

Breath: The New Science Of A Lost Art (2020) - James Nestor

The Sunday Times Bestseller

**'If there's one book you read
this year, make it this one' Chris Evans**

**'Full of dazzling revelations'
Dr Rangan Chatterjee**

Breath

**THE NEW SCIENCE
OF A LOST ART**

JAMES NESTOR

'I highly recommend this book' Wim Hof



About James Nestor

James Nestor is a bestselling author and journalist who has written for and appeared in various outlets, publications, and podcasts throughout his career.

Blurb

There is nothing more essential to our health and wellbeing than breathing: take air in, let it out, repeat 25,000 times a day: Yet, as a species, humans have lost the ability to breathe correctly, with grave consequences. In *Breath*, journalist James Nestor travels the world to discover the hidden science behind ancient breathing practices, discovering that if we make even slight adjustments to the way we inhale and exhale, we can: **Jump-start athletic performance.**

Rejuvenate internal organs. Halt snoring, allergies, asthma and autoimmune disease. Straighten scoliotic spines. None of this should be possible, and yet it is. Drawing on thousands of years of ancient wisdom and cutting-edge studies in pulmonology, psychology, biochemistry and human physiology, *Breath* turns the conventional wisdom of what we thought we knew about our most basic biological function on its head.

[What follows are quotes from the book above. These quotes stood out to psychotherapist Emil Barna in his 2024 reading of the book. They are not meant to be exhaustive nor representative of the entire book. All quotes are to be read in this context and must not replace medical and/or other professional advice. Note: Any typographical errors occurred through the transcription process and do not reflect what may be found in the book.]

In transporting the breath, the inhalation must be full. When it is full, it has big capacity. When it has big capacity, it can be extended. When it is extended, it can penetrate downward. When it penetrates downward, it will become calmly settled. When it is calmly settled, it will be strong and firm. When it is strong and firm, it will germinate. When it germinates, it will grow. When it grows, it will retreat upward. When it retreats upward, it will reach the top of the head. The secret power of Providence moves above. The secret power of the Earth moves below. He who follows this will live. He who acts against this will die.

—500 BCE ZHOU DYNASTY STONE INSCRIPTION

Introduction

[Anybody can teach themselves to build their capacity to breathe, no matter their malady...]

*When most people go underwater in a pool they bail out at ten feet after just a few seconds, ears screaming. The freedivers told me they'd previously been "most people." Their transformation was a matter of training; they'd coaxed their lungs to work harder, to tap the pulmonary capabilities that the rest of us ignore. They insisted they weren't special. **Anyone in reasonable health willing to put in the hours could dive to 100, 200, even 300 feet. It didn't matter how old you were, how much you weighed, or what your genetic makeup was.** To freedive, they said, all anyone had to do was master the art of breathing. [emphasis mine—all bold emphases are mine unless obviously not]*

"This book is a scientific adventure into the lost art and science of breathing. It

explores the transformation that occurs inside our bodies every **3.3 seconds, the time it takes the average person to inhale and exhale**. It explains how the billions and billions of molecules you bring in with each breath have built your bones, sheaths of muscle, blood, brains, and organs, and the emerging science of how these microscopic bits will influence your health and happiness tomorrow, next week, next month, next year, and decades from now. I call this a "lost art" because so **many of these new discoveries aren't new at all**. Most of the techniques I'll be exploring have been around for hundreds, sometimes thousands, of years. They were created, documented, forgotten, and discovered in another culture at another time, then forgotten again. This went on for centuries."

Part One: THE EXPERIMENT

Chapter 1: The Worst Breathers In The Animal Kingdom

"Forty percent of today's population suffers from chronic nasal obstruction, and **around half of us are habitual mouthbreathers**, with females and children suffering the most. The causes are many: dry air to stress, inflammation to allergies, pollution to pharmaceuticals. But much of the blame, I'll soon learn, can be placed on the ever-shrinking real estate in the front of the human skull. When mouths don't grow wide enough, the roof of the mouth tends to rise up instead of out, forming what's called a V-shape or high-arched palate. The upward growth impedes the development of the nasal cavity, shrinking it and disrupting the delicate structures in the nose. The reduced nasal space leads to obstruction and inhibits airflow. Overall, **humans have the sad distinction of being the most plugged-up species on Earth**."

"When the nasal cavity gets congested, airflow decreases and bacteria flourish. These bacteria replicate and can lead to infections and colds and more congestion. Congestion begets congestion, which gives us no other option but to habitually breathe from the mouth."

"These are twice as large as they are today," she said in a staccato Ukrainian accent. She was pointing at the nasal apertures, the two holes that connect the sinuses to the back of the throat. She turned the skull around so it was staring at us. "So wide and pronounced," she said approvingly. Evans and her colleague Dr. Kevin Boyd, a Chicago-based pediatric dentist, have spent the last four years X-raying more than 100 skulls from the Morton Collection and measuring the angles from the top of the ear to the nose and from the forehead to the chin. Every one of the ancient skulls was identical to the Parse sample. They all had enormous forward-facing jaws. They had expansive sinu cavities and broad mouths. And, bizarrely, even **though none of the ancient people ever flossed, or brushed, or saw a dentist, they all had straight teeth**."

Of the 5,400 different species of mammals on the planet, humans are now the only ones to routinely have misaligned jaws, overbites, under-bites, and snagged teeth,

"The innovation of mashing and cooking food [...] had consequences. The quickly growing brain needed space to stretch out, and it took it from the front of our faces, home to sinuses, mouths, and air-ways. Over time, muscles at the center of the face loosened, and bones in the jaw weakened and grew thinner. The face shortened and the mouth shrank, leaving behind a bony protuberance that replaced the squashed snout of our ancestors. This new feature was ours alone and distinguished us from other primates: the protruding nose. The problem was that this smaller, vertically positioned nose was less efficient at filtering air, and it exposed us to more airborne pathogens and bacteria. The smaller sinuses and mouth also reduced space in our throats. **The more we cooked, the more soft, calorie-rich food we consumed, the larger our brains grew and the tighter our airways became.**"

"In colder climates, our noses would grow narrower and longer to more efficiently heat up air before it entered our lungs; our skin would grow lighter to take in more sunshine for production of vitamin D. In sunny and warm environments, we adapted wider and flatter noses, which were more efficient at inhaling hot and humid air; our skin would grow darker to protect us from the sun."

[**Footnote:** Pugs, mastiffs, boxers, and other **brachycephalic dogs** have been bred to have flat faces and smaller sinus cavities, and, as such, suffer from a similar range of chronic respiratory problems. In many ways, modern humans have become the Homo equivalent of these highly inbred dogs.]

[Nestor put himself through an experiment of fully congesting his nose so he could ONLY breathe through his mouth. Here are the consequences...]

"**Inflammation in the throat and polyps both contribute to snoring and sleep apnea. Nasal obstruction triggers this nighttime choking as well,** but nobody knows how quickly the damage comes on, or how severe it might become. Before now, nobody had tested it. Last night, in my first run of self-inflicted nasal obstructed sleeping, my snoring increased by 1,300 percent, to 75 minutes through the night. Olson's [a colleague he did this experiment with] numbers were even worse. He went from zero to four hours, ten minutes. I'd also suffered a fourfold increase in sleep apnea events. All this, in just 24 hours."

Chapter 2: Mouthbreathing

"My blood pressure has spiked by an average of 13 points from where it was before the test, which puts me deep into stage 1 hypertension. If left

unchecked, this state of chronically raised blood pressure, also shared by a third of the U.S. population, can cause heart attacks, stroke, and other serious problems. Meanwhile, my heart rate variability, a measure of nervous system balance, has plummeted, suggesting that my body is in a state of stress. Then there's my pulse, which has increased, and my body temperature, which has decreased, and my mental clarity, which has hit rock bottom."

"Simply training yourself to breathe through your nose [...] could cut total exertion in half and offer huge gains in endurance. The athletes felt invigorated while nasal breathing rather than ex-hausted."

"Finding the best heart rate for exercise is easy: subtract your age from 180. The result is the maximum your body can withstand to stay in the aerobic state. Long bouts of training and exercise can happen below this rate but never above it, otherwise the body will risk going too deep into the anaerobic zone for too long. Instead of feeling invigorated and strong after a workout, you'd feel tired, shaky, and nauseated."

[The differences between mouth- and nosebreathing]

Mouthbreathing, it turns out, changes the physical body and transforms airways, all for the worse. Inhaling air through the mouth decreases pressure, which causes the soft tissues in the back of the mouth to become loose and flex inward, creating less space and making breathing more difficult.

Mouthbreathing begets more mouthbreathing. Inhaling from the nose has the opposite effect. It forces air against all those flabby tissues at the back of the throat, making the airways wider and breathing easier. After a while, these tissues and muscles get "toned" to stay in this opened and wide position. ***Nasal breathing begets more nasal breathing.***

"My snoring has increased 4,820 percent from ten days ago. For the first time that I'm aware of, I'm beginning to suffer from obstructive sleep apnea. At my worst, I've averaged 25 "apnea events," meaning I was choking so severely that my oxygen levels dropped to 90 percent or below. [...] **Mouthbreathing causes the body to lose 40 percent more water.** I felt this all night, every night, waking up constantly parched and dry. You'd think this moisture loss would decrease the need to urinate, but, oddly, the opposite was true."

