful Advantage,” *Leisure Sciences* 35, no. 2 (2013): 129–44. Lastly, Stuart Brown’s *Play* (New York: Avery, 2008) remains a great book on the entire subject.
- 146 the amygdala: For a look at how mindset impacts motor learning in adults: Gabriele Wulf et al., “Altering Mindset Can Enhance Motor Learning in Older Adults,” *Psychology and Learning* 27, no. 1 (2012): 14–21.
- 147 *Crouching Tiger*: <https://www.imdb.com/title/tt0190332/>.
- 147 Keoki Flag: <https://www.gallerykeoki.com>.
- 148 Flow is a four-stage cycle: Jeffery Dusek and Herbert Benson, “Mind-Body Medicine,” *Minnesota Medicine* 92, no. 5 (May 2009): 47–50. Jeffery Dusek et al., “Association Between Oxygen Consumption and Nitric Oxide Production During the Relaxation Response,” *Medical Science Monitoring* 12, no. 1 (January 2006). Also see: Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021), 257–68.
- 151 a midair suggestion: The best examination of how the brain performs during moments of improvisation can be found in John Kounios and Mark Beeman, *The Eureka Factor* (London: Windmill Books, 2015). How this work directly relates to flow is covered in *The Art of Impossible*, 175–90.
- 160 “Yes, and”: Psychologist Keith Sawyer did all of the early research on “yes, and” as a flow trigger. Keith Sawyer, *Group Genius* (New York: Basic Books, 2007). For a detailed look at how group flow impacts athletic performance,

- see: Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2014), 129–48.
- 162 Tom Wallisch: Megan Michelson, “Tom Wallisch,” *The Ski Journal*, see: <https://www.theskijournal.com/exclusive/tom-wallisch/>.

Chapter 8

- 165 Fred McDaniel: <https://www.humanperformancecenter.com>. Also, Fred McDaniel and his wife, Kele, coauthored the definitive guide to flexibility for cyclists. In my experience, it also works great for skiing and all other action sports. You can find it on their website. Also see: Nick Heil, “Reprogramming Your Fitness Brain,” *Outside*, October 5, 2009.
- 167 Tom Day: SnowBrains did a great podcast episode with Tom Day, not long after Tom won his Emmy. See <https://snowbrains.sounder.fm/episode/tom-day>. Also see IMDB for complete filmography, <https://www.imdb.com/name/nm2497471/>.
- 170 Mammoth sits at the epicenter: <https://www.mammothmountain.com/unbound-terrain-parks>.
- 171 full menu of affordances: James Gibson, *The Ecological Approach to Visual Perception* (New Jersey: Lawrence Erlbaum Associates, 1986), 147. It’s also worth noting that Gibson published his original theory of affordances in 1979, and it has changed over time. For a more recent review, see: Harold Jenkins, “Gibson’s Affordances,” *Journal of Scientific Psychology*, December 2008. For a direct look at how affordances impact athletics, see: Brett Fajen, Michael Riley, Michael Turvey, “Information, Affordances, and the Control of Action in Sport,” *International Journal of Sport Psychology* 40, no. 1 (November 2008). For a look at how affordances impact learning in action and adventure sports, see: Ludovic Seifert, Guillaume Hacques, John Komar, “The Ecological Dynamics Framework: An Innovative Approach to Performance in Extreme Environments,” *International Journal of Environmental Research and Public Health* 19, no. 5 (February 2022).
- 171 piques my curiosity: For curiosity as a motivator and in relation to flow, see: Stefano Di Domenico and Richard Ryan, “The Emerging Neuroscience of Intrinsic Motivation,” *Frontiers of Human Neuroscience*, March 24, 2017.
- 172 Joss Christensen: @joss. Also see: <https://www.teamusa.org/Athletes/CH/Joss-Christensen>.
- 175 My chances of dying seemed minuscule: While the literature around pattern recognition and threat detection is fairly thick, it becomes thin when you’re trying to understand how the brain downgrades a threat. Here, when my brain noticed the berms were huge and my chances of dying were small, this is a moment of pleasant surprise, what is considered a better than expected outcome in the literature of predictive coding. For a look at how this works, see: Greg Berns et al., “Predictability Modulates Human Brain Response to Reward,” *Journal of Neuroscience* 21, no. 8 (April 15, 2001): 2793–98.
- 175 A bunch of sensations: Technically, when performance anxiety mounts over time it can produce “stress-response hyperstimulation,” which directly

