



Endure: Mind, Body, and the Curiously Elastic Limits of Human Performance

Alex Hutchinson

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From the National Magazine Award-winning *Runner's World* columnist, frequent *New Yorker* online contributor, and Cambridge-trained physicist: a fascinating and definitive exploration of the extraordinary science of human endurance and the secrets of human performance, for fans of *The Sports Gene*, *Born to Run*, and *Grit*.

From running a two-hour marathon to summiting Mount Everest, we're fascinated by the extremes of human endurance, constantly testing both our physical and psychological limits.

How high or far or fast can humans go? And what about individual potential: what defines a person's limits?

For years, physiology determined the answer: heart size, lung capacity, and muscle strength. But over the past decade, a wave of dramatic findings in the cutting-edge science of endurance has completely overturned our understanding of human limitation. *Endure* widely disseminates these findings for the first time: It's the brain that dictates how far we can go—which means we can always push ourselves further.

Hutchinson presents an overview of science's search for understanding human fatigue, from crude experiments with electricity and frogs' legs to sophisticated brain imaging technology. Going beyond the traditional mechanical view of human limits (like a car with a brick on its gas pedal, we go until the tank runs out of gas), he instead argues that a key element in endurance is how the brain responds to distress signals—whether heat, or cold, or muscles screaming with lactic acid—and reveals that we can train to improve brain response.

An elite distance runner himself, Hutchinson takes us to the forefront of the new sports psychology—brain electrode jolts, computer-based training, subliminal messaging—and presents startling new discoveries enhancing the performance of athletes today and shows how anyone can utilize these tactics to bolster their own performance—and get the most out of their bodies.

Endure: Mind, Body, and the Curiously Elastic Limits of Human Performance Details

Date : Published February 6th 2018 by Endure: Mind, Body, and the Curiously Elastic Limits of Human Performance

ISBN :

Author : Alex Hutchinson

Format : Kindle Edition 321 pages

Genre : Nonfiction, Science, Sports and Games, Sports, Fitness, Health, Psychology



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From Reader Review Endure: Mind, Body, and the Curiously Elastic Limits of Human Performance for online ebook

Atila Iamarino says

Um passeio bem legal e muito bem escrito sobre os limites do corpo humano. Usando a corrida como desculpa (ou contexto), Hutchinson passa uma combinação de medicina, método esportivo e a história do esporte e de esportistas para discutir o tema. Fica um balanço legal do que é limite físico (e muscular) ou fisiológico e o que é limite psicológico – até onde o cérebro segura nosso desempenho tentando gerir nossos recursos. Os exemplos que mostram o papel de cada um desses fatores são bem legais, com histórias de experimentos que mostram recursos que não sabiam que tínhamos ou pessoas em situações que realmente chegaram no limite.

O autor escreve sobre corrida há bastante tempo na Runner's World, então acho que já teve tempo e experiência para deixar de lado modas esportivas que vão embora sem fazer a menor diferença. Achei bem balanceado, ele não dá trela para contos de pessoas hiperfortes ou situações sem comprovação nem fala sobre aparelhos e métodos miraculosos. pelo contrário, o livro usa experimentos e pesquisa bem embasada para discutir o que realmente entendemos dos nossos limites.

Susannah says

Perfect book for anyone gearing up for the Olympics. I'll post my NY Post feature on it when it runs...

Peter says

The full title of this book is actually very apt since it describes exactly what this book focuses on. There was a quite decent split between discussions and theories around how the mind affects performance versus the actual limits of the human body. Most of these discussions went quite deep into the scientific literature regarding each subject which made the book feel very well researched. However, if you're looking for practical advice and ideas on improving your own endurance performance, there isn't actually that much here for you. This is definitely geared more towards either top level athletes or people curious about the peak performance of the human body in general.

I enjoyed the writing though with the book doing a good job of keeping me engaged by interspersing the deep, scientific stat-dumps with anecdotes and human-relatable case studies that gave us an interesting context. There were maybe four or five cases where the author got lost in the numbers and seemed to drone on a bit too long, but even in those cases, you could argue many people would find that extra detail fascinating. The backdrop of the entire book is the 2-hour marathon attempt which we come back to every few chapters and which worked well for having an example of the ideas the author was discussing.

I don't really have anything negative to say about this book. It delivered exactly what it promised and was both interesting and informative. It covered a wide range of disciplines, ranging from ones I knew quite well like running and cycling, to more esoteric ones like free diving and speed walking. There's probably something here for anyone with an interest in the limits of human performance and endurance. It's very

honest in the current limits of our scientific knowledge though, so don't expect too many definitive conclusions or practical advice.