"There are several books that describe the horrendous health effects of snoring and sleep apnea. They explain how these afflictions lead to bed-wetting, attention deficit hyperactivity disorder (ADHD), diabetes, high blood pressure, cancer, and so on. I'd read a report from the Mayo Clinic which found that **chronic insomnia, long assumed to be a psychological problem, is often a breathing problem.**"

[On the effects of mouthbreathing and the prefrontal cortex]

mouthbreathing delivered a disturbance of oxygen to the prefrontal cortex, the area of the brain associated with ADHD. Nasal breathing had no such effects.

"Ninety percent of children have acquired some degree of deformity in their mouths and noses. Forty-five percent of adults snore occasionally, and a quarter of the population snores constantly. Twenty-five percent of American adults over 30 choke on themselves because of sleep apnea; and an estimated 80 percent of moderate or severe cases are undiagnosed. Meanwhile, the majority of the population suffers from some form of breathing difficulty or resistance."

Part Two: THE LOST ART AND SCIENCE OF BREATHING

Chapter 3: Nose

"The nose is crucial because it clears air, heats it, and moistens it for easier absorption. Most of us know this. But what so many people never consider is the noses unexpected role in problems like **erectile dysfunction**. Or how it can trigger a cavalcade of hormones and chemicals that lower blood pressure and ease digestion. How it responds to the stages of a woman's menstrual cycle. How it regulates our heart rate, opens the vessels in our toes, and stores memories. How the density of your nasal hairs helps determine whether you'll suffer from **asthma**."

[The following finding is odd ... to say the least.]

*The interior of the nose, it turned out, is blanketed with erectile tissue, the same flesh that covers the penis, clitoris, and nipples. **Noses get erections.** Within seconds, they too can engorge with blood and become large and stiff. This happens because the nose is more intimately connected to the genitals than any other organ; when one gets aroused, the other responds. The mere thought of sex for some people causes such severe bouts of nasal erections that they'll have trouble breathing and will start to sneeze uncontrollably, an inconvenient condition called "honeymoon rhinitis." As sexual stimulation weakens and erectile tissue becomes flaccid, the nose will, too.*

"The right nostril is a gas pedal. When you're inhaling primarily through this channel, circulation speeds up, your body gets hotter, and cortisol levels, blood pressure, and heart rate all increase. This happens because **breathing through the right side of the nose activates the sympathetic nervous system, the "fight or flight" mechanism that puts the body in a more elevated state of alertness and readiness.** Breathing through the right nostril will also feed more blood to the opposite hemisphere of the brain, specifically to the prefrontal cortex, which has been associated with logical decisions, language,

and computing. Inhaling through the left nostril has the opposite effect: it works as a kind of brake system to the right nostril's accelerator. **The left nostril is more deeply connected to the parasympathetic nervous system**, the rest-and-relax side that lowers blood pressure, cools the body, and reduces anxiety. Left-nostril breathing shifts blood flow to the opposite side of the prefrontal cortex, to the area that influences creative thought and plays a role in the formation of mental abstractions and the production of negative emotions."

[Alternate nasal breathing exercise]

"It involves placing an index finger over the left nostril and then inhaling and exhaling only through the right. I did this two dozen times after each meal today, to heat up my body and aid my digestion. Before meals, and any other time I wanted to relax, I'd switch sides, repeating the same exercise with my left nostril open. To gain focus and balance the body and mind, I followed a technique called surya beda pranayama, which involves taking one breath into the right nostril, then exhaling through the left for several rounds."

[The breathing practices of Native Americans]

it wasn't until the nineteenth century that the Western population ever considered the glories of nasal breathing. It happened thanks to an adventurous artist and researcher named George Catlin. [... He] document[ed] the lives of 50 Native American tribes. He went up the Missouri to live with the Lakota Sioux. He met with the Pawnee, Omaha, Cheyenne, and Blackfeet. Along the banks of the Upper Missouri, he happened upon the civilization of the Mandan, a mysterious tribe whose members stood six feet tall and lived in bubble-shaped houses. Many had luminous blue eyes and snow-white hair. [...] Catlin marveled at the fact that all 50 tribes seemed to share the same superhuman physical characteristics. In some groups, such as the Crow and the Osage, Catlin wrote there were few men, "at their full growth, who are less than six feet in stature, and very many of them six and a half, and others seven feet." They all seemed to share a Herculean make of broad shoulders and barrel chests. The women were nearly as tall and just as striking. Having never seen a dentist or doctor, the tribal people had teeth that were perfectly straight—"as regular as the keys of a piano," Catlin noted. **Nobody seemed to get sick, and deformities and other chronic health problems appeared rare or nonexistent.** The tribes attributed their vigorous health to a medicine, what Catlin called the "great secret of life." **The secret was breathing.** The Native Americans explained to Catlin that breath inhaled through the mouth sapped the body of strength, deformed the face, and caused stress and disease. On the other hand, **breath inhaled through the nose kept the body strong, made the face beautiful, and prevented disease.** "The air which enters the lungs is as different from that which enters the nostrils as distilled water is different from the water in an ordinary cistern or a frog-pond," he wrote. Healthy nasal breathing started at birth. **Mothers in all these tribes followed the same practices, carefully closing the baby's lips with their fingers**

after each feeding. At night, they'd stand over sleeping infants and gently pinch mouths shut if they opened. Some Plains tribes strapped infants to a straight board and placed a pillow beneath their heads, creating a posture that made it much harder to breathe through the mouth. During winter, infants would be wrapped in light clothing and then held at arm's length on warmer days so they'd be less prone to get too hot and begin panting. All these methods trained children to breathe through their noses, all day, every day. It was a habit they would carry with them the rest of their lives. Catlin described how adult tribal members would even resist smiling with an open mouth, fearing some noxious air might get in. This practice was as "old and unchangeable as their hills" he wrote, and it was shared universally throughout the tribes for millennia.

[On the importance of nitric oxide]

"The health benefits of nose breathing are undeniable" [Dr Mark Burhenne—specialist studying the impacts of mouthbreathing on sleep] told me. One of the many benefits is that **the sinuses release a huge boost of nitric oxide, a molecule that plays an essential role in increasing circulation and delivering oxygen into cells. Immune function, weight, circulation, mood, and sexual function can all be heavily influenced by the amount of nitric oxide in the body,** ([...] Viagra works by releasing nitric oxide into the bloodstream, which opens the capillaries in the genitals and elsewhere.) **Nasal breathing alone can boost nitric oxide sixfold, which is one of the reasons we can absorb about 18 percent more oxygen than by just breathing through the mouth. Mouth taping, Burhenne said, helped a five-year-old patient of his overcome ADHD, a condition directly attributed to breathing difficulties during sleep.**

"The whole thing seemed a little sketchy until Ann Kearney, a doctor of speech-language pathology [...] told me the same. Kearney helped rehabilitate patients who had swallowing and breathing disorders. She swore by mouth taping. Kearney herself had spent years as a mouthbreather due to chronic congestion. She visited an ear, nose, and throat specialist and discovered that her nasal cavities were blocked with tissue. The specialist advised that the only way to open her nose was through surgery or medications. She tried mouth taping instead. "The first night, I lasted five minutes before I ripped it off," she told me. On the second night, she was able to tolerate the tape for ten minutes. A couple of days later, she slept through the night. Within six weeks, her nose opened up. "Tis a classic example of use it or lose it" Kearney said."

"To me, these methods are ridiculous and excessive. Looking for an easier way, over the last few days I conducted my own experiments with blue painter's tape, which smelled weird, and Scotch tape, which crinkled. Band-Aids were too sticky. **Eventually I realized that all I or anyone really needed was a postage-stamp-size piece of tape at the center of the lips—a Charlie Chaplin mustache moved down an inch.** That's it. This approach felt less

claustrophobic and allowed a little space on the sides of the mouth if I needed to cough or talk. After much trial and error, I settled on **3M Nexcare Durapore** "durable cloth" tape, an all-purpose surgical tape with a gentle adhesive. It was comfortable, had no chemical scent, and didn't leave residue. **In the three nights since I started using this tape, I went from snoring four hours to only ten minutes.** I'd been warned by Burhenne that sleep tape won't do anything to help treat sleep apnea. My experience suggested otherwise. As my snoring disappeared, so did apnea."

Chapter 4: Exhale

"data from 5,200 subjects, crunched the numbers, and discovered that the greatest indicator of life span wasn't genetics, diet, or the amount of daily exercise, as many had suspected. It was lung capacity. The smaller and less efficient lungs became, the quicker subjects got sick and died. The cause of deterioration didn't matter. Smaller meant shorter. But **larger lungs equaled longer lives.** Our ability to breathe full breaths was, according to the researchers,"literally a measure of living capacity.""

"Any regular practice that stretches the lungs and keeps them flexible can retain or increase lung capacity. Moderate exercise like walking or cycling has been shown to boost lung size by up to 15 percent."