- impacts muscle tightness, soreness, and fatigue. For a general overview, see <https://www.anxietycentre.com/anxiety-disorders/symptoms/hyperstimulation/>.
- 176 Will Kleidon: Will Kleidon is the CEO of Ojai Energetics. He is an expert in cannabis and the endocannabinoid system. On the relationship between flow, cannabis, and creativity, the Flow Research Collective Radio hosted a great discussion between myself, futurist Jason Silva, and Will Kleidon. See <https://flowresearchcollectiveradio.podbean.com/e/16/>.
- 177 “flooding”: For a review of systematic desensitization, which is the technical term for the approach I took to overcoming vertigo at Mammoth, see: Saul McLeod, “Systematic Desensitization as a Counter-Conditioning Process,” *Simple Psychology*, www.simplepsychology.org. I also describe this approach in *The Art of Impossible*, 83–89.
- 178 battled anxiety with curiosity: When you use curiosity and excitement to counteract anxiety, this is known as either “reframing” or “anxious reappraisal.” For a great overview of recent research, see: Olga Khazan, “Can Three Words Turn Anxiety into Success,” *The Atlantic*, March 23, 2016.
- 180 courage is essentially dopamine: Andrew Huberman, author interview, 2020. The discovery of the relationship between courage and dopamine came from Dr. Andrew Huberman’s lab at Stanford. Also see: Bruce Goldman, “Scientists Find Fear, Courage Switches in the Brain,” *Stanford Medicine*, May 2, 2018.
- 182 VO₂ max: Brad Stulberg, “Endurance Guru Joe Friel Says You Can Still Be Fast After 50,” *Outside*, March 4, 2015.
- 182 another use it or lose it skill: Vivian Giang, “You Can Teach Yourself to Be a Risk-Taker,” BBC, June 6, 2017.
- 183 openness to experience: Jill Suttie, “What Neuroscience Can Teach Us About Aging Better,” *Greater Good*, January 20, 2020. Also see: Tess Gregory et al., “Openness to Experience, Intelligence, and Successful Aging,” *Personality and Individual Differences* 48, no. 8 (June 2010): 859–99.

Chapter 9

- 188 another use it or lose it situation: Gary Hunter, John McCarthy, Marcas Bamman, “Effects of Resistance Training on Older Adults,” *Sports Medicine* 34, no. 5 (2004): 329–48.
- 189 “jumper’s knee”: For an overview of jumper’s knee in freestyle skiing see, “Fucking Patellar Tendonitis,” at New Schoolers, <https://www.newschoollers.com/forum/thread/755856/Fucking-Patellar-Tendonitis>.
- 191 keep on learning later in life: For an overview of the impact of late-in-life learning on mental and physical health, see Gene D. Cohen, *The Mature Mind* (New York: Basic Books, 2005).
- 192 Old is a mindset: Ellen Langer, *Counterclockwise: Mindful Health and the Power of Possibility* (New York: Random House, 2009).
- 192 stuff that works like ice: Yes, there is now a giant controversy surrounding ice. There are old schoolers who believe in its healing powers, and new schoolers