Lawrence Xie says

Out of all the books I've added on Goodreads, *Endure* is the most difficult for me to review with an unbiased eye. The reason is that the topic discussed lies within the backdrop of a community I am very immersed in – that of competitive running. Indeed the author is friends with many of my close current track teammates. In addition just this past summer, I remember watching Nike's *Breaking 2* live as it was streamed online late at night. Now, the monumental athletic feat provides the central narrative tying together Hutchinson's strong book on the psychological and physical aspects of endurance.

Surprisingly my preexistent knowledge about running and track history actually decreased my enjoyment of reading the book. Many of the topics described were topics I am intimately familiar with such as lactate threshold and the concept of the central governor in the brain. Furthermore, I have followed Hutchinson's writings over the years and many of the chapters were actually published in earlier forms through various magazine/newspaper articles that I've read. I actually appreciate this aspect though since it provided a "behind-the-scenes" view of the process of writing, something I hadn't witnessed before. Still I have tried to remove personal biases from my rating of the book since I recognize it as a well-researched presentation that the majority of readers will still find fascinating.

There were still many interesting things that I did learn from reading the book. For one, I was unaware of the author's personal exceptional improvements in the 1500m. Many of the questions that he posed (and would later research) were questions I would ask if I were in such a situation. Hutchinson writes these passages well and the prose is highly relatable and easy to read. One area that I wish was covered in more detail is the relationship between research in sports physiology and the for-profit companies that sponsor them. This topic was also posed by Oldster on the Trackie message boards and I'm sure many share this interest.

Overall the book is a well-structured piece worth the time to read for nearly all runners and athletes. My biggest takeaway from reading this is a rejuvenated commitment to endurance training – I will aim to appear at a few Saturday morning tempo runs at Mount Pleasant Cemetery and maybe bump into the author!

Roberto Rigolin F Lopes says

The interesting thing is that most people DON'T die of exhaustion, Tim Noakes noted in the 1997. Thus starting with the hypothesis that your mind is protecting you from misusing your body. Very good, It is all in your mind. But protection comes with a cost. That is, your mind is also stopping you from doing the best you can. And that's what this book is all about. Alex is compiling the current science developments on human performance which includes a great deal of brain training. To make things more dramatic, he sets the book within Nike's *Breaking2* project. You may end up in a full body sweat while reading this book.

Juan says

Libro muy interesante sobre el estado del arte en materia de resistencia física. El cuerpo humano tiene demasiadas variables interesantes. No es un libro de entrenamiento pero ayuda a entenderse mientras se entrena.

Jacques Bezuidenhout says

If you are looking for a step by step guide on how to improve endurance, this is not it.

What it is a journalistic style report trying to apply scientific theories from the last century to different endurance sports (running, speed walking, cycling, mountain climbing, free diving) to try find something that can measure or debunk myths about the limits in human potential.

There is a lot of research that gets delved into/mentioned in this book.

Hutchinson doesn't really come to any conclusions, but lays out the facts, so that you can decide for yourself.

Some of the topics/areas covered:

- Lactic Acid
- VO2 max
- Psychology
- Pain
- Core temperature
- Diet (HFLC - High Fat Low Carb)
- Fuelling and hydration before/during races & training

I really liked that most of the topics covered took a specific athlete/event and then covers the studies / research that went in around that time, and what the outcomes were.

It felt very close to home, since South Africa gets mentioned quite a bit from both the research, athlete and event perspectives.

Really enjoyed this book, and to hear some stories about the limits of the human body.

It does make me feel a bit inadequate listening to some of the feats these athletes reach in terms of distance / speed / endurance.

Allison says

Disclaimer: I don't typically enjoy nonfiction books. I always-ALWAYS-need a narrative. It can be a bunch of little narratives that turn out sort of like short stories (e.g., *What the Dog Saw* by Malcolm Gladwell), or an overarching narrative (...nothing comes to mind, actually). But no matter what, I need a story to hold all the "facts" together.

Hutchinson does a great job weaving what would otherwise be almost chapter-length "research reviews" together with the singular thread of Nike's Breaking 2 Project. He followed the project from conception to completion and although anyone who follows running already knows the outcome of the project, the intimate quality of Hutchinson's on-the-ground experience still had me holding my breath as the story unfolded.