*These discoveries would have been welcome news to Katharina Schroth, a teenager who lived in Dresden, Germany, in the early 1900s. Schroth had been diagnosed with scoliosis, a sideways curvature of the spine. The condition had no cure, and most children who suffered from extreme cases like Schroth's could expect to spend a life in bed or rolling around in a wheelchair. At age 16, Schroth began training herself in something called "**orthopedic breathing.**" She would stand in front of a mirror, twist her body, and inhale into one lung while limiting air intake to the other. Then shed hobble over to a table, sling her body on its side, and arch her chest back and forth to loosen her rib cage while breathing into the empty space. Schroth spent five years doing this. At the end, shed effectively cured herself of "incurable" scoliosis; shed breathed her spine straight again.*

"As we inhale, negative pressure draws blood into the gear; as we exhale, blood shoots back out into the body and lungs, where it recirculates. It's similar to the way the ocean floods into shore, then ebbs out."

"A typical adult engages as little as 10 percent of the range of the diaphragm when breathing, which overburdens the heart, elevates blood pressure, and causes a rash of circulatory problems. **Extending those breaths to 50 to 70 percent of the diaphragm's capacity will ease cardiovascular stress** and allow the body to work more efficiently. For this reason, **the diaphragm is sometimes referred to as "the second heart," because it not only beats to its own rhythm but also affects the rate and strength of the heartbeat.**"

"Before-and-after X-rays showed that **Stough's patients were vastly expanding their lung capacity in only a few weeks**. Even more stunning, they were training an involuntary muscle—the diaphragm—to lift higher and drop lower. Administrators told Stough that this was medically impossible; internal organs and muscles cannot be developed, they said. At one point, several doctors petitioned to ban Stough from treating patients and kick him out of the hospital system. Stough was a choral teacher, not a doctor, after all. But the X-rays didn't lie. To confirm his results, Stough began recording the first footage of a moving diaphragm, using a new X-ray film technology called cinefluorography. Everyone was floored."

"This is not a massage," [Lynn] Martin [professor of functional anatomy and body management] said, making her point clear as she pressed a hand against my ribs. I drew soft and long breaths deep into my gut while Martin helped loosen my rib cage, trying to coax at least 50 percent of my maximum diaphragm movement with each inhale and exhale. Breathing this way wasn't necessary, Martin told me. **Our bodies can survive on short and clipped breaths for decades, and many of us do. That doesn't mean it's good for us. Over time, shallow breathing will limit the range of our diaphragms and lung capacity and can lead to the high-shouldered, chest-out, neck-extended posture common in those with emphysema, asthma, and other respiratory problems.** Fixing this breathing and this posture, she told me, was relatively easy. After several rounds of deep breaths to open my rib cage, Martin asked me to start counting from one to ten over and over with every exhale. "1, 2, 3, 4, 5, 6, 7, 8, 9, 10; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10—then keep repeating it" she said. At the end of the exhale, when I was so out of breath I couldn't vocalize anymore, I was to keep counting, but to do so silently, letting my voice trail down into a "sub-whisper." [...] After a few more minutes of counting, silent and otherwise, I stopped and took a break and felt my diaphragm chugging away like a piston in slow motion, radiating fresh blood from the center of my body. This is the feeling of what Stough called "**Breathing Coordination**," [cf. **conference breathing** exercise] when the respiratory and circulatory systems enter a state of equilibrium, when the amount of air that enters us equals the amount that leaves, and our bodies are able perform all their essential functions with the least exertion."

Chapter 5: Slow

"[Anders] Olsson [Swedish businessman turned breath aficionado, of whom accompanied Nestor in his breath travels and experiments at the beginning] claimed that **we have 100 times more carbon dioxide in our bodies than oxygen** (which is true), and that **most of us need even more of it** (also true). He said it wasn't just oxygen but huge quantities of carbon dioxide that fostered the burst of life during the Cambrian Explosion 500 million years ago. He said that, **today, humans can increase this toxic gas in our bodies and sharpen our minds, burn fat, and, in some cases, heal disease.** [...] Olsson

[...] insisted that carbon dioxide could be beneficial, and he warned me that too much oxygen in my body wouldn't help me but hurt me. "Breathing heavy, breathing quickly and as deeply as you can—I realized this is the worst advice anyone could give you," Olsson told me. **Big, heavy breaths were bad for us because they depleted our bodies of, yes, carbon dioxide.**"

""Until the seventeenth century most of the great physicians and anatomists were interested in the respiratory muscles and the mechanics of breathing. Since then these muscles have been increasingly neglected, lying as they do in a no-man's land between anatomy and physiology.""

*As blood passes through tissues and muscles, oxygen will disembark, providing fuel to hungry cells. As oxygen offloads [...] carbon dioxide—the "waste product" of metabolism—will pile [on ...] Blood will grow darker as oxygen leaves. [...] carbon dioxide will exit the body through the alveoli, up the throat, and out the mouth and nose in an exhale. More oxygen boards in the next breath and the process starts again. Every healthy cell in the body is fueled by oxygen [...] There's nothing controversial about this process of respiration and the role of carbon dioxide in gas exchange. It's basic biochemistry. What's less acknowledged is the role carbon dioxide plays in weight loss. That carbon dioxide in every exhale has weight, and we exhale more weight than we inhale. And the way the body loses weight isn't through profusely sweating or "burning it off." We lose weight through exhaled breath. **For every ten pounds of fat lost in our bodies, eight and a half pounds of it comes out through the lungs; most of it is carbon dioxide mixed with a bit of water vapor.** The rest is sweated or urinated out. This is a fact that most doctors, nutritionists, and other medical professionals have historically gotten wrong. The lungs are the weight-regulating system of the body. [...] **What our bodies really want, what they require to function properly, isn't faster or deeper breaths. It's not more air. What we need is more carbon dioxide.**"*

"Blood with the most carbon dioxide in it (more acidic) loosened oxygen from hemoglobin. [...] This discovery explained why **certain muscles used during exercise** received more oxygen than lesser-used muscles. They **were producing more carbon dioxide, which attracted more oxygen.** It was supply on demand, at a molecular level. **Carbon dioxide also had a profound dilating effect on blood vessels, opening these pathways so they could carry more oxygen-rich blood to hungry cells. Breathing less allowed animals to produce more energy, more efficiently. Meanwhile, rapid and panicked breaths would purge carbon dioxide.** Just a few moments of heavy breathing above metabolic needs could cause reduced blood flow to muscles, tissues, and organs. We feel light-headed, cramp up, get a headache, or even black out. If these tissues were denied consistent blood flow for long enough, they'd break down."

"For a healthy body, overbreathing or inhaling pure oxygen would have no benefit, no effect on oxygen delivery to our tissues and organs, and could

actually create a state of oxygen deficiency, leading to relative suffocation."

"pure oxygen is only useful for those at altitude (where oxygen levels in the air are decreased) or those who are so sick that they cannot retain healthy oxygen saturation levels (above roughly 90 percent) through normal breathing. But **even for sick patients, long-term supplemental oxygen can eventually damage the lungs and decrease red blood cell counts, making it harder for the body to pull oxygen from breath in the future.**"

*"Carbon dioxide is the chief hormone of the entire body; it is the only one that is produced by every tissue and that probably acts on every organ," [the late Yandell] Henderson [director of the Laboratory of Applied Physiology at Yale] later wrote. **"Carbon dioxide is, in fact, a more fundamental component of living matter than is oxygen."***

"when breathing at a normal rate [meaning, typical rate of breathing: ~12-18 breaths/min], our lungs will absorb only about a quarter of the available oxygen in the air. The majority of that oxygen is exhaled back out. **By taking longer breaths, we allow our lungs to soak up more in fewer breaths.**"

"I started playing around with my breathing. I tried to inhale and exhale slower and slower, from my usual exercising rate of 20 breaths a minute to just six. I immediately felt a sense of air hunger and claustrophobia. After a minute or so I looked down at the pulse oximeter to see how much oxygen I was losing, how starved my body had become. But my oxygen hadn't decreased with these very slow breaths, as I or anyone else might expect. My levels *rose*."

"Whenever [one] followed this slow breathing pattern, **blood flow to the brain increased and the systems in the body entered a state of coherence, when the functions of heart, circulation, and nervous system are coordinated to peak efficiency.** The moment the subjects returned to spontaneous breathing or talking, their hearts would beat a little more erratically, and the integration of these systems would slowly fall apart."

Chapter 6: Less

"Rates of breathing are [...] difficult to gauge, because there are fewer studies and the results are inconsistent. Nonetheless, a review of several available studies offers a troubling picture. **What's considered medically normal today is anywhere between a dozen and 20 breaths a minute,** with an average intake of about half a liter per breath. For those on the high end of respiratory rates, that's about twice as much as it was."