- who believe that reducing inflammation after injury (which is what ice does) slows and sometimes blocks healing. You can find a ton of information online by searching for “the ice debate.” I tend to side with the pro-ice camp, because the anti-ice evidence is still less than convincing.
- 193 The first time I experimented with regenerative medicine: If you’re curious about the early history of regenerative medicine, I reported on the subject for the *LA Weekly*. The article is reprinted in Steven Kotler, *Tomorrowland* (New York: New Harvest, 2015), 183–200.
- 193 platelet-rich plasma: PRP therapy is also controversial. For a favorable look at recent evidence, see: Peter Everts et al., “Platelet-Rich Plasma: New Performance Understandings and Therapeutic Considerations in 2020,” *International Journal of Molecular Science* 21, no. 20 (October 2020). For a thoroughly damning review of the evidence, see: Kade Paterson, “Cutting Through the Hype on Platelet-Rich Plasma,” *Pursuit*, University of Melbourne, January 13, 2022. Personally, I believe the real issue isn’t with the therapy itself, but with the skill of the doctor making the injections. As far as I can tell, reading an ultrasound and using that image to guide an injection is more of an art than a science. Additionally, I found PRP useful in treating shoulder injuries, semiuseful in treating back injuries, and not useful in treating ankle injuries. I’m not alone. In talking to other athletes about PRP, you frequently hear stories about similarly mixed results.
- 194 Dr. Matt Cook: Dr. Matt Cook has a podcast, and it’s a great place to start if you’re trying to get a sense of his approach to regenerative medicine: <https://bioresetpodcast.com>.
- 194 Exosomes: Like everything else in regenerative medicine, exosomes themselves are controversial, but there is a mountain of evidence for the level of effectiveness I experienced. See: Donald Phinney and Mark Pittenger, “Concise Review: MSC-Derived Exosomes for Cell-Free Therapy,” *Stem Cell Express*, March 7, 2017. Also: Wumei Wei et al., “Mesenchymal Stem Cell-Derived Exosomes,” *Frontiers in Pharmacology*, January 25, 2021.
- 198 Jeremy Jones: @jeremyjones. Also, Jones founded the excellent organization Protect Our Winters to battle climate change, see: <https://protectourwinters.org>.
- 203 Wittgenstein: Ludwig Wittgenstein, *Tractatus Logico-Philosophicus* (New York: Harcourt, Brace, 1933), 68.

Chapter 10

- 205 I designed my one-inch-at-a-time approach to promote: In my experience, the one-inch-at-a-time protocol that underpins my Gnar Country experiment helps reduce catastrophic injuries, but it can’t prevent them (as my T-boning incident definitely illustrated). Also, by catastrophic, I am referring to anything that requires surgery to heal. There is also a much worse category—permanent injury or the kind that surgery still can’t heal. All of this is to say, my approach is dangerous and can result in serious injury, even death. Proceed with serious caution.

- 205 Regenerative medicine seemed ready to handle: The belief that regenerative medicine is ready to handle chronic injuries is mine alone, and entirely based on personal experience. I've had success using it to treat knees (MCL tears and patellar tendinitis), shoulders (rotator cuff tears), and back problems (arthritis). Will you have the same success? Honestly, I have no idea. It's also worth pointing out that regenerative medicine is not yet covered by insurance and the costs are extremely high. The good news here is that the evidence for its success continues to mount and the treatment is becoming more popular—thus costs are starting to come down. Additionally, while I have focused on exosomes, there are less expensive treatments available via peptides. This too is both new and controversial, but again the evidence for peptides' ability to regenerate tissues and organs is mounting. See, Matthew Webber and Samuel Stupp, "Emerging Peptide Nanomedicine to Regenerate Tissues and Organs," *Journal of International Medicine* 267, no. 1 (January 2010): 71–88.
- 211 the five Blue Zone keys: Dan Buettner, *The Blue Zones* (Washington, DC: National Geographic, 2008), 261–98.
- 212 In the elderly, leg strength: Anne Newman et al., "Strength, but Not Muscle Mass, Is Associated with Mortality in Health, Aging and Body Composition Study Cohort," *Journals of Gerontology* 61, no. 1 (January 2006): 72–77. Also see: Antonio Garcia-Hermoso et al., "Muscular Strength as a Predictor of All-Cause Mortality in an Apparently Healthy Population," *Archives of Physical and Medical Rehabilitation* 99, no. 10 (October 2018).
- 212 common killer of older adults: The Endocrine Society, "Broken Bones Among Older People Increase Risk of Death for Up to 10 Years: Femur, Pelvic Fractures Pose Similar Risk as Hip Fractures," *ScienceDaily*, July 19, 2018.
- 212 researchers at Kings College London: Claire Steves et al., "Kicking Back Cognitive Ageing: Leg Power Predicts Cognitive Ageing After Ten Years in Older Female Twins," *Gerontology* 62, no. 2 (2016): 138–49.
- 212 inflammation, which is the root of much that we call "aging": Luigi Ferrucci and Elisa Fabbri, "Inflammaging: Chronic Inflammation in Aging, Cardiovascular Disease, and Frailty," *Nature Reviews Cardiology* 15 (2018): 505–22; Hae Young Chung et al., "Redefining Chronic Inflammation in Aging and Age-Related Diseases," *Aging and Disease* 10, no. 2 (April 2019): 367–82; Helen Lavretsky and Paul Newhouse, "Stress, Inflammation and Aging," *American Journal of Geriatric Psychiatry* 20, no. 9 (September 2012): 729–33. Also see: Nicholas Justice, "The Relationship Between Stress and Alzheimer's Disease," *Neurobiology of Stress*, April 21, 2018.
- 212 Stress weakens motivation: Nick Hollon, Lauren Burgeno, Paul Philips, "Stress Effects on the Neural Substructures of Motivated Behavior," *Nature Neuroscience* 18, no. 10 (October 2015): 1405–12.
- 212 blocks flow: The relationship between stress and flow is complicated. The most obvious place it shows up in is the tuning of the challenge-skills balance, wherein too much anxiety pushes one out of the balance and makes achieving flow much more difficult. See Steven Kotler, *The Art of Impossible* (New York: Harper Wave, 2021). Also, the research on how stress blocks