As for the chapters in between, they were just as informative as I expected, without being too dry. Of course, I had my favorite and least favorites, based on my own personal interests, but all of the studies and experiments he covered were relayed in an accessible way that didn't make things too complex . . . or too simple. At no point in the book did I feel "talked down to," and as a fellow author, I know personally how hard that line is to walk.

The one other point I want to make is that in no way is this a self-help book. Hutchinson admits from the outset that he had been hoping to find "answers," and instead he found more instances of "we'll have to wait and see." That he can admit this and still produce a compelling book full of novel information is a testament to him as a writer, researcher, and athlete.

Anyone who is interested in the interplay of body and mind, as it pertains to endurance sports: read this book.

P.s. I'd be remiss not to mention the little gems of dry humor sprinkled throughout the book. Just read this:

...the severity of the rig [muscle failure--"rigor mortis"] can be diminished ever so slightly by ingesting baking soda, which counters rising acidity in much the same way that it reacts with acetic acid (that is, vinegar) in grade-school volcano models. (The downside of baking soda doping, while we're on the volcano theme, is the potential for explosive diarrhea.)

Ha Truong says

There are some factors can influence the endurance that I can improve :D

- + Oxygen intake
- + Core body temperature
- + Mindfulness

John Spiller says

Much like Homer Simpson was disappointed to learn that "The Lottery" by Shirley Jackson was not a book on how to win the lottery, I was dismayed to discover that "Endure" offers very little concrete insights on how endurance can be increased. Instead, "Endure" is an exploration of the various factors that affect endurance and how much -- or how little -- we know about each. In a nutshell, Tim Noakes' theory of the brain as a "central governor" of the body's performance appears to be generally supported, but the means to manipulate the brain to enhance performance still appear elusive.

Hutchinson is a lively and engaging writer, though his narrative style tended to grate on me. Time and again, as he built to some point or conclusion, he would then abruptly change to a new story or new tale of clinical

research. He ultimately reaches his conclusion after multiple disquisitions and switchbacks, but the circuitous route left a little to be desired.

Anders Brabaek says

This book is about how your mental limits affects your physical limits, and how great physical performances demands a mindset which can push through pain and suffering. It is about how you can “exercise your mind” to endure more.

The author presents a combination stories and research findings. Most of the examples are from long distances, e.g. marathons/Ironman to ultra-long distance races as well as insane trips to mountains or the Antarctic though there is also a chapter on “the hour” biking time trial.

This was slightly disappointing to me; the writer used to be an elite 1500m runner – and hence know that to endure, is not just about endure the distance but about taking ones’ body to its limits and beyond. This is a very special “treat” at running distances such as 1500-5000m or 400m medley or 5K cycling or the 2K rowing – which really are the sweet spots for maximal lactate buildup. Longer distances let fall into the sensation - much of the distance is really just transport. In a 2K rowing race you are into a world of pain before you hit the 1 minute mark, and from there it really is a leap of faith.

Anyhow, Alex never identifies a panacea or magic bullet which allow us to push through the pain and suffering. He emphasizes the need for frequently exercising in a faster than race pace – something which everyone into competitive endurance sports should already know. Likewise he teaches us to value the concept of the "one hour" time trial for its ability to take suffering to a new level.

However he also emphasize a mindset in which we are not just pursuing maximum VO₂max and maximum lactate tolerance but also pursue the enduring of pain and suffering in this specific relation as a goal for exercise in itself.

This realization can help us endure the training on the days where the performance is crap, but the suffering is real. To me, what Alex never really spells out, it entails that we need to compete more, because, as he does spell out, during competitions we are much better at pushing the envelope and endure more pain.

While he never really addresses my key interest areas, and while he overlooks some of the more interesting findings on lactate tolerance in my perspective, it was a generally entertaining read.

Loomis says

I found Hutchinson's journalistic style of reporting on Endurance to be highly enjoyable. I was able to form my own ideas and often there was an answer coming when I wanted to challenge what I was reading. I appreciated the journey of this book and the fascinating detail.

Viv JM says

Really interesting look at endurance and what the limits are for human performance. Hutchinson discusses

the roles of heat, oxygen, muscles etc but also how much of endurance is related to the brain. Fascinating stuff, with lots of interesting anecdotes and stories, as well as scientific studies.

Phil Sykora says

I don't like that Alex Hutchinson's "Endure" is "written in the spirit of Malcolm Gladwell." It reminds me of what Stephen King said in *On Writing*: "Any book that has the description, 'written in the spirit of,' is probably the pits" (or something to that effect, I'm not going to fish it up).

Well, this is the exception.