[**Endnote:** The breathing rate for an average male, according to a study in the 1930s, used to be about 13 times a minute for a total of 5.25 liters of air. By the 1940s, the rate of breathing hovered a bit over 10 breaths a minute for a total of 8 liters. By the 1980s and 1990s, several studies placed the mean breathing

rate at closer to 10 to 12 breaths per minute, with a total volume, in some cases, that rose to 9 liters and higher. I discussed this with Dr. Don Storey, a prominent pulmonologist who'd worked in the field for more than 40 years (and who is my father-in-law). He told me that when he was first starting out, the normal respiratory rate was about 8 to 12 breaths a minute. The high end of that rate is nearly doubled today. Beyond the anecdotes, dozens of studies suggest we could indeed be breathing more than we used to. Most studies compare subjects with respiratory illnesses against healthy controls. It's the data from the healthy controls that was used for this assessment. Several studies were discovered in Artour Rakhimov's book *Breathing Slower and Less: The Greatest Health Discovery Ever* (self-published, 2014). Those studies that could be independently verified were included. I will continue to gather research in this area and post on my website mrjamesnestor.com/breath. In the meantime, here are several studies: N. W. Shock and M. H. Soley, "Average Values for Basal Respiratory Functions in Adolescents and Adults," *Journal of Nutrition* 18 (1939): 143-53; Harl W. Matheson and John S. Gray, "Ventilatory Function Tests. III. Resting Ventilation, Metabolism, and Derived Measures," *Journal of Clinical Investigation* 29, no. 6 (1950): 688-92; John Kassabian et al., "Respiratory Center Output and Ventilatory Timing in Patients with Acute Airway (Asthma) and Alveolar (Pneumonia) Disease," *Chest* 81, no. 5 (May 1982): 536-43; J. E. Clague et al., "Respiratory Effort Perception at Rest and during Carbon Dioxide Rebreathing in Patients with Dystrophia Myotonica," *Thorax* 49, no. 3 (Mar. 1994): 240-44; A. Dahan et al., "Halothane Affects Ventilatory after Discharge in Humans," *British Journal of Anaesthesia* 74, no. 5 (May 1995): 544-48; N. E. L. Meessen et al., "Breathing Pattern during Bronchial Challenge in Humans," *European Respiratory Journal* 10, no. 5 (May 1997): 1059-63.]

"Indian yogis train themselves to decrease the amount of air they take in at rest, not increase it. Tibetan Buddhists prescribed step-by-step instructions to reduce and calm breathing for aspiring monks. Chinese doctors two thousand years ago advised 13,500 breaths per day, which works out to nine and a half breaths per minute. They likely breathed less in those fewer breaths. **In Japan, legend has it that samurai would test a soldier's readiness by placing a feather beneath his nostrils while he inhaled and exhaled. If the feather moved, the soldier would be dismissed.** To be clear, breathing less is not the same as breathing slowly. Average adult lungs can hold about four to six liters of air. Which means that, even if we practice slow breathing at 5.5 breaths per minute, we could still be easily taking in twice the air we need. **[This confuses me... Does he mean the effort of breathing—so that it isn't forced—is the key here? Think Japanese samurai...]** The key to optimum breathing, and all the health, endurance, and longevity benefits that come with it, is to practice fewer inhales and exhales in a smaller volume. To breathe, but to *breathe less*."

[In the context of running...]

Each breath we draw in should take about three seconds, and each breath out

should take four. We'll then continue the same short inhales while lengthening the exhales to a five, six, and seven count as the run progresses. **Slower, longer exhales [...] mean higher carbon dioxide levels. With that bonus carbon dioxide, we gain a higher aerobic endurance.** This measurement of highest oxygen consumption, called **VO2 max**, is the **best gauge of cardiorespiratory fitness**. Training the body to breathe less actually increases VO2 max, which can not only boost athletic stamina but also help us live longer and healthier lives.

"What if overbreathing wasn't the result of hypertension and headaches but the cause? Buteyko [Soviet physician and the creator of the **Buteyko method** for the treatment of asthma and other breathing disorders] wondered. Heart disease, ulcers, and chronic inflammation were all linked to disturbances in circulation, blood pH, and metabolism. How we breathe affects all those functions. **Breathing just 20 percent, or even 10 percent more than the body's needs could overwork our systems.** Eventually, they'd weaken and falter. Was breathing too much making people sick, and keeping them that way?"

"By the late 1950s, Buteyko left the hospitals of Moscow and headed to Akademgorodok ("Academic City"), a cluster of 35 concrete-block research facilities located in central Siberia. The distant location was by design. For the past few years, the Soviet government had sent tens of thousands of the finest space engineers, chemists, physicists, and others to live in secrecy among the laboratories. Their job was to develop cutting-edge technologies aimed at ensuring the Soviet Union's dominance. In many ways it was a Soviet Silicon Valley, but without the fleece vests, kombucha, sunshine, Teslas, and civil liberties. Buteyko had moved there at the request of the USSR Academy of Medical Sciences, the Soviet equivalent to the Centers for Disease Control and Prevention. After his epiphany in the asthma ward, he pored over research papers and analyzed hundreds of patients. **He'd become convinced that breathing too much was the culprit behind several chronic diseases.** Like Bohr and Henderson, **Buteyko was fascinated with carbon dioxide, and he too believed that increasing this gas by breathing less could not only keep us fit and healthy. It could heal us as well.**"

"Buteyko trained his patients [to breathe less, which] offered huge benefits [for athletes]. If athletes kept at it for several weeks, their **muscles adapted to tolerate more lactate accumulation, which allowed their bodies to pull more energy during states of heavy anaerobic stress, and, as a result, train harder and longer.** Other reports showed **hypoventilation training provided a boost in red blood cells, allowing athletes to carry more oxygen and produce more energy with each breath.**"

"it starts to hit me: an intense heat at the back of my neck and pixelated vision. I'm still jogging, exhaling long breaths, but it feels as though I'm simultaneously jumping headfirst into warm, thick liquid. I run a little harder, breathe a little less, and feel heat, heavy like hot syrup, seeping down into my fingertips, toes,

arms, and legs. It feels great. The warmth moves higher through my face and wraps around the crown of my head. This must be the *good headache* Olsson was talking about, of **carbon dioxide increasing and oxygen dislodging from hemoglobin to those hungry cells**, of the **vessels in my brain and body expanding, so engorged with fresh blood that they're sending dull pain signals to my nervous system.**"

"When we breathe too much, we expel too much carbon dioxide, and our blood pH rises to become more alkaline; when we breathe slower and hold in more carbon dioxide, pH lowers and blood becomes more acidic."

"Mammals with the lowest resting heart rates live the longest. And it's no coincidence that these are consistently the same mammals that breathe the slowest. The only way to retain a slow resting heart rate is with slow breaths. This is as true for baboons and bison as it is for blue whales and us. "The yogi's life is not measured by the number of his days, but the number of his breaths," wrote B. K. S. Iyengar, an Indian yoga teacher who had spent years in bed as a sickly child until he learned yoga and breathed himself back to health. He died in 2014, at age 95. [...] Buteyko and the Catholics, Buddhists, Hindus, and 9/11 survivors [...] discovered that the optimum amount of air we should take in at rest per minute is 5.5 liters. **The optimum breathing rate is about 5.5 breaths per minute.** That's 5.5-second inhales and 5.5-second exhales. This is **the perfect breath.**"

Chapter 7: Chew

[A comparison between cultures with strong breathing and those without...]

*Societies that replaced their traditional diet with modern, processed foods suffered up to ten times more cavities, severely crooked teeth, obstructed airways, and overall poorer health. The modern diets were the same: white flour, white rice, jams, sweetened juices, canned vegetables, and processed meats. The traditional diets were all different. In Alaska, [Weston Price, dentist] found communities who ate seal meat, fish, lichen, and not much else. Deep inside Melanesian islands he found tribes whose meals consisted of pumpkins, pawpaws, coconut crabs, and sometimes long pigs (humans). He flew to Africa to study the nomadic Maasai, who subsisted mostly on cow's blood, some milk, a few plants, and a bite of steak. Then he traveled to Central Canada and studied indigenous tribes who suffered through winters when the temperature, according to Price's notes, could reach 70 degrees below zero and whose only food was wild animals. Some cultures ate nothing but meat, while others were mostly vegetarian. Some relied primarily on homemade cheese; others consumed no dairy at all. Their teeth were almost always perfect; their mouths were exceptionally wide, nasal apertures broad. They suffered few, if any, cavities and little dental disease. Respiratory diseases such as asthma or even tuberculosis, Price reported, were practically nonexistent. **While the foods in***

these diets varied, they all contained the same high amounts of vitamins and minerals: from one and a half to 50 times that of modern diets. All of them. Price became convinced that the cause of our shrinking mouths and obstructed airways was deficiencies not of just D or C but all essential vitamins. Vitamins and minerals, he discovered, work in symbiosis; one needs the others to be effective. This explained why supplements could be useless unless they're in the presence of other supplements. We needed all these nutrients to develop strong bones throughout the body, especially in the mouth and face.