- creativity is thoroughly explored in Mark Beeman and John Kouinos, *The Eureka Factor* (London: Windmill Books, 2015).
- 212 Time in nature: The relationship between time in nature and mental health is so well established that there is an entire field of research devoted to its understanding; see: M. G. Berman, A. J. Stier, and G. N. Akcelik, "Environmental Neuroscience," *American Psychologist* 74, no. 9 (2019): 1039–52. Also, there are now meta-analyses that have figured out what "time dose" (aka time spent outdoors) produces the best mental health benefits. For a thorough review, see Genevive Meredith et al., "Minimum Time Dose in Nature to Positively Impact the Mental Health of College-Aged Students, and How to Measure It: A Scoping Review," *Frontiers in Psychology*, January 14, 2020. Finally, for a look at outdoor activity and health in older adults, see: Jacqueline Kerr et al., "The Relationship Between Outdoor Activity and Health in Older Adults Using GPS," *International Journal of Environmental Research and Public Health* 9, no. 12 (2012): 4615–25.
- 214 use the trampoline park to increase my air sense: Joshua Aman et al., "The Effectiveness of Proprioceptive Training for Improving Motor Function: A Systematic Review," *Frontiers in Human Neuroscience*, January 28, 2015. Also, Fabian Herold et al., "Thinking While Moving or Moving While Thinking—Concepts of Motor-Cognitive Training for Cognitive Performance Enhancement," *Frontiers in Aging and Neuroscience*, August 6, 2018.
- 214 my attempt to lateralize: For lateralization and skill acquisition, see Steven Kotler, *The Rise of Superman* (New York: New Harvest, 2014), 123–26.
- 214 "risk tolerance": Thomas Dohmen et al., "Identifying the Effect of Age on Willingness to Take Risks," *CEPR*, January 21, 2018.
- 215 "match quality": For the best description of match quality, see: David Epstein, *Range* (New York: Riverhead Books, 2019), 128.
- 215 put down resentments: Javier Lopez et al., "Forgiveness Interventions for Older Adults," *Journal of Clinical Medicine* 10, no. 9 (May 2021). See also N. J. Webster, K. J. Ajrouch, T. C. Antonucci, "Towards Positive Aging: Links Between Forgiveness and Health," *OBM Geriatrics* 4, no. 2 (2020): 118.
- 215 Fear blocks empathy and decreases creativity: For fear and empathy, see: Andrew Todd et al., "Anxious and Egocentric," *Journal of Experimental Psychology: General* 144, no. 2 (April 2015): 374–91. For the relationship between fear and creativity, see John Kouinos and Mark Beeman, *The Eureka Factor* (London: Windmill Books, 2015), 115–19.
- 215 further lowers our appetite for risk: Anthony Porcelli and Mauricio Delgado, "Acute Stress Modulates Risk Taking in Financial Decision Making," *Psychological Science* 20, no. 3 (March 2009). Also, Mara Mather and Nichole Lighthall, "Both Risk and Reward Are Processed Differently in Decisions Made Under Stress," *Current Directions in Psychological Science* 21, no. 2 (March 26, 2012).
- 217 Gene Cohen: Gene D. Cohen, *The Creative Age* (New York: Avon Books, 2000); Gene D. Cohen, *The Mature Mind: The Positive Power of the Aging Brain* (New York: Basic Books, 2006); Gene D. Cohen, "The Creativity and Aging Study," George Washington University, 2006.