Endure is a fantastic book that's chock-full of interesting, far-reaching, and applicable research. He masterfully walks the line between hard data and engaging anecdote, never drawing conclusions that are too universal for what the evidence suggests.

It's the only book this year that I've actually read the notes for.

Some memorable bits that stuck with me:

Jons Jacob Berzelius first introduced the idea that cardiovascular fatigue is caused by a build-up of lactic acid in the muscle in 1807 -- although lactic acid is only formed when protons bind to lactate, which is really what the muscles and blood of his subjects, dead animals forced to differing degrees of exhaustion, were producing. When coaches, trainers, and athletes refer to "lactic acid buildup," they really mean "lactate buildup," which seems minor and inconsequential unless you consider the negative connotative implications of the word, "acid," and you combine it with the power of positive thinking, which can considerably influence your performance in a race. (When I think about "lactic acid," I think about that Palahniuk quote from *Fight Club*: "My veins were pumping battery acid" -- that only works if you make the connection between the two). It might help, during a marathon, to think about your fatigue as "lactate buildup," a slight linguistic change that may have a non-negligible effect on the brain, which, as I said, is an important aspect -- possibly the most important aspect -- of physical endurance.

And that, true to *Endure*'s subtitle (*Mind, Body, and the Curiously Elastic Limits of Human Performance*), is my biggest takeaway from the book: Effort, more than anything else, is the true determinant of individual performance.

Inspired by this book -- even though, as Alex Hutchinson says on page 258, it "isn't a training manual" -- I'm going to compete in a mini triathlon in my area (or maybe a sprint triathlon -- I haven't decided). They call it a "mini," but it's essentially a super-sprint that's fit to the trail: a 7mi bike ride, 2mi run, and 250y swim; something that everyone could conceivably finish, so I don't think it's going to be hyper-competitive, but there are always those outliers in your area. I'm going to work some of what I've learned from this book into the program I'm designing for that race. If you don't know me personally, you should know I'm primarily a powerlifter. It's not that I'm completely untrained for endurance work, but I usually keep a higher bodyfat percentage (particularly during the winter) with a focus on lifting progressively heavier weights. This summer I'm going to cut down to sub-170 and work on something new. That's not to say that I'm going to completely dismiss strength training from my routine; I think it's a necessary part of just about any healthy training regimen, but I'm also going to include some serious endurance training in there.

For fun, or something.

Mayo Clinic physiologist Michael Joyner wrote a training haiku that's going to be the crux of my routine:

Run a lot of miles
Some faster than your race pace
Rest once in a while

With that simple poem as my backbone, it's time to overcomplicate things. I'm going to take a polarized approach to my program, splitting up the HIIT/LISS portions along the all-popular Pareto split like Ben Greenfield recommends in this article. (This is just a fancy, self-serving way of saying I'm going to spend 20% of my time working on increasing my VO₂ max by doing high intensity interval training and the other 80% of the time doing easy aerobic work). I *might* be able to reserve a lap at the Rec Center near my house, so swimming might also be an option. As it stands, though, I only have a bike and not-too-dependable Ohio weather.

With that said, I'm not going to focus or measure cardiovascular markers; mostly because I don't have the means to do so, but also because I want to focus on the most important aspect of success in this sport (and all sports): busting my ass. You can have the most aerodynamic bike, the one that cost \$7000, you can have a swimsuit that Phelps would be jealous of, you can have the Nike Vaporfly 4% (which do sound cool, if not unrealistic), but -- on the local level -- you'll lose to the person who's busting their ass the most.

One thing I didn't like: The front flap reads, "The capacity to endure is the key trait that underlies great performance in virtually every field—from a 100-meter sprint to a 100-mile ultramarathon, from summittin' Everest to *acing final exams or completing any difficult project*. But what if we all can go farther, push harder, and achieve more than we think we are capable of?" The italicized portion is a bit of a bait-and-switch. *Endure* doesn't even have a chapter on willpower; it sticks almost exclusively to endurance training – never really touching on how to "endure" anything that isn't related to exercise.

I'm not going to take any stars off because I have a strong feeling it had nothing to do with Hutchinson and everything to do with HarperCollins. They probably wanted to include *something* that was seemingly universal in the summary to draw more readers in. It worked. I'm not an endurance athlete. I picked it up for its more general message on human adversity.

But, if you couldn't care less about cardio, don't expect this to interest you.

Ron S says

An entertaining look at the latest research into human performance, from Arctic explorers to Nike's recent siege on the 2 hour marathon record. Introduction by Malcolm Gladwell.