"The problem had less to do with what we were eating than how we ate it. ***Chewing. It was the constant stress of chewing that was lacking from our diets—not vitamin A, B, C, or D.*** Ninety-five percent of the modern, processed diet was soft. Even what's considered healthy food today—smoothies, nut butters, oatmeal, avocados, whole wheat bread, vegetable soups. It's all soft. **Our ancient ancestors chewed for hours a day, every day. And because they chewed so much, their mouths, teeth, throats, and faces grew to be wide and strong and pronounced. Food in industrialized societies was so processed that it hardly required any chewing at all."**

"About **three-quarters of modern humans have a deviated septum** clearly visible to the naked eye, which means the bone and cartilage that separate the right and left airways of the nose are off center. Along with that, **50 percent of us have chronically inflamed turbinates**; the erectile tissue lining our sinuses is too puffed up for us to breathe comfortably through our noses. **Both problems can lead to chronic breathing difficulties and an increased risk of infections. Surgery is highly effective** in straightening or reducing these structures, but [must] be done carefully and conservatively. The nose, after all, is a wondrous, ornate organ whose structures work as a tightly controlled system. [...] If surgeons drill out or remove too much tissue, especially the turbinates, the nose can't effectively filter, humidify, clean, or even sense inhaled air. For this small and unfortunate group of patients, each breath comes in too quickly, a hideous condition called **empty nose syndrome."**

"This can be especially effective for children: 50 percent of kids with ADHD were shown to no longer have symptoms after having their adenoids and tonsils removed. But these effects can also be fleeting. Years after having tonsils removed, children can develop obstructions in the airways and all the problems that come with it. This is because neither adenoid/tonsil removal nor CPAP nor other procedures provide a satisfying long-term solution, because none deals with the core issue: a mouth that is too small for the face."

"[Dental specialist, John Mew, explained] the first step to improving airway obstruction wasn't orthodontics but instead involved maintaining correct "oral posture." Anyone could do this, and it was free. It just meant holding the lips together, teeth lightly touching, with your tongue on the roof of the mouth. **Hold the head up perpendicular to the body and don't kink the neck. When sitting or standing, the spine should form a J-shape-perfectly straight**

until it reaches the small of the back, where it naturally curves outward.

While maintaining this posture, we should always breathe slowly through the nose into the abdomen. [...] most people have shoulders hunched forward, neck extended outward, and an S-shaped spine. [...] By day, we unconsciously attempt to open our obstructed airways by sloping our shoulders, craning our necks forward, and tilting our heads up. [...] Our bodies hate this position. The weight of the sloping head stresses the back muscles, leading to back pain; the kink in our necks adds pressure to the brain stem, triggering headaches and other neurological problems; the tilted angle of our faces stretches the skin down from the eyes, thins the upper lip, pulls flesh down on the nasal bone."

[Regarding Mew's tongue-thrusting exercises...]

*[These] can train us out of the "death pose" and make breathing easier. The tongue is a powerful muscle. If its force is directed at the teeth, it can throw them out of alignment; if it's directed at the roof of the mouth [...] This exercise ['mewing'] might help expand the upper palate of the mouth and open up the airways. [...] It's difficult to convey mewing without seeing it, but the gist is to **push the back of the tongue against the back roof of the mouth and move the rest of the tongue forward, like a wave, until the tip hits just behind the front teeth.** I tried it a few times. It felt awkward, like I was holding back vomit.*

[Regarding breastfeeding...]

The more we gnaw, the more stem cells release, the more bone density and growth we'll trigger, the younger we'll look and the better we'll breathe.

*It starts at infancy. The chewing and sucking stress required for breastfeeding exercises the masseter and other facial muscles and stimulates more stem cell growth, stronger bones, and more pronounced airways. Until a few hundred years ago, mothers would breastfeed infants up to two to four years of age, and sometimes to adolescence. **The more time infants spent chewing and sucking, the more developed their faces and airways would become, and the better they'd breathe later in life.** Dozens of studies in the past two decades have supported this claim. **They've shown lower incidence of crooked teeth and snoring and sleep apnea in infants who were breastfed longer over those who were bottle-fed.***

"James Sim Wallace, a renowned Scottish doctor and dentist, published several books about the deleterious effects of soft foods on our mouths and breathing.

"An early soft diet prevents the development of the muscle fibers of the tongue," he wrote more than a century ago, **"resulting in a weaker tongue which [cannot] drive the primary dentition out into a spaced relationship with fully developed arches which will lead to more crowding of the permanent teeth."** Wallace's contemporaries began taking measurements of patients' mouths and comparing them to skulls that dated to before the Industrial Revolution. The palates of the ancient skulls measured an average of

2.37 inches. By the late nineteenth century, mouths had shrunk to 2.16 inches. No one was disputing these observations. "That **the human jaw is gradually becoming smaller is a fact which is universally recognized**," Wallace noted. That didn't stop this research from being ignored for the next hundred years."

*Today, the official website of the U.S. National Institutes of Health attributes the causes of crooked teeth and other deformations of the airway "most often to heredity." Other causes include thumb-sucking, injury, or "tumors of the mouth and jaw." **There is no mention of chewing; no mention of food at all.***

Part Three: BREATHING+

Chapter 8: More, On Occasion

"Pulmonary medicine has many scary names for what these more extreme techniques can do to the body and mind: respiratory acidosis, alkalosis, hypocapnia, sympathetic nervous system overload, extreme apnea. Under normal circumstances, these conditions are considered damaging and would require medical care. But something else happens **when we practice these techniques willingly**, when we consciously push our bodies into these states for a few minutes, or hours, a day. In some cases, **they can radically transform lives.**"

[On the PTSD(?) of the Civil War ... and on breathing...]

*As unlikely as it sounds, Civil War battlefields are where the first Breathing+ technique began. It was 1862 and Jacob Mendez Da Costa had just arrived at Turner's Lane Hospital in Philadelphia. The Union Army had suffered a humiliating ing defeat at Fredericksburg, Virginia, where twelve hundred men had been killed and more than 9,000 wounded. Soldiers were laid out in the hallways, bruised and bleeding on rows of cots, missing ears, fingers, arms, and legs. **Even those who hadn't seen military action were falling apart. They came into the hospital in droves, complaining of anxiety and paranoia, headaches, diarrhea, dizziness, and shooting pain in their chests. They sighed a lot. When the men tried to breathe, they'd huff and huff, but would never feel like they could catch a breath.*** These men showed no signs of physical damage; they had spent weeks or months preparing for battle but never saw any action. Nothing had happened to them. And yet each was incapacitated, hobbling beneath the whitewashed walls of the hospital, past the rows of screaming and suffering amputees, trying to find their way into Da Costa's care. Da Costa was [...] arenowned expert in the maladies of the heart and had treated scores of men with myriad ailments. But he'd never seen anything like the soldiers at Turner's Lane. He started the examinations by lifting the men's shirts and placing a stethoscope to their chests. **The soldiers' heartbeats were manic, thumping up to 200 beats per minute, even**

though they were sitting still. Some breathed 30 or more times a minute, double the normal pace. One typical patient was William C., a 21-year-old farmer who, after deployment, developed vicious diarrhea and a bluish tint to his hands. He complained of breathlessness. Henry H. had identical symptoms and shared William C's skinny build, with a narrow chest and a stooped spine. He too had enlisted in good health, then, without explanation, was immobilized. "The man did not look sick," wrote Da Costa. But his heart rate was "of irregular rhythm, some beats following each other in rapid succession." Hundreds of men would come to see Da Costa over the next few years, with the same cluster of complaints, the same backstory. Da Costa would call the malady **Irritable Heart Syndrome**. [...] the symptoms came on, and then they would disappear. **A few days, weeks, or months of rest and relaxation, and heartbeats would soften, digestive problems would abate.** The men became normal again and they'd breathe normally again, too. Most would be sent back to war. The few still suffering would be placed in the "invalid corps" or shipped home to deal with the syndrome for the rest of their lives. Da Costa recorded reams of data on these men, and he released a formal clinical study in 1871, which would become a landmark in the history of cardiovascular disease. But Irritable Heart Syndrome wasn't confined to just the Civil War. **The same symptoms would show up half a century later in 20 percent of soldiers who fought in World War I, a million soldiers in World War II, and hundreds of thousands more in Vietnam and the Iraq and Afghanistan wars.** Doctors dreamed up new names for these problems along the way, believing they had discovered a new kind of illness. They told soldiers they suffered from **shell shock, soldier's heart, post-Vietnam syndrome, and post-traumatic stress disorder**. They considered the ailments to be psychological, some disturbance in the brain brought on by fighting. Soldiers often blamed exposure to chemicals or vaccines, although nobody really knew for sure. Da Costa had his own theories. At Turner's Hospital, he suspected he was dealing with, in his words, a disorder of the sympathetic nervous system."

"Breathing, as it happens, is more than just a biochemical or physical act; it's more than just moving the diaphragm downward and sucking in air to feed hungry cells and remove wastes. The tens of billions of molecules we bring into our bodies with every breath also serve a more subtle, but equally important role. They influence nearly every internal organ, telling them when to turn on and off. They affect heart rate, digestion, moods, attitudes; when we feel aroused, and when we feel nauseated. **Breathing is a power switch to a vast network called the autonomic nervous system.** [...] The lungs are covered with nerves that extend to both sides of the autonomic nervous system, and **many of the nerves connecting to the parasympathetic system are located in the lower lobes**, which is one reason long and slow breaths are so relaxing. As molecules of breath descend deeper, they switch on parasympathetic nerves, which send more messages for the organs to rest and digest."

our bodies are built to stay in a state of heightened sympathetic alert only for short bursts, and only on occasion. **Although sympathetic stress takes just a**

second to activate, turning it off and returning to a state of relaxation and restoration can take an hour or more.