- 219 Sarah Sarkis: Author interview with Dr. Sarah Sarkis, June 2021. Also see: <https://drsarahsarkis.com>. Also, for the Flow Research Collective Radio interview with Dr. Sarkis, see: <https://drsarahsarkis.com/2020/12/28/rethinking-cognitive-bias-and-the-unconscious-the-frc-podcast-episode/>.
- 220 Margaret Atwood: I'm paraphrasing here, the actual quote is: "Everyone else my age is an adult, whereas I am merely in disguise." Margaret Atwood, *Cat's Eye* (New York: Anchor, 1998), 15.
- 221 Laird Hamilton: Author interview with Laird Hamilton, June 2021.

Appendix: The Rules

- 228 In high-risk situations, the brain: Rongjun Yu, "Stress Potentiates Decision Biases," *Neurobiology of Stress* 3 (June 2016): 83–95. Also, Sean Wake et al., "The Influence of Fear on Risk-Taking," *Cognition and Emotion* 34, no. 6 (2020).
- 228 where the brain sets the challenge-skills balance: Susan Jackson, "Factors Influencing the Occurrence of Flow State in Elite Athletes," *Journal of Applied Sport Psychology* 7, no. 2 (1995): 138–66; and Susan Jackson et al., "Psychological Correlates of Flow in Sport," *Journal of Sport and Exercise Psychology* 20, no. 4 (1998): 358–78. Also see: Edward Chavez, "Flow in Sport: a Study of College Athletes," *Imagination, Cognition and Personality* 28, no. 1 (January 21, 2009): 69–91; Stefan Koehn, "Pre-Performance Confidence as a Predictor of Flow State," *Medicine and Science in Tennis* 17, no. 1 (February 2012): 16–21.
- 230 triggers for group flow: Jef van den Hout and Orin Davis, *Team Flow* (Switzerland: Springer, 2019), 31–49. Also Keith Sawyer, "What Mel Brooks Can Teach Us About 'Group Flow,'" *Greater Good Magazine*, January 24, 2012.
- 230 maintaining healthy interpersonal relationships: Katherine Harmon, "Social Ties Boost Survival by 50 Percent," *Scientific American*, July 28, 2010. Also see: Yang Claire Yang et al., "Social Relationships and Physiological Determinants of Longevity Across Human Life Span," *PNAS* 113, no. 3 (January 19, 2016): 578–83. For flow and social bonding, see: Jason Keeler et al., "The Neurochemistry and Social Flow of Singing: Bonding and Oxytocin," *Frontiers in Human Neuroscience*, September 25, 2015.
- 231 the line between "fear" and "too much fear": For the complicated relationship between fear and too much fear, see: Ilse Van Diest, "Interoception, Conditioning and Fear," *Psychophysiology* 56, no. 8 (August 2019). For the relationship between conscious and unconscious fear and interoception: Kai MacDonald, "Interoceptive Cues: When Gut Feelings Point to Anxiety," *Current Psychiatry* 6, no. 11 (November 2007).
- 231 the dopamine generated by pattern recognition: Sergei Gepshtein et al., "Dopamine Function and the Efficiency of Human Movement," *Journal of Cognitive Neuroscience* 26, no. 3 (March 2014): 645–57. For a look at how dopamine amplifies psychological and physical factors, see Pat Davidson, "Central Fatigue and the Role of Neurotransmitters on Reduced Work Output," *Simplifaster.com*, <https://simplifaster.com/articles/central-fatigue-role-neurotransmitters-reduced-work-output/>.

- 232 “Older persons”: Gene D. Cohen, *The Mature Mind* (New York: Basic Books, 2006), 27. Also see: University of Toronto, “Old Brains Can Learn New Tricks,” *Science Daily*, October 25, 1999.
- 232 This health boost comes from: Joanna Hong et al., “The Positive Influence of Sense of Control on Physical, Behavioral, and Psychosocial Health in Older Adults,” *Preventative Medicine* 149 (August 2021).
- 232 sense of control: Ellen Langer and Judith Rodin, “The Effect of Choice and Enhanced Personal Responsibility for the Aged: A Field Experiment in an Institutional Setting,” *Journal of Personality and Social Psychology* 34, no. 2 (September 1976): 191–98.
- 232 Positive emotions increase: Fulvio D’Acquisto, “Affective Immunology,” *Dialogues in Clinical Neuroscience* 19, no. 1 (March 19, 2017): 9–19. Also, B. Easterling et al., “Psychosocial Modulation of Cytokine-induced Natural Killer Cell Activity in Older Adults,” *Psychosomatic Medicine* 58, no. 3 (May–June 1996): 264–72.
- 233 how we create *a whole lot more life*: For the details about well-being and overall life satisfaction, see: Mihaly Csikszentmihalyi, *Applications of Flow in Human Development and Education* (Cham, Switzerland: Springer, 2014), 24–32. Additionally, Martin Seligman’s *Authentic Happiness* (New York: Free Press, 2002) is another great resource.
- 234 Flow fights anxiety: The research into the inverse relationship between flow and anxiety traces back to Herbert Benson, *The Breakout Principle* (New York: Scribner, 2003). For a more contemporary update, see: US Pain Foundation, “How Flow State and the Nervous System Interact,” [USPainFoundation.org](https://uspainfoundation.org), July 28, 2021. Also, for my own experience with how flow can reset the nervous system and boost the immune system, see: Steven Kotler, *West of Jesus* (New York: Bloomsbury, 2006).
- 234 positive emotions stimulate the immune system and slow aging: For a general overview of flow’s impact on healthy aging, see: Miguel Bautista, “Flow State, Exercise and Healthy Aging,” *The Conversation*, April 13, 2022.
- 235 All of the performance-enhancing neurochemicals . . . tie to emotions: For the relationship between emotions and neurochemistry, see: Jaak Panksepp, *Affective Neuroscience* (Oxford: Oxford University Press, 1998), and Lisa Feldman Barrett, *How Emotions Are Made* (Boston: Mariner Books, 2018).
- 235 Flow amplifies our ability . . . to remember what we did: Jennifer Schmidt, “Flow in Education,” *Education*, 2010. Chris Berka et al., “EEG Correlates of Task Engagement and Mental Workload in Vigilance, Learning, and Memory Tasks,” *Aviation, Space, and Environmental Medicine* 78, no. 5 (2007): B231–44. Also Kevin Rathunde and Mihaly Csikszentmihalyi, “Middle School Students’ Motivation and Quality of Experience: A Comparison of Montessori and Traditional School Environments,” *American Journal of Education* 111, no. 3 (2007): 341–71. Also S. Craig, A. Graesser, J. Sullins, and B. Gholson, “Affect and Learning: an Exploratory Look into the Role of Affect in Learning with Autotutor,” *Journal of Educational Media* 29, no. 3 (October 2004): 241–50. Finally, see: Susan Jackson and Mihaly Csikszentmihalyi,