[**Footnote:** Sexual arousal is controlled by the parasympathetic system and is usually accompanied, or can be induced, by soft and easy breaths. Meanwhile, orgasms are a sympathetic response, and are often preceded by fast, short, and sharp breathing. We're attracted to eyes of mates with large pupils partly because pupils dilate—a sympathetic response—during orgasm.]

"The stress that Da Costa's soldiers experienced was unconscious. The men had grown up in rural environments, outside the noise and crowds of the city. The more carnage they saw, the more their unconscious sympathetic responses kept building with no means of release. Eventually, their nervous systems were so overloaded that they short-circuited and collapsed."

*Professional surfers, mixed martial arts fighters, and Navy SEALs use Tummo-style breathing to get into the zone before a competition or black ops mission. It's also especially useful for middle-aged people who suffer from lower-grade stress, aches and pains, and slowing metabolisms. For them—for me—**Tummo can be a preventative therapy, a way to get a fraying nervous system back on track and keep it there.** [...] Sometimes the body needs more than a soft nudge to get realigned. Sometimes it needs a violent shove. That's what Tummo does.*

[On the vagus nerve and Dr. Porges's findings...]

*Dr. Stephen Porges, a scientist and professor of psychiatry at the University of North Carolina, has studied the nervous system and its response to stress for the past 30 years. His primary focus is the vagus nerve, a meandering network within the system that connects to all the major internal organs. **The vagus nerve** is the power lever; it's what **turns organs on and off in response to stress. When perceived stress level is very high, the vagus nerve slows heart rate, circulation, and organ functions.** This is how our reptilian and mammalian ancestors evolved the ability to "play dead" hundreds of millions of years ago, to conserve energy and deflect aggression when under attack by predators. Reptiles still access this ability, as do many mammals. (Imagine the limp body of a mouse in the jaws of a house cat.) People "play dead," too, because we share the same mechanisms in the primitive part of our brain stem. We call it fainting. Our tendency to faint is controlled by the vagal system, specifically how sensitive we are to perceived danger. Some people are so anxious and oversensitive that their vagus nerves will cause them to faint at the smallest things, like seeing a spider, hearing bad news, or looking at blood. Most of us aren't that sensitive. It's much more common, especially **in the modern world**, to never experience full-blown, life-threatening stress, but to never fully relax either. **We'll spend our days half-asleep and nights half-awake, lolling in a gray zone of half-anxiety. When we do, the vagus nerve stays half-stimulated. During these times, the organs throughout the body***

won't be "shut down," but will instead be half supported in a state of suspended animation: blood flow will decrease and communication between the organs and the brain will become choppy, like a conversation through a staticky phone line. Our bodies can persist like this for a while; they can keep us alive, but they can't keep us healthy. **Porges found that patients who suffer Da Costa-like maladies such as tingling in their fingers, chronic diarrhea, rapid heart rate, diabetes, and erectile dysfunction are often treated for each of these symptoms with a focus on individual organs. But there's nothing wrong with their stomachs, hearts, or genitals. What they often suffer from are communication problems along the vagal and autonomic network, brought on by chronic stress.** To some researchers, it's no coincidence that eight of the top ten most common cancers affect organs cut off from normal blood flow during extended states of stress. **Fixing the autonomic nervous system can effectively cure or lessen these symptoms.** In the past decade, surgeons have implanted electrical nodes in patients that work as an artificial vagal nerve to restart blood flow and communication between organs. The procedure is called vagus nerve stimulation, and it's highly effective for patients suffering from anxiety, depression, and autoimmune diseases. But there is another, less invasive way Porges found to stimulate the vagus nerve: breathing. **Breathing is an autonomic function we can consciously control. While we can't simply decide when to slow or speed up our heart or digestion, or to move blood from one organ to another, we can choose how and when to breathe.** Willing ourselves to breathe slowly will open up communication along the vagal network and relax us into a parasympathetic state. Breathing really fast and heavy on purpose flips the vagal response the other way, shoving us into a stressed state. It teaches us to consciously access the autonomic nervous system and control it, to turn on heavy stress specifically so that we can turn it off and spend the rest of our days and nights relaxing and restoring, feeding and breeding.

"researchers brought in two dozen healthy male volunteers and randomly split them into two groups. Half the men spent the next ten days learning [Wim] Hof's version of Tummo [called the Wim Hof Method] while exposing themselves to cold, doing things like playing soccer shirtless in snow. The control group received no training. The two groups were brought back into the lab. **Each was hooked up to monitors, then injected with the E. coli endotoxin. The group trained by Hof were able to control their heart rate, temperature, and immune response, and stimulate the sympathetic system. This practice of heavy breathing along with regular cold exposure was later discovered to release the stress hormones adrenaline, cortisol, and norepinephrine on command.** The burst of adrenaline gave heavy breathers energy and **released a battery of immune cells programmed to heal wounds, fight off pathogens and infection.** The huge spike in cortisol helped downgrade short-term inflammatory immune responses, while a squirt of norepinephrine redirected blood flow from the skin, stomach, and reproductive organs to muscles, the brain, and other areas essential in stressful situations. **Tummo heated the body and opened up the brain's pharmacy,**

flooding the bloodstream with self-produced opioids, dopamine, and serotonin. All that, with just a few hundred quick and heavy breaths."

"I'd heard dozens of these stories. **Men, mainly in their 20s, whod suddenly been diagnosed with arthritis and psoriasis or depression, who, weeks after practicing heavy breathing, no longer suffered any symptoms.**

Twenty thousand others in Hof's community exchange blood work data and other metrics of their transformations online. The before-and-after results confirmed their claims. Some of these **people were reducing inflammatory markers (C-reactive protein) 40-fold within just a few weeks.** "Doctors say this is more pseudoscience than science, that there's no way any of this can be true," [Chuck] McGee [III—breathwork instructor] told me. And yet McGee and thousands of other heavy breathers kept showing profound improvements. They kept getting off medications theyd been on for years. They kept heating and healing themselves."

[How to practice Tummo]

*To practice **Wim Hof's breathing method**, start by finding a quiet place and lying flat on your back with a pillow under your head. Relax the shoulders, chest, and legs. Take a very deep breath into the pit of your stomach and let it back out just as quickly. Keep breathing this way for 30 cycles. If possible, breathe through the nose; if the nose feels obstructed, try pursed lips. Each breath should look like a wave, with the inhale inflating the stomach, then the chest. You should exhale all the air out in the same order. At the end of 30 breaths, exhale to the natural conclusion, leaving about a quarter of the air left in the lungs, then hold that breath for as long as possible. Once you've reached your breathhold limit, take one huge inhale and hold it another 15 seconds. Very gently, move that fresh breath of air around the chest and to the shoulders, then exhale and start the heavy breathing again. Repeat the whole pattern three or four rounds and add in some cold exposure (cold shower, ice bath, naked snow angels) a few times a week. This flip-flopping-breathing all-out, then not at all, **getting really cold and then hot again—is the key to Tummo's magic. It forces the body into high stress one minute, a state of extreme relaxation the next. Carbon dioxide levels in the blood crash, then they build back up. Tissues become oxygen deficient and then flooded again. The body becomes more adaptable and flexible and learns that all these physiological responses can come under our control.** Conscious heavy breathing, McGee told me, allows us to bend so that we don't get broken.*

[Holotropic breathing]

***Whenever the body is forced to take in more air than it needs, we'll exhale too much carbon dioxide, which will narrow the blood vessels and decrease circulation,** especially in the brain. With just a few minutes, or even seconds, of overbreathing, brain blood flow can decrease by 40 percent, an incredible amount. The areas most affected by this are the brain's hippocampus*

and frontal, occipital, and parieto-occipital cortices, which, together, govern functions such as visual processing, body sensory information, memory, the experience of time, and the sense of self. Disturbances in these areas can elicit powerful hallucinations, which include out-of-body experiences and waking dreams. If we keep breathing a little faster and deeper, more blood will drain from the brain, and the visual and auditory hallucinations will become more profound. In addition, the sustained pH imbalance in the blood sends distress signals throughout the body, specifically to the limbic system, which controls emotions, arousal, and other instincts. **Consciously sustaining these stress signals long enough may trick the more primitive limbic system into thinking the body is dying.** This could explain why so many people experience sensations of death and rebirth during **Holotropic Breathwork**. They have consciously driven their bodies into a state that it perceives as potentially lethal, and then lulled it back out by conscious breathing.

Chapter 9: Hold It

"The amygdalae [are] not the only "alarm circuit of fear." There [is] another, deeper circuit in our bodies that [generates] a more powerful sense of danger than anything the amygdalae alone could muster. It was shared not only by S. M., the German twins, and the few dozen others with Urbach-Wiethe disease [all who, for one reason or another, did not have amygdalae], but by everyone and almost every living thing—all people, animals, even insects and bacteria. It [is] the deep fear and crushing anxiety that comes from the feeling of not being able to take another breath."

"The nagging need to breathe is activated from a cluster of neurons called the central chemoreceptors, located at the base of the brain stem. When we're breathing too slowly and carbon dioxide levels rise, the central chemoreceptors monitor these changes and send alarm signals to the brain, telling our lungs to breathe faster and more deeply. When we're breathing too quickly, these chemoreceptors direct the body to breathe more slowly to increase carbon dioxide levels. This is how our bodies determine how fast and often we breathe, not by the amount of oxygen, but by the level of carbon dioxide."

"All this suggests that **for the past hundred years psychologists may have been treating chronic fears, and all the anxieties that come with them, in the wrong way.** Fears weren't just a mental problem, and they couldn't be treated by simply getting patients to think differently. Fears and anxiety had a physical manifestation, too. They could be generated from outside the amygdalae, from within a more ancient part of the reptilian brain. Eighteen percent of Americans suffer from some form of anxiety or panic, with these numbers rising every year. **Perhaps the best step in treating them, and hundreds of millions of others around the world, was by first conditioning the central chemoreceptors and the rest of the brain to become more flexible to carbon dioxide levels. By teaching anxious people the art of holding their breath."**

"Up to 80 percent of office workers (according to one estimate) suffer from something called continuous partial attention. We'll scan our email, write something down, check Twitter, and do it all over again, never really focusing on any specific task. In this state of perpetual dis-traction, breathing becomes shallow and erratic. Sometimes we won't breathe at all for a half minute or longer."

"Breathholding hacks, or [...] carbon dioxide therapies, have been around for thousands of years. The ancient Romans prescribed soaking in thermal baths (which contained high levels of carbon dioxide that was absorbed through the skin) as a cure for anything. from gout to war wounds."

[**Footnote:** thousands of researchers have tested the effects of carbon dioxide therapies on cardiovascular health, weight loss, and immune function. A quick search of "transdermal carbon dioxide therapy" on PubMed brings up more than 2,500 studies. Most of these studies, I've found, confirm what Royat researchers had discovered a hundred years earlier, and the Greeks thousands of years before them: **exposing the body to carbon dioxide, whether in water or through injections or via inhalation, increases oxygen delivery to muscles, organs, brain, and more; it dilates arteries to increase blood flow, helps dissolve more fat, and is a powerful treatment for dozens of ailments.** For an extensive history of carbon dioxide research and several more resources, visit www.mrjamesnestor.com/breath.]

"blends of 30 percent carbon dioxide and 70 percent oxygen became a go-to treatment for anxiety, epilepsy, and even schizophrenia. With a few huffs of the stuff, patients whod spent months or years in a catatonic state would suddenly come to. They'd open their eyes, look around, and begin calmly talking with doctors and other patients. "It was a wonderful feeling. It was marvelous. I felt very light and didn't know where I was," one patient reported. "I knew something had happened to me and I wasn't sure what it was." The patients would stay in this coherent, lucid state for about 30 min-utes, until the carbon dioxide wore off. Then, without warning, theyd stop mid-sentence and freeze, staring into space and striking statue-like poses or sometimes collapsing. The patients were sick again. They'd stay that way until the next hit of carbon dioxide."

"Mindful meditation—as it is typically practiced—is just no. longer conducive to the new world we live in," Feinstein explains.

"Chemoreceptors [...] don't care if the carbon dioxide in the bloodstream is generated from strangulation, drowning, panic, or a foil bag [...] They set off the same alarm bells. **Experiencing such an attack in a controlled environment helps demystify it, teaching patients what an attack feels like before it comes on so we can prevent it. It gives us conscious power over what for too long has been considered an unconscious ailment, and shows us that**

many of the symptoms were suffering can be caused, and controlled, by breathing."

Chapter 10: Fast, Slow, And Not At All

"The concept of prana was first documented around the same time in India and China, some 3,000 years ago, and became the bedrock of med-icine. The Chinese called it *ch'i* and believed the body contained channels that functioned like prana power lines connecting organs and tissues. The Japanese had their own name for prana, *ki*, as did the Greeks (*pneuma*), Hebrews (*ruah*), Iroquois (*orenda*), and so on. Different names, same premise. The more prana something has, the more alive it is. Should this flow of energy ever become blocked, the body would shut down and sickness would follow. If we lose so much prana that we can't support basic body functions, we die."

Epilogue: A Last Gasp

"Two months after the Stanford experiment ended, Dr. Jayakar Nayak's lab emailed Anders Olsson and me the results of our 20-day study. The major takeaway we already knew: mouthbreathing is terrible. **After just 240 hours of breathing only through our mouths, catecholamine and stress-related hormones spiked, suggesting that our bodies were under physical and mental duress. A diphtheroid *Corynebacterium* bug had also infested my nose.** If I'd continued breathing only through my mouth for a few more days, it might have developed into a full-fledged sinus infection. All the while, my blood pressure was through the roof and my heart rate variability plummeted. Olsson's data mirrored mine. By night, the constant flow of unpressurized, unfiltered air flowing in and out of our gaping mouths collapsed the soft tissue in our throats to such an extent that we both began to experience persistent nocturnal suffocation. We snored. A few days later, we started choking on ourselves, suffering from bouts of sleep apnea. Had we continued breathing through our mouths, there's a decent chance we both would have developed chronic snoring and obstructive sleep apnea, along with the hypertension and metabolic and cognitive problems that come with it. Not all of our measurements changed. Blood sugar levels weren't affected. Cell counts in the blood and ionized calcium remained the same, as did most other blood markers. There were a few surprises. My lactate levels, a measure of anaerobic respiration, actually decreased with mouthbreathing, which suggested I was using more oxygen-burning aerobic energy. This was the opposite of what most fitness experts would have predicted. (Olsson's lactate slightly increased.) I lost about two pounds, due most likely to exhaled water loss. [...] The nagging fatigue, irritation, testiness, and anxiety. The horrid breath and constant bathroom breaks. The spaciness, stares, and stomachaches. It was awful."

"Carl Stough spent a half century reminding his students of how to get all the air out of our bodies so that we could take more in. He trained his clients to exhale longer and, in the process, do what had long been considered

biologically impossible. **Emphysemics reported almost total recovery from their incurable conditions, opera singers gained more resonance and tone in their voices, asthmatics no longer suffered from attacks, and Olympic sprinters went on to win gold medals.** As basic as this sounds, **full exhalations are seldom practiced.** Most of us engage only a small fraction of our total lung capacity with each breath, requiring us to do more and get less. One of the first steps in healthy breathing is to extend these breaths, to move the diaphragm up and down a bit more, and to get air out of us before taking a new one in. "The difference in breathing in the coordinated pattern and in an altered pattern is the difference between operating at peak efficiency and just getting along," Stough wrote in the 1960s. "An engine does not have to be in tip-top condition to work, but it gives a better performance if it is."

"The millions of ancient skeletons in the Paris quarries and hundreds of pre-Industrial Age skulls at the Morton Collection had three things in common: **huge sinus cavities, strong jaws, and straight teeth. Almost all humans born before 300 years ago shared these traits because they chewed a lot.**"

*It turns out that **the amygdalae**, those gooey nodes on the sides of our head that help govern perceptions of fear and emotions, also **control aspects of our breathing.** Patients with epilepsy who have had these brain areas stimulated with electrodes immediately cease breathing. The patients were totally unaware of it and didn't seem to feel their carbon dioxide levels rising long after their breathing ceased. **Communication between the chemoreceptors and amygdalae works both ways: these structures are constantly exchanging information and adjusting breathing every second of every minute of the day. If communication breaks down, havoc ensues.** Feinstein believes that people with anxiety likely suffer from connection problems between these areas and could unwittingly be holding their breath throughout the day. **Only when the body becomes overwhelmed by carbon dioxide would their chemoreceptors kick in and trigger an emergency signal to the brain to immediately get another breath. The patients would reflexively start fighting to breathe. They'd panic. Eventually their bodies adapt to avoid such unexpected attacks by staying in a state of alert, by constantly overbreathing in an effort to keep their carbon dioxide as low as possible.***

Additional Endnotes:

*A retrospective review of more than 7,300 adults associated a **2 percent higher risk of obstructive sleep apnea with every tooth lost.** If five to eight teeth were removed, that percentage increased to 25 percent; nine to 31 teeth showed a 36 percent increase. Those **patients who had all their teeth removed suffered a 60 percent greater chance of acquiring sleep apnea.***

*Harvard biologist Daniel Lieberman defines **dysevolution** as "the **deleterious***

feedback loop that occurs over multiple generations when we don't treat the causes of a mismatch disease but instead pass on whatever environmental factors cause the disease, keeping the disease prevalent and sometimes making it worse." A "mismatch disease" begins "***when we get sick or injured from an evolutionary mismatch that results from being inadequately adapted to a change in the body's environment."***

[Could traumatic stress (and other 'disorders') be lumped into a similar category? A controversial thing to say, so let me explain... In his book ***Saving Normal*** former head of the ***DSM-IV*** Taskforce (in charge of 'writing the book' on mental disorders that can be diagnosed today) spoke about how out of control mental health conditions have become over the years, railing, especially, against ***DSM-5*** (the newest version of the manual). He said we're unwittingly (or is it on purpose?) diagnosing ourselves into oblivion so that no 'normal' people are left. Not, I haven't yet read ***The Myth Of Normal*** by Gabor Maté so don't know the point he'd raise against this, but Frances's point (and evidence thereof) is compelling—we've made is normal to be abnormal. Now, back to PTSD—I'm similarly compelled by Edith Eger (Holocaust survivor and clinical psychologist) in her books ***The Choice*** and ***The Gift*** who says we've set up a society of victims, and this propagates the issue. There's a kind of evolutionary mismatch between the utility of identifying with a disorder (because, yes, understanding what's happening inside is indeed helpful in many cases) and overidentifying—a kind of 'identity politics', and ***Deadpool*** kind of comparison of traumas. To be clear, appropriate diagnosis is key to any successful treatment ... alignment to disorder so that it becomes your identity? No. I'm not compelled by that. In fact, it will only propagate the issue and lead to a generation of the walking half-dead. Counter to the problem: Kishimi & Koga's ***The Courage To Be Disliked***. (They even have a chapter inside named 'There Is No Such Thing As Trauma'—an interesting counterpoint to the prevailing argument...)]

animals can use only 50 to 60 percent of the nutrients from a raw egg but more than 90 percent from a cooked egg. The same is true with many cooked plants, vegetables, and meats.