- Flow in Sport: The Keys to Optimal Experiences and Performances* (Champaign, IL: Human Kinetics, 1999), 65–68.
- 236 Recover Like a Pro: Peter Reaburn, Matthew Driller, and Christos Argus, “Age-Related Changes in Performance and Recovery Kinetics in Masters Athletes: A Narrative Review,” *Journal of Aging and Physical Activity* 24, no. 1 (January 2016). For a general overview of training and recovery tips from older pro athletes, see Eric Benson, “How Pro Athletes Like LeBron James and Tom Brady Are Playing Longer (and Better) Than Ever,” *Men’s Journal*.com, <https://www.mensjournal.com/sports/how-todays-ageless-pros-are-reaching-athletic-immortality/>.
- 236 train for old age like a professional: James McKendry et al., “Comparable Rates of Integrated Myofibrillar Protein Synthesis Between Endurance-Trained Master Athletes and Untrained Older individuals,” *Frontiers in Physiology*, August 30, 2019. On the cognitive side, see: Denise Park and Gerard Bischof, “The Aging Mind: Neuroplasticity in Response to Cognitive Training,” *Dialogues in Clinical Neuroscience* 12, no. 1 (April 2022): 109–19. Finally, for the benefits of training body and brain together, see: Clemence Joubert and Hanna Chainay, “Aging Brain: The Effort of Combined Cognitive and Physical Training on Cognition as Compared to Cognitive and Physical Training Alone—A Systematic Review,” *Clinical Interventions in Aging* 13 (July 20, 2018): 1267–1301.
- 236 use it or lose it across the board: Peter Reaburn and Ben Dascombe, “Endurance Performance in Masters Athletes,” *European Review of Aging and Physical Activity* 5 (2008): 31–42; and Kevin Gries and Scott Trappe, “The Aging Athlete: Paradigm of Healthy Aging,” *International Journal of Sports Medicine* 1055, no. 10, February 4, 2022. For a general overview of elite performance and aging, see Jeff Bercovici, *Play On* (Boston: Mariner Books, 2018); and Amanda Akkari et al., “Greater Progression of Athletic Performance in Older Masters Athletes,” *Age and Aging* 44, no. 4 (July 2015). Also, Nick Heil, “Age Is Irrelevant When It Comes to Fitness,” *Outside*, August 21, 2015. For an overview of science-based protocols for older athletes, see: Charlie Hoolihan, “Training Techniques for High Performance Masters Athletes,” *Ideafit*.com, October 14, 2009.
- 236 Once you reach fifty: Abigail Barronian, “Here’s How to Get Stronger after 50,” *Outside*, July 12, 2018.
- 238 smart play works best: Jon Jachimowicz et al., “Why Grit Requires Perseverance and Passion to Positively Predict Performance,” *Psychological and Cognitive Sciences* 115, no. 40 (September 17, 2018). Also see Ana Palis and Peter Quiros, “Adult Learning Principles and Presentation Pearls,” *Middle East African Journal of Ophthalmology* 21, no. 2 (April–June, 2014): 114–22.
- 238 NYU neuropsychologist Elkhonon Goldberg: Elkhonon Goldberg, *The Wisdom Paradox* (New York: Gotham Books, 2005) Also see: Dilip Jeste et al., “The New Science of Practical Wisdom,” *Perspectives in Biological Medicine* 62, no. 2 (2019): 216–36. Also a lot of Goldberg’s thinking about how pattern recognition protects against cognitive decline comes from the study of cognitive reserve; see Jason Steffener and Yaakov Stern, “Exploring the Neural

- Basis of Cognitive Reserve in Aging," *BBA: Molecular Basis of Disease* 1822, no. 3 (March 2012): 467–73.
- 241 the hippocampus is where: For neurogenesis in the adult human hippocampus, see: K. L. Spalding et al., "Dynamics of Hippocampal Neurogenesis in Adult Humans," *Cell* 153 (2015): 1219–27; and P. S. Eriksson et al., "Neurogenesis in the Adult Human Hippocampus," *Nature Medicine* 4 (1998): 1313–17; Rolf Knoth et al., "Murine Features of Neurogenesis in the Human Hippocampus Across the Lifespan from 0 to 100 Years," *PLoS One* 5, no. 1 (2010); Ashutosh Kumar et al., "Adult Neurogenesis in Humans: A Review of Basic Concepts, History, Current Research, and Clinical Implications," *Innovations in Clinical Neuroscience* 16, nos. 5–6 (May 1, 2019).
- 241 the easiest way to get the hippocampus to birth new neurons: For memory, emotion, and location, see: Bret Stetka, "Our Brain Is Better at Remembering Where to Find Brownies than Cherry Tomatoes," *Scientific American*, October 8, 2020; Jordana Cepelewicz, "The Brain Maps Out Ideas and Memories Like Spaces," *Quanta*, January 14, 2019. Also see Jennifer Talarico, Dorthe Berntsen, David Rubin, "Positive Emotions Enhance Recall of Peripheral Details," *Cognition and Emotion* 23, no. 2 (February 24, 2009): 380–98. For how this improves the aging brain, see: Francisco Mora, "Successful Brain Aging: Plasticity, Environmental Enrichment, and Lifestyle," *Dialogues in Clinical Neuroscience* 15, no. 1 (April 1, 2022): 45–52.
- 241 longevity hot spots: Deepan Dutta, "The Longevity Project/Part 1," *Summit Daily*, February 28, 2018; and Deepan Dutta, "The Longevity Project/Part 2," *Vail Daily*, February 13, 2018. Also see: https://en.wikipedia.org/wiki/List_of_U.S._counties_with_longest_life_expectancy.