Anaerobic exhaustion, and its associated lactic acidosis, isn't always triggered by strenuous exercise. It can also occur through liver disease, alcoholism, severe trauma, or other conditions that deprive the body of the oxygen it needs to function aerobically.

*In 2001, researchers at the University of Pittsburgh surveyed several hundred people and found that **half of those with insomnia also suffer from obstructive sleep apnea**. Then they surveyed people with obstructive sleep apnea and found that half had insomnia. Years later, a study published in the Mayo Clinic Proceedings of 1,200 chronic insomniacs found that all 900 of the patients prescribed some kind of drug to help them sleep, including antidepressants, had "pharmacotherapeutic failure." The more than 700*

patients taking prescription drugs reported the most severe insomnia. These drugs not only are ineffective for the patients taking them, but can actually make sleep quality worse because **insomnia for many people isn't a psychological problem; it's a breathing problem.**

The stats for malocclusion vary. Kevin Boyd, a pediatric dentist, and Darius Loghmanee, a physician and sleep specialist, noted that "75% of children, ages 6 to 11 and 89% of youths, ages 12 to 17, have some degree of malocclusion." In addition, an estimated 65 percent of adults have some degree of malocclusion; this population includes those adults who have already had orthodontic procedures. Given this, the actual number of these adults had not received treatment would be closer to 90 percent. Other estimates I found put the figure for children even higher. Suffice to say, it's a lot.

Some studies have shown that **the nasal cycle fluctuates between 30 minutes and two and a half hours; others show the cycle can last up to four hours.**

When yogis finish a meal, they lie on their left side so that they will breathe primarily from their right nostril. The increase of blood flow and heat via right-nostril breathing, yogis believe, can aid in digestion. A few years ago, researchers at Jefferson Medical College in Philadelphia tested this claim by feeding 20 healthy subjects a high-fat meal on different days, having them lie on their right or left sides. Those ordered to lie on their left side (breathing primarily through their right nostril) had significantly less heartburn and measured much lower acidity in their throats than subjects lying on the right side. The study was repeated with the same results. **The extra heating in the body triggered by right nostril breathing likely influenced the rate and efficiency of digestion, but gravity certainly helped. The stomach and pancreas will hang more naturally when the body is positioned on the left side, which allows food to more easily move through the large intestine.** In short, it feels better and is more efficient for digestion.

All the world's beaches contain somewhere in the neighborhood of 2.5 to 10 sextillion grains of sand. Meanwhile, that breath of air you just inhaled contains around 25 sextillion molecules.

Crying will drain tears into the nose, which mix with the mucus, making it thin and watery. Cilia can no longer hold onto the mucus, so it starts running with the flow of gravity: a runny nose. Thick mucus is worse. Excessive dairy, allergies, starchy foods, and more increase mucus weight and density. Cilia slow down, become overwhelmed, and eventually come to a dead stop. This is how the nose gets congested. **The longer the nose is stopped up, the more microbes build up, resulting sometimes in a nasal infection (sinusitis) or a common cold.**

In each exhale, we expel about 3,500 compounds. Much of this is organic

(water vapor, carbon dioxide, and other gases), but we also exhale pollutants: pesticides, chemicals, and engine exhaust. When we don't breathe out completely, these toxins sit in the lungs and fester, causing infections and other problems.

Each blood cell offloads only about 25 percent of the oxygen; the remaining 75 percent stays on board and goes back to the lungs. The oxygen that doesn't get off is considered a reserve mechanism, but if the hemoglobin doesn't pick up new oxygen in the lungs, it will be essentially totally empty after about three circulations, which takes about three minutes.

The Native Americans whom Price visited in northern Canada had no access to fruits or vegetables during the long winters, and thus no vitamin C. Price noted that they should have all been sick or dead from scurvy, yet they appeared to be in vigorous health. An elder chief described to Price how the tribe would occasionally kill a moose, cut open its back, and pull out two small balls of fat just above the kidneys. They'd cut up these balls and distribute them among the family. Price later discovered that these balls were the adrenal glands, the richest source of vitamin C in all animal and plant tissues.

*We create stem cells throughout the body as well. The stem cells made in the sutures and jaws are often used for local maintenance in the mouth and face. **Stem cells will ship off to whatever area needs them most.** What they are attracted to are stress signals—in this case, the signals that come with vigorous chewing.*

*Rocking chairs and porch swings were very common in houses before the first half of the twentieth century. They may have been so popular because **swinging shifts blood pressure, which allows messages to more easily travel back and forth along the vagus nerve. This is why so many autistic children (who often have poor vagal tone and feel constantly under threat) respond so well to swinging. Cold exposure, like splashing cold water on the face, also stimulates the vagus nerve, which sends messages to the heart to lower the heart rate.** (Place your face in cold water and your heart rate will quickly drop.)*

*In the late 1950s, Wolpe was looking for alternative treatments for free-floating anxiety, a form of stress for which there is no specific cause, which today affects about 10 million Americans. He was floored by how quickly and effectively carbon dioxide worked. **Between two and five inhalations of a 50/50 mixture of carbon dioxide and oxygen, Wolpe found, was enough to lower the baseline level of anxiety in his patients from 60 (debilitating) to zero.** No other treatment came close. "It will be hoped that the recently awakened interest in carbon dioxide will lead to active research," wrote Wolpe in 1987. But **the same year Wolpe published his carbon dioxide call to arms, the Food and Drug Administration approved the first SSRI drug, fluoxetine,** which would become better known by its trade names Prozac, Sarafem, and*

Adofen. A decade after Wolpe's study was published, Donald F. Klein, a Columbia University psychiatrist, found what he thought was the mechanism that triggered panic, anxiety, and related disorders. It was a physiologic misinterpretation by a suffocation monitor (that misfires an evolved suffocation alarm system," wrote Klein in his paper "False Suffocation Alarms, Spontaneous Panics, and Related Conditions." And that false suffocation was coming from chemoreceptors that had grown to become too sensitive to fluctuations in carbon dioxide. **Fear, at its core, could be as much a physical problem as a mental one.**

Panic sufferers visit the doctor five times more often than other patients, and are six times more likely to be hospitalized for psychiatric disorders. Thirty-seven percent of them will seek some treatment, usually drugs, behavior therapy, or both. But none of these therapies directly address what could be contributing to this condition: chronic poor breathing habits. That 60 percent of people with chronic obstructive pulmonary disease also have anxiety or depressive disorders is not a coincidence. These patients are very often breathing too much, too fast, panicking in anticipation of not being able to take another breath.

A brief commentary:

Fortuitous that this book was published at the beginning of the COVID-19 pandemic—entirely by coincidence. In glad I first read it in 2024 ... and it formed the basis of my own book **Polyvagal Breathing**. *Breath* is a game-changer, a paradigm shifting work that throws traditional 'wisdom' on its head. Breathing costs nothing yet influences so much. Whether you're as poor as a pauper living on the street or as rich as a Saudi prince, the breath is free. And you can utilise it to manage stress and boost health, according to Nestor and the researchers (and pulmonauts) he cites. I've practised many of the strategies he cites in the book and have come away convinced. I've taught these strategies to my clients, my children, my friends ... so you know I believe in them. We live in a medicalised world whereby something as simple as the breath is often the last thing on a physician's mind when he's trying to get to the bottom of many stress conditions. Nestor does a spectacular job of highlighting what oxygen is, so too with CO₂. He talks about the history of 'breath science' and jam packs his book with awesome anecdotes and research to inform your own breathing practice. One thing that stood out was his discussion on Native American tribes that were taught from a young age the important of nasal breathing, to the point of mothers blocking their babies' mouths to encourage nose breathing. Mouth breathing is the antithesis of good physical health, and Nestor tells you a whole lot more about why. This isn't just a book to be read, but one to be studied and practiced—going at your own pace and finding what works for you. You might be the type of person who thinks breathing sucks, that breathing strategies won't work for you (though, if you are I have no idea why you're reading this summary) ... I guarantee you that

you'll come away with a new found sense of clarity once you've read this book. I've only provided the highlights—the story is much more engaging. Read it. And breathe.

These notes were collected by psychotherapist and author Emil Barna in his efforts to assist with professional development and further education for himself and those who read them. You can find out more about Emil by visiting www.barnacc.com

"A text without a context is a pretext to a proof text."

—Dr. Don Carson